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Environmental & Socio-economic Studies

DOI: 10.2478/environ-2023-0019

Environ. Socio.-econ. Stud., **2023, 11, 4: 1-11**

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Original article

Changes in regional settlement systems in Poland

Anna Runge

University of Silesia in Katowice, Faculty of Natural Sciences, Institute of Social and Economic Geography and Spatial Management, Będzińska Str. 60, 41-200 Sosnowiec, Poland
E–mail address: anna.runge@us.edu.pl
ORCID iD: https://orcid.org/0000-0003-1271-5559

ABSTRACT

This article is an attempt to identify regularities in changes in regional settlement systems in Poland with an indication of the elements that showed the highest population dynamics (growth or decline) in particular periods, thus contributing to changes in the structure of these systems. In order to show similarities and differences in the course of the analyzed changes, univariate statistical measures (median, quartiles) were used. This allowed for presenting a dynamic typology of these changes in order to show their cyclical nature and spatial diversity. The results show that these processes do not occur in a similar direction in all regions. The model of consistent changes in the size structure of cities concerns the settlement core of the country (Mazowieckie, Wielkopolskie, Małopolskie), while the resequential changes generally took place in the agricultural peripheries of the country (Podlaskie, Warmińsko-mazurskie), which were drained from the demographic potential by the migration outflow of the population the earliest, as well as in industrial regions (Śląskie, Łódzkie), where the political and economic transformation significantly affected population processes.

KEY WORDS: population changes, median, quartiles, city, voivodeship, Poland

ARTICLE HISTORY: received 6 October 2023; received in revised form 4 December 2023; accepted 5 December 2023

1. Introduction

Studies of population changes conducted in various territorial systems constitute both a subject of interest of many scientific disciplines and are the starting point for shaping spatial policy (urban or regional). In the case of regional settlement systems, these changes result from both internal conditions (processes taking place in cities themselves) and are a derivative of the impact of the external environment of these settlement systems, as well as of supra-regional, national or global impacts (KWIATEK-SOŁTYS, 2011; KANTOR-PIETRAGA, 2014a). External impacts may be consistent with intra-urban trends, or may be more or less divergent, which mainly results from structural and spatial inertia, i.e.. the resistance of the settlement system to changes. The temporal variability of these conditions may stimulate development, inhibit it (cause stagnation) or reverse the current trends (cause regression) in shaping settlement systems, which constitutes a basis for periodization of changes in settlement systems.

Attempts to periodize the shaping of settlement systems are generally made with regard to the most dynamic elements of these systems in particular periods. Among the topics concerning urban transformations that have been researched for years, attempts to indicate the trajectory of long-term transformations of European cities are of importance (TUROK & MYKHNENKO, 2007). Based on statistics for European cities, the authors distinguished progressive-regressive trajectories of change in European cities, differentiated in terms of direction and intensity of change, whilst simultaneously paying attention to the depopulation of many urban centres over time.

Periodization of the role of cities of different sizes in the development of settlement systems was proposed by GEYER & KONTULY (1993), who created a model of differential urbanization based on migration. This model assumes 6 stages of urban development, of which the first three stages concern the development of the dominant city (concentration), the next two medium-sized towns (deconcentration) and the last stage assumes the development of small towns (deconcentration). Stages I–III refer to urbanization, IV and V are called reversal of polarization and stage VI – counterurbanization. RYKIEL & JAŻDŻEWSKA (2002) used this concept to assess the development of the Polish settlement system.

The study of changes in the size of the components of spatial structures, both social and economic, constitutes an important element of many scientific disciplines, in particular of population geography and settlement geography, which analyze population, settlement or infrastructural structures changing in time and space. The study of structural changes includes not only the characteristics, and a comparison of structures, but also the study of the intensity of changes (WYŻNIKIEWICZ, 1987). Numerical and graphical measures of concentration and the degree of structural differentiation are used for the description, while taxonomic and correlation measures of similarity, or the divergence coefficient, are used for comparisons. To measure the intensity of changes, the coefficient of relative structural changes is applied. For long-term series of data, it is also possible to periodize structural changes.

2. Literature review

The issue of the formation of settlement systems is a subject of numerous foreign and domestic geographic-settlement studies, population studies, or socio-economic studies. Particular attention is paid in the literature to the role of particular size classes of cities in the development of national and regional settlement systems. This is indicated by studies of changes in the population of small and medium-sized towns (SERVILLO ET AL., 2012), including small towns in Hungary (PIRISI & TROCSANYI, 2014; PIRISI ET AL., 2015), in the Balkans (HAJDÚ & RÁCZ, 2011), in Germany (KÜHN, 2015), in Poland (BOGDAŃSKI, 2021; KWIATEK-SOŁTYS, 2015) or medium-sized towns (KUNZMANN, 2010; RUNGE, 2013). However, most publications have been devoted to the population changes of large cities, especially metropolises (MARKOWSKI & MARSZAŁ, 2007; SMĘTKOWSKI AT AL., 2009; ZUZAŃSKA-ŻYŚKO, 2017), simultaneously illustrating the phenomenon of urban sprawl (NUISSL & RINK, 2005). One of such studies is a comparative analysis of the trends in settlement changes of the metropolises of Barcelona, Istanbul and Naples (ZAMBON & SALVATI, 2018). Examples of comprehensive studies of changes in national settlement systems include works on French towns (DOROCKI, 2012) and settlement changes in Serbia (PANTIĆ, 2019). A study of structural changes in Victorian England and Wales (SMITH AT AL., 2018), including the author's attempt to classify these urban centres, is interesting from the point of view of historical geography.

In the Polish geographical literature, there are works containing the European perspective on population and settlement changes (JAŻDŻEWSKA, 2005; SMĘTKOWSKI & WÓJCIK, 2009). Much attention is paid to the problems of metropolization threatening the polycentric nature of the Polish settlement system (KORCELLI, 2018) by weakening the development of the middle hierarchical level of this system (ŚLESZYŃSKI, 2017, 2018).

In shaping the urban settlement system, the variable role of its individual elements (individual size classes of cities) is marked (RUNGE & RUNGE, 2021). This depends on the degree of the advancement of urbanization processes, the achieved level of economic development or the adopted spatial (regional) policy (NOWAK, 2023). The relationship between urban population changes, the process of urbanization and the phenomenon of polycentrism was demonstrated by CHAMPION (2001).

Regional determinants of settlement processes were demonstrated, among others, by HEFFNER (2020), JAŻDŻEWSKA & LECHOWSKI (2019), JAŻEWICZ (2013) or KONECKA-SZYDŁOWSKA & MAĆKOWIAK (2016). At the same time, the impact of the peripherality of the location in relation to the central areas of relevant countries is emphasized (cf. SITEK, 2010) and the role of small and medium-sized towns in shaping settlement systems (JAŻEWICZ, 2005; KWIATEK-SOŁTYS, 2015; RUNGE & KWIATEK-SOŁTYS, 2011).

One of the first generalizations in the field of periodization of the population of cities of various sizes with an indication of the motor elements of the settlement system in the Polish post-war geographical literature was DZIEWOŃSKI'S publication (1983). The author pointed out that the 1950s were a period of development of small towns, the 1960s were mainly characterized by the development of medium-sized towns, and in the 1970s, the development of large cities and metropolitan agglomerations was primarily

noted. This resulted in the first period from the process of settling the Western and Northern Territories recovered after the war, while in the second case from the implementation of large economic investments of the Six-Year Plan assuming the construction of industrial facilities with their accompanying housing estates, and in the third case from creating the development of the largest links of the country's domestic settlement system.

At the turn of the 1970s and 1980s, three mutually complementary publications of the Geographical Papers of the Institute of Geography and Spatial Organization of the Polish Academy of Sciences (1977, 1981, 1989) appeared. They were a summary of research on the national and regional settlement systems of Poland. Their general conclusion was a thesis of a highly balanced process of shaping the country's settlement structure, which was supported, among others, by the new administrative division of Poland into 49 voivodeships introduced in 1975. It was supposed to counteract the excessive centralization of the settlement system and to strengthen regional centres constituting the middle hierarchical level in this system. However, one should point out the significant territorial differences of the settlement changes of that period, especially under the influence of intensive industrialization – the most visible example being the then Katowice Voivodeship (forming the core of the current Silesian Voivodeship). As a result of the decision to build the Katowice Steel Plant, the FSM (Factory of Small Cars) factories in Tychy and Bielsko-Biała, or the further development of hard coal mining, especially in the area of the Rybnik conurbation, only in the years 1971–1974, 300,000 immigrants from all over the country came to the then Katowice Voivodeship, while intra-voivodeship migration turnover reached a similar volume (300,000 people) (RUNGE, 1996, 2020). Thus, significant development impulses were recorded by such cities as: Jastrzębie Zdrój, Dąbrowa Górnicza, Sosnowiec and Tychy.

The slowdown of demographic changes since the beginning of the 1980s was of significant importance for national population changes. The territorial range of migration and daily commuting to cities began to shrink significantly (RUNGE, 1996). The consequences of the political and economic transformation and subsequent changes in the administrative division of the country (in 1999) shaped further changes in regional settlement systems (CZYŻ, 2000), which was accompanied by further depopulation and demographic ageing (KANTOR-PIETRAGA, 2014b; KRZYSZTOFIK, 2019; KRZYSZTOFIK ET AL., 2014).

3. Aim of the study

The aim of this study was to identify the regional differentiation of changes in the size of the population of cities in Poland occurring from the post-war years to the second decade of the 21st century. With a median, as well as an upper and lower quartile, for the ordered series of urban population sizes in particular voivodeships for the eight studied time slices, it is possible to identify the direction and the intensity of changes in the urban population above/below the median. This allows for developing a dynamic typology of changes in regional settlement systems with an indication of the elements that showed the highest population dynamics (growth or decline) in individual periods, contributing to changes in the structure of these systems. Therefore, this can be interpreted both in terms of the post-war consequences of changes in the population of cities of various sizes in different regions of the country, and in terms of the volatility of national economic and social policy priorities (small towns – medium-sized towns – large cities) and local processes of industrialization and urbanization, in accordance with DZIEWOŃSKI'S (1983) thesis. A certain instability of the intra-regional settlement structure may be a result of a long-term trend of changes (e.g., strengthening, or weakening, of individual hierarchical levels of a settlement system). A strong increase in the population of cities (an influx of migrants from the immediate and distant surroundings), or the slowdown in development, or stagnation, in that respect may also be influenced by cyclical fluctuations (SAGAN, 1995). Therefore, after the post-war period of Poland's development, based on forced industrialization within a centrally controlled economy, and then subjected to political and economic transformation and integration into the EU structures, it would be vital to try to determine how regional settlement systems of particular voivodeships (administrative regions) of the country reacted to these variable conditions. It is interesting to indicate which parts of the set of cities (above, or below, the median) reacted the most strongly, leading to structural changes in a given system. They may show more, or less, close links with the implemented economic policy, or reflect to a greater extent more autonomous trends conditioned by historical, or territorial, premises. This applies especially to regions with relatively small population potentials, located peripherally in

relation to centres of socio-economic development. The dominance of usually one leading centre largely polarizes the processes of population changes and perpetuates disproportions in the transformations of particular hierarchical levels of the settlement.

4. Research methodology

The review of methods and tools for studying structural changes made by WYŻNIKIEWICZ (1987) can be supplemented by simple components of univariate statistical analysis. In this article, the median (Me) and upper (Q_3) and lower (Q_1) quartiles were used to periodize structural changes for long-term series of data. The population size of each of the cities of particular voivodeships in the years 1950–2018, as referred to in the administrative division of the country from 1999 (the number of cities as of 2018), was adopted as a basis for changes in the size structure of cities in these voivodeships in Poland. This allowed for comparability of the results of the conducted analysis. The number of cities in the studied time slices of the 1950s, the 1960s, the 1970s, 1978, 1988, 1998, 2008 and 2018 varied, which resulted from the regional diversity of urbanization processes as well as numerous changes and amendments to the administrative division.

This study was based on data sourced from the publications of Statistics Poland presenting the results of the National Censuses for the years 1950–1988 (STATYSTYKA MIAST ..., 1967; STRUKTURA DEMOGRAFICZNA ..., 1972; STRUKTURA DEMOGRAFICZNA ..., 1992). In turn, data for the years 1998–2018 come from the Statistics Poland's website "Local Data Bank", as of December 31, according to the national definition of residence (which includes internal migration for temporary stay). The population of city immigrants staying in Poland temporarily are not counted, but Polish permanent residents temporarily staying abroad are counted (regardless of the period of their temporary stay). Data on residents according to the international definition of residence which takes into account long-term temporary migration – both internal and international – at the level of individual cities are not available.

The applied tool, namely a comparison of the size of the upper quartile (Q_3) and the lower quartile (Q_1) over time, documents the changing populations of cities, basically as those above and below the median value. Positional measures (upper quartile, lower quartile and median) were calculated separately for the set of cities in each voivodeship. Changes between the size of the lower quartile in individual time slices for cities in a given voivodeship were expressed with a dynamics index (baseline year of the period = 100%). Changes in the upper quartile were calculated in a similar way (Table 1). Hence, it was possible to indicate which of the quartiles in a given period showed a greater scale of changes. Thus, one can prove whether the set of cities of a given voivodeship is characterized by a relative balance, i.e., similar changes in the population occur regardless of the size class of the city, or whether there is an increase in the importance of cities in the set of cities of a given voivodeship:
– above the median or even above the upper quartile (Q_3), which means that the largest cities in a given set are the drivers of change in the regional settlement system;
– below the median or even below the lower quartile (Q_1), which means that the smallest towns in a given set are the active elements of changes in the size structure of cities in the regional settlement system.

The use of this method requires caution because there may be special cases in which an increase in the median may not mean an increase in the population of those cities above the median. However, such cases did not occur in this study.

The essence of the research procedure is illustrated in Figure 1. The set of cities of a given voivodeship organized by population size allows for a comparison of the variability of the population of the cities of the upper and lower part of the set and for distinguishing eight types of population changes in the set of cities:
type A – when the upper quartile (Q_3) clearly increases, and the lower quartile (Q_1) decreases in value between a certain time slice and the following one. This means that a population increase occurred in larger cities, while small (smallest) towns showed a decrease in population. At the same time, the scale of population growth in large cities was greater than the scale of population loss in small towns;
type B – in both parts of the set (in cities both below and above the median (<Me and Me>) there was a population increase, but it was stronger in the group of larger cities (>Me);
type C – is the inverse of type B – the population increase occurred in cities both above (>Me) and below the median (<Me), but it was stronger in the group of smaller towns (<Me);
type D – the lower quartile (Q_1) clearly increases between a certain time slice and the following one, while the upper quartile (Q_3) decreases in value, hence the increase in the population of smaller towns (<Me),

Table 1. Changes in the size of the lower and upper quartiles of the population of cities broken down by voivodeship in 1950–2018 [in %]
(Source: own study based on Statystyka miast i osiedli. 1945–1965.; Struktura demograficzna i zawodowa ludności. 1972; Struktura demograficzna i zawodowa oraz warunki mieszkaniowe ludności miejskiej w latach 1978–1988.; Struktura demograficzna i zawodowa oraz warunki mieszkaniowe ludności miejskiej w latach 1978–1988.; Local Data Bank, Statistic Poland (accessed 26 August 2021)

Voivodeships	1950-1960		1960-1970		1970-1978		1978-1988		1988-1998		1998-2008		2008-2018	
	Q_1	Q_3	Q_1	Q_3	Q_1	Q_3	Q_1	Q_3	Q_1	Q_3	Q_1	Q_3	Q_1	Q_3
Dolnośląskie	159,7	111,4	106,3	117,8	115,7	143,2	104,0	107,3	102,3	101,0	92,1	93,0	95,3	95,9
Kujawsko-pomorskie	103,7	113,1	114,8	119,3	100,7	114,6	112,6	113,4	103,7	108,0	100,5	98,9	98,4	98,4
Lubelskie	104,8	107,1	113,6	133,2	107,9	130,3	102,5	123,4	79,1	96,0	89,7	93,1	72,9	89,3
Lubuskie	160,7	145,9	112,7	129,6	109,5	115,9	111,8	118,8	96,7	107,4	98,5	95,2	98,5	94,8
Łódzkie	102,2	115,5	119,9	115,1	135,0	130,4	101,1	171,2	90,6	102,0	87,1	87,2	88,1	86,9
Małopolskie	132,1	126,9	110,3	136,0	110,1	130,6	109,3	114,1	98,6	94,8	86,4	98,8	86,6	97,2
Mazowieckie	107,6	128,9	111,8	112,3	116,8	110,7	125,0	122,3	85,2	109,3	87,7	101,1	103,2	100,4
Opolskie	135,7	130,6	120,5	123,6	104,1	106,2	121,5	111,7	89,1	105,2	80,9	94,4	96,2	91,8
Podkarpackie	106,0	111,2	116,3	131,7	104,7	121,9	123,3	123,9	98,4	103,9	99,2	95,5	89,9	97,8
Podlaskie	139,8	151,6	104,9	123,7	101,1	137,7	99,2	131,3	95,7	97,3	97,2	92,4	92,7	87,8
Pomorskie	107,5	129,0	110,2	116,1	129,7	127,5	109,1	121,7	99,1	107,7	101,2	95,9	97,8	96,4
Śląskie	84,7	61,4	121,5	117,2	159,8	343,5	96,3	108,2	94,1	69,8	94,9	90,5	100,0	98,7
Świętokrzyskie	124,4	114,0	101,3	105,9	104,1	130,4	111,3	113,6	70,1	88,5	93,6	90,7	80,7	74,8
Warmińsko-mazurskie	101,0	159,2	115,6	123,9	122,5	119,4	93,0	118,6	88,0	107,4	97,5	94,1	95,4	96,2
Wielkopolskie	114,9	125,0	105,2	118,4	105,0	124,5	119,9	126,0	104,5	107,4	103,8	98,0	100,3	95,7
Zachodniopomorskie	146,5	166,3	112,3	122,6	102,6	122,2	116,6	123,2	105,0	103,3	104,0	90,2	91,5	97,5

accompanied by a small population loss of larger cities (>Me), is more important for structural changes;
type E – the demographic regression of larger cities (>Me) is of greater importance for structural changes, as indicated by a significant decrease in the size of the upper quartile (Q_3) with a small increase in the lower quartile (Q_1);
type F – there is a decrease in the upper quartile (Q_3) and the lower quartile (Q_1), while a decrease in the upper quartile (Q_3) (larger cities) is stronger; the demographic regression involves cities above and below the median, being more prominent in large cities;
type G – there is a decrease in the upper quartile (Q_3) and the lower quartile (Q_1), with a stronger decrease in the lower quartile (Q_1) (smaller towns);
type H – the size of the upper quartile (Q_3) decreases and the size of the lower quartile (Q_1) increases, with the upper quartile decreasing faster than the increase in the lower quartile.

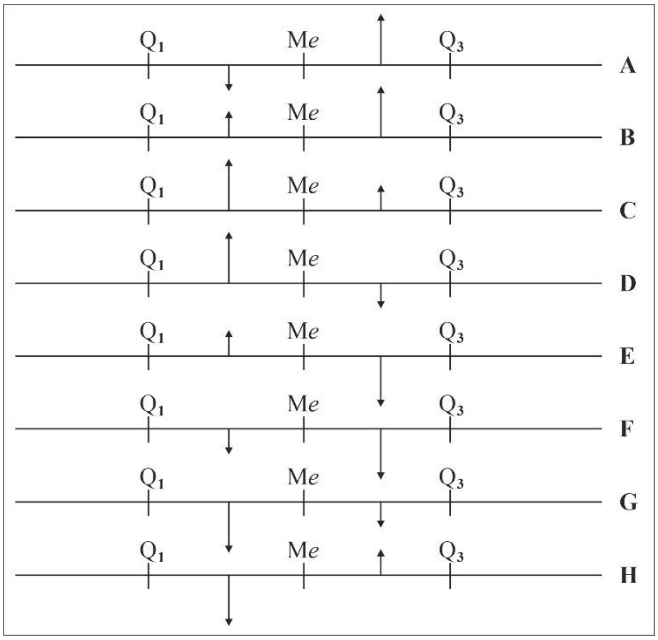


Fig. 1. Model of the types of population changes based on the dynamics of the lower quartile (Q1) and upper quartile (Q3)

This enabled an analysis of the structural changes in the regional settlement systems of particular voivodeships in each of the eight time slices.

5. Results and discussion

Structural changes in the size of the population of cities of particular voivodeships in the years 1950–2018 may refer to the distinguished types of changes that show smaller or greater regularity over time. This enables developing an appropriate dynamic typology of the types of changes A–H. The trends of changes in urban population sizes in regional systems of particular voivodeships in the years 1950–2018 are presented in Table 1 and Figure 2. Changes in quartiles in the figure are expressed in relative values (%), generalizing the course of lines of these changes in order to indicate an overall trend.

The first group with a similar course of changes in the settlement system comprises the voivodeships of: Wielkopolskie, Zachodniopomorskie, Mazowieckie, Podkarpackie, Lubelskie, Dolnośląskie and Małopolskie. Structural changes in the urban settlement network of these voivodeships in the studied multi-year period relied on a consistent transition from type B through type C and subsequent ones to types G and F. The course of changes in the settlement systems of these voivodships referred to the trends of changes in the Polish settlement system (RUNGE & RUNGE, 2021). While in the 1950s the growth of the largest cities (>Me) was decisive, the increase in the population of medium and small towns started gradually, and since the 1980s there has been a significant increase in the population of smaller towns (<Me) with the population declining in large cities.

These changes largely resulted from development impulses not only in the voivodeships located in the centre of the country (Mazowieckie, Wielkopolskie) but also in the voivodeships adjacent to them (Zachodniopomorskie, Dolnośląskie) as a consequence of equalizing the disproportions in the country's population after the formation of the post-war Polish borders and significant migration flows at that time (settlement of the Recovered Territories).

The capitals of most of these voivodeships constituted the main links of the national polycentric settlement system (BAŃSKI, 2007; KORCELLI, 2018), developing economically, population-wise and spatially, which created challenges in the construction of urban infrastructure. In order to counteract the excessive concentration of the demographic potential in the capital city and the disproportions in socio-economic development within voivodeships, a new administrative division of the country into 49 voivodeships was implemented in 1975, giving capital functions to medium-sized cities (including Konin, Płock, Siedlce). Simultaneously, the model of industrial development of industry based on raw material deposits continued. Due to these conditions, the number of medium-sized cities (with a population of 20,000–100,000 inhabitants) significantly increased in the following decades.

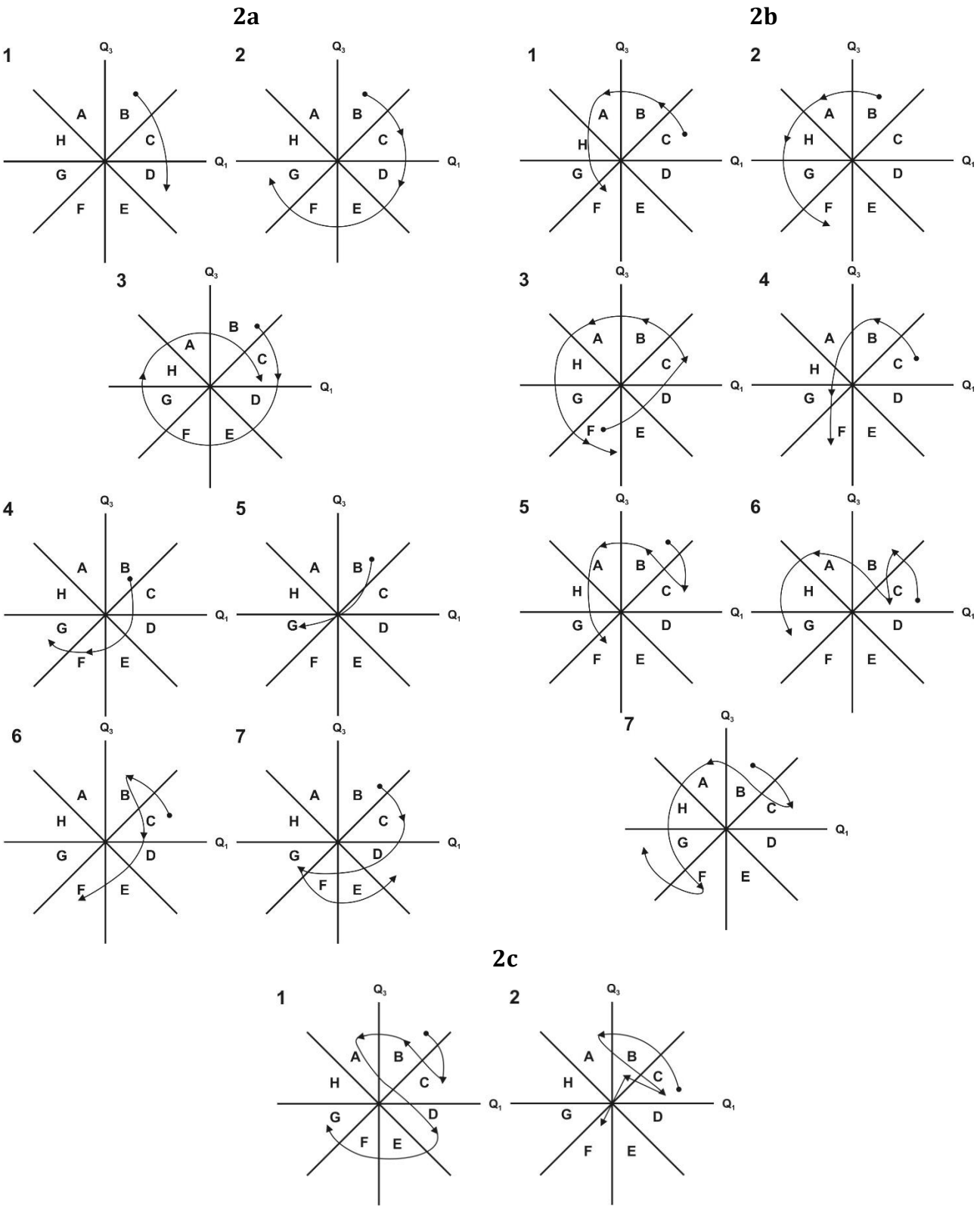


Fig. 2. Dynamic typology of population changes in Polish cities by voivodeship in the years 1950-2018 (Q_1 & Q_3 in %)
2a. Types of consistent changes: 1 – Wielkopolskie voivodeship, 2 – Zachodniopomorskie voivodeship, 3 – Mazowieckie voivodeship, 4 – Podkarpackie voivodeship, 5 – Lubelskie voivodeship, 6 – Dolnośląskie voivodeship, 7 – Małopolskie voivodeship
2b. Types of resequential changes: 1 – Lubuskie voivodeship, 2 – Podlaskie voivodeship, 3 – Świętokrzyskie voivodeship, 4 – Śląskie voivodeship, 5 – Łódzkie voivodeship, 6 – Opolskie voivodeship, 7 – Warmińsko-mazurskie voivodeship
2c. Types of irregular changes: 1 - Pomorskie voivodeship, 2 - Kujawsko-pomorskie voivodeship

The development of small and medium-sized towns located in the immediate hinterland of the country's largest cities is associated with the formation of their extensive suburban zones. Achieving in the 1990s the maximum possibilities of spatial development of voivodeship capitals resulted in the overflow of urbanization processes beyond the administrative boundaries of these cities and in the development of suburban zones, including medium-sized and small towns located in these zones (KRZYSZTOFIK ET AL., 2017; RUNGE, 2016).

Among the regional settlement systems of this group, the following voivodeships show progressive tendencies: Wielkopolskie, which did not record regressive types of changes reaching type D; Mazowieckie, which from types B and C through type H again reached type C; Małopolskie, which from types B and C moved to type G, and then returned to type D. Unfortunately, the transformations of the settlement systems of the remaining four voivodships of this group "got stuck" in the regressive types of changes (mainly G), of which the Lubelskie voivodeship achieved this type the soonest.

The second group consisted of the Lubuskie, Podlaskie, Śląskie, Świętokrzyskie, Łódzkie, Opolskie and Warmińsko-Mazurskie voivodeships. In these voivodeships, the tendencies of structural changes in their urban settlement network were re-sequential – generally opposite to the trajectory of the previous group of voivodships. Although most of them initially referred to transformations of type B or C, they soon shifted to types A, H, and G after F. The weakening of the population dynamics of smaller towns was marked here much earlier, which, with the initial increase in the population of large cities, deepened their dominance. In the following decades, there was a deepening of the regression of the population of towns below the median (a significant decrease in the size of Q_1), which was accompanied by a weakening of the population growth of large cities and, finally, the occurrence of regressive tendencies in the entire set of cities. In the second group of voivodeships, regressive types H, G and F appeared faster than in the first group. The reason for the rapid collapse of urban development was the industrial functional character in which urban development was often based on one dominant branch of traditional industry. The cities of these voivodeships coped the worst with the political and economic transformation, and the collapse of the labour market resulted in economic emigration, especially among young people.

The third and last group consisted of only two voivodeships: Pomorskie and Kujawsko-Pomorskie. They were characterized by a distinct irregularity of structural changes in the size of population over time, i.e., an alternation of stimulation and inhibition of the population growth in both larger and smaller cities. This indicates high variability of both internal and external factors in shaping the urbanization processes.

Studies of population changes in Polish cities conducted in recent years indicate a significant diversification of this process in time and space (RUNGE, 2013; RUNGE & RUNGE, 2021; KRZYSZTOFIK, 2019; WIŚNIEWSKI ET AL., 2020; NOWAK, 2020). The formation of the Polish settlement system for several decades of the second half of the 20th century took place in the conditions of forced industrialization of cities reaching for a workforce from outside. However, efforts were made to maintain its polycentric character (BAŃSKI, 2007; KORCELLI, 2018). Meanwhile, in recent decades, a trend has been noted to concentrate populations in the largest agglomerations (Warsaw, Krakow, Tri-City, Poznań, Wrocław), with a simultaneous loss of the population from the Katowice conurbation, and Łódź or Opole agglomerations. Significant foreign emigration of young Poles, aggravating demographic ageing and natural decline along with the national migration policy that does not expect the influx of immigrants, result in population regression in cities. This applies especially to those cities that in the period of centrally controlled economy based their development on external labour resources (Śląskie – development of mining and metallurgy, Łódzkie – development of the textile industry). This industrial model of development collapsed in the 1990s changing the character of many cities from an immigration to an emigration one.

The presented model of structural changes in urban populations, especially for the second and the third groups of voivodeships, clearly deviates from DZIEWOŃSKI'S thesis (1983) which stated that in the development of the population of Poland there was a transition from the significant importance of small towns in the settlement system, through the development of medium-sized towns to the development of large cities and urban agglomerations. To some extent, this thesis applies to the cities constituting the settlement core of Poland (the distinguished first group of voivodeships); however, an increase in the importance of small and medium-sized towns was marked here only in the 1960s, and in the following decades there was no increase in

population in large cities due to urban sprawl and the weakening of natural traffic. The course of changes in the size structure of cities of this group of voivodeships relates much better to GEYER & KONTULY'S model (1993). On the other hand, in the voivodeships located peripherally to the centre of the country (the second group), with the initial leading role of large cities, the weakening of the development of towns below the median emerged quite early, also followed by a progressive weakening of the population dynamics of cities above the median. Spatial regularities of these changes are presented in Figure 3.



Fig. 3. Distribution of types of population changes in Polish cities by voivodeship in the years 1950-2018
1 – types of consistent changes; 2 – types of resequential changes; 3 – types of irregular changes

6. Conclusions

The conducted dynamic typology of population changes in urban regional systems (particular voivodeships) of Poland in the years 1950–2018 allows for the formulation of several conclusions:

Firstly, in the light of the applied research procedure, it turned out that the directions and dynamics of changes in urban population significantly varied regionally. On this basis, three groups of voivodeships with different types of population changes affecting the structure of urban settlement systems were distinguished:

1) those representing the model of consistent changes from type B to type G (Wielkopolskie, Zachodniopomorskie, Mazowieckie, Podkarpackie, Lubelskie, Dolnośląskie and Małopolskie voivodeships);

2) those representing the model of resequential changes from type B or C through type A to types G and F (the Lubuskie, Podlaskie, Śląskie, Świętokrzyskie, Łódzkie, Opolskie and Warmińsko-Mazurskie voivodeships);

3) those representing an irregularity of population dynamics of cities of particular size classes (the Pomorskie and Kujawsko-Pomorskie voivodeships).

The model of consistent changes in the first group of voivodeships indicates the development of large cities (>Me) until the 1970s, and in the following decades the revival of smaller towns (<Me) with a weakening of the population dynamics of large cities, and finally the intensification of population regression in large cities, and then also in smaller ones. The model of resequential changes in the second group of voivodeships consists in the weakening of the development of small and medium-sized towns in relation to the developing large cities (thus unlike the first group of voivodeships), and then further deepening of the regression of the population of cities below the median, which was accompanied by the weakening of the population growth of large cities and earlier occurrence of regressive trends in the entire set of cities. The third group of voivodships had similar trends to those in the second group, with some irregularity of changes, namely the periodical strengthening of the role of towns below the median.

Secondly, the model of consistent changes in the size structure of cities concerns the settlement core of the country, while the resequential changes generally took place in the agricultural peripheries of the country (Podlaskie, Warmińsko-Mazurskie), which were drained from their demographic potential by the migration outflow of the population (depopulation, aging) the soonest, as well as in industrial regions (Śląskie, Łódzkie), where the political and economic transformation significantly affected population processes.

Thirdly – only the model of consistent changes in urban settlement systems of cities in voivodeships situated mainly in the centre and in the south of the country refers to GEYER & KONTULY'S (1993) model of urbanization transformations.

Fourthly – in the processes of intensifying metropolization after the political and economic transformation, it is no longer enough to include a city within its administrative boundaries as a spatial unit for research. The emerging metropolitan systems form a more or less cohesive whole, in which the ongoing population and economic processes go far beyond the borders of one city. Therefore, the next

stage of research should be to identify, on the one hand, the dynamics of particular size classes of cities within complex settlement systems, and on the other hand, settlement changes in the relationship between the metropolis and the remaining urban network.

In geographic and settlement studies, much attention is paid to the role of urban centres of different population sizes in shaping the settlement system**,** but:

– firstly, more extensive comparative studies of regional changes in the structure of settlement systems are necessary, which would allow for the monitoring of the impact of economic processes and structures on these systems. Each of these regional settlement systems is characterized by a certain degree of historical functional-spatial and demographic-social cohesion on the one hand, and by susceptibility to blurring, and decomposition of this structure, with suburbanization being one of its manifestations, on the other hand;

– secondly, research on structural changes has an important practical dimension for urban and regional policy, giving a possibility to mitigate and even eliminate specific structural disparities with the help of specific instruments.

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