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DYNAMICS OF SIZE CLASSES OF CITIES IN POLAND IN 1950–2018

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Abstract

The study aims to present variability in the population of individual size classes of Polish cities in 1950–2018, its determinants and consequences for the formation of the settlement system. The application of quartiles as the basic statistical measure allowed identifying which parts of particular size classes of cities had the greatest impact (progressively or regressively) on changes in the settlement system. In this respect, strong dynamics of the upper quartile of Polish cities, lasting until the end of the 1970s, becomes apparent. In the 1980s, the dynamics of the upper quartile of large cities showed a shift during development waves in comparison to the culmination of these waves for medium-sized cities. However, since the end of the 1980s, there has been an increasing role of the lower quartile in determining the direction of changes in the size structure of cities, especially in medium and small cities.

Key words

Poland, city size classes, large cities, medium-sized cities, small cities, quartiles.

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1. Introduction

The settlement system of cities in Poland is characterized by a stable distribution according to the size of cities, where the relationship between the rank and the size of individual cities is consistent with the Zipf rule of a linear relationship between the rank logarithm and the urban center size (Dziwoński et al., 1977; Sokołowski, 2003). It is considered to be one of the most mature, polycentric settlement systems

in Europe (Bourne et al., 1984; Rykiel, Jażdżewska, 2002; Smętkowski, 2010).

Based on the number and the size structure of cities in Poland, K. Dziwoński (1983) argued that during the period of the People's Republic of Poland, three characteristic stages of transformation of Polish cities could be observed:

- development of small towns in the 1950s associated with the post-war development of the Recovered Territories (northern and western);

- development of medium-sized cities based on intensive industrialization, and creating regional and sub-regional growth centers – the 1960s–1970s;
- initiation of the process of metropolization in the 1970s, especially as regards Warsaw.

Since the beginning of the 1990s, the city system was shaped in the new conditions related to deindustrialization, globalization of the market economy, as well as the process of metropolization of space, and then intensification of international population migrations (Korcelli, 2018). Due to the complexity in shaping settlement systems, the study of the directions of population changes cannot be limited to indicating pro-development tendencies in cities or to identifying the conditions and consequences of these changes. It is vital to define:

- to what extent individual size classes of urban centers shaped a specific direction of transformations,
- which parts (lower or upper) of these classes had a greater impact on the observed changes in trends, and
- how stable the impact was over time.

In other words, we ask, for example, the question: was the population growth in the class of medium-sized cities determined exogenously or endogenously? Exogenous growth consists in the transition (promotion) of small towns to the class of medium-sized cities because of the dynamic population development of the former. On the other hand, endogenous growth means an increase in the population of the medium-sized centers themselves, which thus moved up in this size class of cities. The increase in the population of the large city class may result from the acquisition of a certain part of dynamically developing medium-sized cities (exogenous growth) or be a derivative of the development of cities within this size class (endogenous growth). Then the question remains: is it an increase in the number of the largest cities or of the smallest ones in a given class? These trends are important not only in terms of cognition, but also they have a practical dimension, related to the optimization of the country's settlement structure.

The aim of the study is to distinguish the stages of development of Polish cities in reference to factors that stimulate or inhibit this development and indicate its consequences for shaping the size structure of cities. This will allow identification of the share of individual size classes of cities in the ongoing changes in the country's settlement system.

2. Data sources and methods of analysis

The study uses secondary data analysis, which is commonly used in both quantitative and qualitative research (see: MacDonald, Headlam, 2011). In this article, it was applied to the first of the distinguished data types (see: Dale et al., 2008).

The data from the National Censuses provided by Statistics Poland (Pl. Główny Urząd Statystyczny) were used for analysis. The data for 1950–1988 came from publications of this institution (*Statystyka miast ...*, 1967; *Struktura demograficzna ...*, 1972; *Rocznik Statystyczny Miast*, 1980; *Struktura demograficzna ...*, 1992), while for 1998–2018 from the website *Local Data Bank* (Pl. Bank Danych Lokalnych). As complementary information, data contained in the *Demographic Yearbook of Poland 2020* (*Rocznik...*, 2020) was used.

Among the tools that allow studying the scale of the dynamics of the discussed phenomena, the most frequently used ones include absolute and relative increases, indices and models of fluctuations in time that enable defining the trend as well as seasonal and resultant fluctuations (Sobczyk, 1995). Slightly less attention is paid to the possibilities offered by the median and quartiles, especially in a comparative analysis of time series (Fig. 1).

If we compare two ordered data series using the median (Me) as well as the lower quartile (Q_1) and the upper quartile (Q_3), there can be a situation where:

- the second series of data compared to the first one is characterized by an increase in the size of all measures (Me , Q_1 and Q_3);
- with the same size of Me , the lower quartile (Q_1) of the second series is lower compared to the first data series, and the upper quartile (Q_3) is higher;
- the second series of data, compared to the first one, is characterized by a decrease in the size of all measures (Me , Q_1 and Q_3), i.e. the opposite to situation A;
- with the same size of Me , the lower quartile (Q_1) of the second series is higher than that of the first data series, and the upper quartile (Q_3) is lower, i.e. the opposite to situation B.

The idea of these comparisons was used in an analysis of the subsystem of medium-sized cities in Poland in the context of the national settlement system (Runge, 2013) and with reference to the model of urbanization by M.S. Geyer and T. Kontuly (1993). The monitoring of further trends in changes in individual components of the size structure of cities in the changing conditions of the urbanization process enables revealing regularities in the course of this process. Data from the period of 1950–2018 were used for the study, distinguishing 10-year

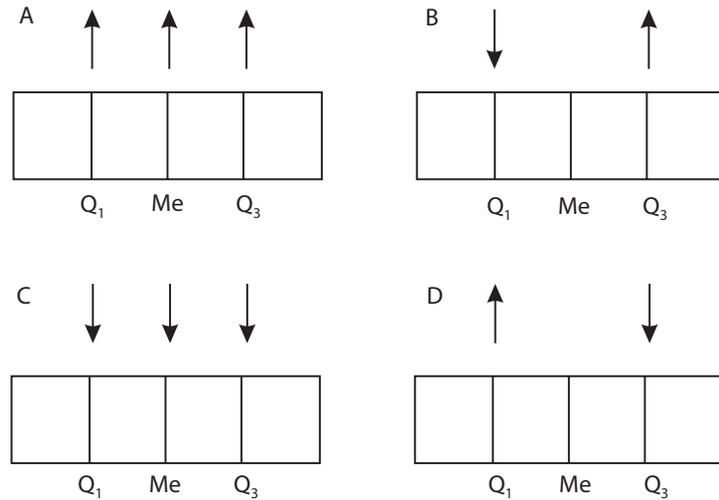


Fig. 1. Changes of the size of the lower quartile (Q_1) and the upper quartile (Q_3) for selected data
Source: Runge, 2013.

sub-periods. The study was conducted not only for the general set of cities in Poland, but also for its sub-sets, broken down into:

- small towns (less than 20,000 inhabitants),
- medium-sized cities (from 20,000 to 100,000 inhabitants),
- large cities (over 100,000 inhabitants).

The issue of the role of the lower quartile Q_1 and the upper quartile Q_3 in determining the direction and the size of population changes in individual size classes of cities was given more careful consideration using J. Webb's (1963) demographic typology,

widely known in population geography. However, instead of the natural and migration increase/decrease, the axes in the graph represent the values of the lower quartile Q_1 and of the upper quartile Q_3 , while the individual sectors from A to H represent the nature of the relationships in shaping the size and direction of changes in both statistical measures (Fig. 2). Generally, types A–D are progressive, regardless of whether the dynamics of Q_1 is greater than Q_3 or vice versa. In turn, types E–H are regressive, regardless of whether regress in Q_1 is greater than in Q_3 or vice versa.

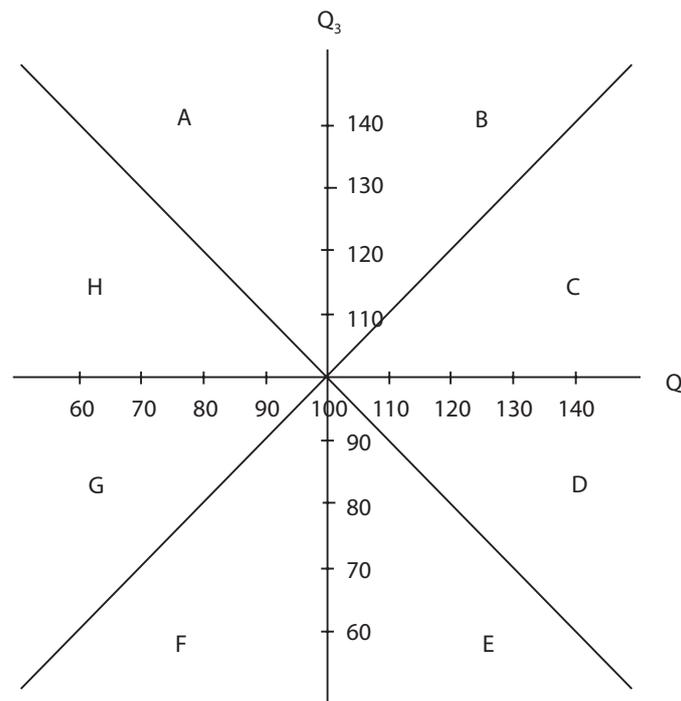


Fig. 2. Types of dynamics of the lower quartile (Q_1) and the upper quartile (Q_3)
Source: Runge (2013) based on J.W. Webb (1963).

3. The development of cities in Poland in 1950–2018 – its determinants and consequences for the size structure of cities

Poland belongs to moderately urbanized European countries. The share of urban population in the total population of the country increased from 36.9% in 1950 to 61.2% in 1988, reaching its maximum level of 62.0% in 1991. Since then, the share of urban population was gradually decreasing – to 60.1% in 2018. The number of cities and their population varied over time (Tab. 1).

In order to maintain the comparability of data, the table uses intervals of a similar span, while maintaining a specific trend in population changes. When a trend continued in the next decade, time intervals were generalized. This allowed distinguishing periods with different population trends in the development of Polish cities (Fig. 3).

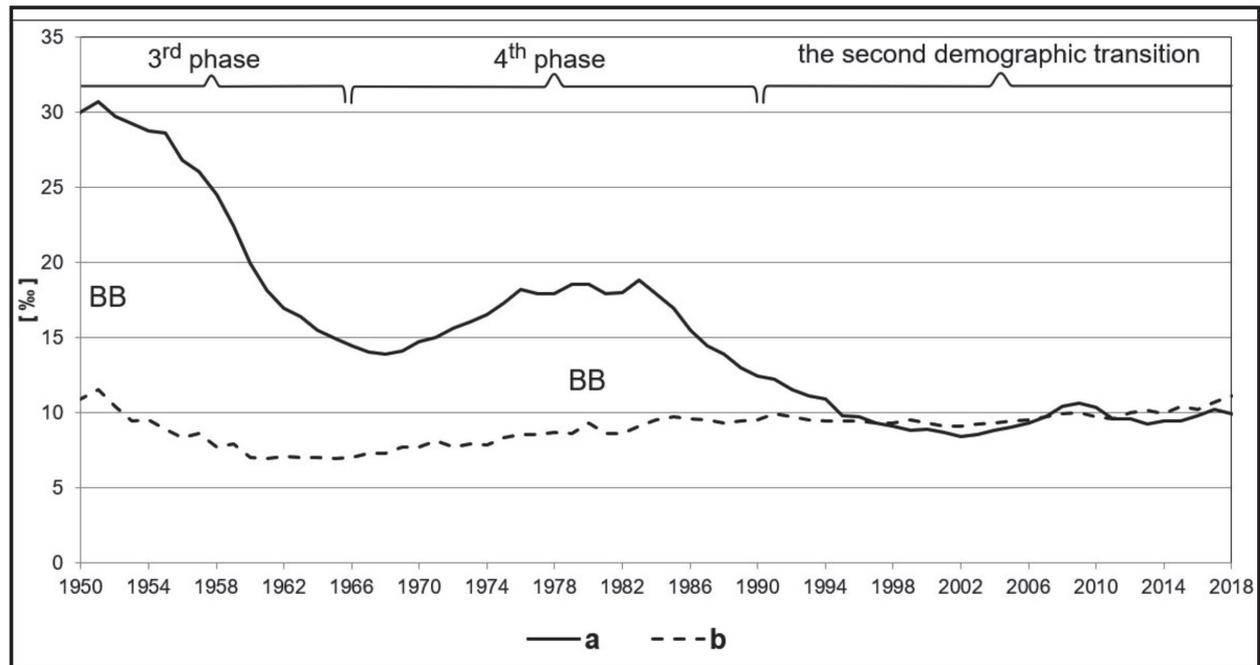
The period of dynamic population growth in the 1950s was related to rebuilding the cities after the war and to overlapping of the post-war baby boom with the declining stage of demographic transformation (the 3rd phase).

The period of rapid urban population growth in 1960–1978 was associated with intense industrialization (mainly of cities) with a view to transforming Poland from an agricultural country into an industrial one (transition from the agrarian to the industrial phase of economic development). This was extensive industrialization, based on traditional industries (among others: mining, metallurgy, shipbuilding, textiles) with a high degree of labor consumption (Kuklinski, 1981; Parysek, 2005). In consequence, by the end of the 1970s, urban labor markets grew rapidly, absorbing enormous resources of the young labor force flowing in from the countryside. From the then overcrowded and underinvested rural areas, enormous migration flowed into cities (Dziewoński

Table 1. Changes in the size structure of Polish cities in 1950–2018

Year CITIES	1950	1960	1970	1978	1988	1998	2008	2018
	Number of cities							
Total	693	887	889	803	822	875	892	930
Large	16	22	24	33	41	42	39	38
Medium-sized	60	88	124	146	175	189	181	180
Small	617	777	741	624	606	644	672	712
Structure (in %)								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Large	2.3	2.5	2.7	4.1	5.0	4.8	4.4	4.1
Medium-sized	8.7	9.9	13.9	18.2	21.3	21.6	20.3	19.3
Small	89.0	87.6	83.4	77.7	73.7	73.6	75.3	76.6
Population (in thous.)								
Total	9 384.0	14 199.9	17 062.6	20 150.4	23 174.8	23 922.8	23 288.2	23 067.2
Large	4 055.1	6 127.4	7 380.5	9 693.8	11 518.1	11 510.3	10 967.5	10 705.5
Medium-sized	2 229.4	3 351.1	4 775.9	6 015.2	7 140.7	7 622.8	7 403.3	7 363.0
Small	3 099.5	4 721.4	4 906.2	4 441.4	4 516.0	4 789.7	4 917.4	4 998.7
Structure (in %)								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Large	43.2	43.2	43.3	48.1	49.7	48.1	47.1	46.4
Medium-sized	23.8	23.6	28.0	29.9	30.8	31.9	31.8	31.9
Small	33.0	33.2	28.7	22.0	19.5	20.0	21.1	21.7
Population dynamics in % (starting year = 100%)								
Year CITIES	1950-1960	1960-1970	(1970-1978)	1978-1988	1988-1998	1998-2008	2008-2018	1950-2018
Total	151.3	120.2	118.1	115.0	103.2	97.3	99.1	245.8
Large	151.1	120.5	131.3	118.8	99.9	95.3	97.6	264.0
Medium-sized	150.3	142.5	125.9	118.7	106.8	97.1	99.5	330.3
Small	152.3	103.9	90.5	101.7	106.1	102.7	101.7	161.3

Source: own study based on: Bank Danych Lokalnych; Rocznik..., 1980; Statystyka..., 1967; Struktura..., 1972, 1992.



a – births; b – deaths; BB – baby boom.

Fig. 3. Natural movement of the population in Polish cities in 1950–2018

Source: own study based on *Rocznik...*, 2020.

et al., 1977; Fierla, 1976; Gawryszewski, 1989). In turn, population growth in cities forced their spatial development by expanding borders and absorbing the neighboring rural areas and even small towns.

In the next period of urban transformation, two sub-periods should be distinguished: gradual weakening of the urban population growth in 1978–1988 and its inhibition in 1988–1998. In some industrial cities, especially those based on raw materials, population growth still continued. Many small and medium-sized cities gained a chance for development thanks to the administrative functions of the voivodship capital due to a new administrative division of the country in 1975.

However, the scale of investment in industry ended in the mid-1980s, and symptoms of an economic crisis resulting from the malfunctioning of the centrally planned economy began to emerge. The migratory influx to the cities began to weaken (Korcelli, 1988). The political and economic transformation opened Poland to the world, but, simultaneously, it severely confronted its economy with the world economy. The collapse of the labor market in industrial cities which based their development on traditional branches of the resource-intensive and labor-intensive industry resulted in difficulties in finding a job. This delayed young people's opportunities to become independent and realize their life plans.

The thus far weakly marked suburbanization process significantly accelerated in the 1990s due to the development of individual motorization and

the construction of systems of access road to cities. There was a separation of places of work from places of residence (Parysek, 2008). Currently, increasingly more often not individual cities are analyzed but entire functional regions or metropolitan areas, as due to the suburbanization process, part of the urban population found itself outside the city but in a zone closely related to it (Smętkowski et al., 2009; Śleszyński, 2013).

The period of depopulation of Polish cities (population decline) occurred in 1998–2018. The intensifying social changes (an increase in the consumption lifestyle, the pursuit of one's own life aspirations, and a sense of responsibility for supporting one's family) and the persistent difficult situation on the labor market delayed decisions about getting married and having children. Since the beginning of the political and economic transformation, both the migration and reproductive supply clearly began to weaken, and since 1998 both components of population changes took negative values (Zborowski et al., 2012). The increasing outflow of residents of a city outside its borders – to the suburban zone – was accompanied by economic emigration of young people in search of work (Jaroszewska, Strykiewicz, 2014). Initially, this outflow was directed to the largest agglomerations in the country with a diversified economic structure and growing foreign capital investments. After Poland joined the European Union, foreign emigration significantly increased, which mainly concerned young people (Marek, 2008) who

started their families in other countries, the effect being a substantial reduction in the birth rate in Poland and the emergence of a natural loss (Kałuża-Kopias, 2014).

Therefore, since the 1990s, the shaping of the components of the actual decline in city populations was affected by external conditions, such as the political and economic transformation, the second demographic transition, the processes of globalization and suburbanization, and the internal socio-economic situation of particular cities.

Population changes were also accompanied by changes in the number of cities. They took place not only because of dynamical urbanization, but also due to administrative reforms of the country implemented every few decades, with completely different assumptions: sometimes giving and sometimes taking away city rights, especially as regards the smallest settlements. This resulted not only in changes in the number of cities and in large diversification of their population dynamics, but also in changes in the size structure of Polish cities, expressed in the share of large cities (over 100,000 inhabitants), medium-sized cities (20,000–100,000 inhabitants) and small town (below 20,000 inhabitants) – (Runge, 2011).

In 1950–1970, the number of cities in Poland increased from 693 to 889, and then, because of a reform of the administrative division of the country in 1975, it dropped to 803 cities in 1978 (Tab. 1). At the same time, the number of large cities increased from 24 to 33, and the number of small towns decreased from 741 to 624 in 1978 and to 606 in 1988.

In 1975, while seeking to decentralize power, the country was divided into 49 small voivodeships, which gave some small and medium-sized centers a chance for dynamic development thanks to the administrative function of the voivodeship capital (among others, Suwałki, Łomża, Ostrołęka, Sieradz, Skierniewice, Ciechanów). In turn, in 1998, a smaller number of 16 voivodeships were restored, degrading the administrative functions of many cities.

The enactment of the bill on local self-government in 1991 (Ustawa..., 1990) restored local self-government. This enabled smaller cities absorbed in the past decades by larger neighbors to regain administrative independence (incl. Bieruń, Pszów, Rydułtowy, Radzionków) (Krzysztofik, 2006). As a result, in the following decades the number of cities increased again to 930 cities in 2018 (Tab.1).

A rapidly growing – both endogenously and exogenously – set of **large cities** encompassed the largest part of the population potential. In 1950, only 43.2% of the total urban population lived in 16 large cities (over 100,000 inhabitants), while in 1988 in 41 large cities, as much as 49.7%. Since then, the

population of large cities began to decline, which resulted both in a decrease in the number of large cities (to 38 cities in 2018) and their share in the population (to 46.4%).

There is a certain wave pattern in the population development of large cities: after a dynamic development in the 1950s, there was a slightly weaker development in the 1960s. Population development accelerated again in the 1970s as a result of intensive industrialization and administrative functions related to the new administrative division of the country. This also accelerated the development of many medium-sized cities, exceeding the number of 100,000 inhabitants. In the next decade, the development of large cities slowed down (the crisis of the economic development model based on forced industrialization), and the 1990s marked a slight regression (collapse of the labor market and then suburbanization), which deepened in the 21st century (the impact of strong suburbanization and the effects of an aging population in cities) (Kurek et al., 2015; Krzysztofik, Szmytkie, 2018). The suburbanization processes occurring since the late 1990s developed powerful suburban zones around large cities (Poznań, Warsaw, Kraków, Łódź) where some of those cities' inhabitants moved (Raźniak, 2007; Krzysztofik et al., 2017).

Medium-sized cities, from 20,000 to 100,000 inhabitants, are an intermediate size class between large cities and small towns. In 1950–1998 the number of such cities rapidly grew (from 60 to 189 cities), but the share of their population in the entire group of cities merely increased from 23.8% to 31.9%. The development of medium-sized cities corresponds to the previously distinguished stages of the development of Polish cities, the difference being that their development in 1960–1998 was more intense than for all cities.

The dynamically developing cities at that time included, among others, those based on exploitation of raw materials (e.g. lignite: Konin, or copper ore: Głogów and Lubin), developing industry (Stalowa Wola, Mielec, Dębica), or small towns which became capitals of voivodeships in 1975 (Suwałki, Łomża, Ostrołęka, Biała Podlaska). However, when the industrial model of development was exhausted and the next administrative reform deprived them of the functions of voivodeship capitals and degraded them to the powiat level, their population growth markedly slowed down.

In Poland, **small towns** (with a population of less than 20,000 inhabitants) clearly dominate in numbers. They constitute 76.6% of the total number of cities and are inhabited by 21.7% of the population of the entire group of cities. The share of small towns in the total number of towns decreased from 89.0%

in 1950 to 73.6% in 1988, but in the 21st century, it increased again to 76.6% in 2018. Only 33.0% of the total number of urban residents lived in small towns in 1950, 19.5% in 1988 and 21.7% in 2018. The class of small towns developed the slowest, because, on the one hand, some of the most dynamically developing small towns advanced to the set of medium-sized towns, while new charters or restitution of municipal rights complemented this set “from below” with very small towns. The population grew dynamically only in strongly industrialized small towns (incl. Łęczna, Bukowno, Połaniec). Since the 1990s, the processes of suburbanization have intensified, significantly accelerating the development of satellites of large cities: Reda (Gdańsk), Murowana Goślina, Pobiedziska (Poznań), Kobyłka (Warsaw).

4. Application of quartiles in the study of the dynamics of population in size classes of cities

Research on the dynamics of population processes is extremely important as it allows identifying regularities of shaping the country's settlement system as well as making attempts at extrapolating changes in the future. In the national structure of the settlement system, three levels of the functional and spatial organization of cities are formed: local, regional and national (Dziewoński, 1975). They correspond to the size classes of large, medium and small cities, among which the largest urban agglomerations play a leading role in the national settlement system. Therefore, apart from the cognitive aspect, such studies have a practical dimension, constituting a premise for the

creation of national, regional and local development strategies. Information about the direction of population changes allows indicating the current and future needs in the field of housing, social and technical infrastructure in the city policy.

Using such measures as the median, the lower quartile (Q_1) and upper quartile (Q_3) in subsequent sub-periods, their variability in time (course) was plotted, both for all Polish cities and for individual size classes of cities (Fig. 4–7). As can be easily seen, both the direction and the scale of changes of the analyzed statistical measures in each series of data (total cities, large cities, medium-sized cities, small towns) significantly differ. This is underlined by an arrow showing for which quartile (Q_1 or Q_3) not only the direction but also the intensity of these changes in time was greater.

Thus, in the case of the entire set of Polish cities (all cities), there is a clear division into two periods of transformation: 1950–1988 and the turn of the 20th and 21st centuries (Fig. 4). In the initial period of the study (1950–1960), the role of the smallest urban centers was incidental (increase in Q_1), which resulted, among others, from the settlement in and development of the Recovered Territories as well as a large number of small and very small towns in all cities in the country (the median size of the population was only 4,000–5,000 inhabitants). In the 1970s, large cities, medium-sized cities and larger small towns played a leading role in the urbanization process. The industrialization processes in cities peaked at that time (the highest share of people employed in industry), and the administrative reform of the country gave medium-sized and even small towns a chance for development. This resulted in a strong

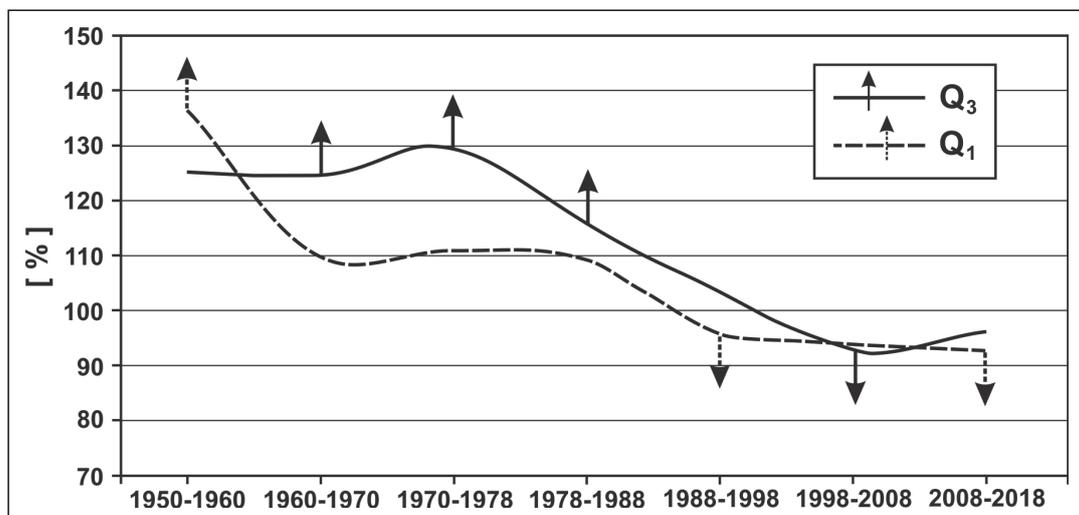


Fig. 4. Changes of the size of the lower quartile (Q_1) and the upper quartile (Q_3) of the population in all towns in Poland in 1950–2018

Source: own study.

increase in the population of cities above the median for the set. As a result of the administrative reform of 1975, many very small towns ceased to be urban centers, and hence the significant dynamics of the lower quartile Q_1 was maintained. Yet, due to the collapse of local labor markets in the period of the political and economic transformation, this dynamics significantly weakened and began to show regressive trends.

The dynamics of Q_3 was also weakening since the 1980s, and in the following years, the decrease in the size of the upper quartile (Q_3) was clearly marked. The extent of the regression after 1988 was large, despite a slight increase in the volume of Q_3 in 2008–2018.

Among large cities, changes in the quartiles sizes in time clearly fluctuated (Fig. 5). In the 1950s and the 1960s, the pace of the demographic development of large cities was high; therefore, the highest increase in Q_3 appeared in the 1960s. In 1950–1960 and in 1970–1988, the set of large cities was expanding owing to dynamically developing medium-sized cities. This affected the lowering of Q_3 at the turn of the 1970s and the 1980s. Since the 1980s, the number of large cities has stabilized with a gradual slowdown in the development of the largest cities. The varied dynamics of the population of individual cities was accompanied by a slight increase in the upper quartile, which persisted until the first decade of the 21st century. However, in the last analyzed period, a decrease in the upper quartile was noticeable due to progressive suburbanization and aging of the urban population. These changes result from the varied dynamics of the population of individual cities, with a population above the median for the set,

because the adopted research procedure is based on an interpretation of positional variables.

A similar, but slightly milder character of the changes was visible among the smallest of large cities (Q_1). The policy of economic activation, especially in the country's peripheral regions, implemented through the country's administrative reform in 1975 and the location of industrial investments, resulted in the dynamic development of large cities concentrated around Q_1 as well as medium-sized cities being promoted to the group of large cities.

In the set of medium-sized cities (20,000–100,000 inhabitants), the fluctuation (variability) of the upper quartile is characteristic, which until the 1980s played a leading role in the transformations of this group of cities (Fig. 6). Initially, cities above the median for this set were the most dynamic; therefore, in 1950–1960 there was an increase in the importance of the upper quartile (an increase in Q_3). Due to the demographic development of medium-sized cities, some of them were moved to the class of large cities, and at the same time the set of medium-sized cities was expanded with dynamically developing small towns. This resulted in a reduction in the size of the upper quartile in the 1960s. Simultaneously, within the set of medium-sized cities, the position of the cities changed, usually in the direction of the median or the upper quartile, which caused another increase in this quartile in the 1970s. During the 1980s, and the 1990s, the position of the upper quartile stabilized and in 2008–2018 it declined. For the lower range of medium-sized cities, the scale of the dynamics of Q_1 was bigger only in the 1990s.

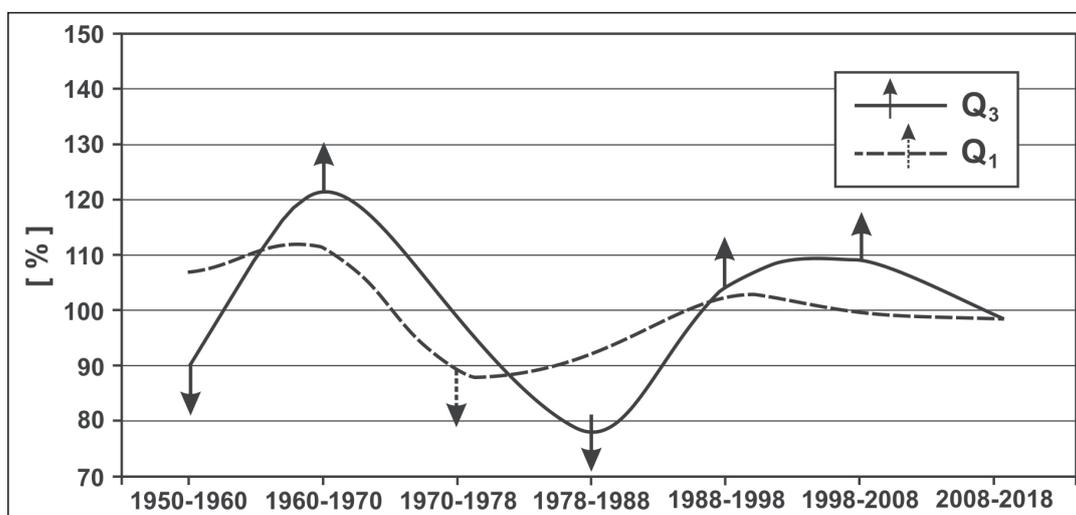


Fig. 5. Changes of the size of the lower quartile (Q_1) and the upper quartile (Q_3) of the population in large cities in 1950–2018

Source: own study.

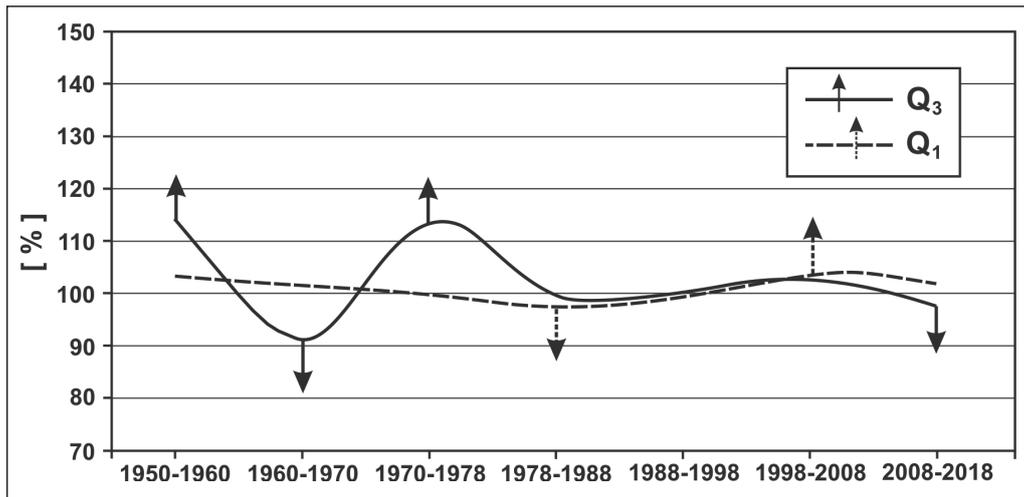


Fig. 6. Changes of the size of the lower quartile (Q_1) and the upper quartile (Q_3) of the population in medium small towns in 1950–2018

Source: own study.

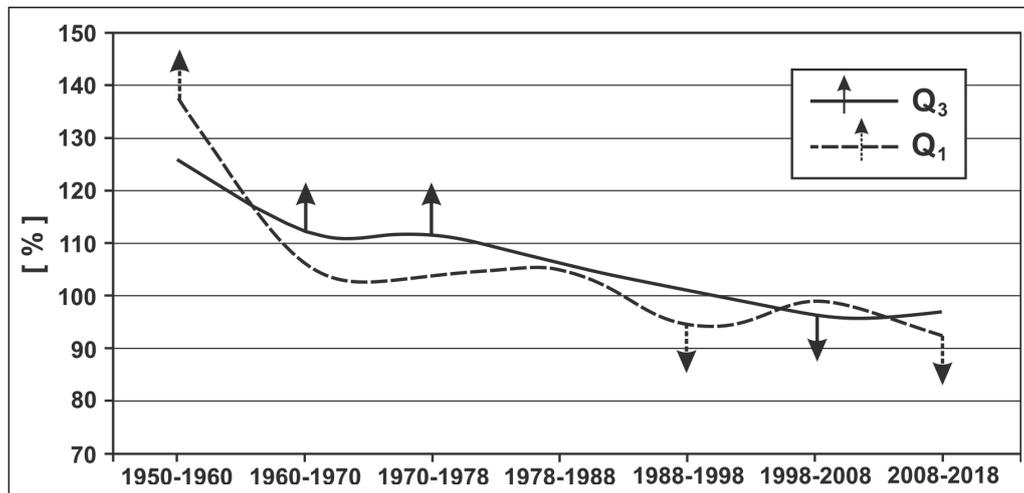


Fig. 7. Changes of the size of the lower quartile (Q_1) and the upper quartile (Q_3) of the population in small towns in 1950–2018

Source: own study.

Among small towns, the dynamics of the upper part of the group of small towns played an important role in urbanization changes, but the role of these towns decreased with time, as some of them exceeded the population threshold of 20,000 inhabitants and advanced to the set of medium-sized cities (Fig. 7). Only in the 1960s and the 1970s, the towns with a similar population (Q_1) played a significant role in the development of small towns. Since the 1990s, their role has slightly increased because of the restitution of municipal rights in some very small towns.

Therefore, the following question arises: did the largest or the smallest urban centers in a given set decide about the dynamics of changes within the sets of cities distinguished here?

As regards all Polish cities until the political and economic transformation, the greatest dynamics of development was manifested by cities of the upper quartile (Q_3), i.e. the biggest ones. Later, the regression of smaller towns from the lower quartile (Q_1) proved more significant in the dynamics of urban population. For the size class of large cities, the dynamics of changes in the upper quartile (Q_3) was dominant – it was alternately strongly progressive (1960–1970 and 1970–1978 as well as 1988–1998 and 1998–2008) and regressive (1950–1960 and 1978–1988).

In the group of medium-sized cities (20,000–100,000 inhabitants), until the 1970s, changes in cities concentrated around the upper quartile (Q_3) were more significant. In later years, cities concentrated

around the lower quartile (Q_1) played a greater role in the dynamics of population changes.

In the class of small towns (below 20,000 inhabitants), variables regarding the direction of transformation of cities concentrated around the upper quartile (Q_3), i.e. the largest cities in this size class, played an important role. In turn, the smallest towns, with several thousand inhabitants each, dynamized the entire set of small towns in the 1950s and after 1988. While in the first period these changes were progressive, in the 1990s they were clearly regressive.

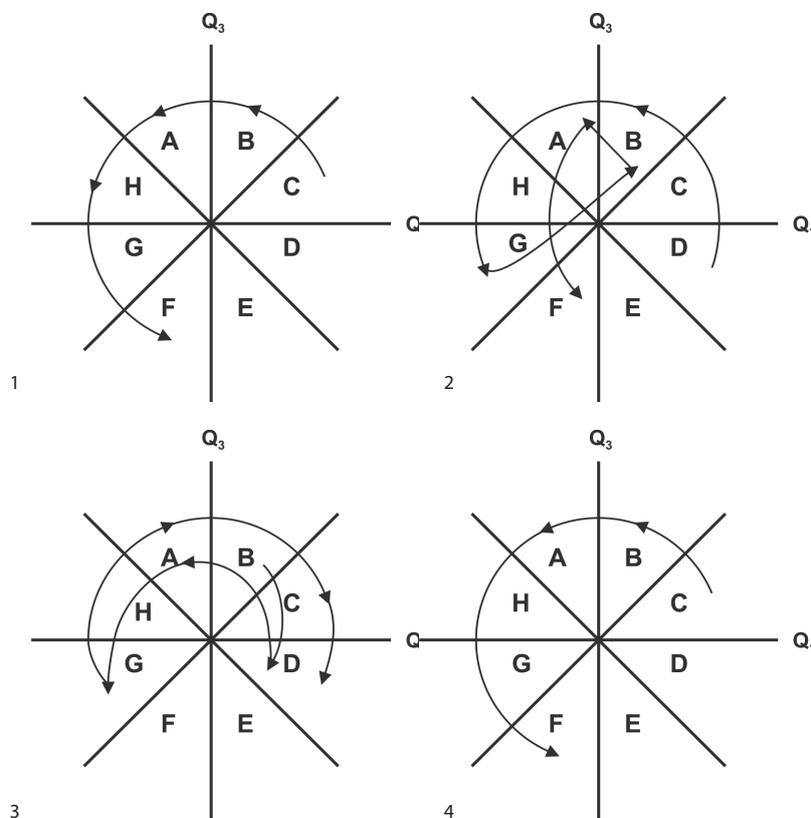
The presented picture of changes shows changes that are more dynamic in the upper quartile (Q_3) in each size class of cities (large, medium and small); however, the smallest scale of differences between the role of Q_1 and Q_3 is visible in the case of medium-sized and small cities.

Figure 8 shows changes in shaping the volume of Q_1 and Q_3 for all cities in Poland and for the distinguished size classes (large, medium, and small cities). In 1950–2018, in the set of all Polish cities, there is a clear transition of the relationships between Q_1 and Q_3 from progressive to regressive positions. A similar situation characterized small towns. On the other hand, large and medium-sized cities were characterized by significant variability in belonging to a specific type of a relationship between Q_1 and

Q_3 . However, a certain difference was noticeable here: large cities were first characterized by a transition from progressive to regressive types, and then this cycle was repeated. In contrast, in medium-sized cities, the development of the relationship between Q_1 and Q_3 initially represented a progressive type, and then these relationships became regressive, although in recent years they have stabilized among progressive types. This means that in the set of medium-sized cities after strong variability of the role of Q_1 and Q_3 in the initial period of the study, since the 1980s, their role was the closest to that of other analyzed city size classes.

5. Discussion

In the 1990s, many Central European countries transformed from a centrally planned economy based on an industrial model to a market economy requiring industrial restructuring and developing the service sector. These changes took place at different times: in some countries quite early (Bole et al., 2020), in others – with a significant delay (Fakeyeva et al., 2018), also influencing the formation of the settlement structure. This was due to the fact that individual size classes of cities reacted to these changes



1. all cities; 2. large cities; 3. medium cities; 4. small towns.

Fig. 8. Types of changes of town population in all cities in Poland, and in large, medium and small towns in 1950–2018
Source: own study.

to a different degree – the strongest regression concerned large and medium-sized cities in Romania (Bănică et al., 2017). The regression was also clear in Hungary, while the city system in Slovakia proved to be the most stable (Mezei, 2009). In Bulgaria and Hungary, administrative reforms also affected an increase in the number of small towns (Mihaylov, 2011; Pirisi et al., 2015). Still, everywhere there is a noticeable increase in disproportions in the development of metropolises in relation to other elements of the settlement system. As M. Smętkowski (2018) writes, the largest disproportions in this regard occur in the least developed countries (Romania, Bulgaria), and the smallest ones in the most developed countries (the Czech Republic, Slovenia). In turn, P. Dostál and M. Hampel (2008) pointed out that while all cities in the Czech Republic developed at a similar pace in the industrial period, and the hierarchical structure of cities was stable, the transition from industrial to post-industrial economy resulted in a differentiation of the hierarchical system of cities into many levels in this hierarchy. As P. Korcelli (2018) states, the development of metropolises strengthens polycentricism and spatial cohesion only at the upper level of the hierarchy of cities, counteracting the increasing concentration of development factors in one of its links – the capital city. Maintaining the polycentric structure of the national system is possible thanks to clear de-concentration of functions performed by large centers in favor of medium-sized cities (Kunzmann, 1992, 2000; Pumain, 2000). Meanwhile, this is the level of medium-sized cities – quite strongly strengthened in Poland since the 1960s – that was most affected by the adverse consequences of the political and economic transformation and then globalization which manifested itself in a significant reduction in the economic base (Śleszyński, 2017; Krzysztofik, Szmytkie, 2018). The reduction of this base limits the links between medium-sized cities and both the supra-regional and metropolitan level and the local and sub-regional level of the settlement system. Therefore, the weakening of this size class of cities may pose a threat to the integration of the settlement system of cities. Meanwhile, as pointed out by P. Korcelli (2008, 2018), the strategic goals of the development of this system involve integrating the national settlement system, maintaining the polycentric structure of the system and strengthening the competitiveness of the main cities.

As noted by D. Szymańska (1996), research on shaping the development of the existing structure and the emergence of new cities results from two important premises:

- firstly, from the proper functioning of the links in the settlement system at various spatial scales (local, regional, national);
- secondly, from the need to study changes in the settlement structure, as the domination of traditional industry exposed industrial centers to huge changes during the political and economic transformation.

6. Conclusions

The number of cities and the number of their inhabitants significantly changed in the analyzed period. Redistribution of these changes within individual size classes of cities varied from the point of view of both the structure of the number of cities and their population. In the total number of cities, the share of medium-sized and large cities significantly increased. The increase in the share of medium-sized cities in the population was slightly smaller. Thus, medium-sized cities, usually identified with regional or sub-regional growth centers, showed the highest dynamics of development throughout the entire period under study. This allowed weakening the disproportion between the development of large cities and the smallest urban centers.

The analysis of the size of the quartiles confirmed the variability of individual parts of the size classes of cities below or above the median. In general, the upper quartile (Q_3) of the set of large and medium-sized cities was the most dynamic. Until the end of the 1970s, its dynamics had positive values, yet alternately in both size classes of cities. In 1950–1960, there was a regression in the upper quartile in large cities, but in the next decade it strongly increased. The crisis of industrial development in the conditions of a centrally planned economy weakened the pace of development of large cities, which resulted in negative values in Q_3 in 1978–1988. However, the largest cities in the country went through the economic transformation the best, intensifying the development of metropolization processes (growth in Q_3). The permanent and deepening natural loss associated with the transition to the 5th phase of demographic changes and the intensification of suburbanization and de-urbanization processes change the spatial systems of agglomerations. Some of the residential and economic functions of endogenous importance are moved to the suburbs, and the development of managerial and control functions concentrates in a large city (Śleszyński, 2007; Dorocki et al., 2018). This also changes the layout of links of this city: it weakens the hitherto close connections with its hinterland (metropolitan area) in favor of

superior, higher-order links with other metropolises, not only national ones.

In turn, the dynamics of the upper quartile of medium-sized cities shows a shift in time of the development waves in relation to the culmination of these waves for large cities. In medium-sized cities, the first period (1950–1960) began with a progressive trend in the upper quartile, followed by its decline in 1960–1970. In 1970–1978, a strong increase in Q_3 was marked again, but in the following decades, the lower quartile mainly played a role in changes in this size class of cities, while the last period marks a clear regression of the upper quartile.

The distinguished types of dynamics of the lower and upper quartiles have also been confirmed. Large and medium-sized cities were characterized by high variability in the formation of progressive and regressive types, which was expressed in the transition from regressive to progressive types and the reoccurrence of regressive types.

In the period of the centrally planned economy, with close internal ties and those within the Eastern Bloc, it was possible to control the development of the settlement system. Development factors stimulated the development of most cities, and it was relatively easy to stimulate the development in a given city, e.g. by locating a large industrial investment in it. Currently, processes often stimulated by external (global) factors that cannot be controlled from the level of a given city or even country take place in cities. Significant differentiation of development trends in cities, greater difficulties in obtaining development factors, changes in the intensity and directions of links in the settlement system consisting in the weakening of hierarchical connections in favor of horizontal (network) connections – all this put the largest cities in a privileged position. This may lead to destabilization of the settlement system.

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