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The Neighbourhood Effect in Russian Regional Policies: Autocorrelation and Cluster Analysis

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Abstract. Regional convergence is one of the greatest strategic challenges for the Russian Federation. Socio-economic zoning directly affects the regional policy in Russia, as most administrative and political practices are reproduced within a federal district or an economic region. This study is aimed at identifying steady clusters or, in other words, groups of Russian regions, based on quantitative data on socio-economic development. The study relies on the methods of spatial econometrics. The authors also aim to compare the results of their study to the macro-regions suggested by the Strategy of Regional Development of the Russian Federation and therefore to the current administrative practices. The paper determines 12 clusters continual in space, based on 62 regional development indicators and reflecting the statistical resemblance of the regions within a cluster. The study has not found stable macro-regions of similar values except in Siberia and the Far East. Thus, the authors conclude that addressing the wide range of socio-economic problems based on one standardized grid for dividing the country will likely not lead to success. Therefore, a more asymmetric and multi-level regional policy should be sought. This implies that every ministry responsible for an area of regional development should come up with its own spatial structure of Russia in order to define its targets and the practices required to meet them.

Keywords: political geography, regional development strategy, regional policy, Russian regions, spatial analysis, spatial econometrics, autocorrelation analysis, cluster analysis, neighbourhood effect

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Эффект соседства в региональной политике России: опыт пространственного автокорреляционного и кластерного анализа

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Аннотация. Проблема выравнивания уровня развития регионов Российской Федерации представляет собой один из наиболее важных вызовов стратегического значения. Социально-экономическое районирование государства напрямую отражается в региональной политике России. Так, большинство административных и политических практик воспроизводится в границах одного федерального округа или экономического района. Задачей настоящего исследования является выделение устойчивых кластеров, иными словами, групп субъектов России на основе количественных данных по социально-экономическим показателям, выполненной методом пространственной эконометрики, а также сравнение полученных результатов с государственной политикой в этой сфере, то есть макрорегионами, выделяемыми в Стратегии пространственного развития РФ, а значит, используемыми в административной практике. В исследовании на основе анализа 62 показателей развития регионов страны и учета уровня их пространственной автокорреляции была проведена кластеризация России на 12 (по числу макрорегионов из Стратегии пространственного развития РФ) пространственно-континуальных кластеров, основанных на статистической близости регионов. За исключением Сибири и Дальнего Востока в полученной кластеризации не наблюдается выделение устойчивых макрорегионов. Таким образом, можно сделать вывод, что решение всего спектра социально-экономических проблем, основанное на одной стандартизированной сетке деления страны, вряд ли приведет к наилучшим результатам. Это наводит на мысль о необходимости разработки более асимметричной, многоуровневой региональной политики, в которой каждое отдельное федеральное ведомство, ответственное за то или иное направление развития регионов, имело бы собственный формат деления страны для разработки целевых показателей и конкретных мер по их достижению.

Ключевые слова: политическая география, стратегия пространственного развития, региональная политика, регионы России, пространственный анализ, пространственная эконометрика, автокорреляционный анализ, кластерный анализ, эффект соседства

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Problem Statement

The uneven development of Russian regions is one of the most important challenges of strategic significance. Firstly, in the current political conditions, when Russia is tasked to achieve the maximum level of self-sufficiency, it is increasingly

important to unlock the economic potential of all Russian regions. Secondly, it is no less important to achieve equality between citizens, and to provide equal opportunities to the population of different regions in order to develop human potential, which forms the qualitative basis of the “knowledge economy”.

Given the scale of Russia’s territory and its diversity, it seems appropriate for both researchers and government officials to develop political solutions to the problem of uneven development by dividing the country’s territory into several spatial clusters, i.e., groups of regions that have close socio-economic indicators and, therefore, share common problems.

Attempts at properly dividing Russia into economic regions were made throughout the 18th and 19th centuries, although at that time the term “economic region” was not specifically used [Kolosovskiy 2006: 156]. Authors such as I.K. Kirillov, V.N. Tatishchev, E.F. Zyablovsky, K.F. German, K.I. Arsenyev, P.P. Semyonov-Tyan-Shansky and others suggested different options for the economic and administrative division of Russia. Interestingly, as early as in the mid-18th century, V.N. Tatishchev pointed out the shortcomings of the country’s existing political division: among others, he named ignoring the ethnic composition of the population and including lower-level administrative-territorial units into higher ones. To eliminate these shortcomings, he, for example, suggested creating 16 provinces based on ethnicity [Tatishchev 1950: 143–198]. At the same time, most researchers based their analysis on the manufacturing (that is, economic) and natural characteristics of Russia.

The socio-economic zoning of Russia was one of the central themes of the Soviet and Russian schools of socio-economic geography. In this regard, it is worth noting the works of G.G. Kolosovskiy [2006] on the economic specialization of districts and E.E. Leyzerovich, who, on the contrary, focused on the micro-zoning of the country [Leyzerovich 2004].

As noted by V.E. Shuvalov, in the Soviet period, following the Marxist idea of the basis of the public sphere, the emphasis was also placed on the economic component, whereas at the present stage, as a result of the “sociologization” and “humanization” of science, zoning is determined by a larger set of parameters [Shuvalov 2015: 27]. For instance, approaches to zoning based on cultural, landscape, historical and geographical characteristics are being developed [Manakov 2014]. It is significant that even the concept of “economic region” has not yet been finally defined [Shuvalov 2015: 22].

Three leading Russian researchers in the field of zoning conducted a valuable study named “Russia’s space and development: A multiscale analysis”. The authors touch upon the problem of uneven development of the country and note that experts and decision makers need spatial thinking and not the aspatial (non-spatial) approach that is currently dominant. It is important to understand that we are talking about not just any country, but a very large and heterogeneous country [Artobolevskii, Baklanov, Treivish 2009]. They conclude that the study of the Russian space, and hence its structuring for the purpose of the most effective management, should be multi-level and “multi-scale” in nature.

The researcher N.V. Zubarevich applied the center-periphery theory of political geography to the domestic Russian context. According to this concept, presented in several public speeches and newspaper publications, Russia is divided into “four Russias”, each with its own level and its own speed of social modernization. The division, however, is not spatial, but qualitative. Thus, the author distinguishes million-plus cities, semi-periphery, periphery, and several special territories, relying, for the most part, on subsidies from the federal budget (for example, the republics of the North Caucasus).¹

Also, under the direction of N.V. Zubarevich [2005], the work “Russia of Regions: What Social Space Do We Live in?” was published. It suggests a typology of Russian regions according to their level of socio-economic development and presents a rating of regions based on integral indices (human development, quality of life and innovation and democracy). When creating the typology, a variety of social problems were taken into account. This study presents Russia rather as a mosaic, a patchwork quilt, and the main conclusion of the work is the impossibility of using simple, standard solutions for all regions, and the need for an “individualized approach”.

The definition of a macro-region and the basis for subdividing the territory of Russia into macro-regions is given in the law “On Strategic Planning” (2014)². The law defines a “macro-region” as a territory within the Russian Federation, “the socio-economic conditions within which require the allocation of certain areas, priorities, goals and objectives of socio-economic development in the preparation of strategic planning documents.” The Spatial Development Strategy for the period up to 2025³ mentions among one of the four central tasks “reducing the level of inter-regional differentiation in the socio-economic development of the constituent entities of the Russian Federation and reducing intra-regional socio-economic differences.” Based on the competitive advantages of each subject of the Federation, the document indicates a promising economic specialization. Appendix No. 2 to the Strategy lists the macro-regions of the Russian Federation, at the level of which the socio-economic indicators of the subjects are due to be equalized. In general, the macro-regions overlap with the boundaries of federal districts, however, some districts contain two macro-regions (Figure 1). For example, the Central Federal District includes two macro-regions (Central and Central Black Earth); the Volga Federal District is divided into the Volga-Kama and the Volga-Ural macro-regions; the North-West Federal District consists of the North-Western and the Northern macro-regions; and the Siberian Federal District includes the South Siberian and the Angara-Yenisey macro-regions.

¹ Natalia Zubarevich: Four Russias // Newspaper «Vedomosti». Retrieved December 30, 2011, from https://www.vedomosti.ru/opinion/articles/2011/12/30/chetyre_rossii

² Federal Law № 172-FZ On Strategic Planning in the Russian Federation from 28.06.2014 // Official website of the President of the Russian Federation. Retrieved August 1, 2022, from <http://www.kremlin.ru/acts/bank/38630>

³ Spatial Development Strategy of the Russian Federation until 2025 // Official website of the Government of the Russian Federation. Retrieved August 1, 2022, from <http://static.government.ru/media/files/UVA1qUtT08o60RktoOXI22JjAe7irNxc.pdf>

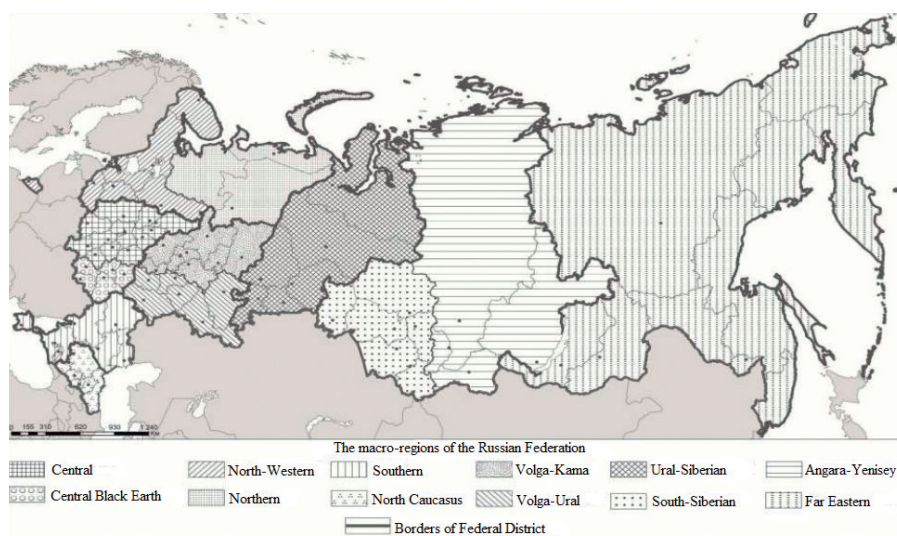


Figure 1. The macro-regions of the Russian Federation

Source: Spatial Development Strategy of the Russian Federation until 2025.

Top line (from left to right): Central, North-Western, Southern, Volga-Kama, Ural-Siberian, Angara-Yenisey.

Middle line (from left to right): Central Black Earth, Northern, North Caucasus, Volga-Ural, South-Siberian, Far Eastern.

Bottom line: Borders of Federal Districts.

The zoning of a state is directly reflected in its regional policy. Thus, most administrative and political practices are reproduced within the boundaries of one federal district or economic region. However, to what extent does this contribute to the task of effective management? This study seeks to identify clusters of Russian regions that demonstrate similar characteristics in terms of individual socio-economic indicators and their entirety. The found clusters are due to be compared with the groups of regions (macro-regions) proposed by the Spatial Development Strategy, that is, with the regional grid that acts as a base for specific political actions.

Research Methodology. The justification and validity of applying the methods of spatial analysis to social studies are widely recognized by the global academic community. Russian researchers widely apply the methods of spatial analysis and geographic information system (GIS) technology, primarily in Earth sciences, to geography, geodesy, cartography, and ecology. At the same time, in terms of social sciences, spatial analysis has become widely used in Russia mainly in the context of spatial statistics and econometrics. As the demand for spatial analysis increases in the human sciences in general, Russian researchers become interested in a variety of topics: the spatial distribution of the growth rates of Russian cities [Balash 2012], youth unemployment [Vakulenko 2015], interregional interactions [Demidova 2014; Klebanova, Guryanova, Trunova, Smirnova 2012], as well as convergence models for Russian regions [Kolomak 2009; Markevich, Mikhailova 2012; Kholodilin, Oshchepkov 2012].

Classical GIS studies hardly pay attention to applied social issues, and spatial analysis is often limited to cartography. While there are advanced developments in spatial statistics and econometrics [Cressie 1993; Anselin 1988; LeSage and Pace 2009], neither of these directly address political science and international relations.

The orientation of geographically integrated research in the social sciences has been changing from data visualization to their spatial analysis in the last decades. In addition to localization and georeferencing, it involves the identification of spatial effects, i.e. patterns of the spatial distribution of phenomena, which are expressed in spatial autocorrelation or spatial heterogeneity. The latter can be determined by statistical calculations, such as spatial autocorrelation indices of Moran [1948], Geary [1954], Getis and Ord [1992], Local Indicators of Spatial Association (LISA) [Anselin 1995], and Geographically Weighted Regression (GWR) [Brunsdon, Fotheringham, Charlton and 1996]. A significant contribution to the development of spatial methods was made by the classic works of scientists Anselin and Rey [Anselin, Rey 2010], Fischer and Getis [2010], Fotheringham and Rogerson [2009]. Of the latest works, we can mention the monograph “Spatial Analysis Methods and Practice” [Grekousis 2020].

Regardless of specific methods, spatial analysis requires data on the location of objects, their characteristics, as well as geographical and functional relationships between them: distance, and proximity. Cartography and geoinformatics account for collecting geodata and maintaining the corresponding infrastructure, but defining proximity is the task of spatial statistics and contributed to the emergence of key developments in this area [Anselin 2003; Morenoff 2003; Getis, Aldstadt 2004].

For the purposes of this study, we used geoinformation systems QGIS and GeoDa. Data were collected on sixty-two indicators that provide a stereoscopic view of all aspects of human life: demography, economics, finance, equality, the level of civil society development, education and science, health, culture, mobility, and ecology. The indicators of the UN Human Development Index were taken as the basis for the selection. When choosing indicators, the authors were guided by the following criteria:

- *multicollinearity criterion*: the indicator should not be a complex index based on a group of other indicators;
- *heteroscedasticity criterion*: the indicator should not be indirectly related to the size of the subject; therefore, priority is given to relative indicators that reflect the quantitative relationship to the size of the subject, population, or GDP;
- *dispersion criterion*: the indicator should reflect a spread of data, where the difference between the maximum and the minimum values of the variation series would be no less than 1000 times;
- *sampling criterion*: the indicator must be collected for at least 80 % (i.e., at least 68 out of 85) of the subjects to enable assessing the level of its spatial autocorrelation in the country;
- *relevance*: the indicator should be relevant, that is, reflect the situation for at least 2015;
- *objectivity*: the indicator should not be based on expert assessments.

Each selected indicator had to meet at least four of the six identified criteria. All data was collected from open sources. To standardize for subsequent multivariate analysis, data were taken for 2018 or the year of collection of indicators closest to it. To normalize individual indicators, data on the area of the territory, population, and nominal GDP of the Russian regions were used.

Initially, it was assumed that the optimal way of defining proximity between regions is by adjacency, that is, based on topological relationships between objects. In this case, objects are considered adjacent if their boundaries have common points (the so-called proximity by “the rule of the chess queen”): the regions that share at least one common point on the border, i.e., have adjoining sides and corners, will be considered neighbouring. For spatial autocorrelation analysis, a special neighbourhood matrix was developed, which allows assessing the proximity effect most accurately for Russian regions:

- 1) first-order land neighbours were determined for all regions of the country, according to the principle of the adjacency (“the rule of the chess queen”);
- 2) the minimum number of neighbours necessary for spatial analysis was set at 3, therefore: for regions of the country with less than three neighbours, the missing nearest regions were determined by the method of k-nearest neighbours by great-circle distance from the centroid;
- 3) for cities of federal importance, only first-order land neighbours were considered according to adjacency (“the rule of the chess queen”), regardless of their number;
- 4) the neighbourhood weight for each cell of the matrix was determined by the method of inverse distance weighting, i.e., the weight of the indicator in calculating the spatial autocorrelation was inversely proportional to the distance through the great circle of the centroid of the analyzed cell.

To determine the degree of spatial autocorrelation for each indicator, the Moran and Geary indices were calculated. Moran’s index is similar to Pearson’s linear correlation coefficient (it also varies between -1 and 1) but takes into account the proximity effect. The spatial effect is measured in Moran’s coefficient through the concept of spatial lag (the average value of the phenomenon in neighbouring cells). In other words, spatial autocorrelation indicates the ratio between the distribution of the phenomenon in cells and the average value in neighbouring cells. The more the value of Moran’s index differs from zero, the stronger the spatial clustering of the phenomenon (direct or inverse). The following formula was used for calculations:

$$\text{Moran's } I = \frac{N \sum_i \sum_j w_{ij} (x_i - \bar{x})(x_j - \bar{x})}{W \sum_i (x_i - \bar{x})^2},$$

where i, j are the units (countries), x_i and x_j are the variables at the i and j units (countries), \bar{x} is the sample mean over all of the units, w_{ij} is the weight of the spatial correlation between units i and j , N is the number of units, W is the sum of spatial weights.

To verify Moran's index, Geary's spatial autocorrelation index was used, ranging from 0 to 2, where a value that is less than 1 indicates positive (direct) and a value greater than 1 indicates negative (inverse) spatial autocorrelation. The following formula was used to estimate Geary's index:

$$\text{Geary's } C = \frac{N-1}{2W} \frac{\sum_i \sum_j w_{ij} (x_i - x_j)^2}{\sum_i (x_i - \bar{x})^2}.$$

The calculation algorithm used in the R Studio programming environment assumed the replacement of empty values with zeros. In all calculations, the significance level (p-value) was controlled: if it exceeded 0.05, the calculation was considered invalid.

Moran's index estimates the spatial autocorrelation for the entire dataset; however, it was important for the research objectives to weigh the spatial autocorrelation between adjacent units in individual clusters. For this, Local Indicators of Spatial Association (LISA) were calculated. This method allowed us to identify four types of spatial clusters:

- *high-high* — spatial autocorrelation cluster of high indicators of the phenomenon (red),
- *low-low* — spatial autocorrelation cluster of low indicators of the phenomenon (blue),
- *high-low* — cells with high indicators of the phenomenon surrounded by a spatial autocorrelation cluster of low indicators of the phenomenon (pink),
- *low-high* — cells with low indicators of the phenomenon surrounded by a spatial autocorrelation cluster of high indicators of the phenomenon (light blue).

The following formula was used for the calculation:

$$L = \frac{N}{\sum_i \sum_j w_{ij}} \frac{\sum_i \sum_j w_{ij} (z_i - \bar{z})(z_j - \bar{z})}{\sum_i (z_i - \bar{z})^2},$$

where N is the number of cells, z_i is the calculated indicator for the cell i , w_{ij} is the estimate of spatial weights showing whether i and j are neighbours, such that if they are not, it is equal to zero, and if they are, it is equal to 1_i , where i is the number of the neighbours of the cell i .

In the final stage, we conducted a spatial cluster analysis. While the goal of the conventional statistical cluster analysis is to divide a set of observations into statistical clusters according to the principle of their similarity, the goal of spatial cluster analysis is to divide a set of observations into statistical clusters according to the principle of their similarity while simultaneously grouping them into spatially continual regions. In this sense, spatial cluster analysis is the mathematical expression of the traditional method of geographic zoning.

Thus, we are dealing with zoning — combining multidimensional data into statistical clusters, taking into account spatial constraints. The resulting clusters (regions) should, firstly, be as different as possible from each other; secondly, contain elements that are as similar as possible to each other; and finally, include objects spatially located next to each other. Spatially bounded clustering can be soft (when geographic coordinates are introduced into the set of features or, as shown above, the weight of geographic centroids changes in the set of the observations' features), or hard, when it is impossible to create a cluster that combines non-neighbouring observations. For the latter, the program requires indicating the proximity principle used in the analysis by specifying the desired spatial neighbourhood weights. We used a hard algorithm called the Automatic Zoning Procedure (AZP).

Study Results. Since the purpose of this article is to compare the results of the study on the role of the spatial factor in the distribution of socio-economic indicators between Russian regions with the macroregions suggested by the Spatial Development Strategy, we are mostly interested in the indicators where the highest spatial autocorrelation is detected (the highest indicator of Moran's and Geary's indices), and where large clusters are formed.

Below is a table with indicators arranged in descending order of Moran's Index values. The table contains only those indicators, the results of the spatial analysis for which can be considered valid, that is, those where the p-value is less than 0.05. It demonstrates which close values of which indicators under consideration are most concentrated in this or that part of the country. In other words, what problems or advantages characterize a group of neighbouring regions, and therefore, in what areas it is possible to develop effective interregional cooperation.

The table shows that most of the indicators with an average (0.30–0.69) and high (0.70–1.00) value of spatial autocorrelation are either demographic (the elderly population, children, women, population growth, etc.) or economic, the latter characterizing the inequality between different social groups (women's unemployment, unemployment, female labour force, poverty). The average values are demonstrated by some indicators that characterize the state of the environment (CO₂ emissions) and the cultural characteristics of the regions (linguistic diversity).

Let's consider some of the indicators that demonstrated average and high spatial correlation.

The “**Population growth**” indicator demonstrates a moderately positive spatial autocorrelation (0.501). The spatial autocorrelation cartogram (Figure 2) shows that almost all of central Russia, and especially the northwest, is characterized by a low level of natural growth. A cluster of regions with the lowest population growth has formed here, with some exceptions, where this figure is higher than the average (Moscow, St. Petersburg). In the North Caucasus, there is a cluster of regions with a maximum level of natural growth, which is associated with high birth rates and life expectancy. Another cluster stands out in Siberia. The high values of the indicator in this part of the country can be explained by the younger structure of the population.

Moran's and Geary's Spatial Autocorrelation Indices by Indicators for Russian regions

Indicator	Moran	p-value	Geary	p-value
Agricultural Land	0,801	0,000	0,224	0,000
Forest Area	0,648	0,000	0,372	0,000
Gasoline Price	0,623	0,000	0,373	0,000
Alcohol abuse	0,610	0,000	0,391	0,000
Age Dependency Ratio	0,589	0,000	0,375	0,000
Moral Freedom	0,569	0,000	0,394	0,000
Children	0,545	0,000	0,440	0,000
Women	0,527	0,000	0,422	0,000
Female Unemployment	0,518	0,000	0,389	0,000
Life Expectancy	0,503	0,000	0,399	0,000
Population Growth	0,501	0,000	0,468	0,000
CO ₂ Emissions	0,496	0,000	0,463	0,000
Female Workforce	0,471	0,000	0,457	0,000
Unemployment	0,452	0,000	0,466	0,000
Hospital Bed Density	0,448	0,000	0,507	0,000
HIV Incidence	0,408	0,000	0,628	0,000
TBC Incidence	0,379	0,000	0,580	0,000
Agriculture	0,363	0,000	0,668	0,000
Linguistic Diversity	0,357	0,000	0,606	0,000
Credit Provided	0,350	0,000	0,566	0,000
Urban Population	0,334	0,000	0,598	0,000
Gross Regional Product	0,324	0,000	0,589	0,000
Poverty	0,314	0,000	0,673	0,000
Medium and High-tech Manufacturing	0,303	0,000	0,662	0,000
Married Women	0,300	0,000	0,636	0,000
Gross Capital Formation	0,300	0,000	0,689	0,001
Financial System Deposits	0,291	0,000	0,593	0,000
Ethnic Minorities	0,284	0,000	0,707	0,000
Industry	0,280	0,000	0,500	0,000
Roadways	0,274	0,000	0,420	0,000
Internet Users	0,273	0,000	0,704	0,000
Mobile Cellular Subscriptions	0,270	0,000	0,595	0,000
Suicides	0,265	0,000	0,665	0,000
Imports	0,265	0,000	0,367	0,000
Corruption Perceptions Index	0,264	0,000	0,637	0,000
Religious Diversity	0,259	0,000	0,682	0,000
Services	0,215	0,000	0,400	0,001
Public Organizations	0,213	0,000	0,453	0,000
The Wealthiest Population	0,185	0,003	0,779	0,002
Economic Inequality	0,185	0,003	0,779	0,001
Tax Revenue	0,174	0,004	0,807	0,008
Railways	0,143	0,001	0,485	0,000
Debt Instruments of Inward FDI stock	0,112	0,000	0,468	0,003

Source: authors' calculations based on data collected.

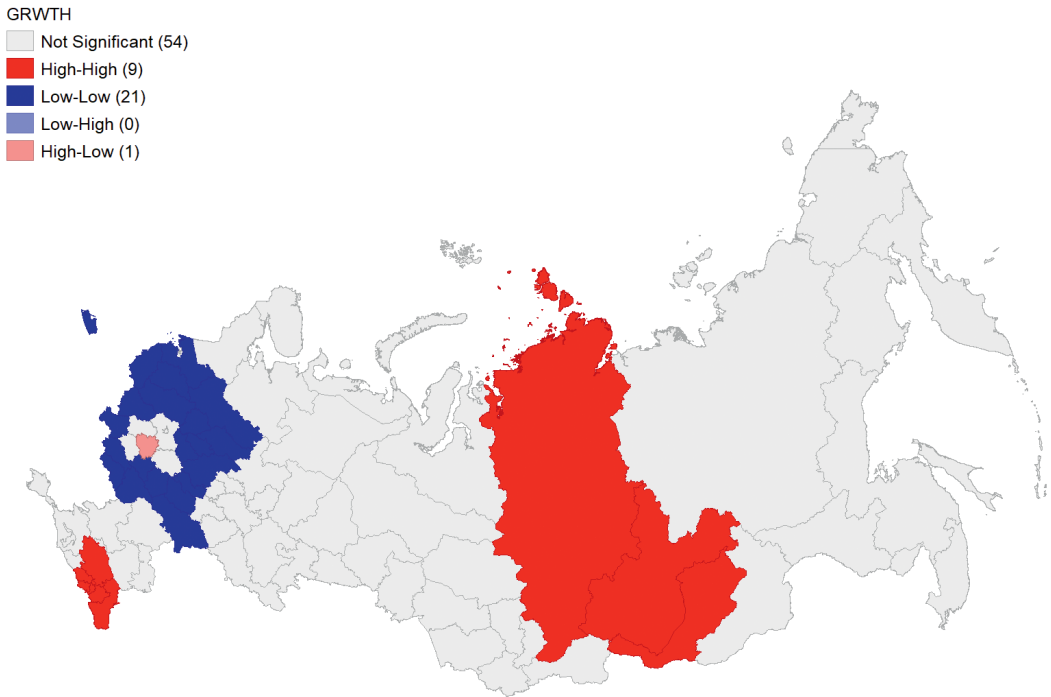


Figure 2. Cartogram of spatial autocorrelation for natural population growth by Russian regions.
Source: made by authors.

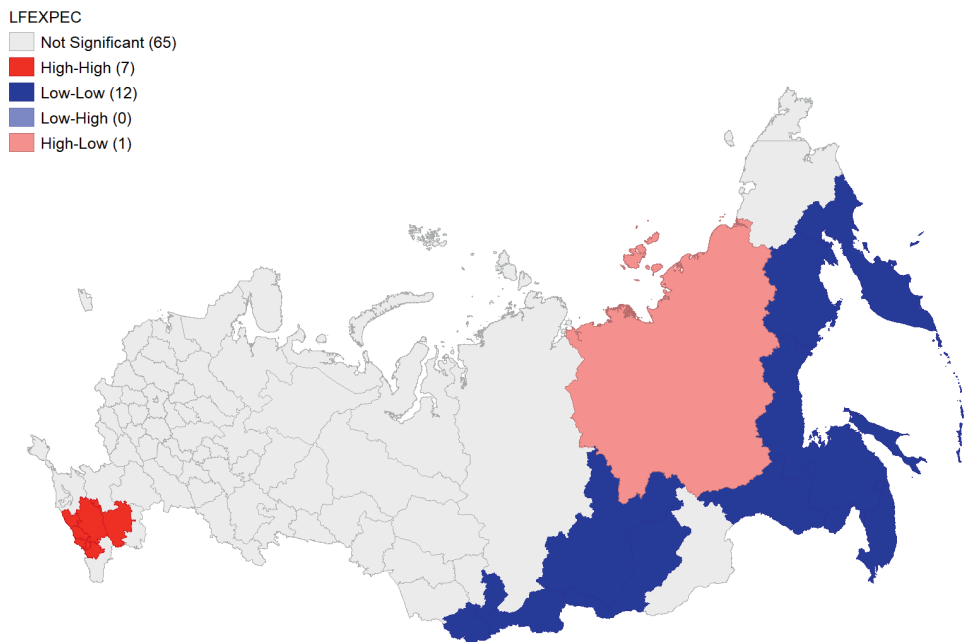


Figure 3. Cartogram of spatial autocorrelation for life expectancy by Russian regions
Source: made by authors.

The *“Life expectancy”* indicator shows a moderate positive spatial autocorrelation (0.503). The spatial autocorrelation cartogram (Figure 3) shows that the highest values of this indicator are characteristic of the southern-European part of Russia, which has natural conditions that are more comfortable. Here a cluster of high values has formed, and record-breaking regions are located. High life expectancy is also recorded in Moscow and St. Petersburg, which can be explained by a higher standard of living and medical care. Life expectancy decreases as we move eastward: the regions of the Far East and the south of Eastern Siberia, where a cluster of low values has been formed, have become anti-leaders on this indicator. This result may be related to such negative factors as poverty, low quality of life, and poor access to medical services. The only notable exception in this part of the country is Yakutia, where life expectancy is higher than that of its surrounding neighbours and close to the Russian average.

The *“Elderly population”* indicator is based on the old-age dependency ratio (the ratio of elderly dependents and the working-age population aged from 15 to 64) and shows a high positive spatial autocorrelation (0.589). According to the spatial autocorrelation cartogram (Figure 4), the regions with the lowest dependency ratio include the Urals, Siberia, and the Far East. The latter form a large cluster of low indicators, which can be explained by the fact that many young people go to the eastern regions to earn money, and after retirement, they tend to move to more comfortable central (high-value cluster) and southern regions of the country. Another cluster of low values in the North Caucasus is explained by higher birth rates and a higher percentage of young population.

AGEDEPOLD

- Not Significant (45)
- High-High (23)
- Low-Low (16)
- Low-High (1)
- High-Low (0)



Figure 4. Cartogram of spatial autocorrelation for dependency ratio by Russian regions

Source: made by authors.

The analysis of the “*Alcoholism*” indicator shows a strong spatial correlation (0.756). The autocorrelation cartogram (Figure 5) demonstrates that the volume of alcohol consumption by Russians largely depends on their religious affiliation: regions with a predominantly Muslim and partly Buddhist population are characterized by low levels of alcohol consumption (a characteristic cluster of low values in the North Caucasian and Southern Federal Districts). On the contrary, the results for the regional clusters with high values formed in the Northwestern, the north of Ural, and the east of Far Eastern Federal Districts may also be due to a more tolerant attitude towards alcohol consumption within the prevailing cultural norms, as well as low level of infrastructure development aimed at maintaining the recreational opportunities of the residents.

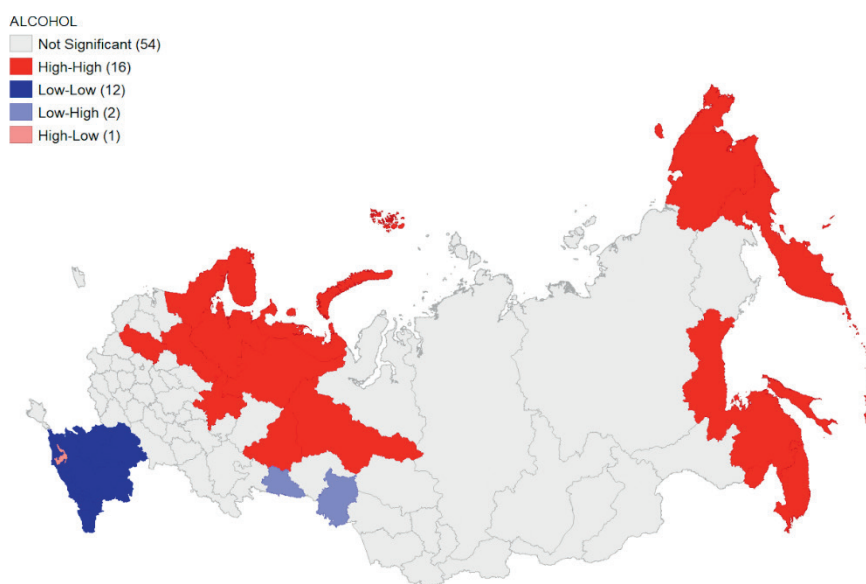


Figure 5. Cartogram of spatial autocorrelation for alcohol consumption per capita by Russian regions
Source: made by authors.

The results of the automatic zoning for all the indicators were compiled in Cartogram 6: it shows 12 clusters consisting of regions that are closest to each other by the totality of indicators. The number of clusters corresponds to the one established by the Spatial Development Strategy.

In terms of territory, the largest cluster was formed in the east of the country. It includes the South Siberian, Angara—Yenisey and Far Eastern macro-regions, except for the Yamalo-Nenets and Khanty-Mansi Autonomous Okrugs: the latter specialize in hydrocarbon production and differ sharply from their neighbours; thus, they formed a separate cluster. Interestingly the Republic of Tyva and the Republic of Altai also formed a separate cluster (as N.V. Zubarevich also attributed these two subjects to a separate, “fourth Russia”). There are strong differences between the Strategy and the results of the study concerning the western part of the country. Instead of the six or seven macro-districts, one large cluster was formed, which includes the central and north-western regions, apart from Moscow. Moscow, the Nenets Autonomous Okrug and the Tyumen Region have formed separate one-subject clusters.

The coincidence is observed only in the south, where the light green cluster on the cartogram (Figure 6) approximately corresponds to the North Caucasus macroregion.



Figure 6. The results of automatic spatial zoning by all the indicators for 12 clusters

Source: made by authors.

Conclusion

On closer examination, designing a competent regional policy turns out to be a multifaceted and multilevel task. Developing an effective system of interconnection between regions and their management requires a formal or informal socio-economic division of Russia, which would be closest to the main goal of spatial development, i.e., equalizing the level of regions' development and unlocking the potential of each region.

The subjects of the federation located in Siberia and the Far East seem to be the most problematic in this regard. They have vast territories and various resources. However, judging by the results of the study, demonstrated on the cartograms of spatial autocorrelation, these regions are “turned off” from the country by most indicators. As a rule, they demonstrate a level of socio-economic development below the average. At the same time, the special characteristics of these territories, in particular, the significant distances between settlements, which also distinguishes Siberia and the Far East from the rest of the country, should be reflected in the development strategy for this space. Methods for solving issues in health care, education, employment, etc. cannot be transferred from one region to another, even if they have proven their effectiveness.

The most important result of the study is visually demonstrated on the spatial autocorrelation cartograms: except for Siberia and the Far East, there is a lack of stable clusters with close values. That is, for each group of indicators, and sometimes

within one group, similar characteristics have different configurations of regions. Thus, we can conclude that the solution to the entire spectrum of socio-economic problems, based on one standardized grid for dividing the country, will likely not lead to the best results. This suggests the need to develop a more asymmetric, multi-level regional policy, in which each department responsible for a particular area of regional development would have its own division of the country to develop certain targets and specific measures to achieve them.

The authors claim that unifying administrative and political practices in managing Russian regions should not become an end goal. The complex, multi-structural Russian society requires a system of territorial development as complex and asymmetric, based on different speeds and different management models. Strengthening the vertical required for some regions (for example, in hard-to-reach or multiconstituent territories) can lead to a slowdown in the development of others, where society wants to take on more responsibility for solving regional problems. The same applies to the country's governance system based on dividing it into stable clusters: the North, the South, the Volga region, the Urals, Siberia, the Far East, and so on. The organization of each administrative process according to such enlarged structures (through, for instance, the creation of representative offices of regulatory and supervisory departments at the level of federal districts) will result in the center not feeling the development dynamics and heterogeneity of the regions. For instance, the administrative practice of organizing the territorial offices of the Ministry of Agriculture, obviously, cannot completely repeat the structure of the regional offices of the Ministry of Natural Resources and Ecology, since they will have different regional accents in their activities. Another detrimental practice, which has become popular recently, is ranking regions on various issues and attempting to assess the effectiveness of regional authorities mainly by such ranking: Russian regions are initially too different to reduce them to a single line and function in different contexts. Thus, the only institution for mobilizing development in Russia's regional policy is not unification and centralization, but the development of the uniqueness of territories, their regional specialization and identity.

It also seems necessary to continue studying the differences within the regions (earlier attempts at micro-zoning were discussed above), since the average indicators for regions, taken as the main measures of progress in the Strategy, may not be indicative, due to the high level of inequality in the lower levels of administrative-territorial division.

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