

Poviats threatened by deprivation: state, trends and prospects



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1. INTRODUCTION

The term “deprivation” means the inability to meet human needs. Deprivation may concern a variety of areas, starting from physiological through social to emotional needs. In social terms, deprivation is part of the marginalization process and can lead to social exclusion¹. Deprivation – understood in this manner – has a number of dimensions, starting from the economic dimension, through the ability and opportunity to participate in the labour market, ending up with access to public goods and services.

Deprivation can be strongly differentiated in the territorial dimension, which is a result of tendency to spatial concentration of problematic phenomena due to the impact of cumulative causation mechanisms. Areas affected by deprivation are considered less attractive as a place of residence, which can lead to the outflow of wealthier and better educated people to areas that offer better living conditions and, consequently, to the phenomenon of spatial segregation. The spatial scale of deprivation can be varied, starting from poor housing estates within cities, through the whole cities and poviats [middle tier of Polish administrative division], affected by socio-economic degradation caused by loss of economic base or poor adaptability to changing external conditions, ending up with less developed regions where one can observe concentration of social problems.

The purpose of this study is to present the different dimensions of spatial differentiation of the phenomenon of deprivation in Poland at the local level. In order to carry out the analysis, the Poviats Index of Deprivation (PID) has been created. The report discusses examples of similar indicators developed in other countries, selection of the level of spatial analysis, as well as indicators included in the synthetic index and how it is constructed. The largest part of the study is devoted to presenting the spatial differentiation of the phenomenon of deprivation in Poland on the basis of the developed synthetic index and partial indices. Moreover, the changes to the threat of deprivation faced by poviats in the period 2002-2013 have been analysed, and the long-term qualitative prediction of changes to the threat of deprivation has been presented.

The practical purpose of the research is to create a comprehensive framework for assessing the social determinants of inequality in health. Social diversity can translate directly into the health of the population. This implies the need to adopt a broader approach to the health care which also includes those areas of social policy that affect health determinants.

¹ The definition issues are presented in more detail *inter alia* by R. Szarfenberg (2010).

2. A REVIEW OF DEPRIVATION STUDIES IN SPATIAL TERMS

The purpose of this chapter is to present results of a review of local deprivation indicators used in nine countries and to outline the theoretical context for the use of deprivation measures in studies relating to spatial differentiation in the public health status.

2.1. The concept of deprivation in the studies of wellbeing

Measurement of the welfare of citizens and its spatial differentiation is frequently adopted as a research topic because of its important application dimension in terms of the conducted social policy. At first, welfare was equated with the level of national income per capita. This approach – although still present – was questioned as early as in the 1960s by the social indicators movement postulating the inclusion for the purpose of welfare measurement of indicators from the social area in addition to the so far dominant economic measures. In the next decade, the concept of the quality of life, according to which individual's welfare is a derivative of the degree of satisfaction of their needs, significantly increased in importance (e.g. with the contribution of the works of Jan Drewnowski, a Polish economist). The turn of the 1980s and the 1990s brought two important changes in the approach to the theory and measurement of wellbeing. Firstly, the emergence of a sustainable development concept resulted in incorporating environmental conditions into quality of life measures. Secondly, the concept of capability and functioning of Amartya Sen (Sen 2000) drew attention to the multidimensionality of human needs and to the fact that ability to satisfy them depends on external conditions. The primary purpose of indicators of deprivation that began to emerge during this period was to indicate those conditions that prevent people from satisfying their different needs.

Deprivation can be seen as a reversal of extended approach to welfare. Similarly, with regard to the measures focussed on income, such a reverse is the concept of poverty describing a situation of a person not having sufficient funds to meet their basic needs. While poverty is also defined in absolute terms (e.g. income below subsistence level), deprivation remains a relative measure. The degree of inability to satisfy certain needs is usually referred to the context of a country, region or local community. **Therefore, deprivation can be defined as lack of access to the opportunities and resources that are perceived as common in a given society.** Two types of deprivation are usually distinguished, i.e. material and social deprivation (Townsend 1987). The former focuses on access to resources and services as well as on environmental conditions for maintaining a decent standard of living. Social deprivation, on the other hand, is concerned with the ability of individuals to participate fully in the life of their community.

2.2. Deprivation in the study of the health status of the population

Socio-economic conditions of life of an individual are one the main determinants of their health (see Dahlgren, Whitehead 1992). The development of indicators of deprivation allowed for more precise verification and deepening of this thesis. Researchers dealing with differences in the health status of the population have found that the level of deprivation correlates with many features of individuals and communities (cf. Messer et al. 2006). These include in particular:

- health-relevant behaviours, including *inter alia* the use of stimulants,
- patterns of interaction with the health service, including e.g. the moment cancer diagnosis is made,
- health status, including among others, incidences of infectious diseases and death rates.

The indicators of deprivation in spatial dimension cover both contextual features of a given area - external for individual inhabitants - as well as aggregated personal characteristics (so called composition effect). It is assumed that inequalities in the health status of the population are derived not only from the sum of individual characteristics of inhabitants of a given area, but also from the social and environmental conditions affecting the entire community (Bertin et al. 2014).

The first local indicators of deprivation used in public health surveys emerged in the late 1980s in Great Britain. The classic approach is represented by two measures, known in literature as the Townsend index (Townsend 1987) and the Carstairs index (Carstairs, Morris 1989). They both consist of 4 indicators, of which 3 occur in both indices:

- percentage of the unemployed,
- percentage of households without car,
- percentage of overcrowded households.

The fourth indicator is:

- the Townsend index: percentage of households living in rented accommodation,
- the Carstairs index: percentage of households belonging to a low social class, respectively.

The above mentioned indicators have become an important reference point for further studies of deprivation at the local level. Other researchers expanded and modified the list of variables used, among others, in order to take into account the social dimension of deprivation and create an index that would be better suited for analyses covering the urban and rural areas.

The indicators of deprivation can be put to practical use by public administration, decision-makers and the inhabitants themselves. The following functions of spatial studies on deprivation can be differentiated in the context of health status of the population:

- analysis and evaluation of the relationship between deprivation and health measures,
- planning and allocation of resources in health care,
- evaluation (assessment) and adjustment of health care related activities.

2.3. Review of foreign local indicators of deprivation

Nine indexes created for nine different countries have been taken into account in the review of deprivation indicators. These are: England (ENG), France (FR), the Netherlands (NL), Japan (JP), New Zealand (NZ), Scotland (SCT), the United States (US), Wales (WLS), Hungary (HU)². The selected studies include internationally-recognised indicator-based studies from various parts of the world carried out or commissioned by the state administration, whose

² The above mentioned country name abbreviations will be used further in the chapter.

analyses were published in peer-reviewed journals. A brief overview of individual initiatives is presented in the box below. The next section of the chapter presents conclusions from analyses of these studies.

England (McLennan et al. 2011)

The latest third edition of the Index of Multiple Deprivation was published in 2010 by the Department for Communities and Local Government. The methodology was developed in the 1990s by a team of scientists from Oxford University and is used in Wales, Northern Ireland and Scotland as well.

France (Havard et al. 2008)

A scientific paper published by a group of researchers from the EHESP - French School of Public Health. The proposed indicator has been tested in relation to the Strasbourg and Lille metropolitan areas.

The Netherlands (Deville, Wiegers 2012)

The indicator is published every few years by the Netherlands Institute for Health Services Research (NIVEL). The latest edition is from 2012.

Japan (Fukuda et al. 2007)

A scientific paper published by a group of researchers from the Japan's National Institute of Public Health (NIPH). The indicator was calculated for prefectures and municipalities (gminas).

New Zealand (Atkinson et al. 2014)

The NZDep index was developed by scientists from the Health Services Research Centre in cooperation with the Ministry of Health. The latest, fifth, edition of the index was published in 2014.

Scotland (SIMD 2012)

The index is based on coherent methodology for the entire Great Britain. The latest edition was published in 2012 (by the Scottish Government).

The United States (Messer et al. 2006)

A scientific paper published by a group of researchers representing, among others, the National Health and Environmental Effects Research Laboratory (NHEERL). The proposed indicator was tested for selected 19 cities and 5 counties located in different states.

Wales (WIMD 2014)

The index based on coherent methodology for the entire Great Britain. The latest edition, taking into account results of consultation organised in 2013, was released in 2014 (published by the Welsh Government).

Hungary (Juhász et al. 2010)

A scientific paper published by a group of researchers representing, among others, the National Institute of Environmental Health (OKI).

All indicators taken into account in the review have several common features. Firstly, they apply a multi-dimensional approach to areas associated with human needs (called dimensions of deprivation). Secondly, they regard deprivation as a relative measure, therefore the results achieved can be compared only inside a given country. Thirdly, research results are always in the form of a synthetic index, thus an aggregated measure useful for making comparisons and examining relationships with other phenomena. Fourthly, the studies relate to local spatial units³.

³ The exception is Japan, where the index was also calculated for regional prefectures.

The population of the territorial units selected for analysis ranges from below 100 persons in case of New Zealand's census area units to nearly 40 thousand persons in case of Japanese municipalities. Most studies use statistical units (below the level of local governments), only HU and JP use the level of administrative units. This is related to the nature of the data used. Vast majority of the indicators are based on census data; however in case of ENG, WLS and SCT administrative data are also included, and in JP - variables from the local database.

2.3.1. Variable selection

Most of the analysed studies use the concept of deprivation dimensions to create the index. These are separate thematic fields relevant for the satisfaction of human needs, to which the variables included in the index are assigned. Between five and eight such areas have been distinguished in the examined cases. Differences in the delimitation of the dimensions of deprivation between individual indices are small, they often come down to the degree of detail with which the problem has been treated. The proposed classification of the dimensions of deprivation included in the nine cases examined is presented in the table below (Table 1). Analysis of the results allows to conclude that among variables commonly used to construct the indicators of deprivation are those relating to income, employment, living and housing conditions, education. Issues associated with crime and health are taken into account relatively seldom - only in indicators from the United Kingdom. Lack of variables relating to this last dimension may be explained by the fact that most indicators of deprivation are to synthetically capture the contextual factors which affect the health status of the population. Therefore, health indicators appear as explanatory variable, separated from other areas of deprivation.

Table 1. Dimensions of deprivation in the analyzed indices – the proposed classification

	Number of dimensions	Income	Employment, labour market	Living and housing conditions	Education	Access to goods and services	Family and groups threatened with exclusion	Crime	Health
England	7	x	x	x	x	x		x	x
France	5	x	x	x	x	x	x		
The Netherlands	N/A	x	x	x			x		
Japan	7	x	x	x	x	x	x		
New Zealand	8	x	x	x	x	x	x		
Scotland	7	x	x	x	x	x		x	x
The United States	5	x	x	x	x				
Wales	8	x	x	x	x	x		x	x
Hungary	N/A	x	x	x	x	x	x		
<i>Number of instances:</i>		9	9	9	8	6	5	3	3

Source: own work.

Selection of variables representing individual dimensions of deprivation depends, among other things, on the local context, availability of data and theoretical framework of the study. Dimensions in which the data used are the most diverse include: living and housing conditions, access to goods and services, family and groups threatened by exclusion. Table 2 shows the general topics of variables included in the above mentioned dimensions of deprivation, in individual indicator initiatives. In case of living and housing conditions, the core variable is overcrowding of flats, and data on the standard of flats and air quality are also used. In case of access to goods and services, among the most frequently included dimensions are owning a car and a flat, and in the British approach these are data on temporal and spatial availability of various services. Two approaches can be also distinguished with reference to the dimension referred to as family and groups threatened with social exclusion. One of these approaches emphasises the presence of ethnic and national minorities and the other one the presence of families that are at relatively high risk of deprivation.

Table 2. Topics of the variable included in the selected dimensions of deprivation

	Living, housing conditions	Access to goods and services	Family, groups threatened with exclusion
England	flats without central heating and in poor condition, overcrowding of flats, air quality, traffic accidents	distance to out-patient clinic, shop, school and post office, the availability of affordable housing, homelessness	-
France	flats in single- and multi-family buildings, overcrowding of flats	owning a car, owning a flat	foreigners, single parents
The Netherlands	population density		ethnic diversity
Japan	overcrowding of flats	owning a flat	lonely elderly people
New Zealand	overcrowding of flats	Internet access, owning a flat, car availability	single parents
Scotland, Wales	environmental pollution, flood risk, overcrowding of flats, flats without central heating	time needed to reach shops, schools, post office, cultural institutions, out-patient clinic, pharmacies	-
The United States	overcrowding of flats	-	-
Hungary	overcrowding of flats	car availability	single mothers, families with multiple children

Source: own work.

The number of variables included in the analysed indices is from 4 to 9 (NL, HU, JP, US, NZ), and from 35 to 40 (ENG, WLS, SCT). Apart from the case of FR (19 variables), two distinctly different approaches are emerging in this regard. It is not the purpose of this chapter to make a detailed review of the variables used in other countries, among others, due to the difference in the availability of data and the distinct nature of some social problems. The variables used in the three studies, namely JP, HU and WLS, will be discussed in more detail (Table 3). The first case has been selected for the use of non-census data and relatively large spatial units included in the analysis. With reference to HU, the socio-cultural proximity of Hungary and Poland and also the fact that the analysis is based on local government units (LAU2 – the level corresponding to Polish gminas) have been decisive. The choice of WLS, on the other hand, allows to bring closer a specific group of indicators of deprivation used in Great Britain, using as an example the latest edition that has been published so far.

Table 3. Variables included in the index of deprivation – the example of Japan, Hungary and Wales*

Japan (7 variables)	Hungary (8 variables)
▪ Income per capita (<i>income</i>) ▪ Unemployment rate (<i>employment, labour market</i>) ▪ Number of dwelling rooms per household (<i>living, housing conditions</i>) ▪ Percentage of persons with higher education (<i>education</i>) ▪ Percentage of households owning their homes (<i>access to goods and services</i>) ▪ Percentage of households receiving social assistance benefits (<i>family, groups threatened with exclusion</i>) ▪ Percentage of single-person households accounted for by the elderly (<i>family, groups threatened with exclusion</i>)	▪ Gross income per capita (<i>income</i>) ▪ The share of the unemployed in the working age population (<i>employment, labour market</i>) ▪ Number of persons per one dwelling room (<i>living conditions, flats</i>) ▪ Percentage of illiterate persons (<i>education</i>) ▪ Persons with primary education in the population over age 15 (<i>education</i>) ▪ Number of passenger cars per 100 inhabitants (<i>access to goods and services</i>) ▪ Percentage of single mothers with children among all the families (<i>family, groups threatened by exclusion</i>) ▪ Percentage of families with multiple children among all the families (<i>family, groups threatened by exclusion</i>)
Wales (35 variables)	
▪ Income (<i>income</i>): percentage of persons who (1) receive social assistance for the poverty-stricken and/or (2) claim child tax credit and their income does not exceed 60% of Wales median and/or (3) seek asylum. ▪ Employment (<i>employment, labour market</i>): percentage of persons at working age receiving unemployment benefits ▪ Health (<i>health</i>): standardized indicators for (1) cancer, (2) chronic illness, (3) mortality and (4) low birth weight of infants (less than 2.5 kg). ▪ Education (<i>education</i>): average test scores after the primary and secondary level, class period absence rate, percentage of persons aged 18-19 not taking up studies, percentage of persons aged 25-64 without education. ▪ Access to services (<i>access to goods and services</i>): average travel time by private car and public transport to the nearest grocery store, out-patient clinic, primary school, secondary school, post office, public library, pharmacy, petrol station, sports and cultural centre. ▪ Security (<i>crime</i>): indicators of recorded instances of: burglary, property damage, theft, crimes that endanger the life and health of individuals, fires and anti-social behaviour. ▪ Natural environment (<i>living conditions, flats</i>): indicators: risk of flood, emission of air pollutants, air quality, proximity to waste storage and processing areas. ▪ Housing (<i>living, housing conditions</i>) Percentage of persons living in overcrowded flats, flats without central heating.	

* The names of the thematic areas are given in parentheses, based on the classification proposed in Table 1.

Source: own work.

2.3.2. Data aggregation methodology

After selecting the variables to be included in the index, the first step in the index construction is the data transformation. A commonly used method is standardization, and sometimes the distribution of variables is additionally normalized based on natural logarithms (NL, HU, JP). In case of NL, a final index is created by simply adding the standardized variables. However, in most cases the next step of index construction is analysis of its principal components, mainly aimed to determine the significance of individual variables for the values taken by the deprivation index, and sometimes also to narrow down the initial list of variables formulated on the basis of literature review (FR, US). Although the variables are divided into separate dimensions, the usual tendency is to identify only one factor that explains as much of the variance as possible (the diversity of the indicator value)⁴. Based on the results of the analysis, (1) the weights are then assigned to individual variables (HU, US) or (2) the selected principal component is adopted as the basis for the constructed index (FR, NZ). In case of JP, the index of deprivation is constructed as the sum of two main components identified in the analysis. More complex is the methodology used for ENG, SCT and WLS. It is composed of the following elements:

1. Aggregation of variables within individual dimensions of deprivation (sub-indices), on the basis of:
 - a. weights from factor analysis (maximum likelihood method) – when component variables measure a given dimension of deprivation with reference to different groups and in a different manner,
 - b. or arbitrarily assigned weights – if factor analysis cannot be carried out because of the quality or character of the data,
 - c. or summing up of non-standardized (non-overlapping) variables – when individual variables have the same reference group and are calculated in a coherent manner⁵.
2. Ranking of individual sub-indices.
3. Normalization of rank distribution and their aggregation according to arbitrarily determined weights, depending on the quality of the data and the role of a given dimension in the deprivation concept (deprivation index).
4. Ranking of the index.

In order to present the results, many indices are grouped into e.g. quartiles (US), quintiles (FR) or deciles (NZ). Another approach is used for NL, where the deprivation index is dichotomous. Value 1 is reached only for 5.5% of the areas with the highest level of deprivation – this allows to track how the number of people living in these areas changes over the years. In case of ENG, SCT and WLS, both the results of the index of deprivation and the sub-indices corresponding to individual dimensions included in the study are presented. The method of cartogram is usually used to visualise the results.

⁴ The disadvantages of this solution are presented in the summary of this chapter.

⁵ For example, the sub index for income in ENG is calculated on the basis of the number of persons in households receiving benefits for the poverty-stricken, unemployment benefits, pension allowance, child tax credit (if the income does not exceed 60% of the national median family income) and asylum-seekers. These data are then summed up in order to avoid cases of double counting of persons recorded in more than one category and divided by the total number of inhabitants of a given territory.

2.4. Local deprivation studies in Poland

In order to complete the international review, it is worthwhile to mention Polish experiences in the scrutinised area. According to the best knowledge of the authors of this report, a comprehensive study of the level of local deprivation across the country has not been carried out in Poland in recent years. On the other hand, there have been conducted regional level analysis using the EU-SILC data focussed on the material dimension of deprivation (see Panek, Zwierchowski 2013), as well as studies on the cities/urban counties (e.g. Szymańska et al. 2011; Arak 2015) or selected voivodeships (e.g. Sobala-Gwosdz 2004).

However, in recent years, at least a few interesting publications have appeared in Poland on various aspects of socio-economic development at the poviats level. The most comprehensive approach is presented in the National Human Development Report (Arak et al. 2012). The purpose of this study was to transfer the assumptions behind the UN-promoted Human Development Index (HDI) to the local level and to create a measure to gauge development processes through the prism of three categories: education, wealth and health. There are also several studies that examine the state of socio-economic development of poviats, which focus however on methodological aspects of the measurement (cf. i.a. Churski 2012, Trojak, Tokarski 2013) or issues relating to threats of socio-economic degradation (e.g. Gorzelak et al. 2007). The Quality of Life Ranking of the Newsweek magazine (Wojtalik 2014) mainly puts emphasis on accessibility of results and so presents a methodologically simplified indicator of development of Polish poviats. On the other hand, the paper by Szymańska et al. (2011) shows how the results of rankings based on synthetic measures of development change depending on the data aggregation method selected.

On the basis of the review, three main, often co-existing, approaches to the development of local development indicators can be distinguished. The first of them aims to develop a material that is accessible to a wide audience, keeping the applied methodology as simple as possible. The second of them focuses primarily on methodological considerations, while the results of the ranking are treated as less significant. The third approach uses the theoretical framework developed in the scientific debates as basis for constructing a useful index for decision-makers. The previously cited Human Development Report, which uses theoretical framework of the HDI indicator, fits into the third approach. This study has a similar character as it refers to operationalisations of the concept of deprivation found in scientific literature.

2.5. Summary – methodological challenges

The analysis of the above-mentioned studies allows for identification of several methodological challenges and issues that are worth considering when a deprivation index is constructed. They relate to the selection and aggregation of variables and interpretation of the results obtained.

First of all, some studies are only based on destimulants, assuming that deprivation should be measured on the basis of variables that show the inability to meet a given need. In most analyses, however, both stimulants (e.g. *per capita* income) as well as negatively perceived variables (e.g. percentage of households without car) are used. Secondly, an important challenge in the cross-sectional spatial studies is to find variables that would describe both the situation in urbanised and rural areas, which is particularly difficult in countries with significantly varied spatial development.

Another methodological challenge, that is the risk of duplication of information, emerges in connection with the use of a number of dimensions to describe deprivation. For example, households without car can at the same time live in overcrowded conditions. D. McLennan (McLennan et al. 2011) argues, however, that this is not a methodological error, as it can be assumed that overlapping dimensions of deprivation are a greater problem than deprivation experienced in only one area.

Another issue is how to use the results of analysis of the principal components. In most studies using this method, a decision was made to select – on the basis of analysis of all the variables or variables that illustrate a given dimension – a single component only. This may in consequence lead to an over-simplification of the deprivation phenomenon, which in this case is limited, above all, to the presentation of differences between areas that are less or more developed in socio-economic terms. This leads to losing important information about niche problems that may have a significant impact on the situation of a given area. Loss of information happens only because the variables that illustrate the information do not correlate so well with the first main component which has been differentiated. This threat is important because some analyses do not limit the variables using the correlation-factor method (Gorzelak 1979), which leads, among other things, to duplication of information if the variables used are strongly correlated and if variables with low diagnostic value are included. Another problem is the use of this method for longitudinal analysis because of considerable differences in characteristics of the principal components selected in particular years. This is due to the changing over time strength of correlation relationships between the indicators used in the studies. This limitation does not apply to other methods of variable aggregation, such as e.g. Perkal's indicator (e.g. Chojnicki, Czyż 1991; Szymańska et al. 2011), which may be criticised, on the other hand, because of greater arbitrariness in variable selection.

What is more, it is worthwhile to bear in mind that spatial studies on deprivation in the context of health status of the population use so called ecological approach. This means that the index describes both the features of the context (the community, the environment, etc.) as well as the aggregated personal characteristics - and it is not possible to unambiguously separate them. In consequence, relationships between the phenomena noted at the gmina or powiat level, may not be, in the course of interpretation of the results, directly transferred to the level of individual persons.

3. THE CONSTRUCTION OF THE POWIAT INDEX OF DEPRIVATION

This section of the report presents issues related to the selection of the level of spatial units for the study of deprivation phenomenon and the principles of construction of the multi-dimensional Powiat Index of Deprivation (PID), and in particular the included dimensions of deprivation and illustrative indicators, as well as describes methodology used for the PID construction.

3.1. Selection of spatial units for analysis

Results of the literature review presented in the previous chapter show that indices of deprivation are often calculated for small territorial units, in particular units used in the national censuses. Thus, the question arises whether it is also possible with reference to the Polish studies on the phenomenon of deprivation. In Poland, apart from the administrative division of the country into gminas, poviats and voivodships, there exists, among others, a system of statistical regions and census areas, i.e. units covering areas smaller than gminas⁶. The census area comprise no more than 500 persons and 200 flats, and statistical regions 2,700 persons and 999 flats respectively. However, the use of data from this level poses a number of problems. Firstly, it limits the possibility of observing the dynamics of the phenomenon. This is because national censuses are carried out in approximately ten-year cycles and the data collected in subsequent editions are not identical, which reduces a possibility of extrapolating changes for the interim periods. Secondly, many variables describing the socio-economic phenomena are only available at the higher levels of spatial aggregation. Furthermore, a large portion of data from the 2011 National Census is not made available at lower than powiat aggregation level (e.g. data concerning the level of education of the population). In addition, certain functional spatial units (e.g. labour markets, secondary school districts) cover more than one administrative unit. In consequence, construction of a comprehensive and multi-dimensional index of deprivation is only possible at the level not lower than the powiat level (LAU1). At spatial levels lower than the powiat level, it is possible to analyse selected aspects of the phenomenon of deprivation (i.e. those for which data are available).

At the same time, the administrative division at the powiat level, from the point of view of constructing the deprivation index, has a rather significant disadvantage that needs to be discussed in more detail, as it translates into the results obtained and may affect their interpretation. This disadvantage is related to the separation of cities with powiat rights, called urban counties from the surrounding rural counties. The characteristic feature of urban counties is that in the spatial dimension they are identical with a given city, and in the administrative sense, the authorities of such units combine the competences of gminas and poviats. The separation of urban and rural counties is not a problem in itself. It is problematic,

⁶ Besides, for the purpose of public statistics, the subregions (intermediate level between the powiat and the voivodeship) and regions (composed of several voivodeships) are also distinguished. The Hierarchical System of Spatial Units in the EU countries is unified according to the Nomenclature of Territorial Units for Statistics (abbreviation NTS or NUTS, from the French *Nomenclature des Unités Territoriales Statistiques*). In case of Poland these are: gminas (NTS5 / NUTS5 or – according to the most recent version of nomenclature – LAU2, *Local Administrative Unit*), poviats (NTS4 / NUTS4 / LAU1), subregions (NTS3 / NUTS3), voivodeships (NTS2 / NUTS2), regions (NTS1 / NUTS1). Cf.: <http://stat.gov.pl/statystyka-regionalna/jednostki-terytorialne>

however, that this division concerns only selected local layouts, and in many other cases the city that is the local socio-economic centre (in particular in terms of the labour market) is combined with the surroundings as part of a single powiat (a single LAU1 unit). As a result, the differences noted between the various types of powiats are to some extent a consequence of the applied spatial division. Urban counties (cities) are usually characterised by better values of socio-economic indicators than rural counties. On the other hand, "regular" counties (those where the main city has not been separated as urban county) usually achieve average levels of indicators, which is a result of averaging of the indicators for the urban centre and the surrounding gminas.

One solution to the problem of comparability of the regular, urban and rural counties is the aggregation of data for urban and rural counties and drawing comparisons between the new analytical units, created in this manner, and regular counties. However, due to considerable variation in the category of urban counties, which includes both towns with population of approx. 50 thousand as well as large voivodeship cities, and due to differences in the size of urban powiats and their spatial configuration, it is very difficult to carry out aggregation that would fully eliminate this problem. Thus, no changes have been made in this study to the existing administrative division for analytical purposes. Another argument for the adopted solution is the fact that the potential aggregation can only to a small extent affect changes to the findings of the study. This is confirmed by a variant study of so called Local Human Development Index (cf. Arak et al. 2012) carried out by A. Płoszaj and J. Rok (2013). This analysis shows that combining urban counties and the surrounding rural counties (only those with office in a given urban county) and integration of metropolitan areas change the value of the indicators for units covered by the changes, but it does not significantly affect the spatial differentiation at the national or voivodeship level. Another aspect in favour of non-aggregation of spatial units is that using the existing administrative division facilitates the application of the results obtained and recommendations formulated (unambiguity of the scope and spatial extent of competence).

The problem of interpretation related to a limited comparability of different types of powiats [counties] (urban, rural and "regular" counties) has been solved in this study by a separate analysis of extreme cases for various types of powiats, i.e.: a) regular, b) rural, c) urban counties and d) voivodeship capitals. This is a manner to ensure that the units compared are comparable, which allows for proper interpretation of the results obtained.

Moreover, it should be noted that although the phenomenon of deprivation has an individual dimension, its analysis at the powiat level relates to aggregated values. It presents average values of the indicators and distribution of the observed values in the population is not possible. Accordingly, the Powiat Index of Deprivation means *de facto* the degree of threat of deprivation faced by a given powiat. That is why the expression powiats threatened with deprivation is used in the description. This means that in powiats with high value of the index the likelihood of discovering deprivation faced by the residents will be higher than in powiats with low values of this index. Obviously, this does not mean that in powiats with low values of this index, the phenomenon of deprivation, which can affect specific social groups as well as smaller territorial units (e.g. gmina, district, housing estate), is non-existent.

3.2. Dimensions and indicators of deprivation

Taking into account the above literature review and assuming a certain diversity of individual dimensions of deprivation, the index (the synthetic indicator) has been finally constructed on the basis of the following five areas/dimensions of deprivation:

- population income,
- employment,
- living conditions,
- education,
- access to goods and services.

Reasons for their selection and indicators used to measure them are presented below. Detailed comments on the construction of the indicators and the estimates made are included in appendix 2, and analysis of individual dimensions of deprivation is presented in appendix 1.

The indicators illustrating the chosen dimensions of deprivation have been selected on the basis of the following three general principles:

- **diagnostic unambiguity**, which means that difficult to interpret indicators (for example electric power consumption by households, in case of which separation of energy consumption for agricultural farms is not possible) are rejected,
- **information contribution**, that is non-duplication of information by subsequent indicators, which means that one of the two strongly correlated units of information has been eliminated (the adopted limit value of the correlation coefficient is 0.80),
- **diagnostic compatibility**, which means that indicators which correlate negatively with the other indicators in a given dimension have not been taken into account (for example revenue of gminas from agricultural tax which, although indirectly indicating the income of farmers dependent, among other things, on soil quality - due to very low agricultural productivity - negatively correlate e.g. with the level of income from non-agricultural activity).

Indicators taken into account to construct the synthetic index but rejected because of the above mentioned principles are presented in appendix 3.

3.2.1. Income

One of basic factors that affect the scale of deprivation is the level of income achieved by the population and its distribution in a given population. This issue is relatively difficult to analyse due to a large diversity of income sources of natural persons, which in addition to paid employment also include, among other things: profits from the conducted business activity, property income, foreign transfers, retirement and disability benefits as well as (unreported) income from the shadow economy. What is more, knowledge of the aggregated value of household income needs to be supplemented with indicators concerning its distribution in the population of a given poviats. Thus, a decision has been made to select indicators that firstly allow for - making estimates of the level of household income, secondly - indirect determination of its structure and distribution, and thirdly - taking into account also some manifestations of income deprivation.

The following indicators have been ultimately used as part of this dimension:

- own revenue of gminas and cities with powiat rights constituting share in personal income tax *per capita*, which allows for making estimates of the income of the population from non-agricultural employment,
- amount of salaries in business entities employing more than nine persons, which indirectly indicates the quality of jobs and should translate into the general level of wealth,
- percentage of families having three or more children up to 24 years of age, which allows for the indication of potential problems with income distribution resulting from the observed higher risk of poverty as the number of children in the family increases,
- percentage of persons in households receiving social assistance benefits, which allows for making estimates of the number of persons with incomes below the statutory income threshold, which may indicate the scale of poverty,
- percentage of flats with more than three months' rent arrears to the total number of flats, which may be one of the symptoms of low income level.

3.2.2. Employment

Another important issue that impacts deprivation of the population is availability of jobs, particularly those that correspond to the qualifications and provide income that meets the requirements. Therefore, indicators selected within this dimension, on the one hand, have taken into account the unemployment rate, long-term unemployment as well as the scale of hidden unemployment in the agricultural sector (about five times lower labour productivity in this sector compared to average national labour productivity may not allow for the generation of adequate income). Another aspect that has been examined is availability of jobs outside agriculture in business entities employing more than 9 persons per 1,000 inhabitants, which shows the possibility of taking up employment in more efficient sectors of economy.

The following indicators have been selected for the Powiat Index of Deprivation within this dimension:

- registered unemployment rate, which shows the scale of problems at the local labour market,
- percentage of long-term unemployed showing what proportion of the unemployed cannot find employment for at least a year, which may indicate, on the one hand, the depth of the labour market problems, and on the other hand, the scale of related social problems,
- number of persons actively employed in agricultural sector per 100 hectares of agricultural land, which can be regarded as approximate indicator of hidden unemployment in agriculture,
- the number of persons employed outside agriculture by entities employing more than 9 persons per 100 inhabitants, which shows the possibility of taking up employment outside this sector.

3.2.3. Living conditions

Indicators that represent living conditions, when compared to the two above mentioned dimensions, have been more diverse as they comprise different spheres. The first of them relates to housing conditions, within which both the level of overcrowding of flats as well as the sanitary facilities have been analysed. The second includes the status of the two basic components of the natural environment, that is air and water (although in a quite imperfect manner given the availability and quality of data).

The following indicators have been ultimately used as part of this dimension:

- number of persons per one dwelling room, which may indicate the degree of overcrowding of flats,
- percentage of flats with bathroom facilities, which indicates substandard housing conditions,
- solid particles emission from particularly bothersome plants per square kilometre, which shows the main sources of air pollution (its diagnostic value is, however, limited by lack of data on emission of pollutants from other sources than industrial plants regarded as particularly bothersome),
- percentage of the population connected to the wastewater treatment plant, which may roughly indicate the quality of water in the powiat.

3.2.4. Education

Low level of formal education, lack of qualifications and skills are factors that, on the one hand, increase the risk of economic deprivation (associated with low wages and increased risk of unemployment) and, on the other hand, may as such represent the socio-economic deprivation. This is visible both at the level of individuals and at the level of spatial units. The low level of education of the population, and more generally speaking, the low level of human capital, is a factor limiting the development potential of cities and gminas. At the same time, this issue is very difficult to investigate on the basis of quantitative data. This is because available data (at the powiat level) show primarily the formal aspect of education, and only indirectly demonstrate the skills and competences of the population.

The following indicators have been selected for the Powiat Index of Deprivation within this dimension:

- percentage of persons with primary education at most (including persons without education) – indicator of formal quality of human capital,
- average score of lower-secondary school exam in mathematics and natural sciences – indicator of human capital quality and, indirectly, performance indicator for institutions,
- public library users per 1,000 inhabitants – indirectly, human capital quality indicator.

3.2.5. Access to goods and services

Lack of access or limited access to goods and services is obviously and undoubtedly a dimension of deprivation. However, this issue is more complex, because access can be seen in different ways. The first of them is the financial aspect: the cost of goods and services in relation to the purchasing power of the population. Secondly, spatial accessibility is important:

the density of the network of points where individual services are provided, accessibility of these points to transport, in particular the public transport network (which is particularly important for the elderly who are less fit and more economically disadvantaged). What is more, availability of goods and services also has a socio-cultural dimension: it is primarily about having competence to allow or facilitate access to certain goods and services - not only for a more sophisticated cultural offer, but also for the use of e-services. Including e-government, for which specific digital competence is required (cf. Batorski, Płoszaj 2012). Another factor complicating analysis of access to goods and services is the issue of their quality. Easy access, but to low quality services, is not a desirable situation. In some cases, more difficult access, but to higher quality services, may be a preferred solution. Lastly, a separate issue is the statistical data describing access to goods and services at the local or subregional level. The scope of available data is disproportionate to the significance and complexity of the issue. In consequence, many issues that are important from the point of view of deprivation, cannot be adequately illustrated. In addition, most data allow for only quantitative analysis, providing little information on the quality of goods and services. Given the above limitations, the following indicators have been included for analysis in this study:

- number of persons per flat⁷ – indirect indicator of flat availability,
- percentage of children covered by pre-school education – indicator of the availability of childcare services,
- number of physicians and doctors per 1,000 inhabitants – indicator of potential availability of health care services in the vicinity of the place of residence,
- number of pharmacies per 1,000 inhabitants – indicator of potential easy access to medicines in the vicinity of the place of residence.

3.3. The construction of the Poviats Index of Deprivation

Construction of the synthetic indicator, that is the multi-dimensional index of deprivation (the Poviats Index of Deprivation – PID) has been conducted in two steps. During the first step, five sub-indices presenting the selected dimensions of deprivation have been created, in the second one, the indices have been aggregated to form a multi-dimensional index of deprivation. A detailed procedure of creating the index of deprivation has been as follows:

- Determination whether a given variable is a stimulant or an inhibitor of deprivation;
- Standardization of the variables according to the following formula:
 - for stimulants: $s_i = \frac{x_i - \bar{x}}{\sigma_x}$
 - for destimulants: $s_i = \frac{\bar{x} - x_i}{\sigma_x}$
- Limiting the impact of extreme values on the index value for a given poviat (standardized values have been limited to the range of <-3; 3>);

⁷ Although strongly correlated with the indicator relating to the number of persons per one dwelling room that is used for living conditions assessments, this indicator illustrates a separate issue associated with the availability of flats in a given local market. In particular, the low supply of flats can result in high prices and reduce their availability, although at the same time the flats may be provided with sufficient number of rooms to prevent the phenomenon of overcrowding.

- Summing up the standardized values of the variables after the limitation and dividing the result by the number of variables in order to obtain five sub-indices: $W_j = \frac{\sum si}{n}$
- Summing up the values of sub-indices and dividing the result by the number of dimensions in order to obtain the synthetic index of deprivation: $PID = \frac{\sum W_j}{n}$

The index has been obtained with the use of the "Z-scores" method (Smith 1972), which in Polish literature is often referred to as Perkal's indicator (see e.g. Chonicki, Czyż 1991; Szymańska et al. 2011). It consists in summing up standardized values of individual variables. Its advantage is little loss of information in the aggregation process in contrast e.g. to the alternative principal component method (see Chapter 2, p. 14). This method uses statistical measures of arithmetic mean and standard deviation. The index of deprivation has been constructed using a modification of this method consisting in limiting the impact of extreme values (so called tails of statistical distribution) of individual variables on the index value⁸. Being guided by the probability distribution within normal distribution the standardised values of the variables have been reduced to a minimum of -3 and the maximum of 3 (99.8% of scores in the normal distribution). This procedure has had no significant impact on the general distribution of values of the Perkal's indicator in the analysed population, but in case of individual poviats it has eliminated the impact of extreme observations that could in an uncontrolled manner accidentally alter the value of partial indicators.

Subsequently – taking into account the fact that sub-index values have had similar distributions as a result of using the above method of aggregation – the synthetic index has been obtained by summing up sub-indicators and dividing them by the number of analysed dimensions. The weighing of individual sub-indices – which is done in case of some other foreign indicators of deprivation, cf. chapter 2 – has not been applied in this case, above all because of the arbitrariness of the selection of the relevant weights.

In a subsequent step, categorisation of the index of deprivation has been conducted on the basis of an assumption that situation of a given powiat is better shown by its affiliation to the class of poviats with similar index values rather than by its position in the ranking. The categorisation has been carried out using the so called natural break method (see Jenks 1967). This method simultaneously minimise the variance within groups and maximise the variance among groups. As a result, the high homogeneity of the distinguished groups is ensured, while all the classes are considerably different from one another. This method can be used iteratively dividing the set into a growing number of classes, starting from two, in order to indicate the most frequent divisions (see Smętkowski et al. 2009). In the study, however, an arbitrary 10-class division has been used in case of the multi-dimensional Powiat Index of Deprivation and a 5-class division in case of the sub-indices.

⁸ This problem is solved in a variety of ways. For example, A. Sobala-Gwosdz (2004) rejected extreme values for each analysed unit. Sometimes, a winsorization method is also used (Gosh, Vogt 2012). It consists in replacing the atypical value of a given variable with the closest typical result.

4. POVIATS THREATENED WITH DEPRIVATION IN 2013

This section of the report presents the general distribution of the Poviats Index of Deprivation with particular regard to spatial differentiation which has been examined with the use of the cartogram as well as the spatial autocorrelation method. In addition, the extreme cases have been analysed in different categories of poviats that take into account the specificity of administrative division. The last step is devoted to presentation of poviats with the highest risk of deprivation by voivodeships.

4.1. Overall characteristics

In 2013, the Poviat Index of Deprivation (PID) took values between a maximum of +1.1 and a minimum of -1.8, with the average value of 0 and standard deviation of 0.58. The higher the value of the index the higher the risk of deprivation faced by the population of a given poviat. The index took positive values in 223 poviats and negative values in 157 poviats, with the distribution displaying a slight skewness to the left (skewness coefficient was -0.83).

The index of deprivation has a high degree of correlation (Person's r) with all sub-indices. The correlation coefficient was from 0.80 in case of living conditions to 0.91 in case of population income (Table 4). There was also a strong mutual correlation between the different dimensions of deprivation. This concerned in particular the relationship between population income and other sub-indices – the correlation coefficient value was 0.73 and for living conditions – 0.66. In addition, the indices of education and availability of goods and services, as well as employment and living conditions (0.68-0.69) were the most strongly correlated, while the index of education displayed the weakest correlation (0.53-0.54) with the indices of living conditions and employment.

Table 4. Correlation coefficient between partial indices and the Poviat Index of Deprivation

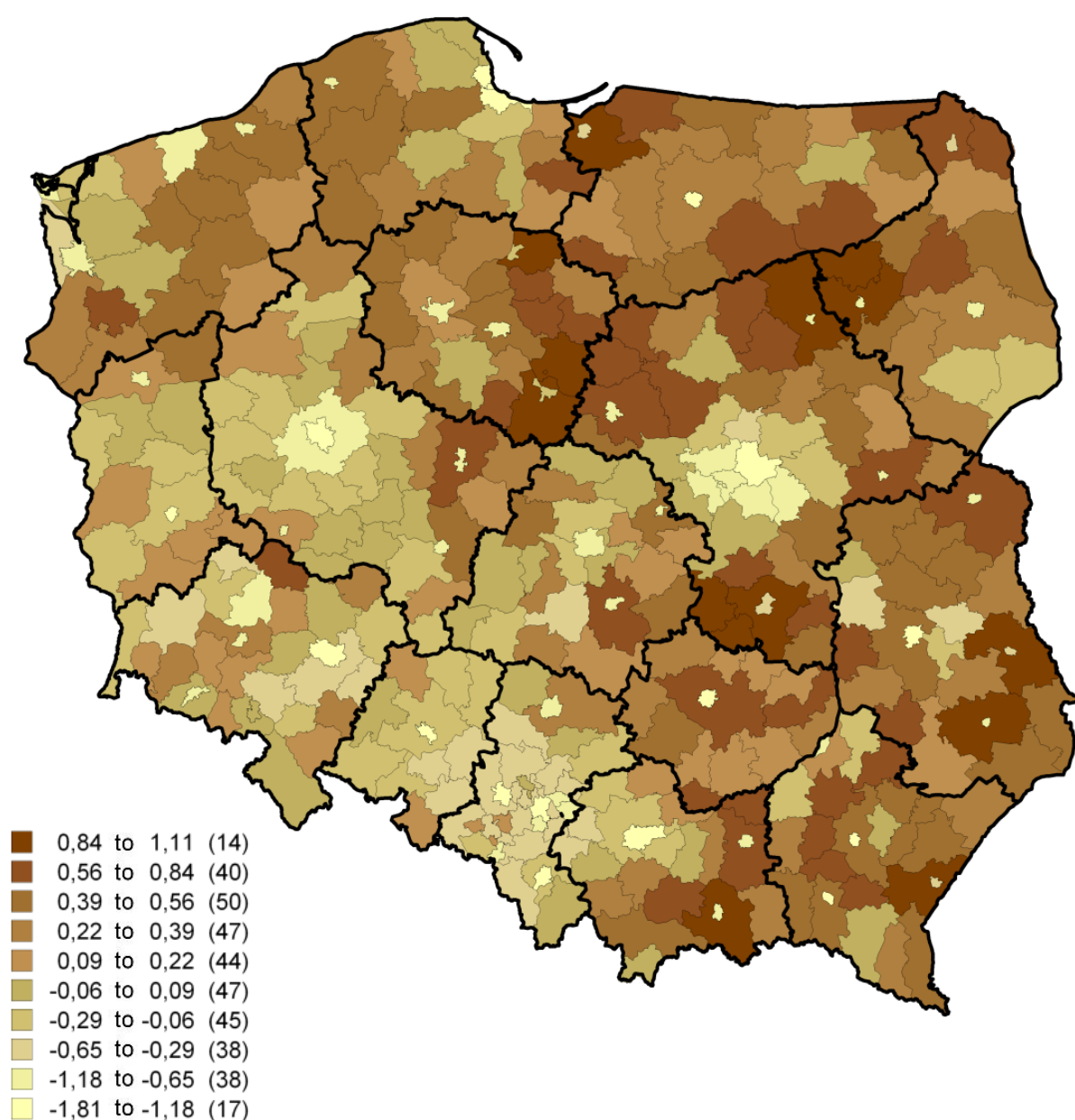
	Population income	Employment	Living conditions	Education	Availability of goods and services	Poviat Index of Deprivation
Population income	x	0.73	0.66	0.73	0.73	0.91
Employment	0.73	x	0.68	0.54	0.57	0.82
Living conditions	0.66	0.68	x	0.53	0.61	0.80
Education	0.73	0.54	0.53	x	0.69	0.84
Availability of goods and services	0.73	0.57	0.61	0.69	x	0.86
Poviat Index of Deprivation	0.91	0.82	0.80	0.84	0.86	x

Source: own work.

4.2. Spatial differentiation of deprivation

Poviats have been categorised into classes based on the value of the Poviats Index of Deprivation with the use of the natural break method and the number of classes has been determined at 10 on an arbitrary basis. Compared to the equivalent (decile) division, there has been a slight difference consisting in reduced size of the two extreme classes, i.e. poviats that are the most and the least threatened with deprivation. According to the natural break method, in one of these classes there have been 14 cases and in the other 17 cases. One of them has been mostly composed of so called rural counties, i.e. those that surround cities with poviat rights, while the other class has been mostly composed of large cities with poviat rights, including voivodeship capitals (Figure 1).

Figure 1. Poviats Index of Deprivation in 2013*



* division into 10 classes using the natural breaks method.

Source: own work.

Poviats with the highest risk of deprivation have formed fairly clear spatial clusters, similarly as areas with low risk of deprivation. Areas with the highest risk of deprivation have included in particular:

- northern part of the Mazowieckie voivodeship (excluding Płock and also Ciechanów and Mława Counties) along with the Łomżyński sub-region and eastern part of the Kujawsko-Pomorskie voivodeship as well as some poviats of the Warmińsko-Mazurskie voivodeship,
- the Radomski sub-region along with the selected poviats of the Świętokrzyskie voivodeship,
- some poviats of the Podkarpackie voivodeship along with eastern part of the Little Poland voivodeship,
- selected poviats of the Lubelskie voivodeship,
- northern part of the Warmińsko-Mazurskie voivodeship, including in particular the Elbląski sub-region,
- the Zachodniopomorskie voivodeship, including in particular poviats located in the belt adjacent to the coastal poviats.

Among areas facing relatively the lowest risk of deprivation have been, among others, the following:

- cities with powiat rights (see the detailed analysis below),
- metropolitan areas of six largest cities, i.e. Warsaw, Tri-City, Kraków, Łódź, Wrocław and Poznań,
- the Śląskie voivodeship (excluding the Częstochowski sub-region and selected cities of the Upper Silesian conurbation) along with the Opolskie voivodeship, and especially its eastern part,
- the Wielkopolskie voivodeship (without the Koniński sub-region) and central part of the Lubuskie voivodeship,
- the Legnicko-Głogowski sub-region as well as Szczecin and Świnoujście including their surroundings.

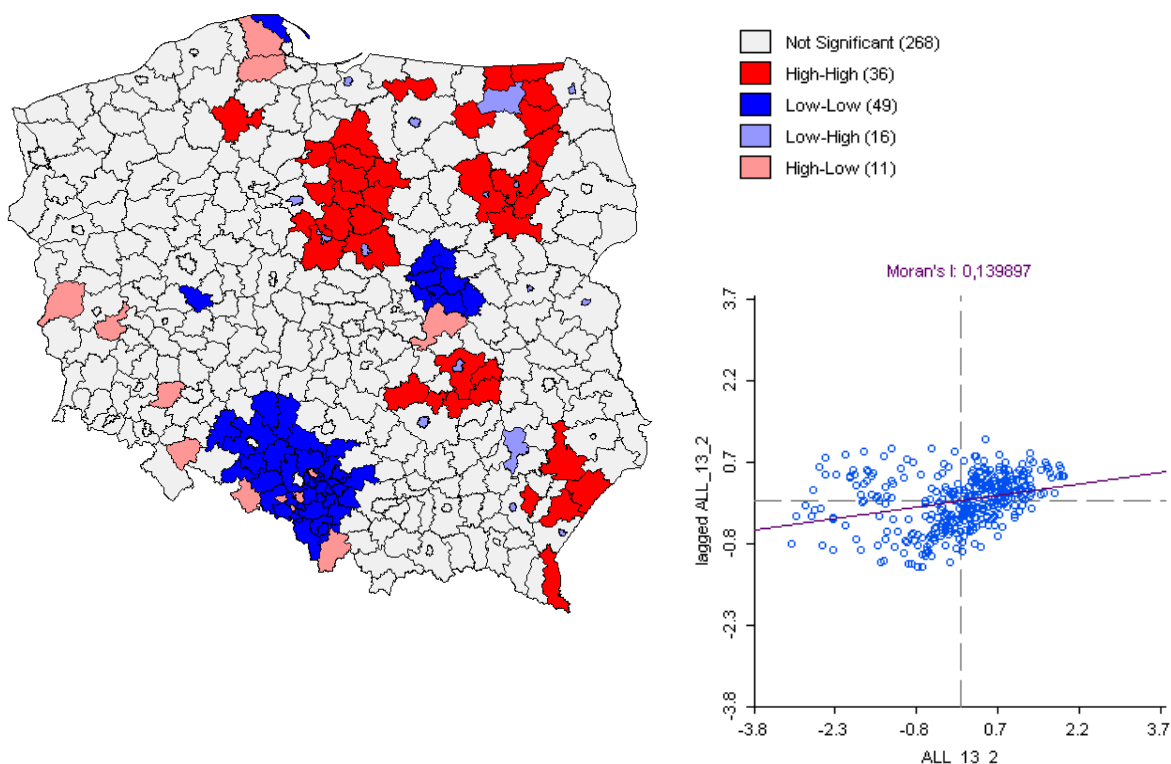
The spatial autocorrelation method (Kopczewska 2006) has been used to determine regularities of spatial differentiation of the Powiat Index of Deprivation. The method uses Global Moran's I which can take values between -1 and 1. Positive values indicate the tendency to the forming of spatial clusters of units with similar values of the analysed indicator, and negative values indicate that units with different index values are adjacent to one another. Values close to 0 represent the random distribution of the phenomenon, or its spatial entropy. When the Local Indicators of Spatial Associations (LISA) are also used, it is possible to determine which units are typical with respect to one of the four situations: HH (clusters of high value units) and LL (clusters of low value units), and of negative autocorrelation of the following type: HL so called "hot spots" and LH so called "cold spots" designating units that stand out against their immediate surroundings due to adequately high or low values of a given indicator.

For the Powiat Index of Deprivation in terms of $k=20$, i.e. 20 nearest neighbours, a slight positive spatial autocorrelation has been observed⁹ indicating the concentration of poviats with similar values of the index of deprivation (Figure 2). The value of this correlation would be higher if the urban and rural poviats had been aggregated, because many of the former constituted so

⁹ Arbitrary selection of the number of neighbours has a relatively insignificant impact on the obtained results (Smętkowski 2013), which has also been confirmed in these studies for other values of parameter k that have been tested.

called "hot spots", i.e. they were characterised by lower risk of deprivation in the context of their surroundings. This was especially true of cities located in the central and eastern part of the country, such as: Toruń, Elbląg, Włocławek, Płock, Olsztyn, Suwałki, Siedlce, Biała Podlaska, Radom, Kielce, Rzeszów and Przemyśl. In addition, such points were also Giżycko and Stalowa Wola Counties. The number of cold points, where the situation was worse than in their surroundings, was significantly smaller. These were usually poviats located in western Poland, i.e.: Krosno and Nowa Sól Counties in the Lubuskie voivodeship, Środa Śląska and Ząbkowice Śląskie Counties in the Dolnośląskie voivodeship, Głubczyce County in the Opolskie voivodeship as well as the city of Bytom, Rybnik and Żywiec Counties in the Śląskie voivodeship, Wejherowo and Kartusy Counties in the Pomorskie voivodeship and Grójec County in the Mazowieckie voivodeship, which is the only powiat located in central Poland. Spatial autocorrelation analysis confirmed the existence of regions at special risk of deprivation identified on the basis of cartographic analysis. In particular this concerned peripheral parts of the Mazowieckie voivodeship along with their surroundings, i.e.: the north-western part of the Mazowieckie voivodeship along with adjacent poviats located in the Kujawsko-Pomorskie and Warmińsko-Mazurskie voivodeships, north-eastern part of this voivodeship along with poviats of the Podlaskie and Warmińsko-Mazurskie voivodeships as well as the southern part of Mazowieckie along with poviats of the Świętokrzyskie voivodeship. Besides, this concerned selected poviats of the Lubelskie and Podkarpackie regions. On the other hand, among areas with the lowest risk of deprivation there were first of all the metropolitan area of Warsaw and most poviats of the Śląskie (without its northern part) and Opolskie (without its western part) voivodeships.

Figure 2. Local spatial interdependence of the Powiat Index of Deprivation (the nearest neighbour method $k=20$)*



* at a statistical significance level of 0.05.

Source: own work.

4.3. Analysis of extreme cases

Given an apparent impact of administrative division on the obtained results, it is necessary to analyse extreme cases in various types of poviats. In case of "regular" counties, i.e. formed by a city along with its surroundings, among those most threatened there have been poviats located in the above mentioned regions, i.e. the Northern part of Mazowieckie voivodship and its surroundings (Kolno County and Lipno County) and the Radom sub-region (Szydłowiec County and Przysucha County). In case of urban counties, these have been mainly poviats surrounding smaller cities located in eastern and central part of the country - the highest values of the index of deprivation have been observed in Przemyśl, Radom and Ostrołęka Counties.

Table 5. Analysis of extreme cases - "ordinary" counties and "rural" counties [value of the Poviats Index of Deprivation]

Position in the ranking	"Regular" poviats (counties) (city and surroundings)			"Rural" poviats (counties) (surroundings of cities with poviat rights)		
	Name	Value	Class	Name	Value	Class
1	Kolno County	1.08	10	Przemyśl County	1.10	10
2	Szydłowiec County	1.05	10	Radom County	1.07	10
3	Przysucha County	0.97	10	Ostrołęka County	1.05	10
4	Lipno County	0.85	10	Chełm County	1.01	10
5	Rypin County	0.77	9	Elbląg County	0.95	10
6	Maków County	0.76	9	Łomża County	0.94	10
7	Strzyżów County	0.75	9	Grudziądz County	0.91	10
8	Limanowa County	0.75	9	Włocławek County	0.91	10
9	Opatów County	0.75	9	Zamość County	0.88	10
10	Żuromin County	0.74	9	Nowy Sącz County	0.85	10
11	Mońki County	0.74	9	Siedlce County	0.73	9
12	Nowe Miasto County	0.74	9	Płock County	0.72	9
13	Nisko County	0.73	9	Kielce County	0.71	9
14	Brzozów County	0.70	9	Suwałki County	0.66	9
15	Janów Lubelski County	0.70	9	Biała Podlaska County	0.64	9
16	Zwoleń County	0.68	9	Tarnów County	0.59	9
17	Sztum County	0.68	9	Konin County	0.58	9
18	Kazimierza County	0.67	9	Piotrków County	0.57	9
19	Białobrzegi County	0.67	9	Lublin County	0.52	8
20	Kolbuszowa County	0.66	9	Koszalin County	0.52	8

Source: own work.

4.4. Urban counties and voivodeship capitals

Cities with poviats rights, so called urban counties, in particular those that function as voivodeship centres, are the category of poviats that need to be analysed separately. They are relatively at the lowest risk of deprivation in the light of the developed index. A positive value of this index has been only noted for one of these 66 cities (Bytom), which gives it a position in the fifth class of cities threatened with deprivation. Overall, among 20 urban counties there are as many as 10 cities from the Upper Silesian conurbation that are most threatened by deprivation. In case of the other cities, relatively the worst situation has been observed in Włocławek, Wałbrzych and Grudziądz. Radom has been the largest urban centre in terms of population classified to the group of urban counties most threatened by deprivation. It should be noted at the same time that in many cases, also rural counties located in the surroundings of these cities have been characterised by high risk of deprivation.

Table 6. Analysis of extreme cases - "urban" counties and voivodeship capitals [value of the Poviat Index of Deprivation]

Position in the ranking	"Urban" poviats (counties) (cities with poviat rights)			Voivodeship capitals (voivodeship capital counties)		
	Name	Value	Class	Name	Value	Class
1	City of Bytom County	0.02	5	City of Toruń County	-0.99	2
2	City of Świętochłowice County	-0.04	5	City of Bydgoszcz County	-1.00	2
3	City of Włocławek County	-0.13	4	City of Łódź County	-1.05	2
4	City of Wałbrzych County	-0.17	4	City of Szczecin County	-1.06	2
5	City of Grudziądz County	-0.19	4	City of Gorzów Wielkopolski County	-1.11	2
6	City of Radom County	-0.30	3	City of Białystok County	-1.12	2
7	City of Piekary Śląskie County	-0.32	3	City of Kielce County	-1.22	1
8	City of Zabrze County	-0.33	3	City of Lublin County	-1.33	1
9	City of Siemianowice Śląskie County	-0.35	3	City of Gdańsk County	-1.36	1
10	City of Ruda Śląska County	-0.37	3	City of Olsztyn County	-1.43	1
11	City of Chorzów County	-0.46	3	City of Katowice County	-1.47	1
12	City of Rybnik County	-0.49	3	City of Zielona Góra County	-1.48	1
13	City of Elbląg County	-0.50	3	City of Rzeszów County	-1.51	1
14	City of Mysłowice County	-0.52	3	City of Poznań County	-1.56	1
15	City of Przemyśl County	-0.57	3	City of Kraków County	-1.58	1
16	City of Żory County	-0.59	3	City of Wrocław County	-1.65	1
17	City of Chełm County	-0.60	3	City of Opole County	-1.75	1
18	City of Dąbrowa Górnicza County	-0.61	3	City of City of Warsaw County	-1.80	1
19	City of Suwałki County	-0.64	3			
20	City of Słupsk County	-0.71	2			

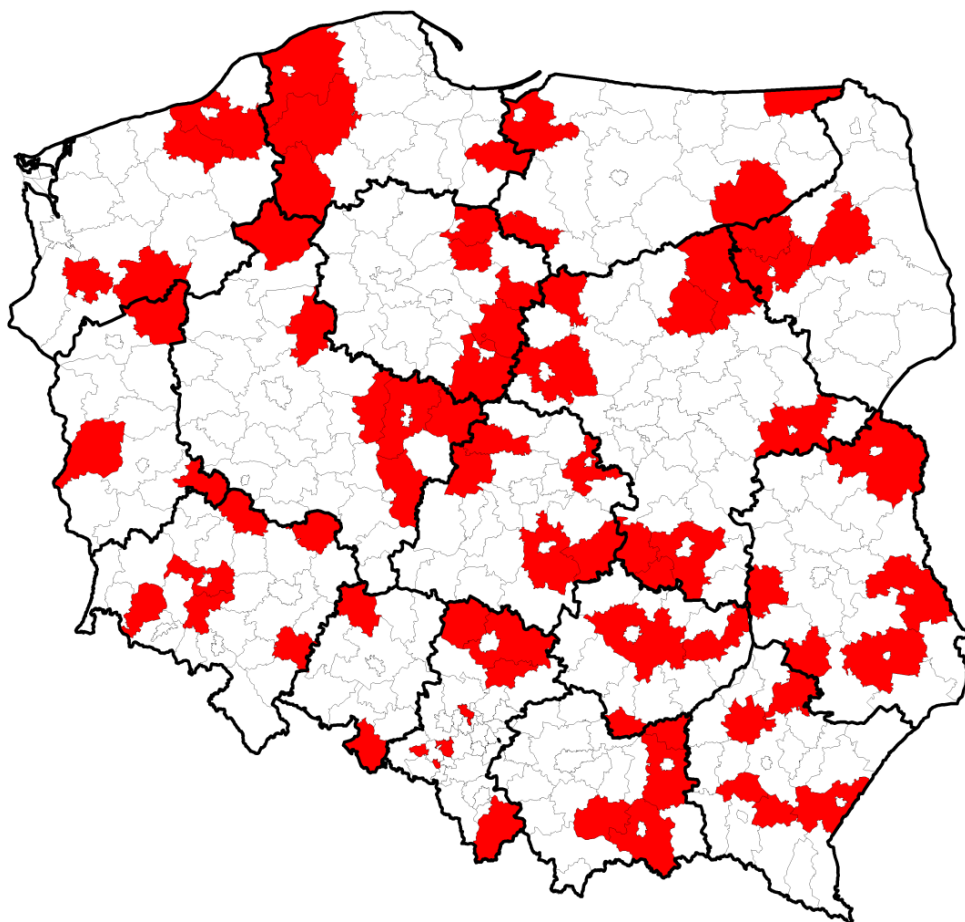
Source: own work.

Only six cities among those that perform voivodeship functions have not been classified to the first class characterised by the lowest risk of deprivation. Relatively the worst situation has been noted in the so called Two-City, i.e. Bydgoszcz and Toruń, as well as in Łódź, Szczecin, Gorzów Wielkopolski and Białystok. The other voivodeship capitals have been classified to the first group, with the weakest positions in terms of deprivation occupied by: Kielce, Lublin and Gdańsk, while Warsaw, Opole and Wrocław have been classified as cities characterised by the lowest risk of deprivation.

4.5. Deprivation from the voivodeship perspective

The scale of deprivation can be also relativised at the voivodeship level, which may be important for the regional policy conducted at this level. For this purpose, a map has been drawn up presenting approximately 20% of poviats with the highest risk of deprivation in each voivodeship (Figure 3). The map shows that the situation is worse in poviats located near the borders of voivodeships (this phenomenon is also observed in other studies, e.g. Gorzelak et al. 2008) as well as in "rural" counties that surround "urban" counties of smaller urban centres. This may indicate barriers to diffusion of developmental processes from major urban centres as well as smaller cities to their immediate surroundings and the accompanying negative processes of backwashing the developmental resources (see e.g. Gorzelak, Smętkowski 2005).

Figure 3. Poviats threatened with deprivation at the voivodeship level*



*approximately 20% of the number of poviats characterised by the highest risk of deprivation in each of the voivodeships.

Source: own work.

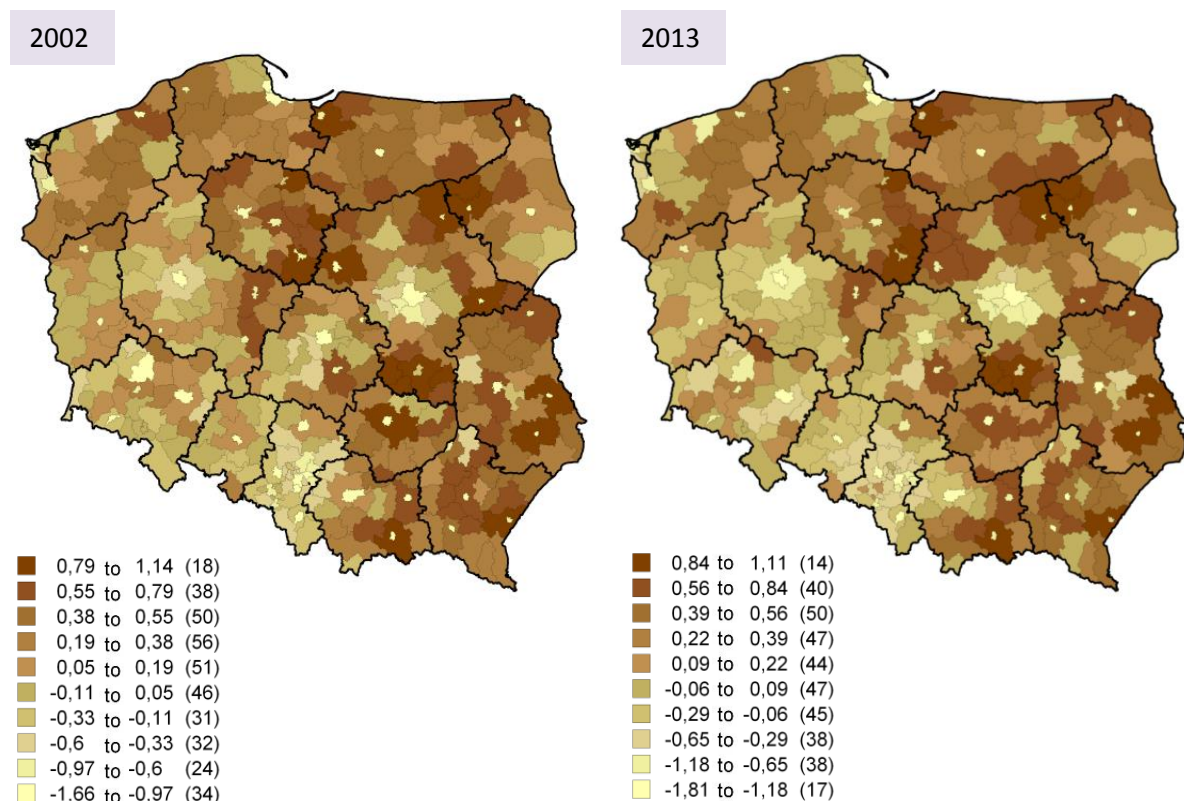
5. TRENDS AND PREDICTION OF DEPRIVATION AT THE POVIAT LEVEL

This part of the study first of all compares the threat of deprivation faced by poviats residents between 2002, for which the national census data are available, and 2013. The dynamics of changes to the threat of deprivation is then presented. This has been used as basis to indicate poviats with the greatest relative improvement and those with a relative deterioration of the situation. The next step presents a proposal of on-going monitoring of the threat of deprivation phenomenon with the use of indicators which can be calculated on the basis of the available annual data (i.e. excluding e.g. the national census data which are available approximately every 10 years). Finally, a qualitative prediction of the threat of deprivation has been formulated using the scenario method.

5.1. Change to the threat of deprivation faced by poviats in 2002-2013

There are no significant differences between maps presenting values of the Poviat Index of Deprivation in 2002 and 2013 (Figure 4). This indicates a large inertia of spatial differentiation in Poland in this respect, also visible with regard to the examined sub-indices and the indicators used to construct them (see appendix 1 for more details).

Figure 4. Poviat Index of Deprivation in 2002 and 2013



* division into 10 classes using the natural breaks method.

Source: own work.

In case of over half of the poviats the threat of deprivation class did not change in the analysed period, and most of the poviats which changed their position, were moved to the neighbouring classes. As a result, no significant changes in spatial differentiation have been noted. This illustrates the transition matrix of changes in the categorisation of poviats (on the basis of the natural break method) between 2002 and 2013 (Table 7). In total, 51% of poviats did not change their class in this period. In the other cases, the change involved a shift to a neighbouring class, while the number of instances when the situation worsened (20% poviats) and the number of instances when it improved (21% of poviats) have been the same. Most shifts have been noted between middle classes, starting from the fourth class and ending with the seventh class. It should be noted at the same time that the above image could to some extent be a result of differences in the division into classes between 2002 and 2013 (Table 8).

Table 7. The transfer-matrix for poviats between classes determined using the natural breaks method for 2002-2013*

Transfer	from:	2013										
to:	Class	1	2	3	4	5	6	7	8	9	10	Total
2002	1	17	16	1								34
	2		17	6	1							24
	3		5	20	5	2						32
	4			8	15	7	1					31
	5			1	17	16	11	1				46
	6			2	7	16	16	10				51
	7					6	12	26	11	1		56
	8						4	9	28	9		50
	9							1	11	25	1	38
	10									5	13	18
	Total	17	38	38	45	47	44	47	50	40	14	380

* in red significant deterioration in the poviat position, in green significant improvement in the poviat position.

Source: own work.

Approximately 8% of poviats have changed their position by more than one class. Of these, only seven poviats have gone down in their position by two classes, while 19 poviats have gone up by two classes, and the other two by three classes. The positions of the following poviats have changed two classes down: the Łask, Zduńska Wola, Skarżysko, Płońsk counties as well as such cities as Starachowice, Włocławek and Chełm. The largest relative improvement, on the other hand - a shift two classes up - have been noted in the Wrocław and Łęczyńska Counties. Poviats which improved their positions in the ranking are usually located in the vicinity of large cities or are of industrial character, for example the Mielec, Tarnobrzeg, Sanok, Kościerzyna Counties, which may indicate in the first case the role of suburbanisation in the process of local development, and in the other case - positive social effects of successful industrial restructuring.

Table 8. Comparison of the range of classes of the threat of deprivation faced by poviats

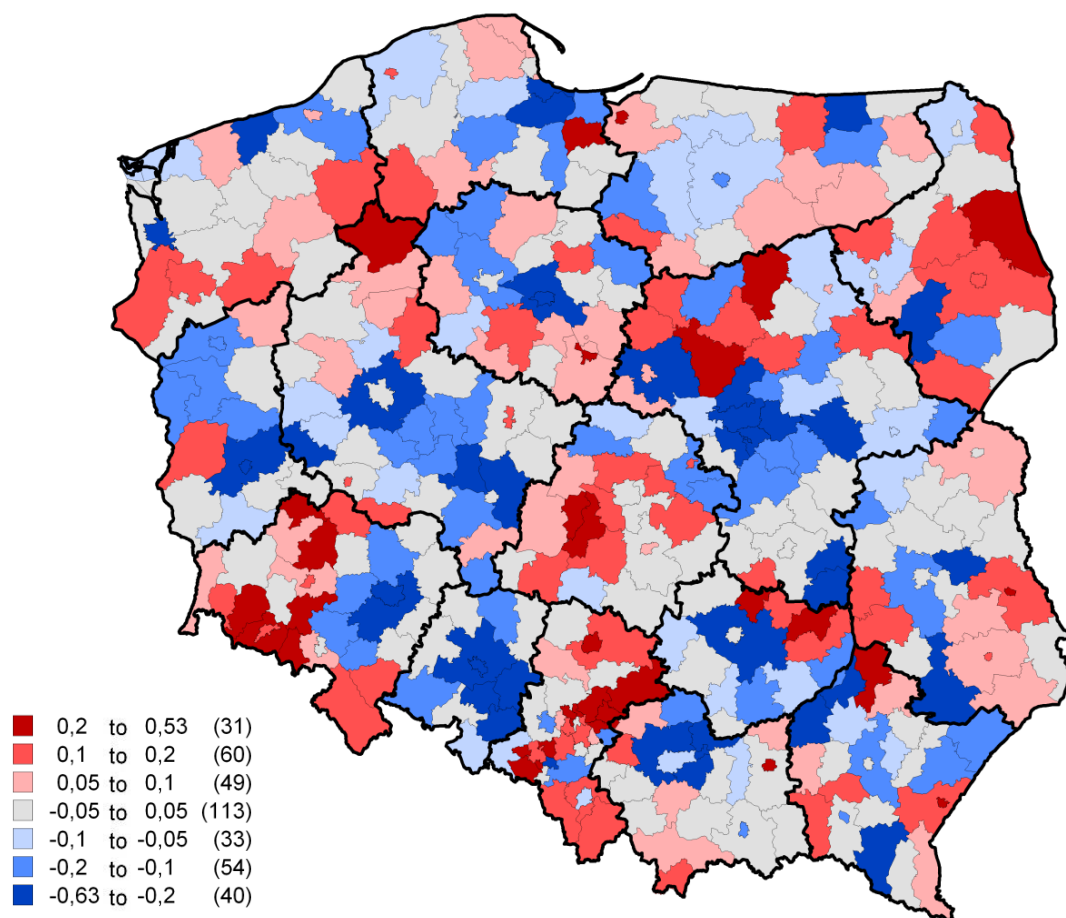
Class	2002		2013	
	Range	N	Range	N
10	<0.79 ; 1.14>	18	<0.84 ; 1.11>	14
9	<0.55 ; 0.79>	38	<0.56 ; 0.84>	40
8	<0.38 ; 0.55>	50	<0.39 ; 0.56>	50
7	<0.19 ; 0.38>	56	<0.22 ; 0.39>	47
6	<0.05 ; 0.19>	51	<0.09 ; 0.22>	44
5	<-0.11 ; 0.05>	46	<-0.06 ; 0.09>	47
4	<-0.33 ; -0.11>	31	<-0.29 ; -0.06>	45
3	<-0.60 ; -0.33>	32	<-0.65 ; -0.29>	38
2	<-0.97 ; -0.60>	24	<-1.18 ; -0.65>	38
1	<-1.66 ; -0.97>	34	<-1.81 ; -1.18>	17

* the classes have been determined using the natural breaks method.

Source: own work.

Although the number of significant transfers between groups of poviats has turned out to be rather small, analysis of changes to the value of the Poviat Index of Deprivation allows us to see, however, the existence of relatively clear spatial differentiation layouts (Figure 5).

Figure 5. Changes to the Poviat Index of Deprivation in the period 2002-2013 [in points]*



* improvement of the situation (in blue), relative deterioration of the situation (in red).

Source: own work.

Areas where the situation has improved include in particular:

- metropolitan areas of the largest five Polish cities (excluding Łódź), i.e. Warsaw, Poznań, Tri-City, Kraków and Wrocław, and also Toruń and Bydgoszcz,
- in western Poland: the Opolskie region, central part of the Lubuskie voivodeship as well as southern part of Wielkopolskie voivodship, including in particular poviats in the vicinity of Ostrowiec Wielkopolski,
- in eastern Poland: some poviats in the Kielce-Lublin-Rzeszów triangle cities, including those belonging to the former Central Industrial Area and selected poviats of the Podlaskie and Warmińsko-Mazurskie voivodeships.

On the other hand, the greatest increase in the threat of deprivation faced by poviats has been observed in:

- the western and southern part of the Dolnośląskie voivodeship,
- northern part of the Mazowieckie voivodeship (with the exception of Mława County and rural counties of Płock and Ostrołęka),
- most cities in the Upper Silesian conurbation (with the exception of Gliwice and Jaworzno), as well as Rybnik and Częstochowa,
- poviats of the former Old-Polish Industrial Region (Staropolski Okręg Przemysłowy),
- the Sieradzki sub-region in the Łódź voivodeship,
- some poviats in the Podlaskie and Zachodniopomorskie voivodeships and northern part of the Wielkopolskie voivodeship.

5.2. Monitoring the threat of deprivation at poviat level

For ongoing monitoring of the threat of deprivation faced by poviats, a proposal may be made to reduce the number of analysed indicators to those for which annual data are available. This entails the need to abandon the creation of sub-indices. Instead, one or two indicators that meet the criteria of annual data availability have been arbitrarily selected from each of the analysed dimension of deprivation. Then, similarly as in the case of the multidimensional synthetic index, a simple index of deprivation has been created, i.e. standardised values of variables have been summed up (after reducing the values to the range between -3 and 3) and then divided by the number of indicators used.

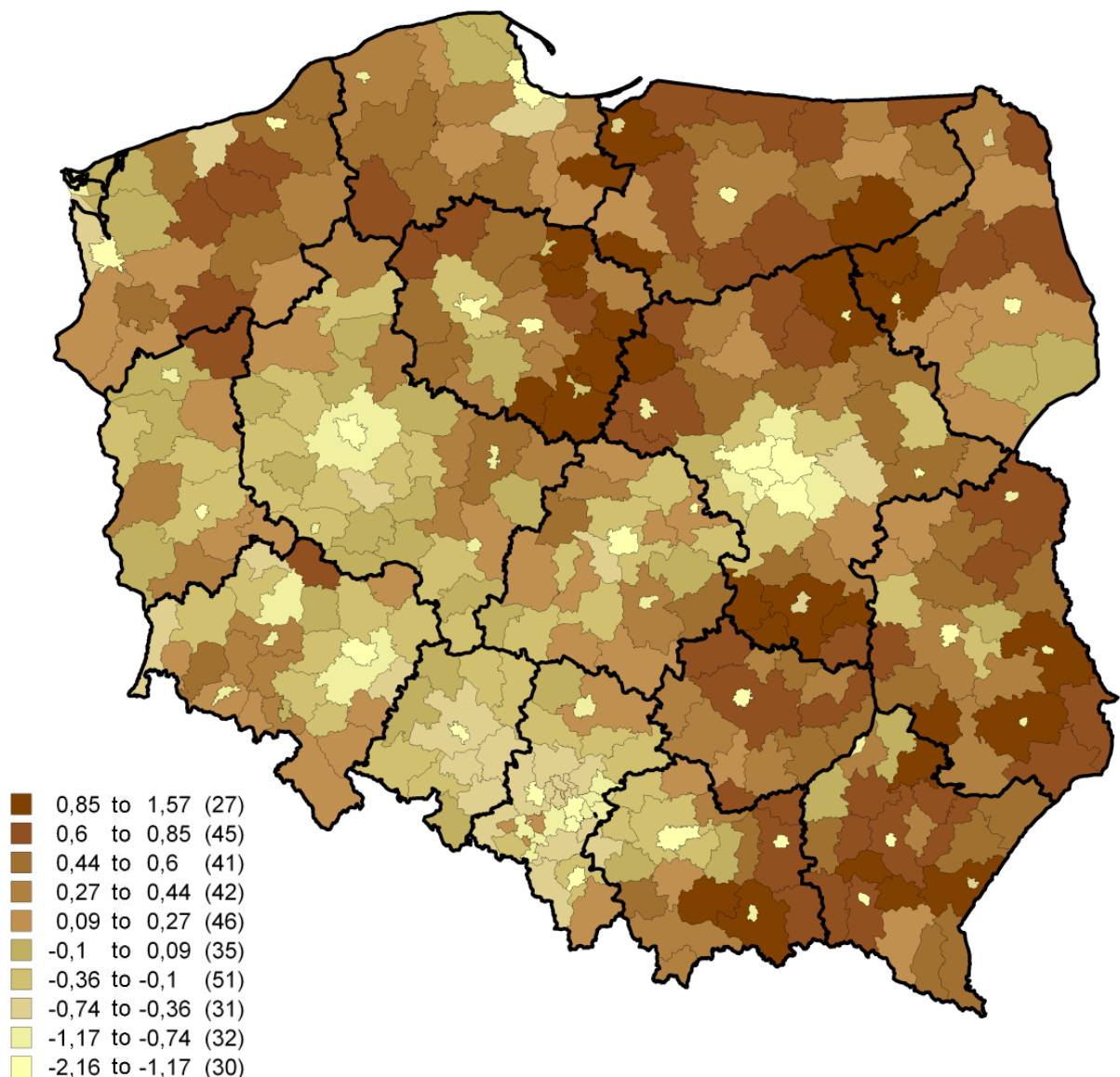
The following variables have been included in the construction of a simple index of deprivation (their assignment to individual dimensions of deprivation is shown in parenthesis):

- own revenue of gminas and cities with poviat rights constituting a share in personal income tax (*income*),
- share of persons living in households receiving social assistance benefits (*income*),
- registered unemployment rate (*employment*),
- number of persons actively employed in agricultural sector per 100 hectares of agricultural land (*employment*),
- percentage of flats with bathroom facilities (*living conditions*),
- score of junior high school exam (*education*),

- population per flat (*access to goods and services*),
- percentage of pre-school children (*access to goods and services*),

The simple index constructed in this manner is strongly correlated (Person's $r=0.91$) with the synthetic Poviats Index of Deprivation. As a result, the map (Figure 6) presenting differences between poviats with respect to the values of the simple index of deprivation according to 10 classes differentiated with the use of the natural breaks method shows an image that is very similar to the one shown by the synthetic index map (Figure 1). The main difference is greater polarisation of poviats with respect to deprivation, as evidenced by higher extreme values between 1.57 and -2.15 and standard deviation of 0.69.

Figure 6. Simple Index of Deprivation in 2013

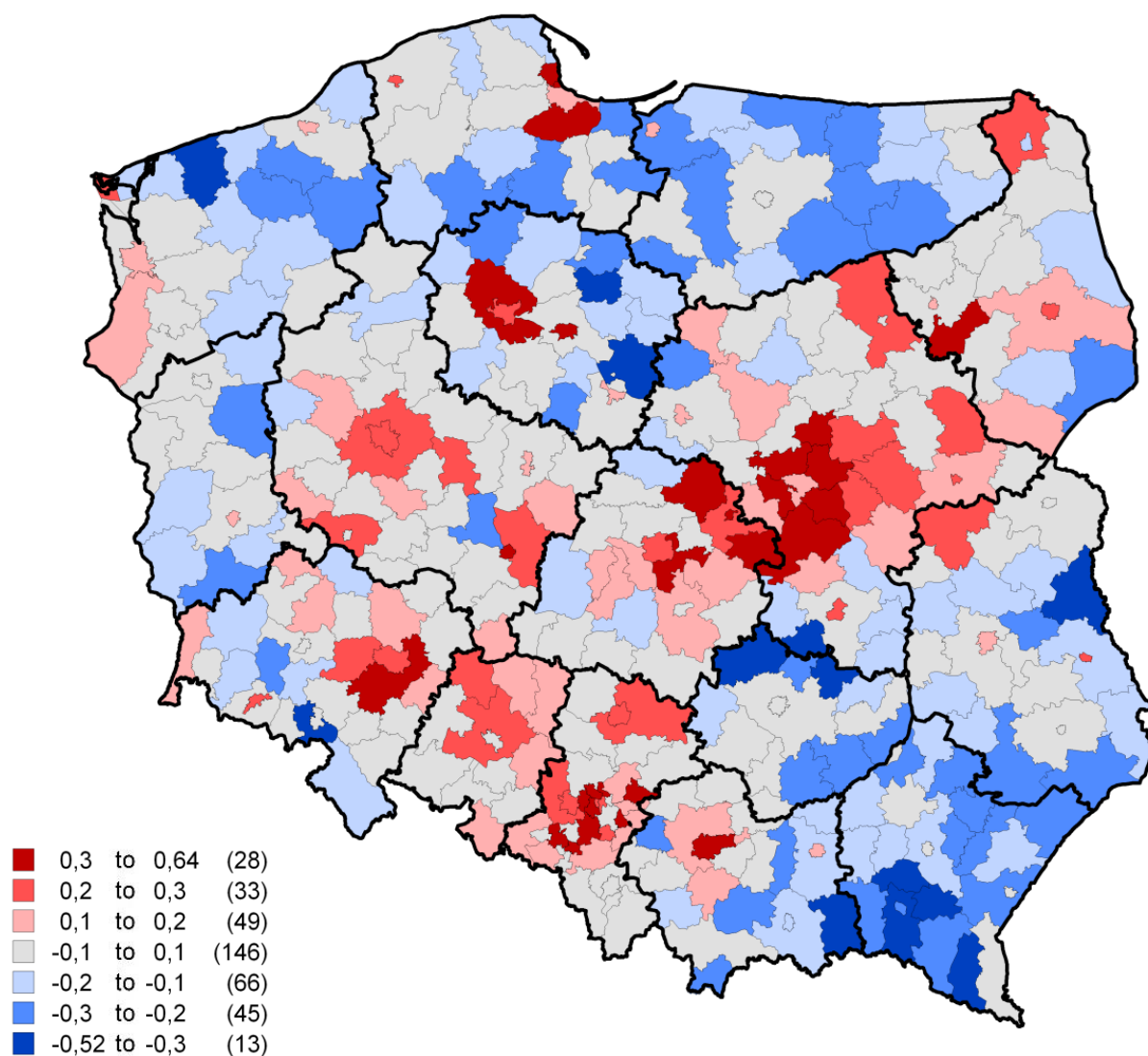


* division into 10 classes using the natural breaks method.

Source: own work.

Differences in the values of the two indices are better visible when compared directly (Figure 7). On this basis it can be stated that the simple indicator, on the one hand, to a greater extent than the PID "improves" the situation of poviats at the lowest risk of deprivation, but on the other hand, "deteriorates" the situation of poviats at the highest risk of deprivation. Thus, the first group comprises, among others, metropolitan areas of the six largest cities, but also the Upper Silesian conurbation, north-eastern part of the Łódzkie voivodeship, northern part of the Opolskie region as well as most cities with powiat rights. The second group comprises in particular poviats of the Podkarpackie voivodeship, eastern part of the Małopolskie voivodeship and northern part of the Świętokrzyskie voivodeship. What is more, a relative deterioration of the situation has been observed, to the greatest extent, in some poviats located in the voivodeships of northern Poland, i.e. the Zachodniopomorskie, Pomorskie, Warmińsko-Mazurskie and Kujawsko-Pomorskie voivodeships.

Figure 7. Difference between the simple index and the Powiat Index of Deprivation (synthetic index) in 2013 [in points]



Source: own work.

Thus, it can be stated that limiting the number of included indicators has highlighted the polarisation of poviats in terms of the level of threat of deprivation and, at the same time, has not significantly affected the observed spatial variations.

In the course of analysis – for practical purposes – of the vulnerability to public intervention of the phenomena presented by the examined indicators, they can be divided into two broad groups. The first group comprises phenomena showing low vulnerability to external intervention, especially in the short term. It includes hidden unemployment in agriculture and the housing market situation. The process of structural changes related to the modernisation and growth of agricultural productivity in Poland is slow, partly due to still insufficient alternatives to taking up employment outside agriculture. On the other hand, the process of building new homes is long-lasting, and besides, it takes place above all in those local layouts that are attractive to the influx of new residents. The second group comprises phenomena that are to a greater extent vulnerable to occurrence of changes in the short term. This group includes phenomena represented by the other indicators, in case of which one may expect much faster adaptation to changeable external conditions, including the public intervention. An example may be Mława County in the Mazowieckie voivodeship, which has significantly improved its situation in the recent years, among other things, thanks to the appearance of a large external investor (see Smętkowski 2015).

The current policy of mitigating the effects of deprivation should take first and foremost the form of social assistance integrated with other social policies, with increased importance of benefits-in-kind and with special emphasis put on the needs of children from large families (see also Bakalarczyk 2011). As regards the social policy conducted and, in particular, social assistance, it is necessary to strive to make it to some extent conditional and to improve its targeting. The fact that it is conditional should not be a consequence of a short-term purpose of limiting the number of beneficiaries, but should use instruments that could motivate its beneficiaries to engage in the labour market and social life in the long-term (social inclusion). Secondly, it is necessary to deviate, if possible, from the rigid income criterion when making a decision on eligibility for the benefits in favour of a qualitative assessment of a situation of persons and families. It is supposed to extend the group of potential beneficiaries to individuals achieving incomes that slightly exceed statutory thresholds, but eliminate, on the other hand, some recipients whose financial standing, although they formally meet the criteria, is better because of unreported and/or property income. Although the changes should be horizontal, it can be assumed that they should be introduced with particular intensity in poviats with the highest risk of deprivation.

5.3. Qualitative long-term prediction of the threat of deprivation faced by poviats

The phenomenon of deprivation is very durable in the spatial dimension. There is no point, therefore, in creating short-term predictions of changes to the threat of deprivation faced by poviats. Even in the long run, one should not expect that the situation will change quickly. This is due to the inertia and overlapping of four dimensions of differentiation of the Polish space, including the historically shaped level of development and wealth, transformation processes, social attitudes and efficiency of local governments (cf. i.a. Hryniewicz 2004, Gorzelak 2009). These factors reinforce each other, which leads to consolidation of the existing spatial differentiation. What is more, it is important to remember that deprivation at the poviat level is measured in relation to average value, which even if the situation improves nationwide, will not

necessarily lead to a considerable mobility between individual classes of poviats with respect to threat of deprivation. Thus, **the absence of significant changes with respect to threat of deprivation faced by poviats can be regarded as the baseline scenario for making long-term predictions.** In this scenario, only a small fraction of the total number of poviats may significantly change their position in the ranking – mainly due to the influence of external factors. These external stimuli can take on different forms, starting from finding a large external investor through the qualitative improvement of accessibility to a large urban centre thanks to the development of supra-local transport infrastructure, to the implementation of large investment projects of supra-local dimension, such as a nuclear power plant. As a result, they can be treated in spatial terms as fairly accidental and not leading to any changes to the existing centre-outskirts layout.

In addition to the baseline scenario, two other scenarios can be formed, including also an attempt to identify the actions of public authorities that may be conducive to their occurrence. The first of them implies **a significant acceleration of the migratory flows from areas threatened with deprivation.** This scenario has the potential to be implemented if public authorities take actions that, on the one hand, support the factors that attract people to poviats with higher levels of development (pull factors), *inter alia* in the form of affordable housing development, increased aid and development of scholarship programs for pupils/students, and – on the other hand – strengthen the push factors that consist in reducing the scale of social assistance and refraining from supporting unprofitable industries. Consequences of the implementation of this scenario by poviats threatened with deprivation will depend on whether or not adequate mitigation measures are taken. A likely outcome of not taking such actions is deepening marginalization of peripheral areas and the relative deterioration of the situation with regard to the risk of deprivation, although with a tendency to limit its absolute scale over the long term due to depopulation. Maintaining or increasing, however, the scale of public transfers *per capita* intended for the provision of public services (education, health, housing) may lead to a relative improvement in the situation of residents of these areas. Although in this case, it is necessary to bear in mind that improvement will take place in the context of considerable decrease in the population of peripheral areas.

The second scenario assumes **the activation of the endogenous growth potential of poviats threatened with deprivation** as a result of systemic changes in public intervention objectives. This scenario has the potential to be implemented under the conditions of active policy of the public authorities, including the local authorities, for economic restructuring processes and improving the quality of human and social capital. Its implementation is largely conditional on obtaining external developmental resources as well as skilful adjustment – adaptation – of the local socio-economic systems to the changing external conditions (cf. Celińska-Janowicz, Płoszaj 2015), including those associated with the development of new technologies (cf. Batorski et al. 2014). In case of restructuring, this involves private external capital and directing public external intervention to achieve supply effects, including in particular effects associated with increasing labour productivity rather than short-term demand effects of investments (it should be also remembered that external intervention itself is not a sufficient development factor – see Gorzelak 2000). In case of human and social capital, the intervention should firstly cover the educational and cultural spheres which provide basis for lasting changes in the long term perspective. As a result of the combination of these two types of operations, new jobs can be expected to emerge in economic sectors that create higher added value, which may trigger durable developmental processes that reduce the risk of deprivation in the peripheral population.

It should be assumed that both scenarios can be implemented simultaneously depending on the diagnosed level of the risk of deprivation faced by poviats. In case of poviats at the highest risk of deprivation, a more likely choice may be the first scenario, and in case of those at the lower risk - the second one.

Regardless of the above development scenarios, the following general recommendations can be formulated for development policy at national and regional level and the actions of local authorities in order to address, at least to some extent, the problems associated with the threat of deprivation faced by poviats over the long term (cf. Gorzelak 2004, 2009, 2014, and also Celińska 2010, Herbst 2012, Kozak 2014, Olechnicka 2012, Smętkowski 2013):

- the development of functional links between growth poles, i.e. metropolitan areas and their regional surroundings,
- pro-growth use of external aid focussed on achieving long-term supply effects,
- development of education and strengthening educational institutions at all levels,
- increasing the innovation of local economies, among other things by stimulating cooperation between enterprises and research institutions,
- strategic orientation of activities and also monitoring and evaluation of their effects necessary in order to make appropriate adjustments to the conducted policies.

6. CONCLUSIONS

The phenomenon of deprivation in Poland encompasses the whole complex of interrelated dimensions, starting from income and deprivation with regard to employment, through deprivation associated with living conditions, and ending with education and access to goods and services. All these fields have to a similar extent contributed to the construction of the synthetic index. At the same time, the Polish poviats are strongly differentiated in terms of threat of deprivation faced by their residents. In addition, the spatial differentiation of the deprivation index displays a relatively high regularity. Next to areas with low risk of deprivation there are also areas with high risk of this phenomenon. Among the former, there can be enumerated in the first place cities with poviats rights and metropolitan areas of the largest urban centres as well as voivodeships located in south-western part of Poland. At the other extreme, there are poviats located outside areas positively impacted by large cities, including in particular in the eastern part of the country, as well as – although to a lesser extent – in the north. Poviats with the highest risk of deprivation include also those where there are no large urban centres, and in particular rural poviats in the surroundings of smaller cities. The relativization of the threat of deprivation at the voivodeship level shows that among poviats with the highest risk of deprivation there are those located in the peripheral parts of individual regions. Particularly visible is the dichotomy found in the functional macro-region of Warsaw, where Warsaw and the surrounding ring of poviats, on the one hand, form an area with the lowest threat of deprivation, and, on the other hand, peripheral parts of the Mazowieckie voivodeship along with poviats that belong to neighbouring voivodeships occupy top positions in the ranking of poviats threatened with deprivation (see also Smętkowski 2003).

Overlapping of various dimensions of deprivation, which are in many cases conditioned by historic long-term processes, may imply low efficiency of actions aimed at changing the existing spatial differentiation. Thus, the phenomenon of deprivation can be expected to be characterised by considerable durability in spatial perspective. The analysis of trends and prediction of the phenomenon of deprivation at the poviats level are discussed further in the report.

The study of trends relating to the threat of deprivation faced by poviats confirms that this is a very durable phenomenon. In the period of more than 10 years covered by the study (2002-2013), only few poviats considerably changed their positions in the deprivation threat ranking. Changes were to a large extent limited to poviats with average risk of deprivation, while extreme classes in the ranking displayed very high stability. In the privileged position, there were large cities and poviats located in their close vicinity. This confirms the importance of metropolization processes in the shaping of Poland's space (Gorzelak, Smętkowski 2005), which is also visible in the countries of Central and Eastern Europe and in most highly developed countries (Smętkowski 2013; Smętkowski et al. 2011). On the other hand, there was a relative marginalization of poviats located in the peripheral parts of individual voivodeships, which contributed to an increase in the threat of deprivation faced by their residents and was one of the reasons for migration outflow from these areas, which in turn led to worsening of their demographic situation (Celińska et al. 2011). This dimension of differentiation is connected with long-term processes rooted in the historical divisions of Polish space, established by the eighteenth-century partitioning (Gorzelak, Jałowiecki 1998, Hryniewicz 2004). In consequence thereof, eastern areas of Poland are disadvantaged not only in structural terms but also in terms of cultural conditions of economic development

processes. This concerns in particular the level of availability of human capital and bridging social capital, which are important factors of development in the modern economy (cf. Fukuyama 1997, Herbst 2007). Meanwhile, as a result of the migration outflow, such resources are very easily lost, which deepens the differentiation of the Polish space in the east-west dimension.

Regular monitoring of the threat of deprivation faced by poviats is possible on an annual basis using a simple index of deprivation, which is very highly correlated with the multi-dimensional synthetic index. In particular, it seems important to evaluate the conformity of the direction of change of all its component indicators, as only poviats that undergo a complex change stand a chance to improve their position in the ranking so that they can be assigned to a higher class.

Taking into account high durability of the observed spatial differentiation and very low poviat mobility in the deprivation threat ranking, the baseline scenario assumes no significant changes in this respect in the long run. Two complementary scenarios can be formed with respect to it. The first of them assumes acceleration of the processes of migration outflows from areas threatened with deprivation, which in case of maintaining or increasing the scale of public financial transfers (education, public services) may lead to a relative improvement of the situation of their population (more resources for fewer people). The second scenario assumes, in turn, activation of the endogenous growth potential of these areas. This may be done through active operations of the public authorities, including local governments, and simultaneous support for the restructuring processes provided by external investors, coupled with well-targeted public intervention. Creation of jobs in economic sectors with higher added value can launch developmental processes conducive to limiting the threat of deprivation faced by residents of these poviats. It should be assumed that while both of these scenarios can be implemented concurrently depending on the analysed poviat, in most cases the first variant seems to be more likely, while the second path of development can be only followed by the few poviats currently categorised as being at the highest risk of deprivation.

7. WORKS CITED

- Arak P., 2015, Europolis: Miasta uczące się. Raport [Learning cities. The report], Warsaw: Polityka INSIGHT, The Polish Robert Schuman Foundation.
- Arak P., Ivanov A., Peleah M., Płoszaj A., Rakocy K., Rok J., Wyszowski K., 2012, National Human Development Report. Poland 2012. Regional and Local Development. Warsaw: UNDP Project Office in Poland.
- Atkinson J., Salmond C., Crampton P., 2014, NZDep2013 Index of deprivation, New Zealand Ministry of Health, Wellington.
- Bakalarczyk R., 2011, Bieda i wykluczenie społeczne, Raport Fundacji Amicus Europae [Poverty and social exclusion, Report of the "Amicus Europe" Foundation.], Warsaw.
- Batorski D., (ed.), Bendyk E., Filiciak M., Płoszaj A., 2012, Cyfrowa gospodarka: Kluczowe trendy rewolucji cyfrowej. Diagnoza, prognozy, strategie reakcji. [Digital economy: Key trends of digital revolution. Diagnosis, predictions and response strategies.] Warsaw: MGG Conferences, pp. 62-78.
- Batorski D., Płoszaj A., 2012, Diagnoza i rekomendacje w obszarze kompetencji cyfrowych społeczeństwa i przeciwdziałania wykluczeniu cyfrowemu w kontekście zaprogramowania wsparcia w latach 2014–2020. [Diagnosis and recommendations in the field of digital competences of the society and preventing digital exclusion in the context of programming the support for the period of 2014-2020.] Warsaw: Ministry of Regional Development.
- Bertin M., Chevrier C., Pelé F., Serrano-Chavez T., Cordier S., Viel J. F., 2014, Can a deprivation index be used legitimately over both urban and rural areas, International Journal of Health Geographics, No. 13(22).
- Carstairs V., Morris R., 1989, Deprivation: explaining differences in mortality between Scotland and England and Wales, British Medical Journal, No. 299(6704), pp. 886-889.
- Celińska-Janowicz D., Płoszaj A., (ed.), 2015, Rozwój lokalny w turbulentnym otoczeniu: mazowieckie samorządy wobec wyzwań adaptacyjności. [Local development in turbulent environment: Masovian local governments and the challenges of adaptability.] Warsaw: MGG Conferences.
- Celińska-Janowicz D., Kozak M., Miszczuk A., Płoszaj A., Smętkowski M., Tucholska A., Wojnar K., 2010, Ocena wpływu polityki spójności na rozwój miast polskich (w ramach ewaluacji ex post NPR 2004-2006). [Assessing the impact of cohesion policy on the development of Polish cities (within the ex post evaluation of the National Development Plan 2004-2006)]. Warsaw: EUROREG and Ministry of Regional Development.
- Celińska-Janowicz D., Miszczuk A., Płoszaj A., Smętkowski M., 2010, Current Demographical Problems of the Eastern Poland Macroregion, EUROREG Reports and Analyses, No. 5/2010, Warsaw: EUROREG.
- Celińska-Janowicz D., Płoszaj A., 2015, Rola samorządów w kształtowaniu potencjału adaptacyjnego lokalnych układów społeczno-gospodarczych – przykład Mazowsza. [The role of local governments in shaping the adaptive potential of local socio-economic systems - on the example of Masovia.] [in:] Celińska-Janowicz D., Płoszaj A., (ed.), 2015,

- Rozwój lokalny w turbulentnym otoczeniu: mazowieckie samorządy wobec wyzwań adaptacyjności. [Local development in turbulent environment: Masovian local governments and the challenges of adaptability.] Warsaw: MGG Conferences, pp. 4-52.
- Chojnicki Z., Czyż T. (ed.), 1991, Zróżnicowanie przestrzenne poziomu i warunków życia ludności [Spatial differentiation of the living standards and conditions of the population], Boulettine of the Committee for Spatial Economy and Regional Planning, Polish Academy of Sciences No. 153.
- Churski P., 2012, Zróżnicowanie przestrzenne obszarów wzrostu i obszarów stagnacji gospodarczej w Polsce – wyzwania dla polskiej polityki spójności po 2013. [Spatial differentiation of economic growth and stagnation areas in Poland - challenges for Polish cohesion policy after 2013.] [in:] Ciok S., Raczyk A., (ed.), Wyzwania polityki regionalnej i lokalnej [Challenges of regional and local policy], Rozprawy Naukowe Instytutu Geografii i Rozwoju Regionalnego Uniwersytetu Wrocławskiego [Scientific Dissertations of Institute of Geography and Regional Development at the University of Wrocław], Volume 27, pp. 27-40.
- Dahlgren G., Whitehead M., 1992, Policies and strategies to promote social equity in health, Copenhagen: WHO Regional Office for Europe.
- Devillé W., Wiegers T. A., 2012, Herijking stedelijke achterstandsgebieden 2012, Utrecht: NIVEL - The Netherlands Institute for Health Services Research.
- Fukuda Y., Nakamura K., Takano T., 2007, Higher mortality in areas of lower socioeconomic position measured by a single index of deprivation in Japan, Public Health, No. 121(3), pp. 163-173.
- Fukuyama F., 1997, Zaufanie: kapitał społeczny a droga do dobrobytu. [Trust: The Social Virtues and the Creation of Prosperity.] Warsaw: Wydawnictwo Naukowe PWN [Polish Scientific Publishers].
- Ghosh D., Vogt A., 2012, Outliers: An Evaluation of Methodologies, Section on Survey Research Methods – JSM.
- Gorzela G. 2009, Społeczno-ekonomiczne regionalne zróżnicowanie Polski. [Socio-economic regional diversification of Poland.] [in:] K. Zagórski, G. Gorzelak, B. Jałowicki (ed.) Zróżnicowania warunków życia. Polskie rodziny i społeczności lokalne [Diversification of living conditions. Polish families and local communities], Warsaw: Scholar Publishing House, pp. 86-148
- Gorzela G., 1979, Dobór zmiennych w statystycznej analizie porównawczej [The selection of variables in statistical comparative analysis], Wiadomości Statystyczne [Statistical News] Nos. 3 and 4.
- Gorzela G., 2000, Zewnętrzna interwencja jako czynnik rozwoju lokalnego (na przykładzie Programu Inicjatyw Lokalnych) [External Intervention as a Factor of Local Development - the Example of Local Initiatives Programme], Studia Regionalne i Lokalne [Regional and Local Studies] No. 3, pp. 99-120.
- Gorzela G., 2004, Polska polityka regionalna wobec polskiej przestrzeni [Poland's regional policy for the Polish space], Studia Regionalne i Lokalne [Regional and Local Studies] No. 4(18), pp. 37-72.

- Gorzelak G., 2009, Fakty i mity rozwoju regionalnego [The facts and myths of regional development], *Studia Regionalne i Lokalne* [Regional and Local Studies] No. 2(36), pp. 5-27.
- Gorzelak G., 2014, Wykorzystanie środków Unii Europejskiej dla rozwoju kraju – wstępne analizy [The use of European Union funds for national development - preliminary analyses], *Studia Regionalne i Lokalne* [Regional and Local Studies] No. 3(57).
- Gorzelak G., Jałowiecki B., Kozak M., Smętkowski M., 2007, Władze miast wobec zagrożenia degradacją społeczno-gospodarczą w warunkach transformacji ustrojowej [City authorities and the threat of socio-economic deprivation under the conditions of system transformation], *Studia Regionalne i Lokalne* [Regional and Local Studies] No. 3(29), pp. 5-31.
- Havard S., Deguen S., Bodin J., Louis K., Laurent O., Bard D., 2008, A small-area index of socioeconomic deprivation to capture health inequalities in France, *Social science & medicine*, No. 67(12), pp. 2007-2016.
- Herbst M., 2007, Kapitał ludzki i kapitał społeczny a rozwój regionalny. [Human capital, social capital and regional development] Warsaw: Wydawnictwo Naukowe Scholar [Scholar Publishing House].
- Herbst M., 2012, Edukacja jako czynnik i wynik rozwoju regionalnego [Education as a cause and effect of regional development], Warsaw: Wydawnictwo Naukowe Scholar [Scholar Publishing House].
- Hryniewicz J. T., 2004, Polityczny i kulturowy kontekst rozwoju gospodarczego [Political and Cultural Context of Economic Growth], Warsaw: Wydawnictwo Naukowe Scholar [Scholar Publishing House].
- Jenks G. F., 1967, The Data Model Concept in Statistical Mapping, *International Yearbook of Cartography* No. 7, pp. 186-190.
- Juhász A., Nagy C., Páldy A., Beale L., 2010, Development of a deprivation index and its relation to premature mortality due to diseases of the circulatory system in Hungary: 1998–2004, *Social science & medicine*, No. 70(9), pp. 1342-1349.
- Kopczewska K., 2006, Ekonometria i statystyka przestrzenna [Econometrics and spatial statistics], Warsaw: CeDeWu.
- Kozak M., 2014, Konflikty wokół nowego paradygmatu a rozwój regionalny Polski po 1990 roku [The Conflicts Around the New Development Paradigm and Polish Regional Development after 1990]. Volume 37 (1/2014) Nierówności Społeczne a Wzrost Gospodarczy [Social Inequalities and Economic Growth]. Rzeszów: The University of Rzeszów, Department of Theory of Economics and International Relations, pp.163-180.
- McLennan D., Barnes H., Noble M., Davies J., Garratt E., Dibben C., 2011, The English indices of deprivation 2010, London: Department for Communities and Local Government.
- Messer L. C., Laraia B. A., Kaufman J. S., Eyster J., Holzman C., Culhane J., Elo I., Burke J. G., O'Campo P., 2006, The Development of a Standardized Neighbourhood Deprivation Index, *Journal of Urban Health*, No. 83(6), pp. 1041–1062.

- Olechnicka A., 2012, Potencjał nauki a innowacyjność regionów [The Potential of Science and the Innovation of Regions]. Warsaw: Wydawnictwo Naukowe Scholar [Scholar Publishing House].
- Panek T., Zwierzchowski J., 2013, Porównawcza analiza sfery ubóstwa w krajach UE w ujęciu regionalnym [Comparative Analysis of the Poverty Area in the EU Member States at the Regional Level], Working Papers no. 35, Institute of Statistics and Demography, Warsaw School of Economics.
- Płoszaj A., Rok J., 2013, Multidimensional measurement of local development – case study from Poland, paper presented at the Regional Studies Association European Conference 2013. Shape and be Shaped: The Future Dynamics of Regional Development. 5-8 May 2013, University of Tampere, Tampere, Finland.
- Sen A., 2000, Nierówności. Dalsze rozważania [Inequalities. Further Considerations], Kraków: Wydawnictwo Znak [Znak Publishing].
- SIMD, 2012, Scottish Index of Multiple Deprivation 2012, Edinburgh: Scottish Government.
- Smętkowski M., 2003, Polaryzacja procesów rozwoju w regionie metropolitalnym Warszawy? [Polarisation of Development Processes in the Warsaw Metropolitan Area?] [in:] I. Jażdżewska (ed.), Funkcje metropolitalne i ich rola w organizacji przestrzeni [Metropolitan Functions and Their Role in Space Organisation]. Łódź: Triada, pp. 53-71.
- Smętkowski M., 2013, Rozwój regionów i polityka regionalna w krajach Europy Środkowo-Wschodniej [Development of Regions and Regional Policy in Countries of Central and Eastern Europe], Warsaw: Wydawnictwo Naukowe Scholar [Scholar Publishing House].
- Smętkowski M., 2015, Adaptacyjność na poziomie lokalnym – studium przypadku Mławy [Adaptability at local level – Mława case study]. [in:] D. Celińska-Janowicz, A. Płoszaj (ed.) Rozwój lokalny w turbulentnym otoczeniu: mazowieckie samorządy w wobec wyzwań adaptacyjności [Local Development in the Turbulent Environment: Masovian Local Governments and the Challenges of Adaptability], Warsaw: MGG Conferences Sp. z o.o., pp. 53-66.
- Smętkowski M., Gorzelak G., Kozak M., Olechnicka A., Płoszaj A., Wojnar K., 2011, The European Metropolises and Their Regions: from Economic Landscape to Metropolitan Networks, Warsaw: Wydawnictwo Naukowe Scholar.
- Smętkowski M., Jałowiecki B., Gorzelak G., 2009, Obszary metropolitalne w Polsce: problemy rozwojowe i delimitacja [Metropolitan Areas in Poland: Developmental Problems and Delimitation], EUROREG Reports and Analysis 1/2009, Warsaw: EUROREG.
- Smith D., 1972, Geography and social indicators, South African Geographical Journal No. 54, pp. 43-57.
- Sobala-Gwosdz A., 2004, The Change in the Rural Standard of Living During the Transformation Period in the Podkarpackie Province. [in:] M. Paszkowski (ed.) Effectiveness geographical space quality of life, Prace geograficzne IGiPG No.114, pp. 93-106.
- Szarfenberg R., 2010, Marginalizacja i wykluczenie społeczne – panorama językowo-teoretyczna [Marginalisation and social exclusion – language and theoretical panorama]. [in:] R. Szarfenberg, C. Żołędowski, M. Theiss (ed.) Ubóstwo i wykluczenie społeczne.

- Perspektywa poznawcza [Poverty and social exclusion. Cognitive perspective.], Warsaw: DW Elipsa, pp. 121-142.
- Szymańska D., Domin J. D., Kwiatkowski G., Rogatka K., 2011, Ranking miast w Polsce na podstawie warunków życia w świetle różnych metod pomiaru [Ranking of Polish Cities on the Basis of Living Conditions in the Light of Various Measurement Methods], *Studia i Prace z Geografii i Geologii* [Studies and Papers in Geography and Geology] Volume 22, pp. 121-133.
- Townsend, P., 1987, Deprivation, *Journal of social policy*, No.16, pp. 125-146.
- Trojak M., Tokarski T., 2013, Statystyczna analiza przestrzennego zróżnicowania rozwoju ekonomicznego i społecznego Polski [Statistical Analysis of Spatial Differentiation of Poland's Socio-Economic Development], Kraków: Wydawnictwo Uniwersytetu Jagiellońskiego [Jagiellonian University Publishing House].
- WIMD, 2014, Welsh Index of Multiple Deprivation 2014, Cardiff: Welsh Government.
- Wojtalik M., 2014, Gdzie w Polsce żyje się najgorzej, a gdzie najlepiej? [Which locations in Poland are the best and the worst to live in?] *NEWSWEEK* magazine, obtained from <http://polska.newsweek.pl/gdzie-w-polsce-zyje-sie-najgorzej-a-gdzie-najlepiej-ranking-powiatow,artykuly,351712,1.html> [access: 8 October 2015].

8. APPENDICES

Appendix 1. Sub-indices of deprivation

This section of the study analysis partial indices of deprivation, which should facilitate understanding of the image presented by the synthetic Poviats Index of Deprivation. For each of the examined dimensions of deprivation, the correlation between its component indices is firstly presented, followed by maps of the sub-index and variables that it is formed with, together with a brief interpretation of the observed spatial layouts.

Income

Four of the five variables included in the index of deprivation with respect to income have been fairly strongly correlated (Table 9). This was particularly the case for correlation between, aggregated at the poviats level, revenue achieved by gminas from personal income tax *per capita* with the percentage of social assistance users and the percentage of households with more than three children. The value of the share in personal income tax *per capita* has been also strongly correlated with the amount of average salary; however the latter has displayed much weaker correlation with the other two indicators. On the other hand, the last of the considered indicators, that is the share of flats with more than three months' rent arrears has not been clearly correlated with the other indicators, which may indicate that this problem occurs on a smaller spatial scale and in selected territorial layouts only. Besides, its insignificant negative correlation with the percentage of families with multiple children (typical especially in rural areas) may indirectly indicate that it has to a greater extent represented urban dimension of deprivation.

Table 9. Correlations between component variables of deprivation with respect to income dimension in 2013

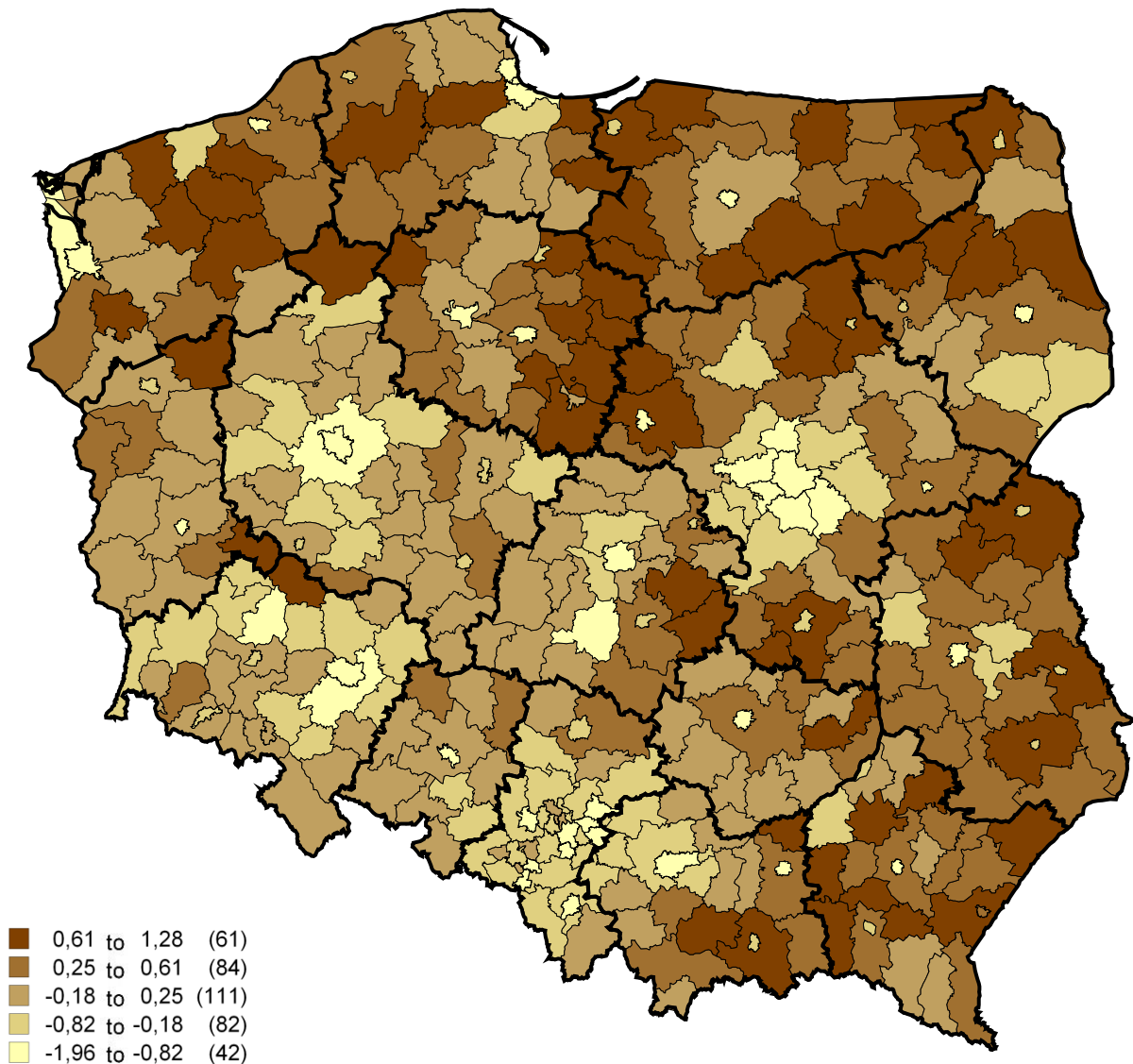
	Own revenue <i>per capita</i> from personal income tax	National average salary	Percentage of families with multiple children	Percentage of social assistance users	Percentage of flats with rent arrears
Own revenue <i>per capita</i> from personal income tax	x	0.67	0.73	0.68	-0.12
National average salary	0.67	x	0.46	0.46	-0.07
Percentage of families with multiple children	0.73	0.46	x	0.60	-0.31
Percentage of social assistance users	0.68	0.46	0.60	x	-0.04
Percentage of flats with rent arrears	-0.12	-0.07	-0.31	-0.04	x

* in red the r Person's indicator, relevant at the 0.05 level.

Source: own work.

With respect to income of the population in Poland at the poviats level, deprivation has in the spatial dimension the south-west vs. the rest of the country layout (Figure 8). Among voivodeships at lower risk of deprivation are in particular the south-western voivodeships, i.e. the Dolnośląskie, Wielkopolskie, Lubuskie, Opolskie, Śląskie voivodeships as well as the Łódzkie voivodeship without its eastern part. In the northern part of the country among poviats at lower risk of deprivation are poviats adjacent to the voivodeship centres, i.e. Gdańsk, Szczecin, Bydgoszcz, and in the eastern part to Warsaw and Kraków, this to a much lesser degree relates to poviats adjacent to Białystok, Lublin, Rzeszów or Kielce.

Figure 8. Poviats by partial index of income deprivation in 2013

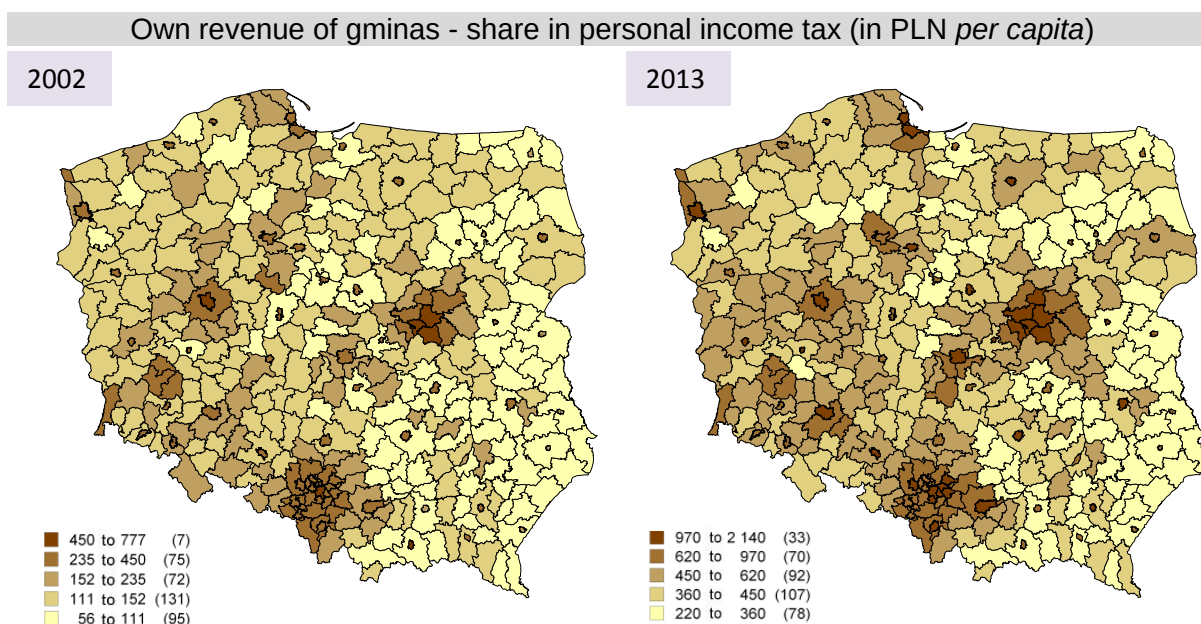


Source: own work.

The other reasons for such a spatial layout can be found by analysing maps of component indicators (Figure 9). Revenue from personal income tax *per capita* has been the highest in metropolitan centres and areas as well as in the Upper Silesian conurbation. Generally, it has been higher in the western part of the country, and in particular in the Lubuskie and Śląskie voivodeships and in the western part of the Wielkopolskie voivodeship. The lowest values have been noted, on the other hand, in eastern Poland, and in particular the south-eastern Poland

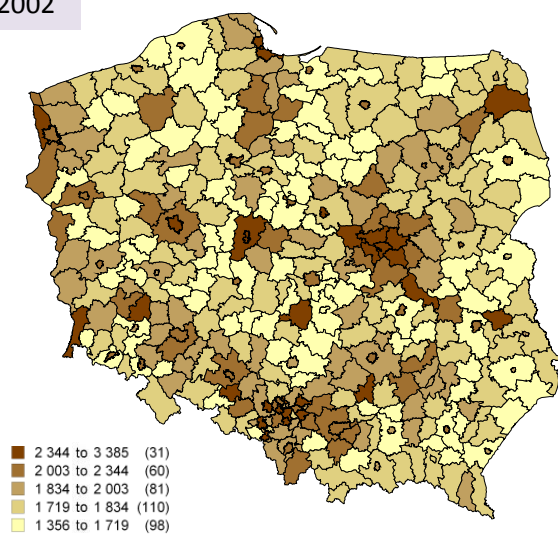
as well as in part of the Małopolskie voivodeship, which has been largely due to the agricultural nature of these areas. Low values have been also noted for parts of poviats located in central Poland on the peripheries of the former Congress Kingdom of Poland. The amount of salary beyond the metropolitan dimension (large cities and their surroundings) to some extent depends on the existence of large industrial plants, especially those operating in the raw materials and energy sectors. This indicates random distribution of the value of the indicator, which is especially visible e.g. in case of Łęczna County (the Bogdanka Coal Mine) and Bełchatów County (the coal mine and the power station). In turn, for the dimension comprising families with multiple children a clear east-west layout has been displayed. The indicator has had particularly high values in poviats located in eastern Poland, with the exception of urban poviats. With reference to the high percentage of social assistance users there have been noticed quite clear north-south and east-west dimensions, which should be linked to the labour market situation (see below). The rent arrears, in turn, have been the highest in central Poland and poviats located along the Vistula river as well as in the western borderland of the country.

Figure 9. Component indicators of the sub-index of deprivation with respect to income [division into classes with the use of the natural breaks method]

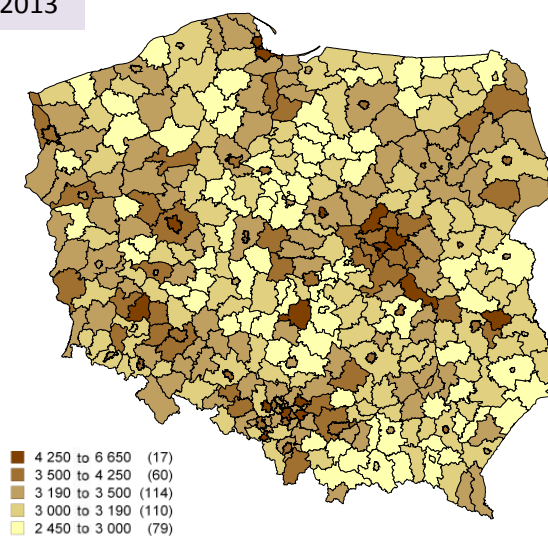


Average salary (in PLN)

2002

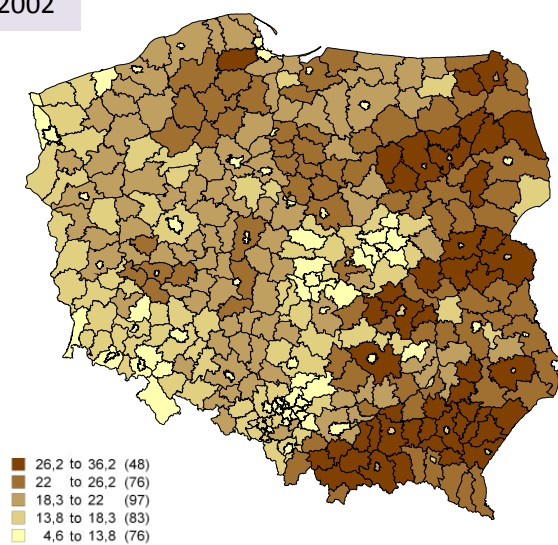


2013

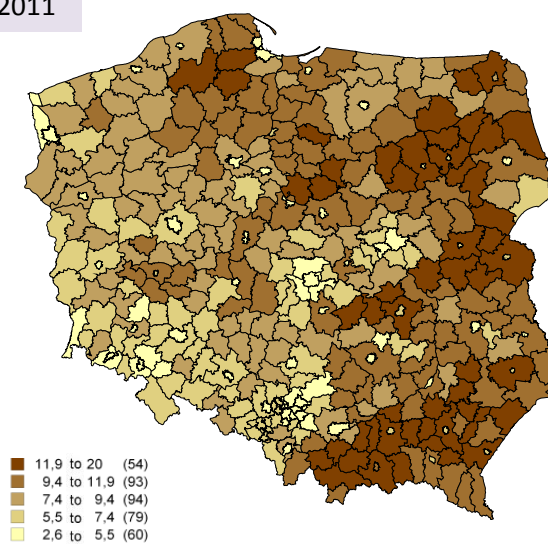


Multiple-children families (percentage)

2002

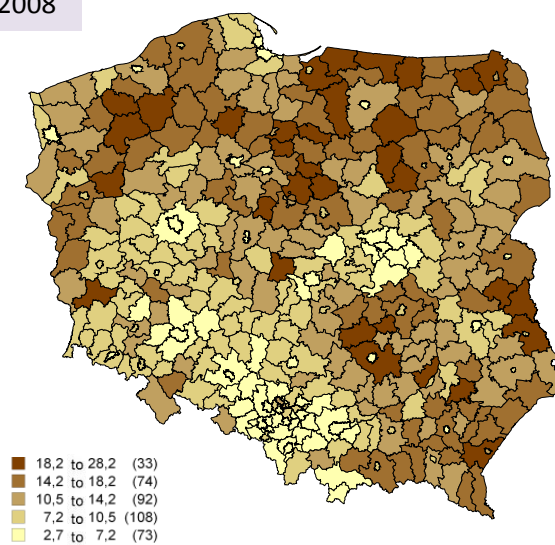


2011

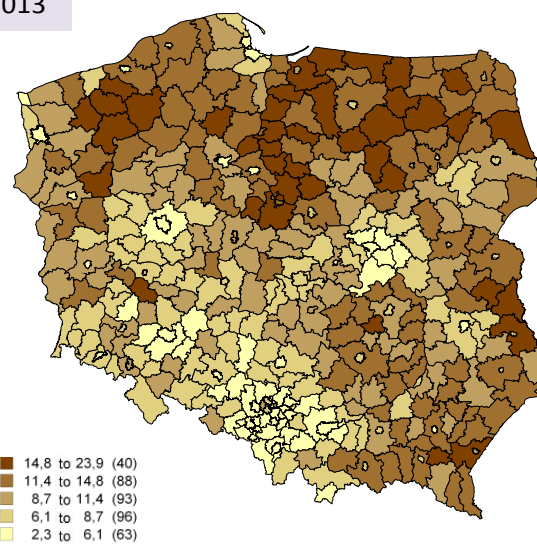


Social assistance users (percentage)

2008

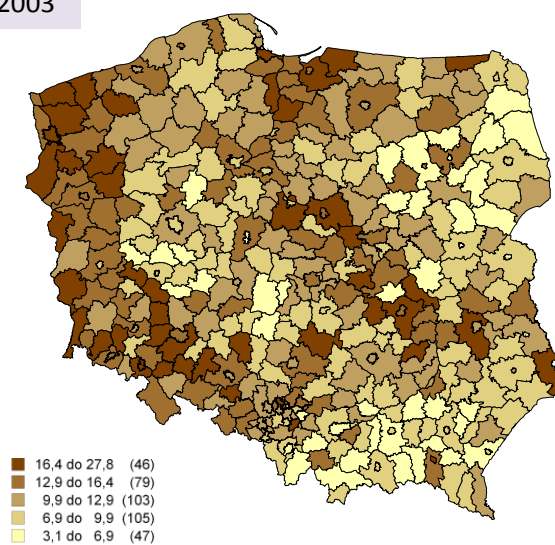


2013

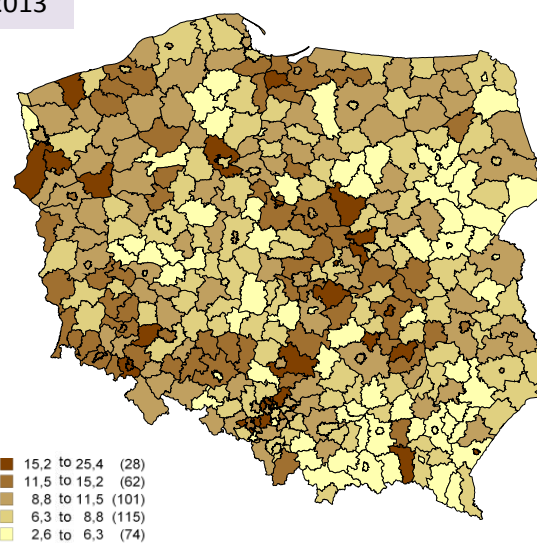


Percentage of flats with more than three months' rent arrears

2003



2013



Source: own work.

Employment

The variables used to represent deprivation with respect to employment at the poviats level have been correlated relatively low. Interestingly, the highest correlation ($r=0.60$) has been noted between the registered unemployment rate and employment outside agriculture, which may be an indicator of frictional unemployment in areas characterised by relatively well-developed labour markets.

Table 10. Correlations between component variables of deprivation with respect to employment in 2013

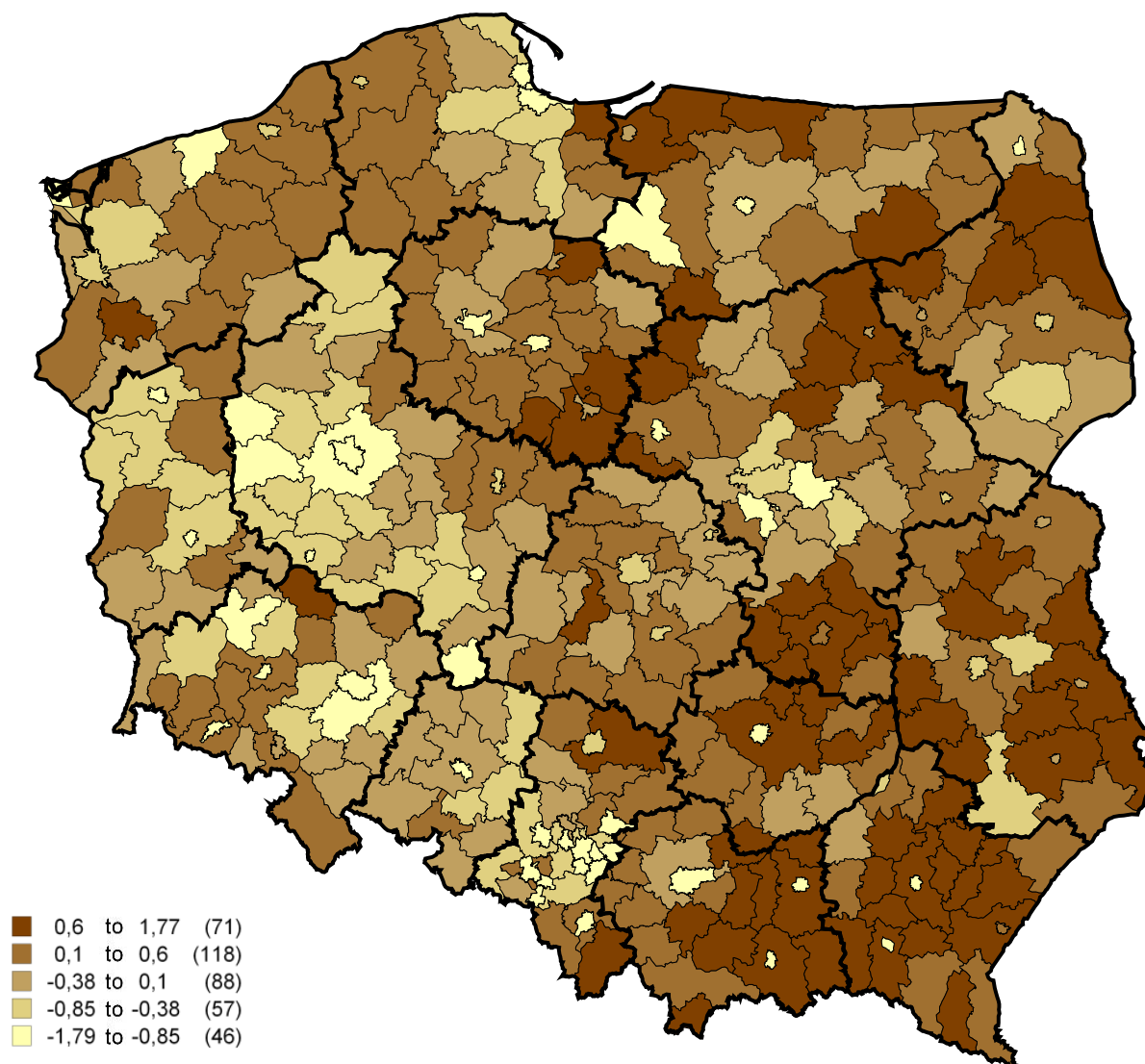
	Registered unemployment rate	Percentage of long-term unemployed	Number of people actively employed in agriculture per 100 hectares of agricultural land	Number of people employed outside agriculture per 100 inhabitants
Registered unemployment rate	x	0.36	-0.01	0.60
Percentage of long-term unemployed	0.36	x	0.23	0.23
Number of people actively employed in agriculture per 100 hectares of agricultural land	-0.01	0.23	x	0.41
Number of people employed outside agriculture per 100 inhabitants	0.60	0.23	0.41	x

* in red the r Person's indicator, relevant at the 0.05 level.

Source: own work.

Analysis of the spatial differentiation of the index of deprivation with respect to employment has, on the one hand, allowed to indicate the best-developed labour markets, and on the other hand, areas where one may encounter a number of difficulties finding a job (Figure 10). The first group includes in particular metropolitan areas of Poznań, Warsaw, Tri-City, Wrocław and the Upper Silesian conurbation. The other group includes mainly poviats located in eastern Poland, and in particular in the south-eastern and north-eastern part, where it is possible to indicate distinct clusters of poviats facing this problem.

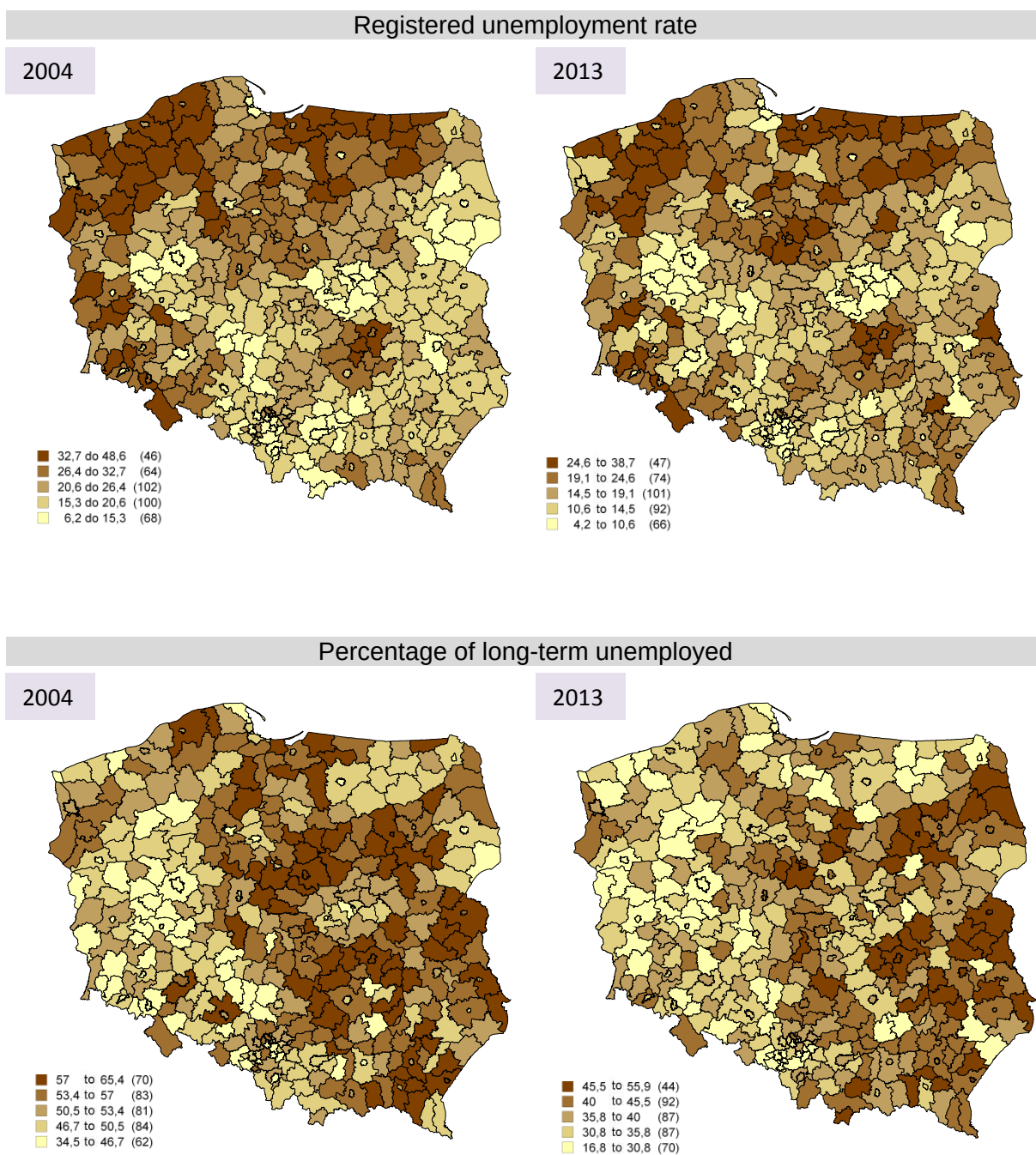
Figure 10. Poviats by sub-index of deprivation with respect to employment in 2013



Source: own work.

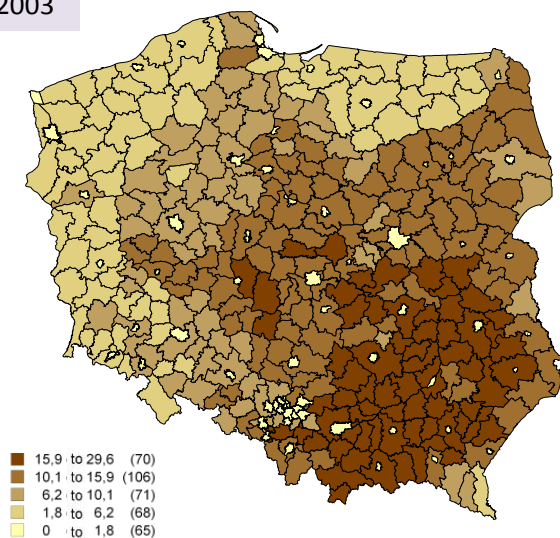
This image has been a result of mutually overlapping factors which are quite strongly historically conditioned (Figure 11). The first of these factors has been the registered unemployment rate - particularly high in areas which after 1989 experienced liquidation of state farms (PGR), i.e. mainly in the western and northern territories. Unemployment has also been high in poviats with low degree of diversification of the economy, where restructurisation has affected industrial plants, which has been particularly visible in the Świętokrzyskie and Podkarpackie voivodeships. The other factor has been hidden unemployment in agriculture expressed by a large number of persons actively employed per 100 hectares of agricultural land. In this respect, the south-eastern Poland has been the leader and the change gradient of the phenomenon has run in the north-west vs. the south-east layout. In turn, the percentage of long-term unemployed has to a large extent had a layout connected with the course of the former boundaries of annexed territories, reaching high values in the Congress Kingdom of Poland and Galicia, as well as in the Kujawsko-Pomorskie voivodeship. In turn, the number of persons employed outside agriculture per 100 inhabitants has been the highest in western Poland, and in central Poland - in the Łódź voivodeship and the Warsaw metropolitan area.

Figure 11. Component indicators of the sub-index of deprivation with respect to employment [division into classes with the use of the natural breaks method]

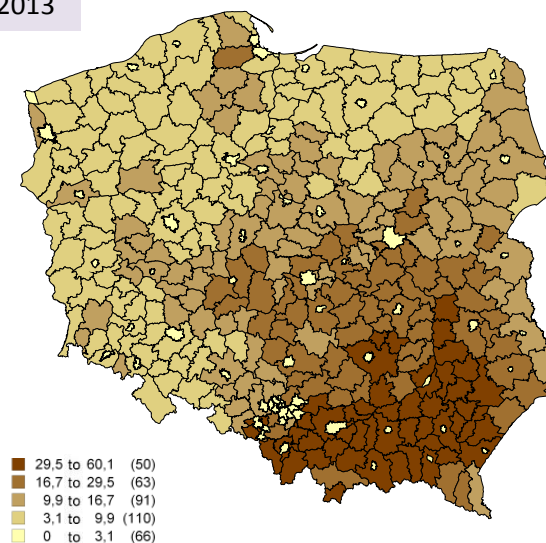


Number of people actively employed in agriculture per 100 hectares of agricultural land

2003

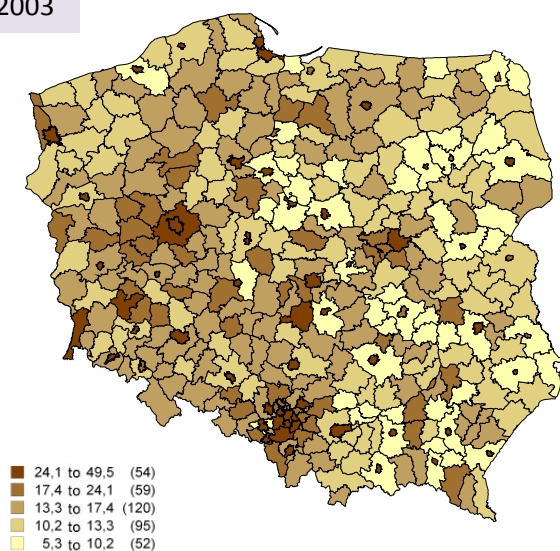


2013

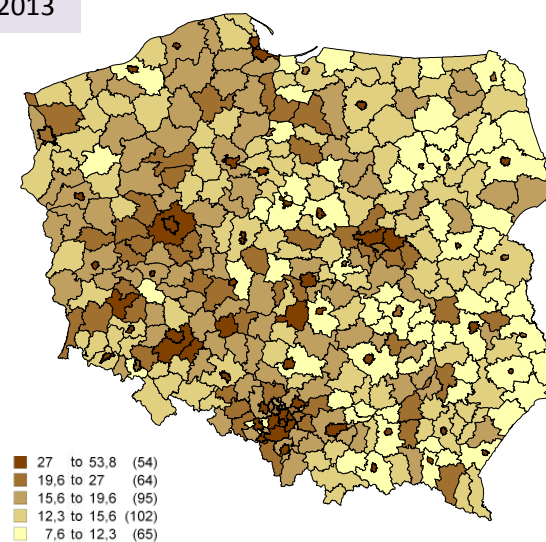


Number of people employed outside agriculture per 100 inhabitants

2003



2013



Source: own work.

Living conditions

Two areas have been taken into account for indicators selected to represent deprivation with respect to living conditions: accommodation and environment. Each of them has been represented by two indicators which have not been strongly correlated, except for the negative correlation ($r=0.54$) between dust emission and the population connected to the wastewater treatment plant noted for highly industrialised areas (higher emissions) that are well-equipped with communal infrastructure (higher percentage of the population connected to the wastewater treatment plant). High correlation, on the other hand, has been noticed between the percentage of flats with bathroom facilities and the population connected to the wastewater treatment plant, which may also indicate the existence of areas with significantly better infrastructure facilities.

Table 11. Correlations between component variables of deprivation with respect to living conditions in 2013

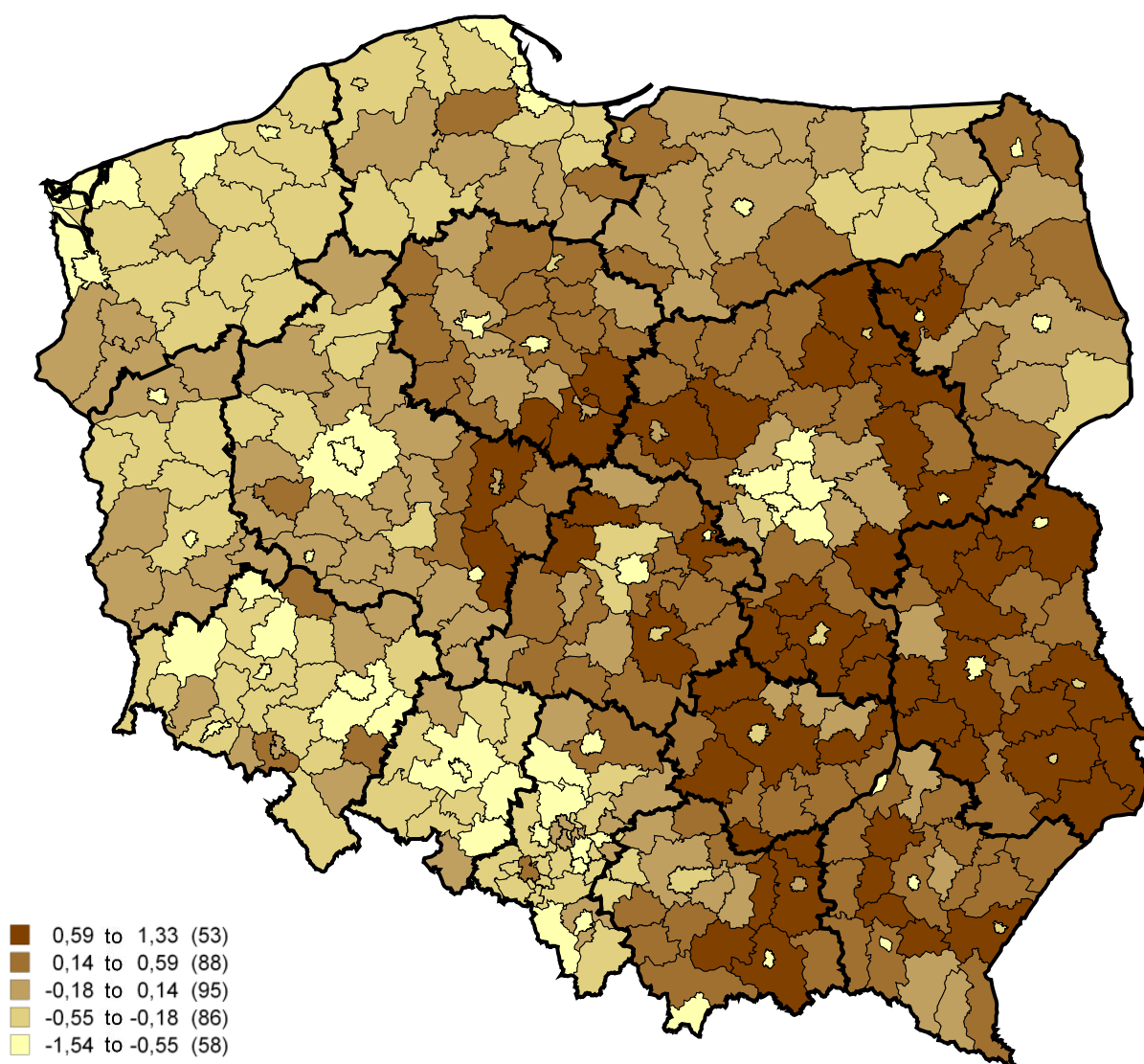
	Registered unemployment rate	Percentage of long-term unemployed	Number of people actively employed in agriculture per 100 hectares of agricultural land	Number of people employed outside agriculture per 100 inhabitants
Number of persons per room in a flat	x	0.24	-0.25	0.33
Percentage of flats with bathroom facilities	0.24	x	-0.37	0.73
Dust emissions per 100 sq.km.	-0.25	-0.37	x	-0.54
Percentage of the population connected to the wastewater treatment plant	0.33	0.73	-0.54	x

* in red the r Person's indicator, relevant at the 0.05 level.

Source: own work.

The spatial variation in the values of the deprivation index with respect to living conditions clearly stems from historical circumstances relating to poor development of infrastructure in the former territories of the Congress Kingdom of Poland and Galicia, with the exception of cities with powiat rights (Figure 12). The best situation, on the other hand, has been noted in the Warsaw metropolitan area (in particular in its western part) and Poznań as well as in the Dolnośląskie and Zachodniopomorskie, and also in selected poviats of the Śląskie, Pomorskie voivodeships and the eastern part of the Warmińsko-Mazurskie voivodeship.

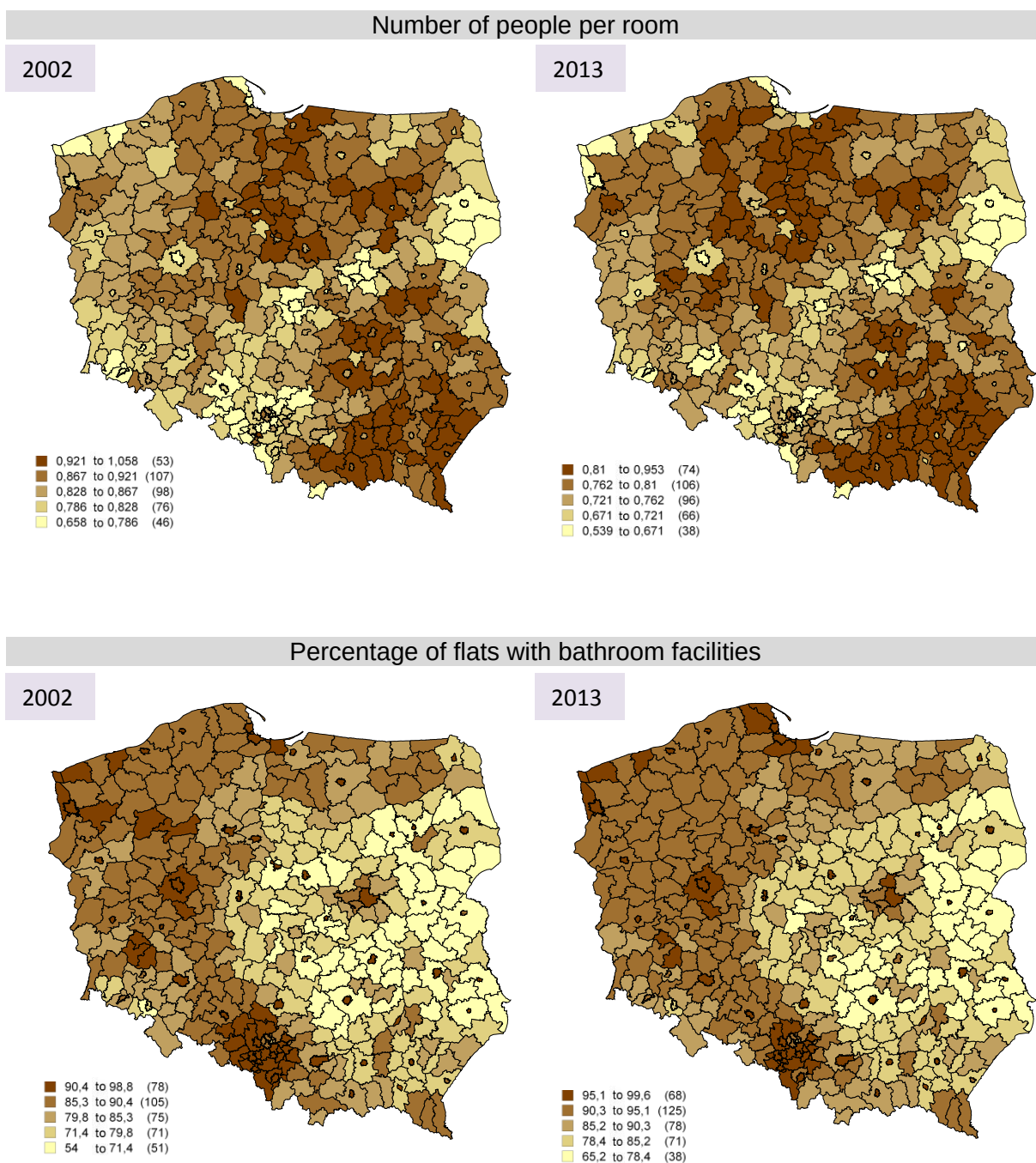
Figure 12. Poviats by sub-index of deprivation with respect to living conditions in 2013



Source: own work.

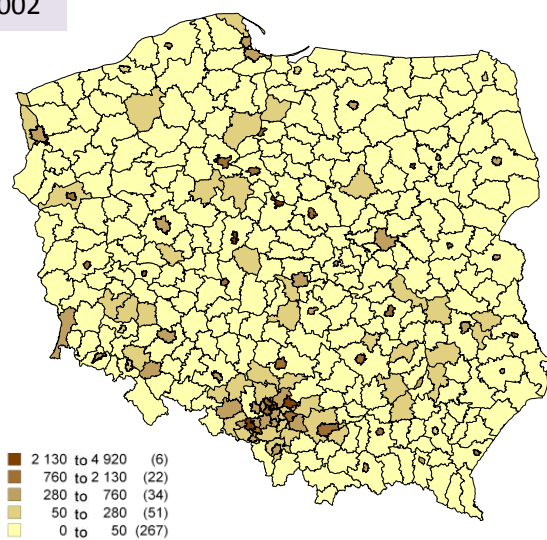
The obtained image has mainly consisted of the percentage of flats with bathroom facilities with a clear pattern referring to the division of annexed territories of Poland and percentage of the population connected to the wastewater treatment plant (Figure 13). Both these indicators have achieved the highest values in western Poland, especially in the so called Regained Territories. In case of the former, however, the situation has been equally good in the eastern part of the Podkarpackie voivodeship. The indicator referred to as the number of persons per one dwelling room has had a bipolar spatial layout with one pole located in south-eastern Poland and the other in northern Poland. On the other hand, dust emission per square kilometre related to industrialisation has been the highest in the Śląskie voivodeship, and clearly lower in the less industrialised northern, eastern and south-eastern outskirts of the country.

Figure 13. Component indicators of the sub-index of deprivation with respect to living conditions [division into classes with the use of the natural breaks method]

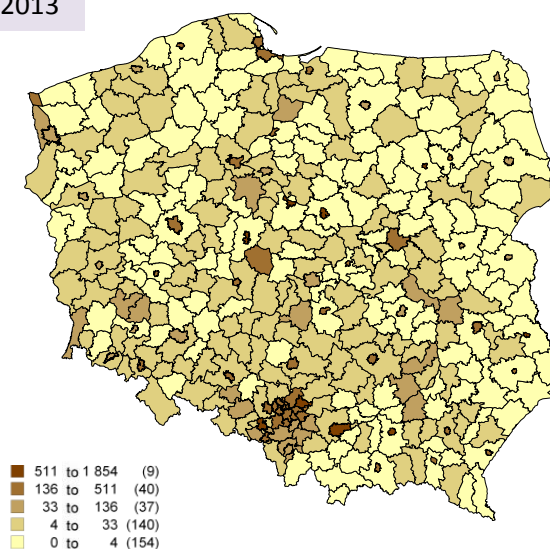


Dust emissions per 1 sq.km.

2002

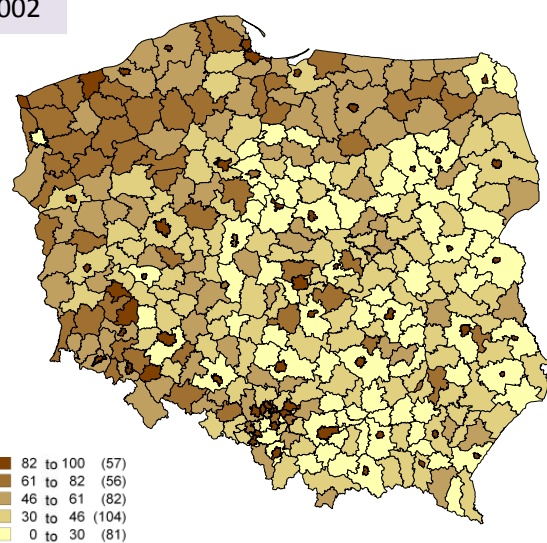


2013

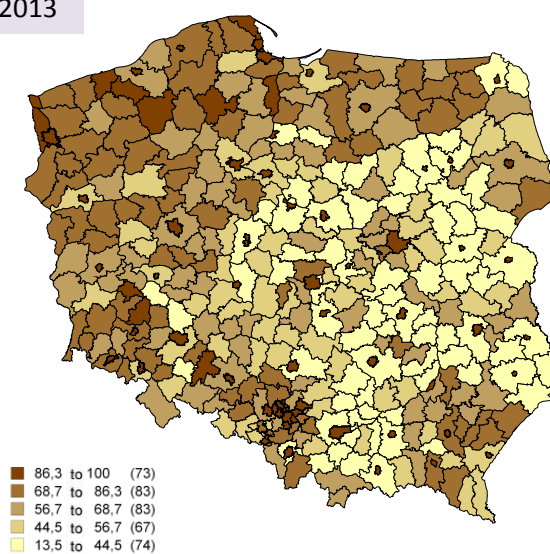


Percentage of the population connected to the wastewater treatment plant

2002



2013



Source: own work.

Education

Analysis of deprivation as regards education has been carried out with the use of three indicators: (1) percentage of persons with primary education at most (including persons without education); (2) average scores of junior high school (gimnazjum) exam in mathematics and natural sciences; (3) and the number public library users per 1,000 inhabitants. At the poviats level, all three analysed variables are related, and yet they differentiate the Polish space in a slightly different manner - this is confirmed by the correlation coefficients ranging from $r=40$ to $r=55$ (Table 11). The highest correlation coefficient has been noted between the level of formal education and the use of public libraries ($r=55$) - the higher the percentage of persons with primary education at most, the lower the number of public library users per thousand inhabitants. A slightly lower correlation coefficient relates to the level of formal education and junior high school exam scores ($r=45$), and the lowest - the junior high school exam scores and the use of libraries ($r=40$). Generally speaking, poviats with a higher degree of deprivation are characterized by a higher percentage of inhabitants with a lower level of formal education, lower junior high school exam scores and lower percentage of inhabitants using public libraries.

Table 12. Correlations between component variables of deprivation with respect to living conditions in 2013

	Percentage of people with primary education at most	Average score of junior high school exam in mathematics and natural sciences	Public library users per 1,000 inhabitants
Percentage of people with primary education at most	x	0.45	0.55
Average score of junior high school exam in mathematics and natural sciences	0.45	x	0.40
Public library users per 1,000 inhabitants	0.55	0.40	x

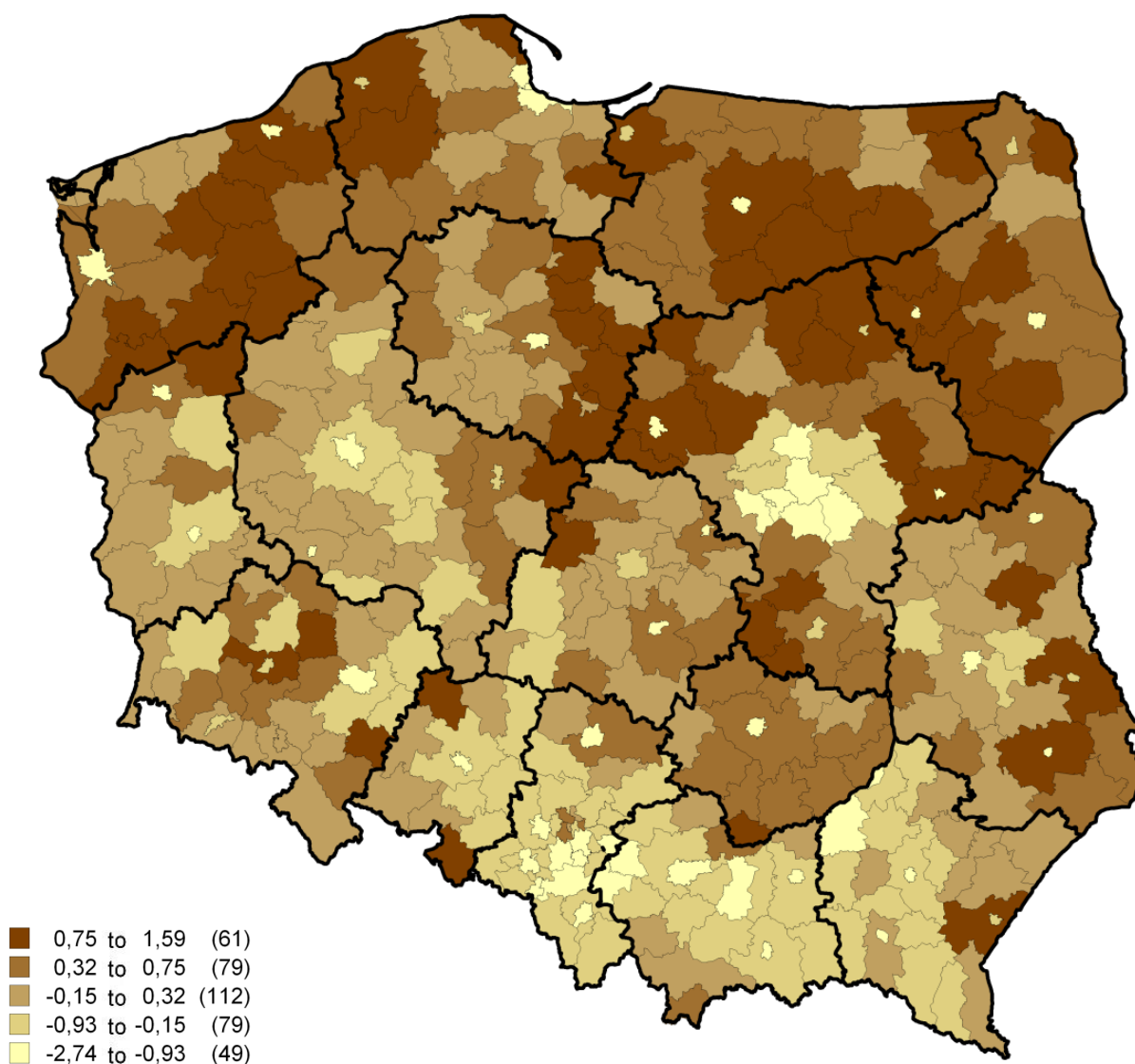
* in red the r Person's indicator, relevant at the 0.05 level.

Source: own work.

There are two main dimensions of spatial variation of the partial index of deprivation for education. First of all, the difference in the city/country axis is clear. The situation is clearly better in urban than in rural counties. The areas that distinguish themselves include in particular the largest cities (and some metropolitan areas, above all the Warsaw metropolitan area). Among large Polish cities, Łódź has distinguished itself clearly negatively. Secondly, worse than average situation with respect to deprivation in the area of education is noted in the northern (Zachodniopomorskie, Pomorskie, Warmińsko-Mazurskie voivodeships, northern part of the Lubuskie voivodeship), central (Kujawsko-Pomorskie, Mazowieckie, Łódzkie voivodeships) and eastern regions of the country (Podlaskie, Lubelskie, Świętokrzyskie voivodeships). In addition, significant internal differences have been noted in the Dolnośląskie voivodeship - with the lowest results in the central and southern poviats. The voivodeships that distinguish themselves positively are the Małopolskie and Podkarpackie voivodeships (perhaps it is a long-term effect that goes back to the good traditions of Galician schools), Śląskie, Opolskie and Wielkopolskie voivodeships (which perhaps is a consequence of a well-

developed network of cities). However, within the territory of the last three of the enumerated voivodeships there are poviats in which the index of deprivation for education is high or very high - these are usually poviats situated peripherally to the centre of the voivodeship. Differences between urban and rural counties have been noted in all voivodeships; however, in regions where the situation is worse than average, the gap between the city and the country is particularly blatant (cf. Figure 14).

Figure 14. Poviats by sub-index of deprivation with respect to education in 2013

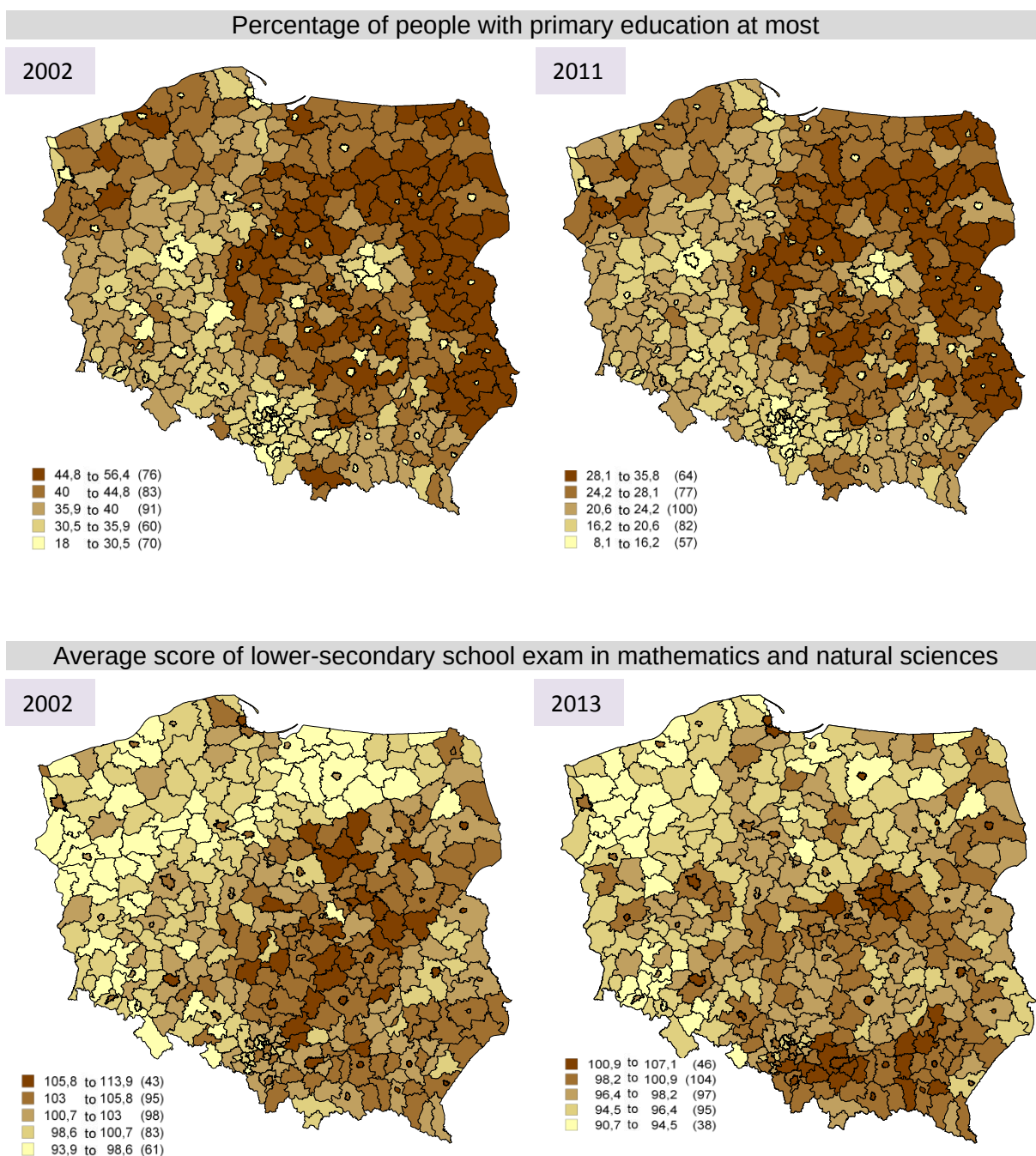


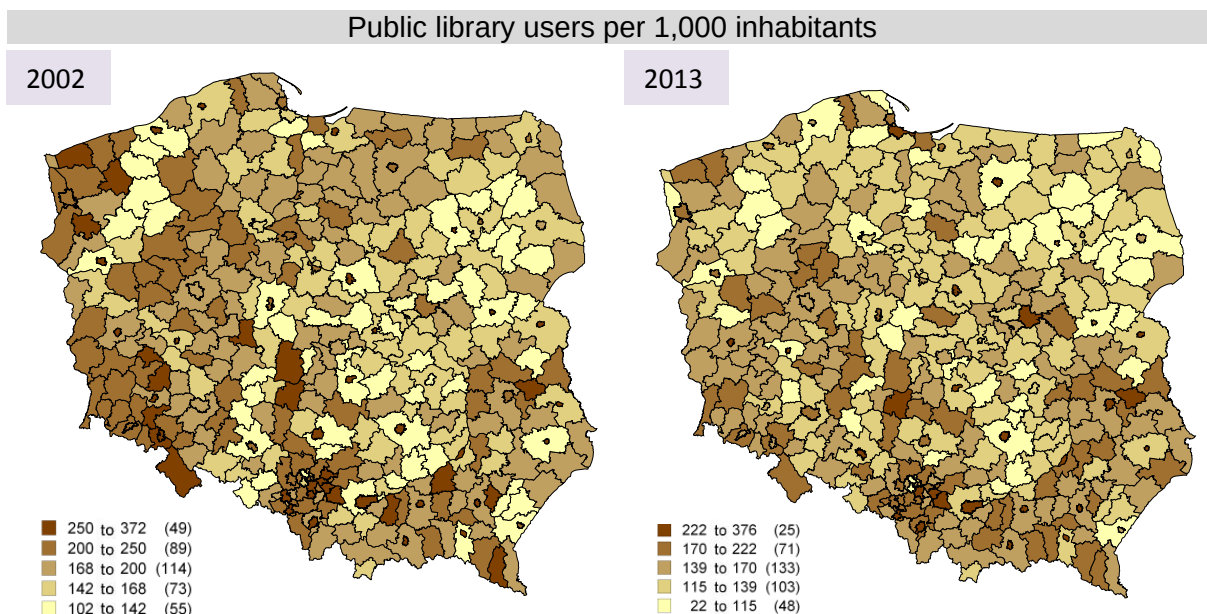
Source: own work.

Spatial distribution of component indicators of the index of deprivation allows for better understanding of the above discussed differences. First of all, it should be noted that the three analysed indicators in the field of education differentiate the poviats in a completely different manner. In case of formal education, the boundaries of historical territorial divisions are clearly visible. The largest percentage of persons with the lowest level of formal education has been noted in rural areas of the former Congress Kingdom of Poland (the Russian sector) as well as northern parts of the country (however, without the territories that were part of Poland in the

inter-war period). In turn, the scores of junior high school exams are the lowest in the northern-central part of the country, including in the northern part of the Wielkopolskie and Mazowieckie voivodeships as well as in some poviats of the Dolnośląskie and Świętokrzyskie voivodeships. The urban counties distinguish themselves positively, of course, although very good exam scores also relate to rural counties of the Małopolskie and Podkarpackie voivodeships. Relatively the least noticeable spatial variations have been noted in case of use by the population of public libraries. Nevertheless, in this case the situation is also better in more urbanised areas, and worse in rural counties, in particular those located in the north-eastern part of the country (cf. Figure 15).

Figure 15. Component indicators of the sub-index of deprivation with respect to education [division into classes with the use of the natural breaks method]





Source: own work.

Access to goods and services

Four variables are taken into account in the partial index of deprivation for access to goods and services. Mutual correlations between them are varied. The lowest value of the correlation coefficient relates to the number of pharmacies per 1,000 inhabitants and the number of persons per flat ($r=0.37$) as well as the number of pharmacies per 1,000 inhabitants and the percentage of children covered by pre-school education ($r=0.44$). This is probably due to the fact that the network of pharmacies is to some extent derived from the structure of the settlement network, and to a lesser degree from the socio-economic characteristics of poviats. In other cases, the correlation coefficients range from $r=0.51$ to $r=0.60$ (Table 13).

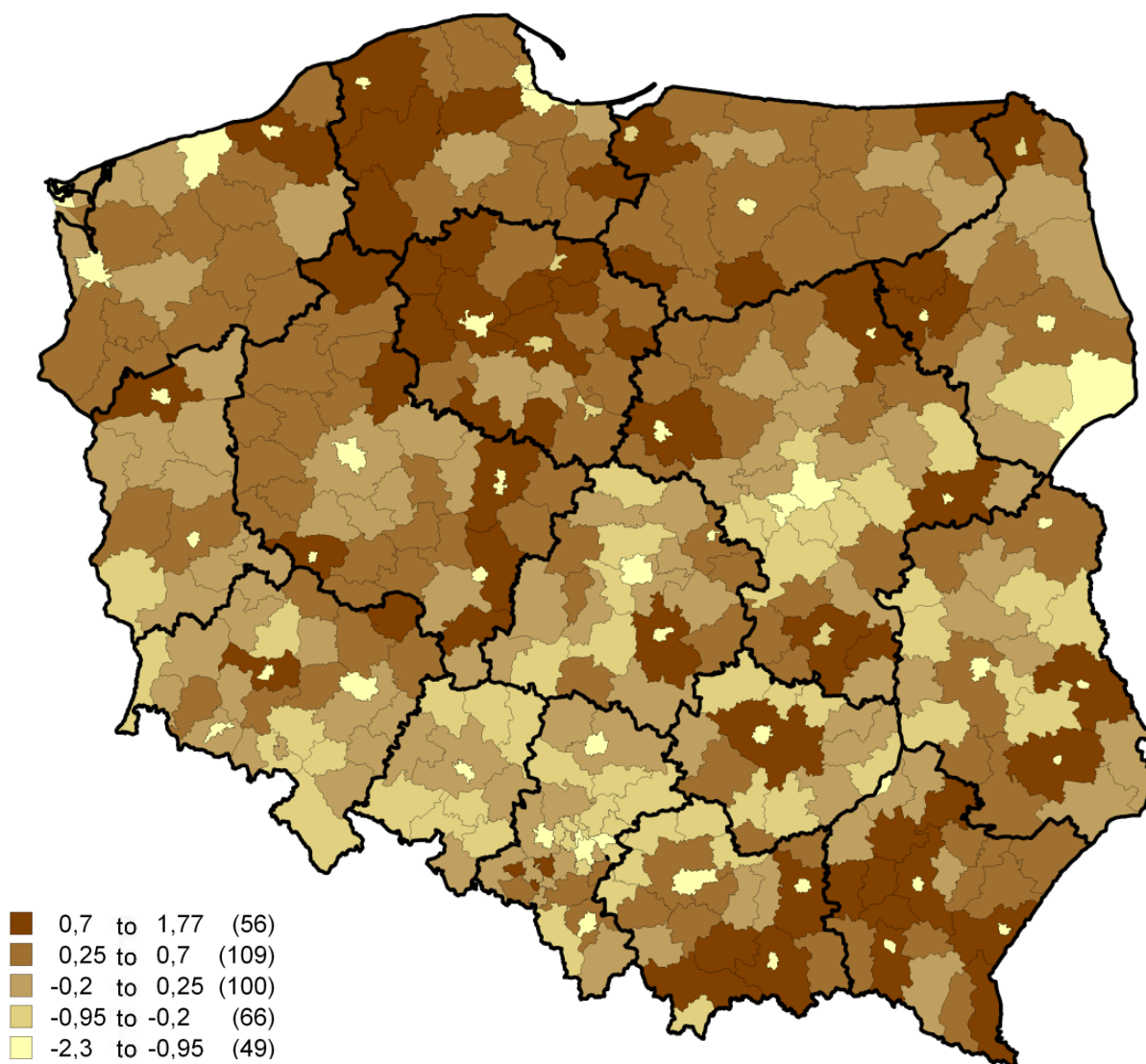
Table 13. Correlations between component variables of deprivation with respect to access to goods and services in 2013

	Number of persons per flat	Percentage of children covered by pre-school education	Number of physicians and dentists per 1,000 inhabitants	Number of pharmacies per 1,000 inhabitants
Number of persons per flat	x	0.54	0.60	0.37
Percentage of children covered by pre-school education	0.54	x	0.58	0.44
Number of physicians and dentists per 1,000 inhabitants	0.60	0.58	x	0.51
Number of pharmacies per 1,000 inhabitants	0.37	0.44	0.51	x

* in red the r Person's indicator, relevant at the 0.05 level.

Source: own work.

Figure 16. Poviats by sub-index of deprivation with respect to access to goods and services in 2013



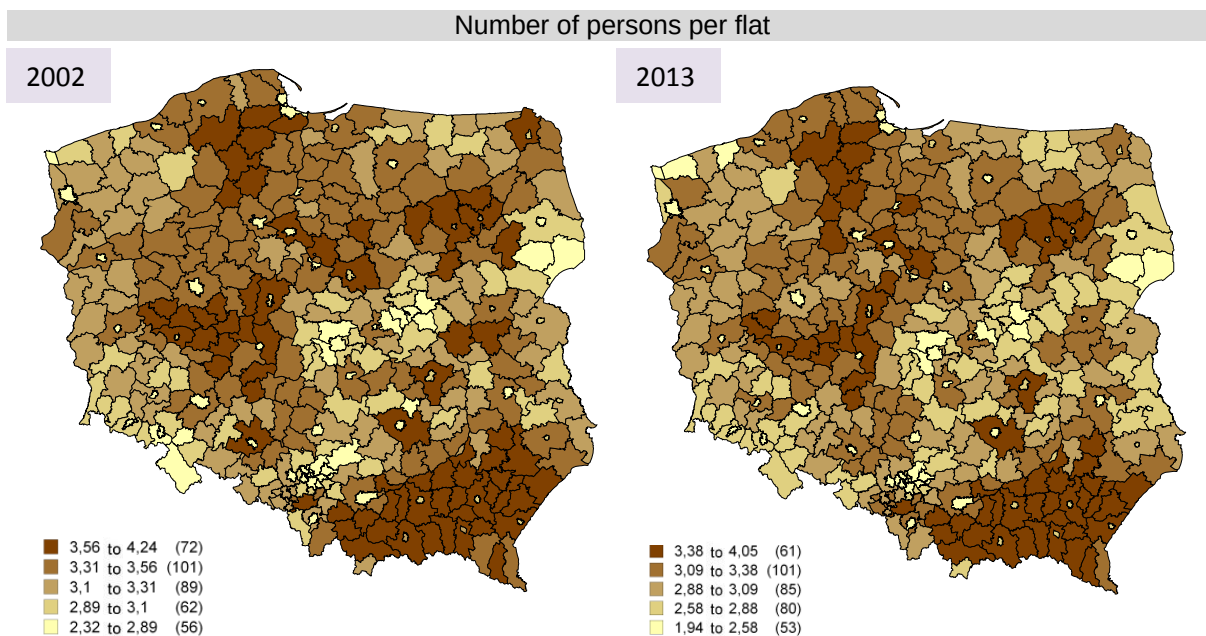
Source: own work.

Spatial distribution of the sub-index of deprivation with respect to access to goods and services clearly highlights the difference between urban and rural counties, which can largely be reduced to the urban-rural dimension of diversity of Polish space. It should be emphasised, however, that this diversity can be milder or more acute in nature. We have, on the one hand, a situation like in the Kujawsko-Pomorskie voivodeship, where urban counties characterised by low indicators of deprivation with respect to access to goods and services border rural counties characterised by a very different - bad - situation. On the other hand, in the Śląskie or Opolskie voivodeships, the gap between the urban and rural counties is significantly smaller. A relatively good situation has also been noticed in some poviats located in the sphere of influence of metropolis (this relates to Warsaw in particular, and to a lesser degree, to Łódź and Poznań). The strong dimension of the urban-rural axis of differentiation in the case of access to public services is largely due to the nature of the analyzed phenomenon, i.e. the concentration of services in cities. The weaker results of the rural counties surrounding the urban counties do not necessarily indicate the exceptionally bad situation in these poviats.

Some of the services can be effectively provided in one central location (e.g. this relates to health service, and partially also to pre-school care - e.g. in case of parents working in a "central city" sending a child to a kindergarten in this centre may be more convenient than making use of the local offer in the rural county (cf. Figure 16).

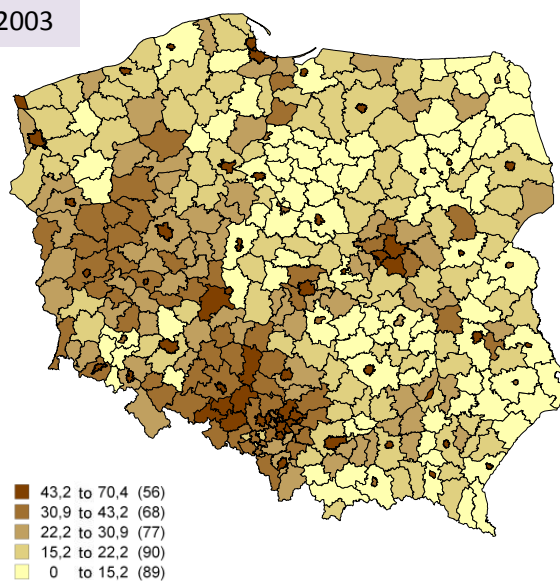
In terms of spatial variation of the component indicators of the index of deprivation for access to goods and services, the situation is very diverse (Figure 17). In case of the number of persons per flat, there have been noted compact groups of poviats with extremely high values of this indicator. Such poviats can be found first of all in the Podkarpackie, Małopolskie, Kujawsko-Pomorskie, Pomorskie voivodeships, in the south and east of the Wielkopolskie voivodeship as well as in the north-east of the Mazowieckie voivodeship. In turn, in case of the percentage of children attending kindergartens, the best situation has been noted in urban counties, and the worst in rural counties, in particular those with high share of areas characterised by low level of urbanisation and with more dominant rural areas. As of 2002, the weaker position of poviats from the former Russian sector has been fairly noticeable in this case. In 2013, this dimension is clearly less pronounced (which is a result of general increase in the percentage of children covered by pre-school education in Poland). Finally, in case of two indicators included in this analysis relating to access to goods and services from the health care area, the main dimension of differentiation includes a clearly better position of more urbanised poviats and worse situation of poviats characterised by lower level of urbanisation. Moreover, in case of the number of pharmacies per 1,000 inhabitants, it is possible to indicate groups of poviats with fairly high levels of this indicator (e.g. in Eastern Poland).

Figure 17. Component indicators of the sub-index of deprivation with respect to access to goods and services [division into classes with the use of the natural breaks method]

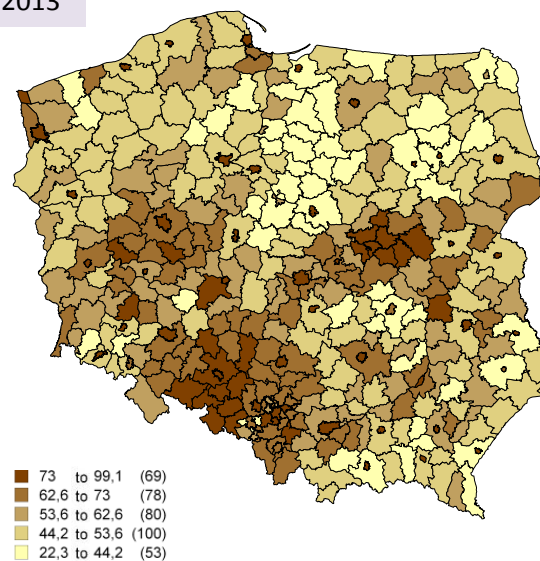


Percentage of children covered by pre-school education

2003

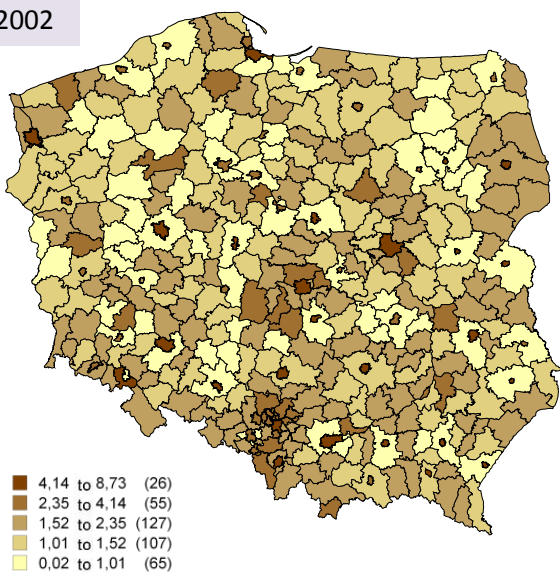


2013

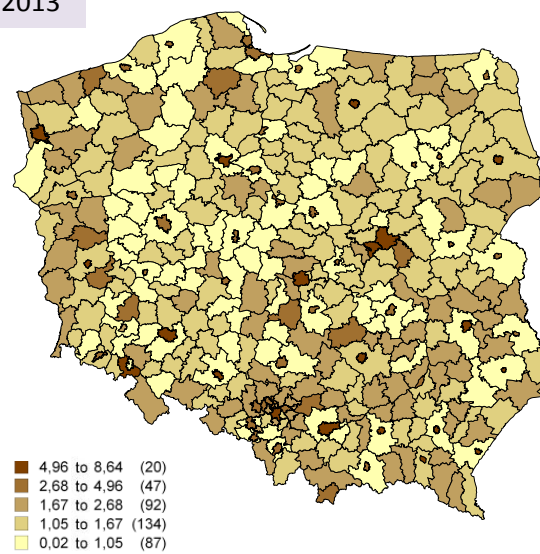


Number of physicians and dentists per 1,000 inhabitants

2002

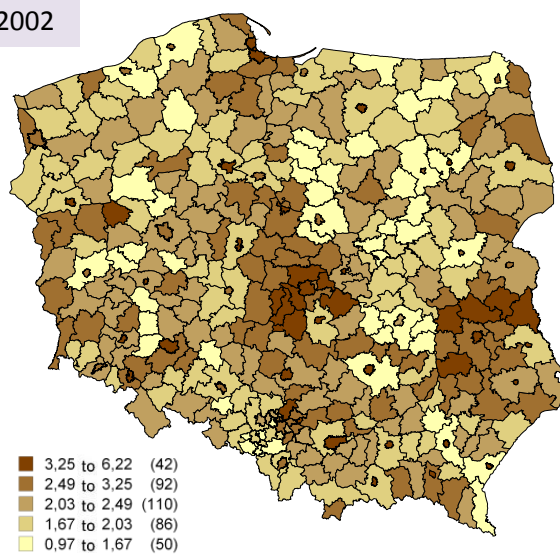


2013

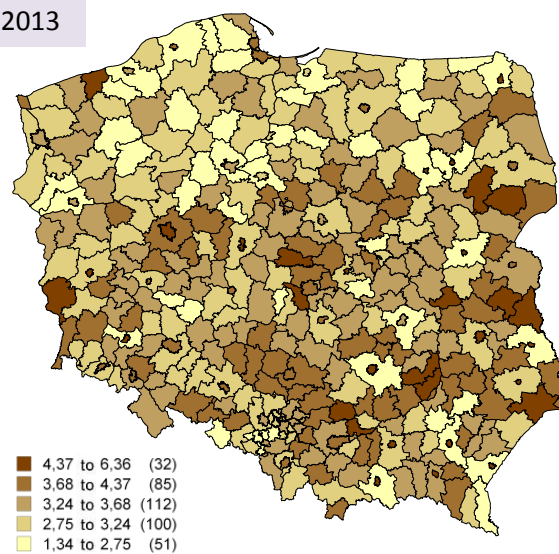


Number of pharmacies per 1,000 inhabitants

2002



2013



Source: own work.

Appendix 2. Indicators included in the construction of the Poviats Index of Deprivation

Income

- Share of gminas and cities with poviat rights in taxes constituting the National Budget revenue – personal income tax – Local Data Bank 2002 and 2013
- Average salary in entities employing more than 9 persons – Local Data Bank 2002 and 2013
- Persons living in households receiving social assistance benefits - Local Data Bank 2008 and 2013

* estimates were made for the city of Wałbrzych in 2008, the 2013 proportion was used in order to estimate the 2008 data between the city of Wałbrzych and Wałbrzych County

- Families with 3 dependent children up to 24 years of age - 2002 and 2011 census data

* estimates were made for the city of Wałbrzych, the 2002 proportion was used in order to estimate the 2011 data between the city of Wałbrzych and Wałbrzych County

- Flats in the resources of various entities with more than three months' rent arrears to the total number of flats – Local Data Bank 2003 and 2013

* in 2003 flats in the resources of physical persons were excluded from the total number of flats; in 2013 flats in the resources of gminas, housing cooperatives, employment enterprises, the State Treasury, housing associations (TBS), physical persons in housing communities were included

* estimates were made for the city of Wałbrzych, the 2003 proportion was used in order to estimate the 2013 data between the city of Wałbrzych and Wałbrzych County

Employment

- Registered unemployment rate – Local Data Bank 2004 and 2013

* estimates were made for the city of Wałbrzych in 2004 and Wałbrzych county on the basis of the number of unemployed in 2002

- Percentage of persons unemployed for over 12 months – Local Data Bank 2004 and 2013

* estimates were made for the city of Wałbrzych, the 2013 proportion was used in order to estimate the 2004 data between the city of Wałbrzych and Wałbrzych County

- Number of persons actively employed in agricultural sector (including forestry, hunting and fishing) per 100 hectares of agricultural land – Local Data Bank 2003 and 2013

* 2010 data on the area of agricultural land were used for 2013

** the adopted indicator value was zero for cities with poviat rights

- The number of persons employed outside agriculture by entities employing more than 9 persons per 100 inhabitants – Local Data Bank 2003 and 2013

* estimates were made for the city of Wałbrzych, the 2013 proportion was used in order to estimate the 2003 data between the city of Wałbrzych and Wałbrzych County

Living conditions

- Number of persons per room in a flat – Local Data Bank 2002 and 2013
- Percentage of flats with bathroom facilities – Local Data Bank 2002 and 2013
- Dust emission from particularly bothersome plants per square kilometre – Local Data Bank 2002 and 2013
- Percentage of the population connected to the wastewater treatment plant – Local Data Bank 2002 and 2013

Education

- Percentage of persons with primary education at most (including persons without education) – Local Data Bank, 2002 and 2011 national census data
- Average score of lower-secondary school exam in mathematics and natural sciences – the Educational Research Institute 2002 and 2013
- Public library users per 1,000 inhabitants – Local Data Bank 2002 and 2013

Access to goods and services

- Number of persons per flat – Local Data Bank 2002 and 2013
- Percentage of children covered by pre-school education – Local Data Bank 2003 and 2013
- Number of physicians and dentists per 1,000 inhabitants – Local Data Bank 2002 and 2013
- Number of pharmacies per 1,000 inhabitants – Local Data Bank 2002 and 2013

Appendix 3. Potential measures of deprivations rejected for methodological reasons

- The revenue of gminas coming from agricultural tax - Local Data Bank 2013
- Electric power consumption – Local Data Bank 2013
- Crimes against health and life per 10,000 inhabitants – Local Data Bank 2013
- Crimes against property per 10,000 inhabitants – Local Data Bank 2013 (erroneous 2013 data in the Local Data Bank for poviats included at NUTS3 Będzin, Mikołów and Racibórz counties)
- Expenditure on education from gmina and powiat budgets – Local Data Bank 2013
- Number of teachers per student – Local Data Bank 2013
- Number of volumes in public libraries per 1,000 inhabitants – Local Data Bank 2013