



**Tomasz Klimanek**

 <https://orcid.org/0000-0001-6411-8145>

Centre for Urban Statistics  
Statistical Office, Poznań, Poland  
t.klimanek@stat.gov.pl

**Sylvia Filas-Przybył**

Centre for Urban Statistics  
Statistical Office, Poznań, Poland  
s.filas@stat.gov.pl

## **The statistical picture of population aging in towns of Wielkopolskie Province: TERYT and DEGURBA perspectives**

Accepted by Editor Ewa Ziemba | Received: January 12, 2019 | Revised: September 30, 2019;  
October 23, 2019; November 25, 2019 | Accepted: November 27, 2019.

### **Abstract**

**Aim/purpose** – The aim of the paper is to compare the statistical picture of aging of the urban population of the Wielkopolskie Province in terms of two typologies: TERYT and DEGURBA.

**Design/methodology/approach** – Selected demographic aging measures for years 2010 and 2016 were calculated for 112 towns according to TERYT typology and for 53 urban areas according to DEGURBA classification. The demographic aging measures were the following: median age, parent support ratio, aging index, elderly dependency ratio, proportion of population aged 65 and over and total dependency ratio.

**Findings** – TERYT classification using the formal and legal status of the city gives a slightly different picture in relation to urban areas defined based on the DEGURBA classification. The results obtained showed that the population aging process was slightly less intense in urban areas in 2016 according to the DEGURBA typology, compared with the indicators for the city group separated on the basis of the TERYT register identifier.

**Research implications/limitations** – The results obtained are promising. The implications of the approach presented are at least twofold. At the methodological level, the paper presents an alternative possibility of distinguishing urban areas based on the DEGURBA classification in relation to the TERYT classification. However, in the cognitive layer, it shows differences in the aging of urban areas distinguished on the basis of these two classifications. These implications are limited only to the so-called traditional demographic aging measures and to urban population in the Wielkopolskie Province. To overcome these limitations further analysis should include, first of all, extending the research to the whole country.

Cite as: Klimanek, T., & Filas-Przybył, S. (2020). The statistical picture of population aging in towns of Wielkopolskie Province – TERYT and DEGURBA perspectives. *Journal of Economics & Management*, 39(1), 41-61. <https://doi.org/10.22367/jem.2020.39.03>

**Originality/value/contribution** – This paper is one of the first publications in Poland which looks at the urban aging problem from two perspectives DEGURBA and TERYT. This approach in regional analysis should be applied more often to avoid possible distortions caused by using only TERYT classification.

**Keywords:** TERYT register, DEGURBA classification, urban statistics, urban aging.

**JEL Classification:** J11, J14, O18, R11.

## 1. Introduction

Official statistics is currently facing a number of challenges, some of which are to do with the creation of a comprehensive system of information about cities and towns that could meet the needs of various users. Some of these challenges include the best possible exploitation of administrative registers and the use of smart data as alternative<sup>1</sup> sources of data, a more flexible perception of the city as an important spatial element and the use of modern methods and tools of analysis.

As a part of the specialisation strategy, implemented in Polish official statistics at the start of 2009, the existing unit dealing with urban statistics in the Statistical Office in Poznań which became the Centre for Urban Statistics. The main idea of the specialisation strategy was to make each regional office responsible for conducting tasks for the whole country within specific fields. In other words, the regional offices were no longer limited to collecting data from a single province. Since its creation, the tasks of the Centre for Urban Statistics have focused on initiating surveys and formulating new methodological proposals for the statistical observation of cities and towns as well as conducting methodological studies aimed at delimiting and surveying areas that do not overlap with the country's administrative division.

The following paper addresses the challenges associated with the use of a more flexible approach to the perception of the city as an important spatial element in relation to the one based on the administrative division consisting of TERYT units (Szymytkie, 2018). The purpose of the paper is to compare the statistical picture of the aging process of the urban population of the Wielkopolskie Province using two typologies. One of them is based on the definition of a town in the Act of 29 August 2003 on official names of localities and physiographic objects (cf. Ustawa z dnia 29 sierpnia 2003 r. o urzędowych nazwach

---

<sup>1</sup> In relations to traditional ways of collecting information by survey takers conducting computer assisted personal interviews (CAPI) or computer aided telephone interviews (CATI).

miejscowości i obiektów fizjograficznych, Article 2, Item 3). The second typology used in this study is the European classification of administrative units based on the degree of urbanisation – DEGURBA (Dijkstra & Poelman, 2014). The statistical picture of the aging process of the urban population of the Wielkopolskie Province has been created on the basis of six demographic measures of population aging: median age, parent support ratio, aging index, elderly dependency ratio, proportion of population aged 65 and over (% of total), total dependency ratio. The selection of these demographic measures was motivated by previous studies on this topic (GUS, 2015). In order to track changes over time, the data for 2016 are compared with those for 2010, which, in both cases, come from the Local Data Bank maintained by Statistics Poland.

Research motivations are at least threefold. The first of these results from the experience of cooperation on many national and international projects in which an attempt was made to relax the rigid treatment of the city only within its administrative boundaries, but a wider impact of a city was also considered, e.g. under the concept of the so-called larger urban zones (LUZ). The second motivation is related to taking up research problems related to the statistical activity of the Centre for Urban Statistics, and such undoubtedly includes the aging of the population which affects cities more than rural areas. Finally, there is also motivation related to the research interests of one of the authors, whose works devoted to comparing the TERYT and DEGURBA typology are one of the first in Poland.

The paper consists of six parts. After the introductory part, to show a wider perspective, in the section on the literature review, the key challenges facing official statistics in the context of urban analyses were presented including the use of administrative registers, alternative space divisions and the use of the kilometre grid concept. The third part presents the assumptions of the TERYT and DEGURBA classifications and the selected measures of demographic aging used in this paper were introduced and briefly characterised. The last three parts of the paper contain results of the research, discussion and conclusions made based on the research, respectively.

## **2. Literature review**

As regards the challenges associated with the use of administrative registers, the contribution of the Centre for Urban Statistics consists above all in the study of work-related commuting (Filas-Przybył, Kowalewski, & Stachowiak, 2016; GUS, 2014; Kruska, 2010; Śleszyński, 2012) and the study of students

commuting to schools (GUS, 2018b). In the first study, the directions and intensity of work-related commuting flows were determined based on register data from the Ministry of Finance, the Social Insurance Institution and Farmers' Social Security Fund. In the case of students commuting to schools located in provincial capital cities, the size of commuting flows and spatial connections were established on the basis of data from the Educational Information System maintained by the Ministry of National Education. As regards the use of smart data as data source information for urban statistics in Poland, it is still too early to talk about its implementation in the system of regular statistical production, though various research projects are being conducted that focus on accessibility of transport systems (Piekarski, 2017), or, more broadly, spatial/territorial accessibility (Burdziej, 2016; GUS, 2018c).

Another field of research, which is becoming increasingly important, is the delimitation and statistical study of areas that do not overlap with an administrative division of the country. It is one of the problems that call for a more flexible approach to the perception of the city as an important spatial element, especially now that the shortcomings of spatial analyses based solely on units of administrative division (TERYT system) or statistical division (NUTS classification) can no longer be ignored.

In this context, the grid concept (a network of grid squares, with a certain spatial resolution, e.g. 500x500 m, or 1x1 km) is especially relevant, making it possible to depart from the fixed administrative division and analyse phenomena both within urban structures (Dąbrowski, Filas-Przybył, & Pawlikowski, 2016; Filas-Przybył, Klimanek, Kruszka, & Stachowiak, 2016) and across administrative city borders – e.g. urban functional zones. For example, the 1x1 km grid network serves as the basis for the European classification of administrative units, which is used to determine the degree of urbanisation – DEGURBA (Dijkstra & Poelman, 2014).

The European classification, based on the degree of urbanisation, was first implemented in 1991 in order to characterise areas inhabited by respondents of official statistical surveys. That original DEGURBA typology distinguished between three kinds of areas: densely populated, intermediate and thinly populated (Eurostat, 2011). Their definition was based on population size, population density and geographical contiguity of LAU2 units. However, even at that time it became obvious that the approach based on LAU2 units, whose area varied considerably across UE countries, leads to distorted results and limits the scope of comparative analyses between EU countries.

In 2010, Eurostat introduced a new regional typology which originated from a method developed by OECD (Brezzi, Dijkstra, & Ruiz, 2011). The method was based on grid square cells of 1 km<sup>2</sup> which in combination with the results of another Urban Audit provided an opportunity to revise the definition, borders and number of cities according to the idea of a densely populated area used in the degree of urbanisation classification. This work resulted in the creation of a new methodology for classifying spatial units developed by DG AGRI (Directorate-General for Agriculture and Rural Development), DG REGIO (The Directorate-General for Regional and Urban Policy) in cooperation with Eurostat and Joint Research Centre (JRC), the European Commission's science and knowledge service.

Growing demands placed by users of statistical information on official statistics not only call for more advanced analytical software, but also require the application of the latest methods of analysis, including techniques of spatial statistics and econometrics, and products that meet user needs.

Two elements are worth mentioning in this context. One of them is the way statistical outputs are made available to the public, which is an innovative solution in official statistics, namely in the form of a matrix of flows, which has been used to present the results of the work-related commuting study (GUS, 2014; Kruska, 2010; Śleszyński, 2012), and the study of commuting to schools (GUS, 2018b). This form of presentation should help users employ advanced analytical methods, e.g. those based on matrix or graph theory. The second element worth emphasising is the use of relatively modern methods of spatial econometrics in urban studies, including the method of local indicators of spatial association (LISA) based on Local Moran's I statistic (GUS, 2015) or gravity models (Filas-Przybył, Klimanek, & Kowalewski, 2012). One important economic factor that cannot be ignored in this kind of studies is the growing popularity of open source software in official statistics.

Many European countries, including Poland, are facing with a serious demographic challenge in the form of population aging which is commonly defined as the increasing percentage of elderly people accompanied by a declining percentage of children. Towns are particularly affected by the growing intensity of this process. Unfavourable demographic trends, associated with low natural increase, contribute to the growing share of elderly people in society. Population aging is bound to affect many spheres of life, such as the labour market, health care, social care and institutional assistance, but also trade and services, as elderly people will become a growing group of consumers.

The problem of population aging in Poland, its regional variation (Kurek, 2008; Stańczak & Szałtys, 2016), and the way it affects Polish towns (GUS, 2018a) is becoming increasingly relevant in public awareness and discourse. The advancement in population aging is measured by means of various indicators: either traditional ones based on the threshold of population aging and relations between basic age groups or less common, alternative measures which take into account changing mortality rates and life expectancy (Abramowska-Kmon, 2011). It should be noted, however, that the traditional typology of towns according to the TERYT register makes it more difficult to conduct an in-depth and multidimensional analysis and evaluation of socio-economic phenomena that take place in space, especially in the era of urban sprawl.

### 3. Research methodology

Official statistics for cross-classification domains at different levels of territorial aggregation are calculated and presented on the basis of the TERYT register. The TERYT system consists of four components: TERC – identifiers and names of territorial units, SIMC – identifiers and names of localities, BREC – statistical regions and enumeration areas, and NOBC – address details of streets, properties, buildings and dwellings. The TERC system contains identifiers and names of units that constitute the three-tier territorial division of the country: province, district, commune (municipality). The system can be used to distinguish other levels of spatial aggregation, such as towns with district status, urban communes, rural communes, towns and rural areas in urban-rural communes, as well as districts of the capital city of Warszawa and four other major cities: Kraków, Łódź, Poznań and Wrocław. These additional divisions are created on the basis of identifiers (codes) of basic territorial units, i.e. communes. The territorial code of every commune consists of seven digits. The first two denote the province where the commune is located, the first four denote the district, while the last digit represents the commune type (Table 1).

**Table 1.** Codes and commune types in the TERYT system

Commune type (last digit of the 7-digit territorial code)	Description
1	Urban commune
2	Rural commune
3	Urban-rural commune
4	Town in an urban-rural commune
5	Rural area in an urban-rural commune

Source: Central Statistical Office (2019).

In official statistics the town/city is defined as a unit of territorial division which has been granted town status by a municipal charter (cf. Ustawa z dnia 29 sierpnia 2003 r. o urzędowych nazwach miejscowości i obiektów fizjograficznych, Article 2, Item 3). According to the regulation, this includes urban communes and towns in urban-rural communes. Analogically, rural communes and rural parts of urban-rural communes are classified as villages. However, spatial analyses based solely on the legal/administrative classification of territorial units in the TERYT register often results in a distorted picture of phenomena and processes taking place inside administrative units or between neighbouring units. What is needed, then is an analytical approach based on the concept of 1x1 km grid and DEGURBA classification.

The new typology of areas (Dijkstra & Poelman, 2014) based on their degree of urbanisation introduces the following classification of LAU<sup>2</sup> statistical units (the brackets on the left contain DEGURBA codes):

(1) densely-populated area: (alternative name: city/large urban area):

- at least 50% lives in high-density clusters

(2) intermediate area (alternative name: towns and suburbs/small urban area):

- less than 50% of the population lives in rural grid cells; and
- less than 50% lives in high-density clusters.

(3) thinly populated area (alternative name: rural area):

- more than 50% of the population lives in rural grid cells.

In the above, the following definitions are used:

- rural grid cells: grid cells outside urban clusters.
- urban clusters: clusters of contiguous grid cells of 1 km<sup>2</sup> with a density of at least 300 inhabitants per km<sup>2</sup> and a minimum population of 5,000;
- high-density cluster: contiguous grid cells of 1 km<sup>2</sup> with a density of at least 1,500 inhabitants per km<sup>2</sup> and a minimum population of 50,000 (alternative names: urban centre or city centre).

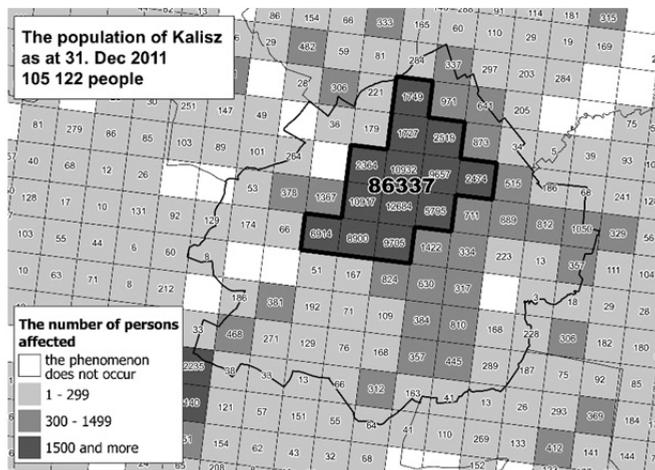
Details of the methodology of establishing the DEGURBA typology can be found in the these publications (Dijkstra & Poelman, 2014; Eurostat, 2011); below we present two examples for illustrative purposes: the town of Kalisz and the rural commune of Komorniki which are classified as a densely-populated area (DEGURBA Code 1) and an intermediate area (DEGURBA Code 2) respectively (Figure 1 and Figure 2).

---

<sup>2</sup> To meet the demand for statistical information at the local level, Eurostat has established the system of local administrative units (LAUs). Until 2016, there were two levels: LAU1 (in the case of Poland, this level corresponded to districts, Pol. *powiat*) and LAU2 (in Poland – communes or municipalities, Pol. *gmina*). Since 2017, there has been only one level of local administrative units, which, in the case of Poland, corresponds to communes (cf. Local administrative units (LAU), 2018).

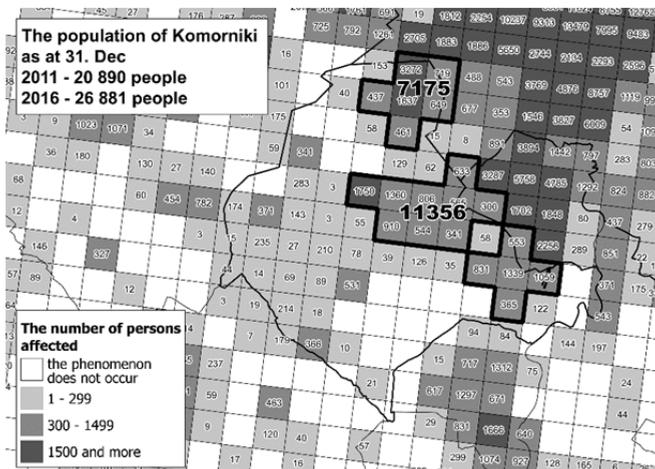
According to the definition of a high-density cluster, i.e. groups of contiguous grid cells of 1 km<sup>2</sup> with a density of at least 1,500 inhabitants per km<sup>2</sup> and a minimum population of 50,000. Figure 1 shows (marked in dark grey) a group of such cells in which the population ranges from 1,727 to 12,684. The combined population of the entire cluster of grid cells in this case is equal to 86,337 persons, which accounted for about 82% of the population of the entire town of Kalisz. This in turn means that this LAU unit should be classified as Code 1, i.e. a densely populated area.

**Figure 1.** A densely-populated area – the town of Kalisz (example)



Source: Prepared in the Centre for Urban Statistics, Statistical Office in Poznań.

**Figure 2.** Intermediate area – the rural commune of Komorniki (example)



Source: Prepared in the Centre for Urban Statistics, Statistical Office in Poznań.

Figure 2 shows two urban clusters with a population over 5,000, namely 7,175 and 11,356 people. These clusters are also characterised by a population density of over 300 persons per 1 km<sup>2</sup>. The inhabitants of this area represent over 50% of the total population of the commune, which means that, according to the DEGURBA typology, this LAU should be assigned Code 2 and classified as an intermediate area.

When discussing the new DEGURBA classification, one should mention two main benefits of this approach: it facilitates international comparisons and harmonises four spatial approaches to the delimitation of urban-rural areas. The first advantage of the DEGURBA typology is often illustrated by referring to the cases of Uppsala (Sweden), Aalborga (Denmark) and Badajoz (Spain) which were classified as thinly populated areas according to the original 1991 DEGURBA approach despite the fact that their populations considerably exceeded 100,000 people. This resulted from the fact that these LAU2 units differed greatly in terms of area. The new classification, where the criterion of population density is applied to areas of the same size (grid square cells of 1 km<sup>2</sup>), improves comparability and minimises the risk of distorting the degree of urbanisation for comparable LAUs.

Before the revised DEGURBA classification was introduced in 2010, there were four similar approaches to distinguishing between urban and rural areas:

- the concept of rural areas (according to the OECD definition),
- the concept of thinly populated areas (according to the original DEGURBA classification),
- the concept of densely populated areas (according to the original DEGURBA classification),
- the concept of the city (according to the definition adopted in the Urban Audit project).

The relationships between the four concepts are shown in Table 2.

**Table 2.** Four competing spatial approaches to territorial division

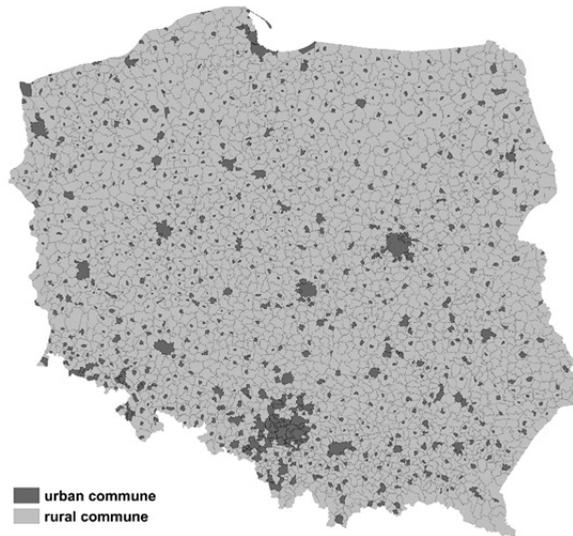
Urban-rural typology		Degree of urbanisation		Urban Audit	
Rural LAU2	≠	Thinly populated			
		Intermediate density			
		Densely populated		≠	Cities

Source: Eurostat (2011).

The methodology of the new DEGURBA classification has established definitional equivalence between the concepts of rural and thinly populated areas. This also means the application of the same approach to the delimitation of rural areas (the share of population inhabiting grid square cells with rural characteristics). Similarly, densely populated areas are now equivalent with cities as defined by Urban Audit (Eurostat, 2011).

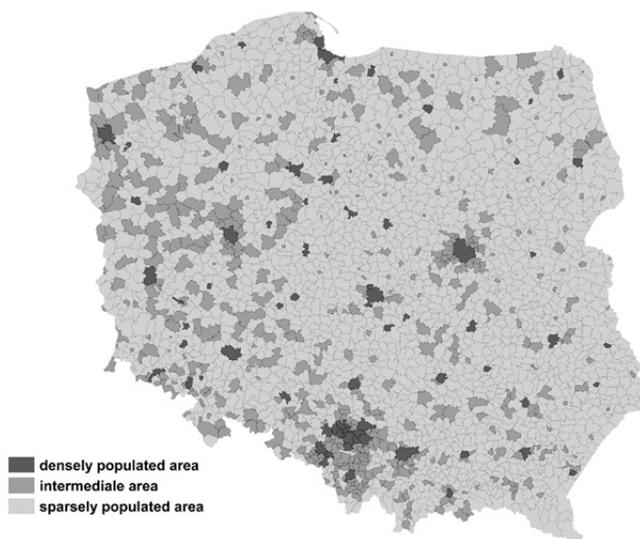
Obviously this requires an appropriate statistical and IT infrastructure to ensure the regular updating of information for the delimitation of densely-populated, intermediate and thinly populated areas. It was assumed that information about changes in LAU borders would be updated annually (Eurostat, 2011). A more challenging problem is how to update the spatial distribution of the population. Censuses, which are the main source of data required for the DEGURBA classification, are conducted every 5 or 10 years. The choropleth maps above show the classification of LAUs (communes) according to the TERYT register and the DEGURBA typology (Figure 3 and Figure 4).

**Figure 3.** Classification of LAUs (communes) according to the TERYT register



Source: Prepared in the Centre for Urban Statistics, Statistical Office in Poznań.

**Figure 4.** Classification of LAUs (communes) according to the DEGURBA typology (based on Census 2011)



Source: Prepared in the Centre for Urban Statistics, Statistical Office in Poznań.

A simple comparison of the number of towns according to the definition used in the TERYT register and the number of areas classified as urban according to the DEGURBA typology (densely populated and intermediate areas, codes 1 and 2, respectively) indicates significant discrepancies. There are 930 towns in the TERYT register, compared to only 601 urban units according to the DEGURBA typology. A more detailed comparison of the two classifications was conducted by Filas-Przybył (2012), who analysed such characteristics as province area per one town/urban area, area of towns/urban areas per one town/urban area, urban population per one town/urban area, the share of urban population in the total population of the province. Filas-Przybył (2012) found that the largest number of towns according to the TERYT classification can be found in the Wielkopolskie Province (109); according to the DEGURBA typology, the Śląskie Province is the most urbanised region of the country (92 urban units). The biggest urban density was found to exist in the Śląskie Province, where the proportional share of the province area per one town was equal to 173.7 km<sup>2</sup> (TERYT) and 134.1 km<sup>2</sup> (DEGURBA). It turned out that regardless of the classification used, the Śląskie Province was also the most urbanised province. This was reflected by the size of an average town both in terms of area and population, which was almost twice as big as the average town size in Poland

(TERYT). However, according to the DEGURBA typology, the largest average town in terms of size was found in the Wielkopolskie Province, while in terms of population – in the Zachodniopomorskie Province. Regardless of the classification, the smallest average town in terms of area was found in the Warmińsko-Mazurskie Province, which according to the DEGURBA typology, was a third of the average town in Poland.

In this study, the statistical picture of population aging in the Wielkopolskie Province according to TERYT and DEGURBA typologies was compared on the basis of median age and the following demographic measures characterising intergenerational relations:

#### 1. Parent support ratio

$$PSR = \frac{L_{85+}}{L_{50-64}} * C \quad (1)$$

where:

*PSR* – parent support ratio,

*L*<sub>85+</sub> – number of people aged 85 and over,

*L*<sub>50-64</sub> – number of people aged 50-64,

*C* – constant (=100).

PSR is a ratio between the population aged 85 or more and those aged 50-64, which represents the ‘theoretical’ generation of their children. In the case of countries such as Poland, where social assistance and health care available to elderly people are rather basic, what matters is the number of people aged 50-64 who will take care of their ‘parents.’

#### 2. Aging index

$$AI = \frac{L_{65+}}{L_{0-14}} * C \quad (2)$$

where:

*AI* – aging index,

*L*<sub>65+</sub> – number of people aged 65 and over,

*L*<sub>0-14</sub> – number of people aged 0-14,

*C* – constant (=100).

AI is a basic measure of population aging, which represents the ratio of number of people aged 65 or and the youngest age group (0-14 years). By 2045 AI is predicted to exceed 100 in all European countries, meaning the elderly population will outnumber the youngest one (Kurek, 2008).

## 3. Elderly dependency ratio

$$EDR = \frac{L_{65+}}{L_{15-64}} * C \quad (3)$$

where:

*EDR* – elderly dependency ratio,

$L_{65+}$  – number of people aged 65 and over,

$L_{15-64}$  – number of people aged 15-64,

*C* – constant (=100).

This measure represents the relations between the number of people aged 65 or more and the subpopulation aged 15-64.

## 4. Proportion of elderly people

$$PEP = \frac{L_{65+}}{L} * C \quad (4)$$

where:

*PEP* – proportion of elderly people,

$L_{65+}$  – number of people aged 65 and over,

*L* – total population.

*C* – constant (=100).

PEP describes the share of people aged 65 and over in the total population. According to the UN data (Abramowska-Kmon, 2011), a population is considered young when the share of people aged 65 and over is below 4%. A population is classified as mature when this share ranges from 4% to 7%, and is regarded as old, when it exceeds 7%<sup>3</sup>.

## 5. Total dependency ratio

$$TDR = \frac{L_{0-14} + L_{65+}}{L_{15-64}} * C \quad (5)$$

where:

*TDR* – total dependency ratio; the ratio of people aged 0-14 and 65 and over to the subpopulation aged 15-64. This measure is a sum of the youth dependency ratio and elderly dependency ratio,

$L_{0-14}$  – number of people aged 0-14,

$L_{65+}$  – number of people aged 65 and over,

$L_{15-64}$  – number of people aged 15-64,

*C* – constant (=100).

<sup>3</sup> However, as Abramowska-Kmon (2011) notices, the UN scale seems to have now only historical meaning.

The impact of the typology used (TERYT vs. DEGURBA) on the statistical picture of population aging in the towns of the Wielkopolskie Province was evaluated taking into account the following assumptions:

- as regards the TERYT classification, the analysis included urban communes and towns in urban-rural communes located in the Wielkopolskie Province (TERYT code = 1 or 4);
- as regards the DEGURBA classification, the analysis included urban areas (communes) characterised as densely populated or intermediate areas (DEGURBA code = 1 or 2);
- the selected territorial units (towns according to TERYT, urban areas according to DEGURBA) were characterised in terms of median age and selected measures of population aging (parent support ratio, aging index, elderly dependency ratio, proportion of elderly people, total dependency ratio);
- analysis was based on official statistics from the Local Data Bank maintained by Statistics Poland;
- the analysis of population aging was conducted for 2010 and 2016;
- the same DEGURBA typology was used for both reference years based on population counts established in the last census (NSP 2011) and LAUs updated in 2016.

#### 4. Research findings

According to the TERYT classification, there were 112 towns out of a total of 226 communes, 19 of which were urban communes, while 93 were towns located in urban-rural communes (Table 3).

**Table 3.** Classification of communes in Wielkopolskie Province according to TERYT and DEGURBA in 2016

Degree of urbanisation	Urban commune	Rural commune	Urban-rural commune	Total
Densely populated area	7	0	0	7
Intermediate area	10	4	32	46
Thinly populated area	2	110	61	173
Total	19	114	93	226

Only 7 urban communes of the Wielkopolskie Province can be classified as densely populated areas according to the DEGURBA typology: Gniezno, Kalisz, Konin, Leszno, Ostrów Wielkopolski, Piła and Poznań. The majority of urban communes (10) can be classified as intermediate areas: Chodzież, Czarnków, Koło, Kościan, Luboń, Puszczykowo, Słupca, Turek, Wągrowiec, Złotów. Only two urban communes have been classified as thinly populated: Obrzycko and Sulmierzyce. Interestingly, the group of urban areas according to the DEGURBA classification also includes 4 rural communes (Czerwonak, Komorniki, Rokietnica and Suchy Las) and 32 urban-rural communes.

**Table 4.** Comparison of population aging measures in towns and urban areas for 2010 and 2016

Demographic measure	Year			
	2010		2016	
	urban areas (DEGURBA)	towns (TERYT)	urban areas (DEGURBA)	towns (TERYT)
Median age	37.7	38.3	39.9	40.6
PSR – formula (1)	5.8	5.8	8.6	8.8
AI – formula (2)	82.3	88.3	106.0	116.1
EDR – formula (3)	17.1	17.7	24.1	25.3
PEP – formula (4)	12.4	12.8	16.4	17.2
TDR – formula (5)	38.0	37.6	46.9	47.0

Between the two reference years all measures of demographic aging increased. This is true for urban areas defined according to the DEGURBA classification and for towns listed in the TERYT register. In 2016, half of the population living in urban areas was older than 39.9 years. The change in median age reflected by an index calculated in reference to the base year 2010 was 105.8 and was lower compared to that for towns in the TERYT register, where median age was equal to 40.6 years in 2016, which is over 2 years more than in 2010.

Parent support ratios for both reference years, regardless of the classification, are below 10%. This means that the generation of parents (people aged 85 and over), who require direct support and care, accounted for less than 10% of the subsequent generation of ‘children’ (people aged 50-64). In this case, values of the PSR measure for urban areas are lower than for towns. One particularly worrying trend is the intensity of change in the PSR indicator, which is the highest of all measures of population aging. In 2016, PSR for urban areas increased by 48% relative to 2010, in the case of towns, the increase was even higher – as much as 51.7%

The aging index also underwent significant changes: 28.8% in the case of urban areas and 31.5% in the case of towns. Moreover, between the 2 reference years, the indicator exceeded the level of 100, which means that both in urban areas and in towns, the population aged 65 and over outnumbered the youngest age group (0-14 years).

The second most dynamically growing measure of population aging was the elderly dependency ratio, which in the case of urban areas rose by 41% between 2010 and 2016 and by 42.9% in the case of towns. This means the growing burden of supporting the post-working age population by people of working age.

The proportion of elderly people in 2010 already exceeded the level of 12%, only to sky rocket in 2016 to 16.4% in urban areas and 17.2% in towns. This means that, in terms of the terminology adopted by the UN, the urban population of the Wielkopolskie Province in 2010 could already be classified as old (above the threshold of 7%).

The total dependency ratio in towns, despite a 20-percent increase over the reference period, was more or less similar for both classifications and in 2016 was equal to 46.9 and 47.0 for urban areas and towns respectively. Interestingly, in 2010, it was slightly lower in the towns of the Wielkopolskie Province (37.6 compared to 38.0 in urban areas).

**Table 5.** Measures of population aging in rural areas by commune type in 2016

Demographic measure	Urban areas in total (DEGURBA)	Urban communes (densely populated areas)	Urban-rural communes (intermediate areas)	Rural communes (intermediate areas)
Population in thous.	1,883.4	997.8	798.5	87.1
Number of communes	53	7	32	4
Median age	39.9	41.3	38.5	36.7
PSR – formula (1)	8.6	10.4	7	5.2
AI – formula (2)	106.0	132.0	85.2	50.0
EDR – formula (3)	24.1	27.7	20.7	15.1
PEP – formula (4)	16.4	18.6	14.3	10.4
TDR – formula (5)	46.9	48.6	45.1	45.3

The results presented in Table 4 and Table 5 clearly indicate how strongly the levels of population aging measures in urban areas are affected by the inclusion of areas with intermediate population density according to the DEGURBA classification. The median age, which in densely populated areas exceeded 41 years, was lower by nearly 3 years in urban-rural areas classified as intermedi-

ate, and in the case of 4 rural communes (Czerwonak, Komorniki, Suchy Las and Rokietnica) classified as intermediate was lower by as many as 4.6 years. In recent years, these four communes have been experiencing an intensive influx of migration for permanent residence from Poznań. These migration flows consist mainly of young families with small children who could expect to buy a flat at much lower prices in communes surrounding Poznań than in the city itself. This group also includes families that, after moving out of Poznań, have seen the birth of their first and subsequent children, thus contributing to a decrease in demographic measures. This is particularly evident in the case of the other measures shown in the table below. The parent support ratio, equal to 10.4 in densely populated areas, did not exceed seven in areas with intermediate population density. This difference is particularly large in the case of the aging index, which is over 130 in densely populated areas, but as low as 50 in rural areas classified as intermediate (the four communes: Czerwonak, Komorniki, Suchy Las and Rokietnica). Similar relations can be observed in the case of the elderly dependency ratio, the proportion of elderly population and the total dependency ratio.

## **5. Discussion**

The paper provides a comparison of the statistical picture of the aging process of the urban population of the Wielkopolskie Province according to two typologies – TERYT and DEGURBA – based on selected measures of population aging for 2010 and 2016. In 2016, all these measures in urban areas identified according to the DEGURBA classification were found to be lower than those obtained for the population of towns listed in the TERYT register. This represents a less advanced stage of population aging in urban areas delimited not on the basis of legal or administrative town status, but based on a more objective criterion of the degree of urbanisation. Such findings, among other things, are the result of the inclusion of some rural communes in areas classified as urban according to the DEGURBA typology. In the case of the Wielkopolskie Province, these are four communes: Czerwonak, Komorniki, Suchy Las and Rokietnica. It is worth noting that in recent years these communes have experienced an intensive influx of migration for permanent residence from Poznań. Moreover, these migration flows consist mainly of young families with small children, who decided to move out of flats rented in Poznań or shared with their parents. These migration flows have a considerable influence of relations between basic age groups that are the basis for calculating classical measures of population aging.

To a certain degree, the same can be true in the case of urban-rural communes classified as urban areas according to DEGURBA. Of the 93 communes of this type, a third were classified as urban areas, while the remaining 61 – as thinly populated areas. The group of urban-rural communes, classified as urban areas according to the DEGURBA typology, includes, among others, Buk, Kórnik, Mosina and Murowana Goślina, all of belonging to the Poznań district and experiencing an equally intensive migration for permanent residence, mostly young families from Poznań.

It should be also noted that the traditional typology of towns according to the TERYT register makes it more difficult to conduct an in-depth and multidimensional analysis and evaluation of socio-economic phenomena that take place in space. It is therefore recommended that this traditional typology should be complemented by the approach described in this paper, which is based on the 1x1 km grid and the DEGURBA classification, making it possible to increase the scope and depth of analysis, also as regards population aging processes. Given the dynamic changes that the demographic structure is currently undergoing, it is necessary to apply increasingly more sophisticated analytical methods which rely on a modern statistical infrastructure supported by spatial (geocoded) statistics.

## **6. Conclusions**

The statistical picture of the aging process of the urban population of towns in the Wielkopolskie Province according to two typologies – TERYT and DEGURBA – based on selected measures of population aging for 2010 and 2016 is slightly different. In 2016, all these measures in urban areas identified according to the DEGURBA classification were found to be in general slightly lower than those obtained for towns listed in the TERYT register. There are a lot of studies in Polish demographic literature which deal with the problem of population ageing from the perspective of administrative division of country (provinces, poviats, communes). However, the approach presented in the paper is the first one, according to our knowledge, which suggests the alternative perspective based on DEGURBA approach. Application of both TERYT and DEGURBA typologies is also the way of broadening the urbanity conceptualisation, as they take into account not only its formal aspect (TERYT) but also demographic and morphological aspects (DEGURBA).

Obviously, the comparative analysis of the impact of the typology used on the statistical picture of population aging described in this paper includes certain limitations and simplifications. First of all, it should be noted that application of DEGURBA typology requires good statistical infrastructure, especially in terms of georeferenced demographic data. That is why the approach is applicable only for Census population data – available every ten years. Secondly, population aging in urban areas/towns is described only by a selected set of so-called traditional demographic aging measures. One should consider applying also alternative demographic aging measures which take into account, for example, changing mortality rates and life expectancy. Moreover, the analysis was limited to the Wielkopolskie Province. It seems, however, that the results are promising and indicate directions for future research, including the extension of the scope of such studies to cover the whole country, taking into account how the migration of young generation for permanent residence affects measures of population aging, and the application of methods of multivariate statistics for identifying similar patterns of population aging in towns.

## References

- Abramowska-Kmon, A. (2011). O nowych miarach zaawansowania procesu starzenia się ludności [On new measures of the population ageing process]. *Studia Demograficzne*, 1(159), 3-22.
- Brezzi, M., Dijkstra, L., & Ruiz, V. (2011). *OECD Extended regional typology: The economic performance of remote rural regions* (OECD Regional Development Working Papers, No. 06). Paris: OECD Publishing. <https://doi.org/10.1787/20737009>
- Burdziej, J. (2016). Analiza dostępności przestrzennej za pomocą technologii GIS na przykładzie obiektów użyteczności publicznej w Toruniu [Analysis of spatial accessibility using GIS technology on the example of public buildings in Torun]. *Prace Komisji Geografii Komunikacji PTG*, 19(1), 43-51. <https://doi.org/10.4467/2543859XPKG.16.004.6302>
- Central Statistical Office. (2019). Retrieved from <https://bdl.stat.gov.pl/BDL/metadane/teryt/rodzaj>
- Dąbrowski, A., Filas-Przybył, S., & Pawlikowski, D. (2016). *Identification of specific areas within provincial capital cities and their functional areas in terms of the demographic and economic situation of their inhabitants using GIS-based spatial analysis*. Paper presented at the SCORUS Conference in Lisbon. Retrieved from <http://scorus.org/index.php/conferences/2016-2/scorus-conference-in-lisbon-portugal/>
- Dijkstra, L., & Poelman, H. (2014). *A harmonised definition of cities and rural areas: The new degree of urbanisation* (Regional Working Paper, No. 01/2014). Brussels: European Commission. Retrieved from [https://ec.europa.eu/regional\\_policy/sources/docgener/work/2014\\_01\\_new\\_urban.pdf](https://ec.europa.eu/regional_policy/sources/docgener/work/2014_01_new_urban.pdf)

- Eurostat. (2011). *Degree of Urbanisation (DEGURBA) – Local Administrative Units, Methodological notes – The New Degree of Urbanisation*. Correspondence table. Retrieved from [http://ec.europa.eu/eurostat/ramon/miscellaneous/index.cfm?TargetUrl=DSP\\_DEGURBA](http://ec.europa.eu/eurostat/ramon/miscellaneous/index.cfm?TargetUrl=DSP_DEGURBA)
- Filas-Przybył, S. (2012). *Nowa metodologia klasyfikowania jednostek przestrzennych oparta na stopniu urbanizacji* [A new methodology for classifying spatial units based on the degree of urbanization] (Unpublished graduation thesis). Adam Mickiewicz University, Poznań, Poland.
- Filas-Przybył, S., Klimanek, T., & Kowalewski, J. (2012). Analiza dojazdów do pracy za pomocą modelu grawitacji [An attempt to use the gravity model in the analysis of commuters]. *Taksonomia*, 19, 135-143.
- Filas-Przybył, S., Klimanek, T., Kruska, K., & Stachowiak, D. (2016). *Identyfikacja obszarów specjalnych wewnątrz miast wojewódzkich – na przykładzie miasta Poznania* [Identification of specific areas within provincial capital cities – Poznań case]. Retrieved from <https://www.arcanagis.pl/identyfikacja-obszarow-specjalnych-wewnatrz-miast-wojewodzkih-na-przykladzie-miasta-poznania/>
- Filas-Przybył, S., Kowalewski, J., & Stachowiak, D. (2016). *Wykorzystanie danych zawartych w źródłach administracyjnych do analizy i prezentacji mobilności przestrzennej ludności* [The use of administrative data sources for the analysis and presentation of population spatial mobility]. Paper presented at the Conference in Kazimierz Dolny. Poznań: Urząd Statystyczny w Poznaniu. Retrieved from [https://lublin.stat.gov.pl/files/gfx/lublin/pl/defaultstronaopisowa/1278/1/1/kowalewski\\_us\\_poznan.pdf](https://lublin.stat.gov.pl/files/gfx/lublin/pl/defaultstronaopisowa/1278/1/1/kowalewski_us_poznan.pdf)
- GUS. (2014). *Dojazdy do pracy* [Commuting to work]. Narodowy Spis Powszechny Ludności i Mieszkań 2011. Warszawa: Author. Retrieved from [http://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultaktualnosci/5670/7/1/8/1\\_dojazdy\\_do\\_pracy\\_nsp2011.pdf](http://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultaktualnosci/5670/7/1/8/1_dojazdy_do_pracy_nsp2011.pdf)
- GUS. (2015). *Identyfikacja obszarów specjalnych wewnątrz miast wojewódzkich oraz na ich obszarach funkcjonalnych uwzględniających sytuację demograficzną i ekonomiczną ich mieszkańców na podstawie analiz przestrzennych z wykorzystaniem Geographic Information System (GIS). Raport końcowy* [Identification of specific areas within provincial capital cities and their functional areas in terms of the demographic and economic situation of their inhabitants using GIS-based spatial analysis. Final report]. Retrieved from [http://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultstronaopisowa/5850/1/1/raport\\_obszary\\_specjalne\\_gis\\_1.pdf](http://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultstronaopisowa/5850/1/1/raport_obszary_specjalne_gis_1.pdf)
- GUS. (2018a). *Miasta w liczbach 2016. Analizy statystyczne. Basic urban statistics 2016. Statistical analyses*. Retrieved from [https://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultaktualnosci/5499/3/8/1/miasta\\_w\\_liczbach\\_2016.pdf](https://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultaktualnosci/5499/3/8/1/miasta_w_liczbach_2016.pdf)
- GUS. (2018b). *Dojazdy uczniów do szkół zlokalizowanych w miastach wojewódzkich. Raport końcowy. Students commuting to schools located in provincial cities. Final report*. Retrieved from [http://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultstronaopisowa/6157/1/1/raport\\_dojazdy\\_uczniow\\_do\\_szkol.pdf](http://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultstronaopisowa/6157/1/1/raport_dojazdy_uczniow_do_szkol.pdf)

- GUS. (2018c). *Wskaźniki dostępności terytorialnej mieszkańców Polski do wybranych obiektów użyteczności publicznej. Raport końcowy. Indicators of territorial accessibility of Poland's residents to selected public utilities. Final report*. Retrieved from [https://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultstronaopisowa/6157/1/1/raport\\_wskazniki\\_dostepnosc\\_terytorialnej.pdf](https://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultstronaopisowa/6157/1/1/raport_wskazniki_dostepnosc_terytorialnej.pdf)
- Kruszka, K. (Ed.) (2010). *Dojazdy do pracy w Polsce. Terytorialna identyfikacja przepływów ludności związanych z zatrudnieniem* [Commuting to work. Territorial identification of population flows related to working]. Poznań: Ośrodek Statystyki Miast, Urząd Statystyczny w Poznaniu. Retrieved from [http://stat.gov.pl/cps/rde/xbcr/poznan/ASSETS\\_dojazdy\\_do\\_pracy\\_w\\_polsce\\_2010.pdf](http://stat.gov.pl/cps/rde/xbcr/poznan/ASSETS_dojazdy_do_pracy_w_polsce_2010.pdf)
- Kurek, S. (2008). *Typologia starzenia się ludności Polski w ujęciu przestrzennym* [The typology of population ageing in Poland from a spatial perspective] (Prace Monograficzne, No. 497). Kraków: Wydawnictwo Naukowe Akademii Pedagogicznej.
- Local administrative units (LAU). (2018). Nomenclature of Territorial Units for Statistics (NUTS). Brussels: European Commission. Retrieved from <https://ec.europa.eu/eurostat/web/nuts/local-administrative-units>
- Piekarski, K. (2017). *Jak za pomocą Map Google zbadaliśmy dostępność komunikacyjną instytucji kultury* [How we have examined the communication accessibility of a cultural institution with the use of Google Maps]. Projekt Shared Cities: Creative Momentum. Retrieved from <http://blog.medialabkatowice.eu/jak-za-pomoca-map-google-zbadalismy-dostepnosc-komunikacyjna-instytucji-kultury>
- Stańczak, J., & Szałtys, D. (2016). Regionalne zróżnicowanie procesu starzenia się ludności Polski w latach 1990-2015 oraz w perspektywie do 2040 roku [Regional diversification of the aging process of the Polish population in the years 1990-2015 and in the perspective until 2040]. Paper presented at the V Zielonogórskie Spotkania z Demografią. Retrieved from [https://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultaktualnosci/5468/28/1/1/regionalne\\_zroznicowanie\\_procesu\\_starzenia\\_sie\\_ludnosci.pdf](https://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultaktualnosci/5468/28/1/1/regionalne_zroznicowanie_procesu_starzenia_sie_ludnosci.pdf)
- Szmytkie, R. (2018). Kryteria morfologiczne w procedurze administracyjnej nadawania statusu miasta [An attempt to assess the degree of urbanity of new towns in Poland based on the morphological criterion]. *Wiadomości Statystyczne*, 12(691), 40-56.
- Śleszyński, P. (2012). Kierunki dojazdów do pracy [Commuting directions]. *Wiadomości Statystyczne*, 11, 59-75.
- Ustawa z dnia 29 sierpnia 2003 r. o urzędowych nazwach miejscowości i obiektów fizjograficznych. Dz.U. 2003 nr 166 poz. 1612 [The act of 29 August 2003 on official names of localities and physiographic objects, Dz.U. 2003 No. 166 item 161].