

Large cities in Poland in face of demographic changes

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Abstract. The growth of rural population, to the detriment of cities in Poland is caused mainly by agglomeration processes, including suburbanisation. Consequently, intense and sudden changes in demographic structure of large cities and surrounding regions are observed. The paper presents demographic changes in the largest Polish cities. The aim of the study was to verify whether the phenomenon of population aging was more distinct in large cities than in surrounding municipalities. We also aimed to answer the question of how changes in demographic processes should shape the social policy pursued by authorities in large cities. Discussion covers activities rising out of demographic challenges to meet the needs in the field of “services” for children and increasing demand for ventures related to care for the elderly. The analysis includes selected areas of the education, health care and social assistance fields.

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1. Introduction

In the twentieth century the number of inhabitants of the largest Polish cities increased several times. Difficult experiences during the war significantly disrupted this trend. However, the intensive process of post-war urbanisation and industrialization favoured further development of cities. The process of urbanisation historically has been associated with other important economic and social transformations, which have brought greater geographic mobility and demographic changes. Poland is a country with one of the lowest total fertility rates in Europe, one of the largest increases in life expectancy, extremely intense population aging and a very large emigration abroad. The intensity of these demographic changes means that their consequences are considered a major challenge for social policy of local authorities (Jonda, 2008; Rocak, 2012). The effects of migration, fertility decline and population aging are particularly evident in large cities and their nearest surroundings. These processes are characterized by a unique intensity in Central and Eastern Europe, including Poland (Gołata, Jonda, 2008; Frątczak, 2011).

The aim of the study was to give statistical evidence of past and future population trends in the largest cities in Poland, in association with change in demographic processes. Our purpose was also to show the interlinked development of core cities and fringe areas as regards ageing and social needs. The aim of the study was also to verify whether the phenomenon of population aging was more distinct in large cities than in surrounding municipalities.

The paper presents demographic changes in the largest Polish cities and points out important issues rising from these changes, which might be helpful for local authorities to prevent unfavourable demographic trends. Our intention was also to answer the question of how changes in demographic processes should shape the social policy pursued by authorities in large cities. Discussion covers activities rising out of demographic challenges to meet the needs in the field of “services” for children and increasing demand for ventures related to care for the elderly. The analysis includes education, health care and social assistance fields.

The spatial scope of the study includes five largest Polish cities: Warsaw, Łódź, Kraków, Wrocław

and Poznań. Additionally, in accordance with the purpose of the study, the suburban areas surrounding each city were also taken into account. Each of the metropolitan areas is analysed in terms of the division into a core city and fringe areas. The study is conducted using data from last population censuses: 2002 and 2011. Information from censuses has been updated with the most recent data. Therefore, the study used different sources of information, including vital statistics, Central Statistical Office databases, population censuses and data from administrative records, particularly as refers to education (e.g., secondary school exam results).

The structure of the paper reflects stages of our research undertaken in order to reach the research goal. The paper consists of three parts. The first one describes the problem, results of previous studies, formulates the thesis and discusses methods used in the study. Some basic information about the population of the largest Polish cities is analysed. This includes a brief history of the city’s development, current situation and future trends based on population projections. On this background we continue with some methodological issues referring to classic cyclical urbanisation model (van den Berg et al., 1982).

The main part of the analysis contains results obtained and their discussion. It is divided into three parts: the first part shows changes in demographic processes and their consequences. Then, population ageing from the bottom and from the top of the age pyramid is presented. Social issues are the subject of the last part. It covers information on education, and on the changes in the population structure as reflected by the level of education and social assistance for the elderly.

Considerations end with summaries and conclusions of the analysis. An attempt was also made to compare the results obtained to goals set out in urban development strategies.

2. Research problem, hypothesis and methods

For over fifty years, until 2000, Poland observed an intensive process of urbanisation and associated outflow of population from the countryside. This situation being the result of socialist econo-

my performed in all the countries of Central and Eastern Europe, in contrast to the developed countries. In the transition period changes in political and economic situation caused significant changes in current trends. Polish cities began to shrink. We watched changes that earlier have occurred in some cities of developed countries (Hausserman, Siebel, 1988; Friedrichs, 1993; Węclawowicz, 2003, 2014; Turok, Mykhnenko, 2007; Jaroszewska, Stryjakiewicz, 2014).

According to 2011 Population Census, over 60% of Polish people are urban residents, although this percentage has declined between the last censuses. This increase in rural population to the detriment of cities is caused not only by territorial differentiation of fertility, mortality and migration, but also by agglomeration processes, including suburbanisation (Stryjakiewicz et al., 2014). Survey conducted in Poznan indicated that suburbanisation involves mainly young families with children, people with higher education, and professionals who want to improve housing conditions (change a block apartment to a detached house, Klimanek, 2012). Consequently, we can observe not only intense, but very

sudden changes in demographic structures of residents in large cities and surrounding regions. Apart from births and deaths, the impact of direct and indirect migration on population structure is revealed.

Since 1900, the number of Wrocław residents increased by half, while an increase by two and a half was observed for Łódź and Warsaw; in Poznań population grew almost five times, and in Kraków over eight times. However, the last 20 years or so have seen a decline in the population of both Łódź and Poznań. In 1989, the population of Łódź was 851,690 and in 2014 it was only 706,004, which means it dropped by more than 145,000 (17.1%, see Fig. 1). Similarly, but to a lower extent, Poznań population decreased from 590,101 residents in 1990 to 545,680 in 2014, meaning a decrease by over 44,000 (7.5%). The populations of Wrocław and Kraków remain almost unchanged. Warsaw is the only large Polish city experiencing slow increase. The increase in the number of Warsaw residents might be associated with the ability of rapid adaptation to new market conditions. The reverse situation is observed in Łódź, which is a city experiencing problems with nonindustrial economy (Zborowski et al., 2012).

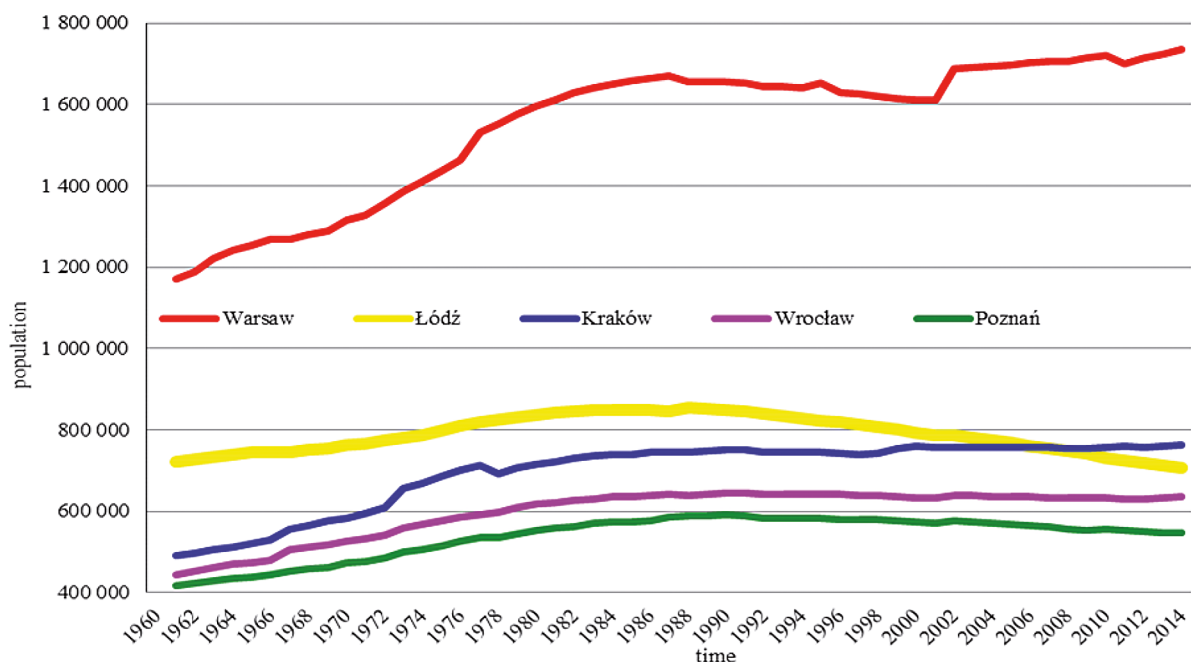


Fig. 1. Population in five largest cities, Poland 1960–2014

Source: CSO Demography Data base (Baza Demografia, GUS: <http://demografia.stat.gov.pl/bazademografia/> and Local Data Base, GUS <http://stat.gov.pl/bdl/>)

A shift from intensive growth to decline is now evident. Last decade brought a different score: net migration between urban and rural areas is now positive for the village. Changes in the number of inhabitants of large cities in Poland will be presented in conjunction with suburban areas from the perspective of city development phases according to the classical, cyclical van den Berg model of urbanisation (Van den Berg et al., 1982).

Presenting the current trends in city and surrounding region population development allows for a discussion on the stages of development of the city from the perspective of the model proposed by van den Berg (1982). This model is based on a four-phase development process of city population (core city, inner city) and surrounding region (fringe, suburbs, ring), which together form a functional urban area (functional urban region – FUR). These stages are: urbanisation, suburbanisation, desurbanisation, reurbanisation. Depending on the compatibility of the observed changes, these stages are divided into phases, known as absolute – with the opposite direction of population change in core city and in suburbs (divergence) – or relative, when we observe unidirectional change of different intensity (convergence, cf. Kabish, Haase, 2011; Rérat, 2012). Basing on the theory of urban life-cycle, we attempt to present a more complete picture of demographic evolution of the largest Polish cities. Our intention is to show not only changes in the population size, but a comprehensive characteristic of demographic processes associated with suburbanisation. Having regard to changes in the age structure of the core city and ring population, we try to assess and compare the progress of the aging process. To complete the picture, assessment of age structure will be supplemented with demographic analysis covering basic characteristics of fertility and life expectancy that show aging from the bottom and from the top of the age pyramid.

The observed urban development and demographic trends made us formulate a thesis of more rapid ageing of core cities in comparison to fringe areas. This can be motivated by both direct and indirect effects of migration and suburbanisation. The direct impact of suburbanisation process manifested itself primarily in the outflow of young people who, after graduation, finding good work and professional success, try to improve their standard of

living and enlarge their family. This mobility results in a change of age structure: population of city centre is reducing because of outflow of people of the highest professional, family and reproductive mobility (aged 30–44). Suburbanisation process rejuvenates the age structure of the ring population. In addition, indirect effects will reveal advancement in ageing processes: greater fertility decline and more pronounced lengthening of life expectancy in inner cities compared to fringe areas.

When beginning an analysis of the city's development phases, one must define areas constituting the core city and fringe areas. Delimitation of functional urban area is a very complex problem often solved by administrative and political decisions and goes beyond the scope of this study. According to the idea of FUR expressed by 'ring' as one of its description, this study assumed circle surrounding the city centre formed by the directly neighbouring counties. Due to statistics availability, for the purpose of this study FUR was designated as a combination of the urban and rural counties. However, individual approach was necessary for each agglomeration, as there can be more than one rural district surrounding the city district regarded as the FUR centre. The multiplicity of criteria for determining the functional area of a city and the generality of the definition mean that determining the scope of a city is highly subjective (Heffner, Gibas, 2013).

The boundaries of Poland's largest agglomeration – Warsaw – were determined repeatedly. One can indicate here the approach arising from "The spatial development plan of Mazowieckie voivodship in 2004" (Plan ..., 2004), delimitation presented in the study by Swianiewicz (2005), the boundaries of the metropolitan area by the Mazovian Voivodship Board in 2006 as determined by the Mazovian Office of Regional Planning in Warsaw, further approved by the Voivodship Urban-Architecture Commission, Strategy for the Spatial Plan and Regional Development Commission of Mazovian Council and finally, in January 2006, by Mazovian Voivodship Board. Since 2006, the Statistical Office in Warsaw has been preparing a publication called *Warsaw Metropolitan Area*, which adopts the last proposal. Another approach to determine the limits of Warsaw agglomeration might be based on the administrative division of the country at NUTS3 level and constitutes two NUTS3 subregions: the Warsaw city and the War-

saw subregion. Due to its simplicity, this approach is often used by different institutions and includes the following poviats (administrative region of the 2nd order): grodziski, grójecki, legionowski, miński, otwocki, piaseczyński, pruszkowski, sochaczewski, Warsaw city, warszawski zachodni, wołomiński and żyrardowski. However, for the purposes of this study only poviats immediately adjacent to the capital city were taken into consideration, these being: Warsaw city poviat, legionowski, miński, otwocki, piaseczyński, pruszkowski warszawski zachodni and wołomiński poviats.

Without going further into discussion on the limits of other large urban areas, we adopted the abovementioned solution, laying down FUR as the city centre and the districts directly surrounding it. For Łódź these are the poviats of the Łódź city, brzeziński, łódzki wschodni, pabianicki and zgierski poviats. In the case of a functional urban area of Kraków, it was created by combining the following poviats: the Kraków city, krakowski, myślenicki, proszowicki and wielicki. Functional area of Wrocław is identified as: the city of Wrocław, średzki, trzebnicki and wrocławski poviats. The simplest solution applies to Poznań, the smallest of the five largest Polish cities. In this case, the functional area

consists of two counties: of the city of Poznań and the surrounding poviat of Poznań.

Only during last decade (from 2002 till 2014) population of the largest cities (excluding Warsaw and Kraków) reduced (Table 1). In case of Łódź a decline by almost 80,000 (10.1%) was noticed. Łódź, which was an icon of an industrial city, since the beginning of the era of urbanization, is currently the fastest shrinking big city in Poland (Ogrodowczyk, Marcińczak, 2014: 79). In case of Poznań, population decreased by over 30,000 (5.4%). According to the definition of Shrinking Cities International Research Network (SCAN), as a shrinking city were considered those in which “... on the one hand there is a significant loss of population (for at least 5 years, more than 0.15% per year), and on the other hand there is the process of economic transformation with signs of a structural crisis” (Strykiewicz et al., 2014). Both criteria were met in the case of Łódź. Quantitative criterion was met also in the case of Poznań.

In contrast, fringe areas experience different trends – an intensive growth. Definitely the sharpest increase in the population of the surrounding area is observed for Poznań. Just one decade brought an increase of 89,514 (33.23%).

Table 1. Population in the five largest cities: core cities and fringe areas, Poland 2002–2014–2050

City	Population					
	Core city			Fringe Area		
	2002	2014	2050	2002	2014	2050
Warsaw	1,688,194	1,735,442	1,768,418	902,102	1,063,225	1,348,359
Kraków	757,547	761,873	710,464	499,768	556,955	656,641
Łódź	785,134	706,004	484,845	373,243	369,674	371,397
Wrocław	634,487	632,067	577,658	221,909	267,051	357,301
Poznań	577,117	545,680	402,076	269,380	358,894	554,649

Source: Central Statistical Office, Demography Data Base, Local Data Base

Łódź is experiencing a large drop in the number of city core inhabitants, and at the same time a decrease in the number of residents of surrounding areas. In the 2002–2014 decade there was a slight decrease in the number of residents of the Łódź suburbs.

Large population growth in the suburbs of Poznań should be associated with a faster than in other regions adaptation to the new socio-econom-

ic conditions. In the suburbs it is easier than in the city centre to develop entrepreneurship and start a new business. Therefore development of the suburbs could be observed, growing prosperity and an increasing wealth of their residents. Expected further substantial growth of fringe-areas population indicates that most cities will experience the transition from urbanization to suburbanisation.

It should be noted that over time there was a shift in FUR inhabitants: at the start of the century, about two thirds of FUR population lived in the city core, with the proportion varying slightly between cities. The smallest percentage of core city inhabitants was found in Kraków (60.3%) and the largest in Wrocław (74.2%). In the first decade of 21st century, the percentage of core city inhabitants among the general FUR population decreased: in 2014 it was 57.8% for Kraków and 70.4% for Wrocław. The biggest change was recorded in Poznań, from 68.2% to 60.3%.

Referring the presented changes in the number of inhabitants to the phases of the Van den Berg model, one can say that at the beginning of the new century all considered cities are experiencing the process of suburbanization (Jaroszewska, Stryjakiewicz, 2014). However differences in the intensity of observed changes, indicate various stages of the process. In Warsaw and Kraków the number of residents increased in both core city and its surroundings, but bigger intensity was observed in the fringe. Growth in population of the city centres should be associated with the development of the service sector, new jobs resulting from foreign direct investment which, like universities attracts people to these centres. By contrast, Łódź, Wrocław and Poznań were in various stages of suburbanisation phase with decreasing core city population. In Łódź it was a very advanced stage of suburbanisation.

Despite different intensity of changes observed in all analysed agglomerations (including Wrocław), the total number of inhabitants increased, with the exception of Łódź. Other changes could be noticed in Łódź. In the years 2002–2014 there was a considerable decrease in the number of core city inhabitants, and similarly in the fringe areas, though to less extent. It resulted in the overall decrease in the number of residents in the entire agglomeration. So we can conclude that the process of suburbanization was there the most advanced.

Demographic projections of CSO, show that by 2050 Poland will follow significant changes in the population of considered cities and their surroundings. Further decrease in the number of inhabitants of Łódź is expected, by more than 300,000 that is 38.25% of its population in 2002. Poznań population in 2050 will be over 30% (175,041) smaller

than in 2002. In case of Wrocław the projected reduction amounts to 9.6%, which is almost 61,500. And Kraków will be inhabited by 47,083 (6.2%) people less than in 2002. Only Warsaw can expect a further increase in the number of inhabitants, for 80,224 (4.75%) in comparison to 2002.

According to the population projection, in the perspective of 2050 there will be a further and very significant increase in the share of population living in suburban areas. In Poznań, the residents of the suburban zone will constitute vast majority – 58% as an effect of 18.8 pp increase. In Warsaw, Kraków and Łódź the share of inhabitants of the core city and the suburban zone will be roughly the same, with a small majority of the inner city population. Only in Wrocław, residents of the city centre will still constitute about 60%, despite 8.8 pp. increase. This information should send a clear signal to the authorities of the cities and surrounding communes to make further efforts towards a sustainable development policy. All the same, city centres are clearly losing importance, compared to the entire urban area.

3. Results and discussion

3.1. Population ageing

Changes in population age structure are the first information about population aging. Already in the first decade of the twenty-first century, an intense aging of the population living in the largest Polish cities is visible. This is especially clear with a much smaller share of population aged up to 20 years (from 18.8% in Łódź up to 20.9% in Poznań, Table 2) compared to the average for the whole country (26.7%). Note that this applies to the core cities, as the share of children and youth in fringe areas was similar to the average (or even higher in Kraków, Wrocław and Poznań).

In 2014, great intensification of aging was observed in the whole country: the share of the population aged up to 20 years decreased in first decade by more than 6 percentage points. The percentage of the population aged 80 years and more increased from 2.2% to 4.0%. Furthermore, as in 2002, share of population aged up to 20 years is much lower in the largest cities than the country average and in

comparison to fringe areas (by about 5 percentage points in Kraków, Łódź, Poznań and Wrocław and 0.7 pp. in Warsaw – which is the ‘youngest’ city). However, in counties surrounding the largest cities, except Łódź, share of the population under the age

of 20 years is slightly above the national average. In the suburbs of Łódź the percentage of population aged 80 years and older is the same as the average. The youngest in this dimension are the surroundings of Wrocław and Poznań.

Table 2. Population by age in the five largest cities Poland 2002–2014–2050

City/Year	Population by age (%)							
	Core city				Fringe Area			
	0–19	20–69	70 +	80 +	0–19	20–69	70 +	80 +
2002	26.7	64.7	8.5	2.2				
Warsaw	18.5	70.0	11.5	2.9	25.8	65.8	8.4	2.3
Kraków	20.9	69.5	9.6	2.4	28.6	62.6	8.9	2.3
Łódź	18.8	69.4	11.8	2.9	23.6	66.8	9.6	2.5
Wrocław	20.0	69.8	10.2	2.2	27.6	64.1	8.3	2.0
Poznań	20.8	69.7	9.5	2.5	28.2	65.2	6.5	1.8
2014	20.3	69.6	10.1	4.0	–	–	–	–
Warsaw	17.8	69.3	13.0	5.7	22.8	68.2	9.1	3.5
Kraków	17.4	70.6	11.9	4.8	22.8	68.2	9.0	3.6
Łódź	15.9	71.1	13.0	5.5	19.3	70.2	10.4	4.0
Wrocław	16.8	71.3	12.0	5.2	22.1	70.4	7.6	3.2
Poznań	17.3	71.3	11.3	4.7	24.0	69.5	6.5	2.4
2050	16.3	59.5	24.2	10.4	–	–	–	–
Warsaw	17.5	60.0	22.5	9.0	19.3	59.8	20.9	8.2
Kraków	15.7	60.9	23.4	10.0	17.7	61.1	21.2	8.6
Łódź	13.8	58.1	28.1	12.3	16.4	59.3	24.3	10.0
Wrocław	16.8	61.0	22.1	9.0	18.2	61.9	19.8	7.4
Poznań	14.4	60.6	25.0	10.4	20.6	61.1	18.3	6.6

Source: Central Statistical Office, Demography Data Base, Local Data Base

In the perspective of 2050, according to the CSO population projection, a further decrease of the youngest population will take place, up to 16.3% for the whole country, 13.8% for core city of Łódź and 14.4% for Poznań. At the same time, the fringe areas will be characterised by much higher share of population under the age of 20. The ring of Poznań population is going to be the ‘youngest’ with 20.6% compared to the average equal to 16.3%. Even Łódź’ suburbs are expected to achieve slightly higher share of young population.

Ageing may also be presented by indices showing the relations between old and young population or by the median age. Still the fringe areas are younger. An index showing relationship between the elder-

ly and young population (grandparents to grandchildren) is often used in assessing advancement of ageing. Determining the threshold of old age – beyond which a person is considered as ‘elderly’ – is controversial and causes discussion. UN Population Division publishes data on population structure and ageing defining elderly persons as aged 60 years or over, but some statistics are published also for 65 or even 80 years and over. Eurostat provides the old and young age dependency ratios defined as a relation of the population in specified age groups: 0–14, 15–64, 65 and over. Recognizing conventionally 60 years as this threshold, already in 2002, in each of the largest cities, the number of grandparents exceeded the number of grandchildren (by 35%

in Poznań and Kraków and about 73% in Łódź). In 2014 the dominance of the elderly amounted to about 85% in Warsaw, Kraków and Poznań. In Łódź the number of grandparents was twice as big (2.40) as the number of children. The fringe areas population is much younger: in 2002, only the suburbs of Łódź showed the elderly-to-young ratio higher than one, meaning that in rings surrounding the other large cities, population of grandchildren dominated the grandparents. In 2014, in fringe areas surrounding core cities in most of the largest metropolises, the number of grandparents exceeded the number of grandchildren for about 12–15%. Only in the case of Poznań surroundings an opposite situation was noticed. The number grandchildren exceeded the grandparents for 11%.

In the assessment of the aging process the two aforementioned age groups are of particular importance. A small number of children and decreasing fertility results in increasingly lower proportion of children and young people. This effect is known as ageing 'from the bottom of the pyramid'. The result of reduced fertility is compounded by lengthening

of life expectancy and associated greater share of the older age population. This is known as 'aging from the top of the age pyramid', and in analyses of the aging process is referred to as a positive effect, especially if it means longer life in good health. That is why we will shortly discuss both: fertility and life expectancy in large cities, subdividing into inner and fringe areas.

3.1.1. Population ageing: fertility

Fertility in Poland is very low, lower than the replacement level. Poland is a country with one of the lowest fertility rates in Europe. In addition, in all five largest cities in Poland, fertility is lower than the country average (Table 3). It is even lower than in cities with population over 100,000. Although in Poland as a whole, fertility remained stable in the first decade of the 21st century, in large towns it increased a little. The most significant increase, by 0.34, was observed in Warsaw, where in 2014, TFR was the biggest among the largest cities. Relatively big increase of TFR (0.30), was noticed also in Wrocław.

Table 3. Total Fertility Rates, in the five largest cities, Poland 2002–2014

City	TFR Core city			TFR Fringe area		
	2002	2014	2014/2002	2002	2014	2014/2002
Poland	1.250	1.290	1.032	–	–	–
Towns 100,000 +	1.020	1.190	1.167	–	–	–
Warsaw	0.958	1.280	1.336	1.172	1.423	1.214
Kraków	1.006	1.110	1.103	1.396	1.331	0.953
Łódź	0.976	1.158	1.186	1.088	1.288	1.184
Wrocław	0.893	1.161	1.300	1.238	1.310	1.058
Poznań	0.967	1.179	1.219	1.212	1.449	1.196

Source: Central Statistical Office, Demography Data Base, Local Data Base

In fringe areas fertility is higher than in the core cities. Though the increase observed in the period 2002–2013 was smaller than in core cities, the fertility of ring population remains bigger. The youngest, in the meaning of slightly greater fertility are the fringe areas of Poznań with TFR = 1.45, Warsaw (1.42) and Kraków (1.33). Kraków is an interesting city, requiring some attention. In 2002 it was a city of the biggest TFR in both inner and ring

area. The TFR in the fringe area was even bigger than the country average. Still, Kraków might be considered as city of "high" fertility, although its intensity did not change, and in fringe areas even slightly decreased.

The TFR is a measure that is not influenced by the age structure. But migration, known for its selectivity, may affect TFR because of the particular reproductive behaviour of migrating population.

3.1.2. Population ageing: life expectancy

Lengthening of life expectancy is the first symptom of ageing. For decades, Poland was a country of relatively low life expectancy at birth (e_0). But in the last half-century, since 1950, life expectancy in Poland increased by over 16 years for men (from 56.1 to 73.8) and nearly 20 years for women (from 61.7 to 81.6, Table 4). About 40% of the increase observed for men and 30% for women applies to last

20 years (since 1990.). Significant lengthening of life expectancy refers to the population in older age, 60 or more years (e_{60}).

Life expectancy at birth in the largest Polish cities is bigger than the country average, with one exception – Łódź. As noticed earlier, Łódź the city experiencing is not only the most intensive depopulation with no increase of the suburban population, but also the lowest fertility and one of the lowest life expectancies.

Table 4. Life expectancy by sex and age, in the five largest cities, Poland 2002–2014

City	Life expectancy by sex and age							
	Core city				Fringe Area (NTS3)			
	Males		Females		Males		Females	
	e_0	e_{60}	e_0	e_{60}	e_0	e_{60}	e_0	e_{60}
Poland 1950	56.1	14.6	61.7	17.1	–	–	–	–
Poland 1990	66.2	15.3	75.2	20.0	–	–	–	–
Poland 2002	70.4	17.2	78.8	22.2	–	–	–	–
Warsaw	74.7	20.3	81.0	24.0	69.2	16.6	78.0	21.6
Kraków	73.1	18.6	79.8	22.9	71.7	17.9	79.0	22.3
Łódź	68.0	18.3	78.9	21.3	68.4	16.4	78.0	21.5
Wrocław	72.2	18.3	79.5	22.8	71.4	17.5	78.3	22.1
Poznań	72.0	17.8	78.7	22.1	70.5	16.7	78.5	21.8
Poland 2014	73.8	19.2	81.6	24.3	–	–	–	–
Warsaw	76.2	20.6	82.6	24.9	73.7	19.3	81.3	24.2
Kraków	76.8	20.8	82.5	24.8	75.0	19.6	82.1	24.4
Łódź	71.2	18.3	79.8	23.3	71.1	18.2	80.8	24.0
Wrocław	75.0	20.1	81.9	24.6	73.3	18.7	81.8	24.1
Poznań	75.1	19.8	81.4	23.8	74.4	19.0	80.6	23.3

Note: Due to lack of data on life expectancy for communes the fringe areas are considered here as subregions – NTS 3

Source: Central Statistical Office, Demography Data Base, Local Data Base

As far as the remaining four cities are concerned, in 2002, the expectancy at birth was significantly higher than the country average, for both men and women. The longest life was expected for a new-born child in Warsaw: 74.7 years for a boy and 81.0 years for a girl, compared with 70.4 and 78.8 respectively for the whole country. The difference of more than 4 years for boys is really meaningful. In the fringe areas, life expectancy is lower than in the core cities (except for Łódź). But in this case, due to lack of data on life expectancy for communes, this information must be interpreted with

great caution, because fringe areas are considered here as subregions – NTS 3.

Ten years later, in 2014 there has been a significant increase in life expectancy. In Poland e_0 increased more than 3 years for men and for almost 3 years for women. In the subregions surrounding the largest cities, this increase was even bigger: in Warsaw 4.5 years and Poznań 3.9 years, as for men and 3.5 years in Wrocław or 3.3 in Warsaw, as for women. An intensive improvement in quality of life in the regions results in equalizing the level of life expectancy in core cities and their surroundings.

Alignment in life expectancy between residents of inner cities and suburbs is even more clearly visible for the older population, aged 60 years and more (e_{60}). This is especially visible in the case of Warsaw, where in 2002 the difference in e_{60} for inhabitants of core city and the ring amounted to 3.7 years for men and 2.4 for women. After ten years, this difference was reduced to 1.3 for men and 0.7 for women. One can speak of assimilation of living conditions in the core city and its nearest surroundings. In the case of other cities these changes varied by gender, so that the convergence process may not be defined with certainty.

3.2. Social change

3.2.1. Social change: education

Extending the life expectancy is usually viewed as a positive dimension of aging. However, aging from the bottom of the population pyramid, visible in decreasing number of children and adolescents, is generally perceived as a negative dimension of aging. Less numerous generations are not able to supply labour at the current level, which causes complications for the smooth operation of the pension system. Leaving aside, for the moment, the economic aspect of decreasing number of children and young people, we shall note the changes in the educational needs and education that shape the quality of the potential labour force in the future. The effect of increase in the level of education may translate into greater productivity and efficiency. Lutz et al. (2008:6) point that many of the countries that have seen rapid fertility declines during the 1960s and 1970s have subsequently experienced significant economic growth – a phenomenon that economists have labelled “demographic dividend”.

Presenting population forecast by education level for Central and Eastern European countries, Lutz et al. (2008: 12) formulate a theory that education is a primary differentiating factor shaping demographic processes. Typically, a higher level of education is associated with increased life expectancy and lower fertility. In Poland an incredible increase in education attainment was observed during last decades. In 1991 there were 403,824 students and 56,078 university graduates. According to CSO (2012) there were 1,841,251 students and 497,533 graduates in

2011. That means a 456% increase in the number of students and 887% of graduates.

The average share of population with University education, according to the 2002 population census, was to 9.9%, while in 2011 it grew to 17%. In 2002, in all the largest Polish cities, the percentage of population with university education exceeded the country average. In Warsaw it was more than twice as high, in other cities it amounted to over 17%, and the lowest percentage was observed in Lodz (12.77%). But in 2002, the percentage of people with university education in fringe areas of the largest cities was much lower, and only in Warsaw it aligned with the country mean. The highest share of people with university education was noticed for the age group 30–39 years.

Ten years later, substantial changes were noticed. Not only has the national average increased (for over 70%, and yet higher education is still much more common in large cities), but the percentage of population with university education in fringe areas has also increased, significantly reducing the distance. Moreover, an increase in the share of population with higher education in the ring was far more intense than in the core city. The most impressive was the growth of population with university education noticed in Wrocław fringe areas – it increased by about 167% (5.28% in 2002 compared to 14.1% in 2011, Fig. 2) and the ‘least’ impressive in the ring of Warsaw – by over 90% (9.95% in 2002 compared to 18.98% in 2011). Meanwhile, the increase noted in the core cities was 80% on average. Taking into consideration only the age group in which university-level education is most common (30–34 years), an increase of 210% can be observed for Wrocław ring.

In the case of primary education, reduction in the number of children ‘contributed’ to the improvement of teaching conditions. On the basis of available statistical data, it is difficult to assess the quality of the teaching process, so we quote here only an indicator of ‘quality of education services’, defined as the ratio of pupils to classes (Table 5). We are aware of its imperfections and treat it with great care. Adoption of another index presenting the ratio of the number of pupils per teacher could also be questionable, because of the difficulty in skills assessment or labour market problems. Evaluation of all these issues in a macro scale is much easier because of greater variety of available data.

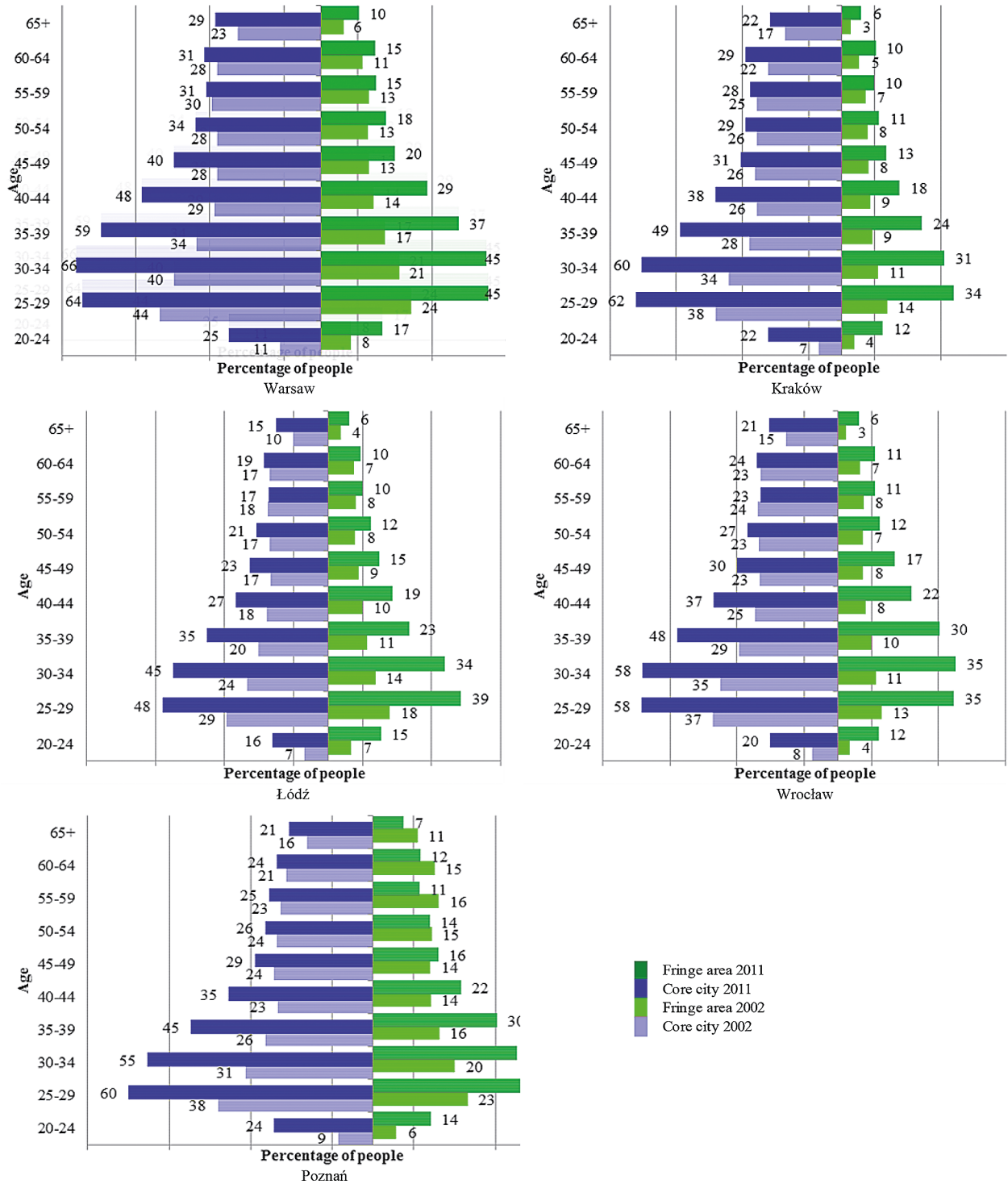


Fig. 2. Population with university education by age, in the five largest cities (core cities and fringe areas), Poland 2002, 2011

Source: CSO Demography Data base <http://demografia.stat.gov.pl/bazademografia/> and Local Data Base, <http://stat.gov.pl/bdl/>

Table 5. Number of primary school pupils per school room, in the five largest cities, Poland 2002–2012

City	Number of primary school pupils per school room			
	Core city		Fringe area	
	2002	2012	2002	2012
Warsaw	19.0	14.9	20.9	15.8
Kraków	19.8	14.3	16.7	11.7
Łódź	20.1	13.7	20.6	14.1
Wrocław	21.0	13.6	15.9	12.6
Poznań	19.2	13.9	20.0	15.7

Source: Central Statistical Office, Demography Data Base, Local Data Base

The same direction of changes observed as the indicator of quality of education services, can be explained by general ‘improvement’ of the situation caused by the decreasing number of children. In addition, in surroundings of large cities, aspirations of local authorities and desires of parents lead up to improvement of teaching conditions, maintenance of existing schools, and even building of new ones, providing adequate equipment for schools, creating classes with a small number of pupils and employing appropriate personnel.

It is worth noting that the observed increase in education attainment (in the first decade of 21st century) will result in higher education and better skills of the future cohorts. As a result, in 2050, working age population will be generally better qualified. In addition, the currently observed trend in growth of women’s education and their professional activity, will also translate to education, and ultimately correlate with an increase in labour productivity. Changes in education and the resulting increase in labour productivity can potentially offset shrinkage of these cohorts for the labour market.

3.2.2. Health and social care

Changes in the population age structure, in particular progressive aging, directly translate to specific social needs. Primarily, the extension of life expectancy means a necessity to secure needs related to health and social care. These needs are not only difficult to define, but also to measure. Only for purposes of comparing living conditions in city centres and suburbs, two indicators are discussed: the number of people aged 65 years and older per 1 hospital bed, and per place in a stationary social assistance centre (Table 6). It should be emphasized that we treat them as symptoms of social needs in health and social care resulting from aging of the population.

Table 6. Health and social care in the five largest cities, Poland 2002–2014

City	Population aged 65+ per a hospital bed				Population aged 65+ per place in stationary social assistance centres			
	Core city		Fringe area		Core city		Fringe area	
	2002	2014	2002	2014	2002	2014	2002	2014
Warsaw	26.2	26.1	36.4	41.3	110.2	87.1	40.8	34.2
Kraków	18.1	21.5	72.5	81.5	49.1	47.0	49.6	55.9
Łódź	20.4	23.0	24.9	45.8	50.5	51.2	39.8	49.5
Wrocław	17.7	21.4	36.8	56.7	98.5	68.5	102.5	58.9
Poznań	14.4	15.7	40.1	123.2	70.7	62.7	187.5	140.8

Source: Central Statistical Office, Demography Data Base, Local Data Base

Number of people aged 65 and more per a hospital bed is much lower in core cities than in the surrounding regions. In large cities more hospitals are located in the inner city, and they ‘support’ the surrounding areas, and in case of specialization ad-

mit patients from further surroundings. With the exception of Warsaw, population aging observed during the last decade worsened indicators related to health care. In Łódź this indicator almost doubled and in Poznań ring it tripled. This implies an

urgent need to invest in health institutions such as hospitals, sanatoriums, nursing homes, or rehabilitation care centres.

As concerns social assistance for the elderly, the situation has improved, but it varies greatly in different cities, which can be explained as the effect of local policies, different strategies and priorities.

4. Conclusions: city development strategy

The analysis of demographic changes in large cities and their surroundings indicates shrinking of city centres and growing suburbanization. This leads to demographic changes in age structure and levelling of living conditions in the core city and its rings. These changes mean that a common plan of development for the city and neighbouring municipalities has to be developed (Kuroпка, Pisz, 2012). It

should take into account both the need to ‘revitalize’ the centre, especially in the case of Lodz and Poznan, but also the needs of residents who want to improve their standard of living, particularly housing conditions. The most important matter, however, is to secure needs stemming from population aging. An example of such an endeavour may be adapting disused schools in core cities to leisure centres for the elderly. Concluding the results obtained in the analysis above, it would be crucial to see how important the consequences of the demographic change are for the local authorities. That is why we checked the records of the city development strategies. Documents for each of the cities are open to public opinion. We wanted to see what problems of demographic change were included in the documents and what solutions were proposed. Another significant finding was to determine the importance that the mayors attribute to the demographic challenges. Comparison of the objectives of city strategies is presented in Table 7.

Table 7. Demographic problems in city development strategies of the five largest cities

City development strategy document	Objectives in city development strategies
Warsaw: “Warszawa 2020”	Strategic objective: <ul style="list-style-type: none"> ▪ Improving quality of life and safety of Warsaw citizens Operational objective: <ul style="list-style-type: none"> ▪ Raising the level and availability of public services, including education, culture, recreation and sports, health care and social assistance
Kraków: “Strategia rozwoju Krakowa”	Strategic objective: <ul style="list-style-type: none"> ▪ Cracow – family friendly city, attractive place to live and stay Operational objective: <ul style="list-style-type: none"> ▪ Broadening the scope of education, provision of health security, protection of status and living conditions of the family
Łódź: “Strategia zintegrowanego rozwoju Łodzi 2020+”	One of the most important challenges: <ul style="list-style-type: none"> ▪ Improving the quality of life of residents through housing, spatial, educational and health policy ▪ Reversal of unfavourable demographic trends (not specified) Due to demographic changes: <ul style="list-style-type: none"> ▪ Urban policy should be revised towards increasing coherence of urban areas, ▪ Take advantage of the demographic decrease to raise the standards of schools, ▪ Stop the exodus of the young and active outside the city ▪ Wrocław attractive for young people
Wrocław: “Wrocław 2020 plus”	One of the most important challenges: <ul style="list-style-type: none"> ▪ Stop decline of the population of Poznan – To be achieved through an active housing and quality of life policy Strategic objective: <ul style="list-style-type: none"> ▪ Improving the quality of life and attractiveness of the space and the architecture of the city
Poznań: “Strategia rozwoju miasta Poznania do roku 2030”	Strategic objective: <ul style="list-style-type: none"> ▪ Improving the quality of life and attractiveness of the space and the architecture of the city

Source: Official Websites of City Authorities: Strategies for urban development

The ageing processes and shrinking populations pose new challenges for local authorities. Ways of tackling the demographic problems in city strategies are very diverse. Directly, these issues are listed in the strategy for Wrocław. Indirectly, but also as the most important challenges, demographic problems are listed in strategies of Poznań and Łódź.

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