Problems of periphery agro-industrial regions of the Volga Federal District

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Abstract. The article analyzes the approaches to the assessment of peripherality in the framework of the center-peripheral models of the economic space. Identification of the core, semi-periphery and periphery of the Volga Federal District was made on the basis of clusterization according to two criteria: gross regional product per capita and population density. A process of centro-periphery polarization takes place in the Volga Federal District. Economic activity is concentrated in the largest metropolitan areas, forming the core of the macro-region. Moderately developed regions with gross regional product per capita from 75 to 100 % of the average level of the Volga Federal District form semi-periphery. The periphery covers a continuous belt of seven agro-industrial regions, in which 30% of the macro-region’s population lives. The peculiarities of the Volga Federal District periphery were revealed: depopulation and aging of the population, general unemployment is at the level of 4-6 %, the level of innovation and investment is lower than the average level of the Volga Federal District and strongly differentiated by the regions, the quality of roads and the availability of the Internet are lower than the average level of the Volga Federal District. A process of further peripheralization is observed in all peripheral regions.

1. Introduction

Spatial socio-economic disproportions are the main problems of the spatial development of Russia, which lead to the peripheralization of a considerable part of the country. High interregional disparity, despite its level reduction over the past ten years; living standards differentiation of urban and rural areas; transport, power, and information and communication infrastructure restrictions cause the greatest concern. Spatial inequality leads to polarization and the emergence of the “core-periphery” problem, which arises both at the global and national and local levels.

I Wallerstein’s world-systems analysis [1], J Friedmann’s core-periphery theory [2], R Prebisch’s dependency theory [3], P Krugman’s new economic geography [4] and A Copus’s polycentric development theory [5] serve as theoretical basis of the polarized center-periphery development of economic space. The economic space of any level is structured into a developed core, a semi-periphery, which receives core impulses, and an undeveloped periphery. At the national level structuring is possible in growing regions around the country’s largest cities (cores), regions around major industrialized cities (second-order centers or semi-periphery), and undeveloped regions with a significant primary sector of the economy.
The problems of regional peripheralization are observed both in the large countries of the catching-up development (India, China, Brazil, Russia) with a large number of peripheral regions, and in the relatively prosperous European Union at the level of regional division NUTS2 or NUTS3. A number of foreign authors study peripherality only from a geographical point of view, using accessibility indicators (for example, the gravity model, multimodal accessibility indicator [6,7]); in this case, calculations showed that 20 % of the EU population lives in peripheral territories. Other scientists believe that accessibility indicators go into the background and indicators of socio-economic development are more important. The periphery is characterized by geographical remoteness, migration, aging population, limited access to public services with their low quality, poor transport and info-communication infrastructure, poor access to the market, population decline is accompanied by political or economic dependence on the center, marginalization. These issues are considered in the works of C Schürmann and A Talaat [8], D Keeble, P Owens and C Thompson [6], M G Pezzi and G Urso [9], etc. In 2017 European Spatial Planning Observation Network (ESPON) has made the most complete study of the internal periphery of the EU [10]. The development of regional policy instruments for overcoming regional peripheralization and reducing center-periphery polarization is on the agenda of many countries, including Russia. N P Ketova and V N Ovchinnikov [11], Y V Preobrazhenskiy [12], L G Matveeva and O A Chernova [13], A I Treivish [14], A A Anokhin and V Yu Kuzin [15], M Yu Kazakov [16,17] paid a lot of attention to the peripheral problems in Russia in their works.

The purpose of the study is to identify the peripheral regions of the Volga Federal District and to analyze their common development problems due to the process of peripheralization.

2. Data and methods

The information basis of the research constituted the statistical data of the Federal State Statistics Service of the Russian Federation (Rosstat) for the period of 2009-2017 [18]. Identification of the core, semi-periphery and periphery of the Volga Federal District (VFD) was made on the basis of clusterization according to two criteria: gross regional product per capita (GRP per capita) and population density. Correlation analysis was used to assess the relationship between GRP per capita and population density. A system of indicators has been developed that allows to evaluate the process of peripheralization. The system of indicators includes GRP per capita, GRP growth, population growth/decline, the proportion of older people in the total population, the increase in the proportion of older people, the overall unemployment rate, the increase/decrease in the overall unemployment rate, the share of innovative products in total production, investments per capita, increase in the investments volume, the share of paved roads in the total volume of roads, the share of households with broadband Internet access.

3. Results and discussion

After analyzing the approaches to the periphery definition, we chose two main indicators characterizing mainly the socio-economic situation: GRP per capita and population density. As the clustering of the VFD regions shows (figure 1), the core is more economically developed with a high population density with the regions centers in million-plus cities, medium-sized regions with an average population density were included into the semi-periphery, seven agro-industrial regions can be considered peripheral (Table 1).

At first glance, the correlation between population density and per capita GRP is low, the correlation coefficient is 0.13. However, we may notice a special position of the Chuvash Republic in the diagram with a very high population density and low economic development. Historically, the indicator of population density in the Chuvash Republic is one of the highest in Russia. This is due to the significant agricultural development of the territory and the sustainable ethnic composition of the indigenous population. The Chuvash Republic could be seen as a local outlier. The correlation coefficient increases and becomes equal to 0.47, if we exclude the Chuvash Republic from a sample of regions. This indicates that there is a moderate linear relationship between indicators. Global trends are confirmed: population density growth is accompanied by economic growth (figure 2).
**Figure 1.** Clustering of the VFD regions.

**Figure 2.** Clustering of the VFD regions (without the Chuvash Republic).

**Table 1.** Typology of the Volga Federal District Regions.

| Types of regions *a* | Core (GRP per capita > average GRP per capita of the VFD) | Semi-periphery (GRP per capita is within 75-100% of the average GRP per capita of the VFD or population density < the average population density in the VFD) | Periphery (GRP per capita < 75% of the average GRP per capita of the VFD) |
|----------------------|---------------------------------------------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------|
| With a diversified economy | Republic of Tatarstan | Republic of Bashkortostan |
|                        | Nizhny Novgorod Region | Perm Krai |
|                        | Samara Region | |
| Based on the mining industry | | |
| Industrial and Agricultural | | Udmurt Republic |
| Agro-industrial | Orenburg Region | Mari El Republic |
|                        | | Republic of Mordovia |
|                        | | Chuvash Republic |
|                        | | Kirov Region |
|                        | | Penza Region |
|                        | | Saratov Region |
|                        | | Ulyanovsk Region |

*a* According to the Analytical Center for the Government of the Russian Federation.

The VFD core is formed by three regions with a diversified economy. Semi-periphery includes regions of three types: regions based on the mining industry, industrial and agricultural and agro-industrial. The periphery is represented by agro-industrial regions (Table 1). A similar picture is observed in the EU countries, the inner periphery of which is formed by regions with a high proportion of the primary sector and, accordingly, agriculture.

The area of peripheral regions is between the well-developed regions of the VFD core: it is bordered by Nizhni Novgorod Region in the north, the Republic of Tatarstan and Samara Region in the south (figure 3). The VFD core is the centers of economic activity. The geographic proximity of the periphery to the core causes the outflow of resources from the periphery to the core, as well as to the largest metropolis of Moscow. The depopulation mechanism starts: young people migrate (school graduates...
leave to study and do not come back), qualified personnel leave in search of high earnings, the population is aging, the quality of human capital is deteriorating.

The lowest share of the rural population is in the core regions: from 20 % to 23.2 %, the share of agricultural production in the branch structure is 3-7 %; population density is high (42.2-59.6 inhabitants per square kilometre). In semi-periphery, the share of the rural population varies between 24.2 and 39.2 %, the share of agriculture is 7-9 % (with the exception of the Perm Krai), the population density is differentiated: 16-16.4 inhabitants per square kilometre in the Perm Krai and the Orenburg Region, 28.4 inhabitants per square kilometre in the Republic of Bashkortostan, 35.9 inhabitants per square kilometre in the Udmurt Republic. In the periphery, the share of the rural population is 23.2-37.5 %, the share of agriculture in the economy structure is 7.4-13 %, and population density (with the exception of the Chuvash Republic) is 10.7-33.5 inhabitants per square kilometre. The periphery is characterized by settlement sparseness with low population density and low urbanization.

![Figure 3. Map of the Volga Federal District regions.](image)

The result obtained is logical, since world experience shows that areas with low population density, low urbanization and a high proportion of the primary sector in the structure of the economy usually become peripheral. Depopulation of the population, high unemployment, low level of investment and innovation activity, poor transport and communication infrastructure are the main signs of peripheralization.

A system of indicators was developed that reflects not only the level, but also the dynamics of the process. The system of indicators includes GRP per capita, GRP growth, population growth/decline, the proportion of older people in the total population, the increase in the proportion of older people, the overall unemployment rate, the increase/decrease in the overall unemployment rate, the share of innovative products in total production, investments per capita, increase in the investments volume, the
share of paved roads in the total volume of roads, the share of households with broadband Internet access (Table 2-4).

**Table 2. Core of the Volga Federal District.**

| Indicators                                                                 | Republic of Tatarstan | Nizhny Novgorod Region | Samara Region |
|---------------------------------------------------------------------------|-----------------------|------------------------|---------------|
| GDP per capita in 2017, thousands rubles                                  | 543.5                 | 388.8                  | 422.0         |
| GRP growth in 2016 compared to 2014, %                                   | 101.0                 | 99.4                   | 94.9          |
| Population growth in 2017 compared to 2009, %                            | 102.8                 | **97.2**                | 99.1          |
| The proportion of people over working age in the total population in 2017, % | 24.8                  | **28.0**                | **27.2**      |
| Growth in the proportion of older people in 2017 compared to 2005, %      | 5.0                   | 4.4                    | 5.5           |
| The overall unemployment rate in 2017, %                                  | 3.5                   | 4.2                    | 4.2           |
| The decrease in the unemployment rate in 2017 compared to 2005, %          | -3.2                  | -1.8                   | -1.2          |
| The share of innovative products in total production in 2017, %           | 19.6                  | 15.4                   | 15.6          |
| Investments per capita in 2017, rubles                                    | 163.9                 | 75.3                   | 78.6          |
| Growth in the investments volume in 2017 compared to 2009, %              | 45.0                  | **31.5**                | 43.7          |
| The share of paved roads in the total volume of roads in 2017, %           | 75.5                  | 69.6                   | **45.3**      |
| The share of households with broadband Internet access in 2017, %         | 83.1                  | 69.7                   | 73.7          |

**Table 3. Semi-periphery of the Volga Federal District.**

| Indicators                                                                 | Republic of Bashkortostan | Udmurt Republic | Orenburg Region | Perm Krai |
|---------------------------------------------------------------------------|---------------------------|-----------------|-----------------|----------|
| GDP per capita in 2017, thousands rubles                                  | **343.5**                 | **367.1**       | 415.0           | 453.3    |
| GRP growth in 2016 compared to 2014, %                                   | 98.8                      | 101.5           | 95.2            | 96.3     |
| Population growth in 2017 compared to 2009 r., %                         | 99.9                      | 99.25           | **96.8**        | 99.0     |
| The proportion of people over working age in the total population in 2017, % | 24.0                      | 24.8            | 25.2            | 24.8     |
| Growth in the proportion of older people in 2017 compared to 2005, %      | 5.1                       | **6.8**         | 5.7             | 5.3      |
| The overall unemployment rate in 2017, %                                  | **5.6**                   | **4.8**         | 4.6             | **6.1**  |
| The decrease in the unemployment rate in 2017 compared to 2005, %          | -1.4                      | -3              | -4.6            | -2.0     |
| The share of innovative products in total production in 2017, %           | **7.0**                   | **10.8**        | **3.2**         | 16.0     |
| Investments per capita in 2017, rubles                                    | **64.2**                  | **52.8**        | 91.6            | 96.6     |
| Growth in the investments volume in 2017 compared to 2009, %              | -7.4                      | 33.2            | 18.3            | 19.5     |
| The share of paved roads in the total volume of roads in 2017, %           | 90.7                      | **59.5**        | 80.7            | 68.5     |
| The share of households with broadband Internet access in 2017, %         | 73.5                      | **70.8**        | 80.7            | **67.9** |
The Republic of Tatarstan is the undisputed leader among the core regions: it has a positive trend in all indicators, and their level exceeds the average VFD regions level. Nizhni Novgorod and Samara Regions have 2-3 indicators with values below the average VFD regions level (Table 2). All negative indicators are highlighted in bold type in the tables. Semi-peripheral regions have 3-6 negative indicator values (Table 3).

All the negative attributes of peripherality are manifested to some extent in all agro-industrial regions of the VFD: a reduction of the population is accompanied by its aging, total unemployment is 4-6 % and systematically decreases, the level of innovation is low, the level of investment is below the average among the VFD regions and very uneven across regions, the quality of roads and the availability of the Internet are below the average among the VFD regions, the availability of the Internet is increasing (Table 4). All regions are subsidized and have significant credit obligations. Out of twelve indicators, the Kirov Region has negative ratings on eleven criteria; the Mari El Republic, the Chuvash Republic and the Saratov Region – on nine indicators; the Penza and Ulyanovsk Regions – on eight indicators; the Republic of Mordovia – on seven indicators and the growth of GRP by 4.7 % over the past 2 years. Unfortunately, the process of peripheralization becomes more profound.

Table 4. Periphery of the Volga Federal District.

| Indicators | Mari El Republic | Republic of Mordovia | Chuvash Republic | Kirov Region | Penza Region | Saratov Region | Ulyanovsk Region |
|------------|------------------|----------------------|------------------|--------------|--------------|----------------|-----------------|
| GDP per capita in 2017, thousands rubles | 247.9 | 264.3 | 219.4 | 238.7 | 273.2 | 270.8 | 272.6 |
| GRP growth in 2016 compared to 2014, % | 97.7 | 104.7 | 97.9 | 98.8 | 100.8 | 99.9 | 99.9 |
| Population growth in 2017 compared to 2009 г., % | 98.2 | 96.0 | 97.9 | 94.9 | 95.7 | 97.2 | 95.8 |
| The proportion of people over working age in the total population in 2017, % | 25.5 | 27.7 | 25.0 | 29.2 | 29.6 | 27.7 | 28.9 |
| Growth in the proportion of older people in 2017 compared to 2005, % | 7.0 | 6.0 | 5.4 | 7.2 | 5.9 | 5.2 | 7.2 |
| The overall unemployment rate in 2017, % | 6.1 | 4.2 | 5.1 | 5.3 | 4.5 | 4.8 | 4.4 |
| The decrease in the unemployment rate in 2017 compared to 2005, % | -3.9 | -2.4 | -6.6 | -1.9 | -2.1 | -4.4 | -3.3 |
| The share of innovative products in total production in 2017, % | 14.2 | 27.5 | 12.2 | 6.2 | 10.1 | 2.3 | 12.8 |
| Investments per capita in 2017, rubles | 35.2 | 74.3 | 42.1 | 44.3 | 54.3 | 58.9 | 73.4 |
| Growth in the investments volume in 2017 compared to 2009, % | -1.0 | 29.8 | -17.0 | 8.9 | 14.0 | 42.8 | 20.7 |
| The share of paved roads in the total volume of roads in 2017, % | 58.9 | 56.1 | 61.8 | 55.6 | 80 | 63.5 | 71.6 |
| The share of households with broadband Internet access in 2017, % | 71.4 | 59.7 | 60.7 | 61.9 | 70.6 | 70.3 | 63.6 |

4. Conclusion
A process of core-periphery polarization takes place in the VFD. Economic activity is concentrated in the largest metropolitan areas, forming the core of the macro-region. Moderately developed regions with
GRP per capita from 75 to 100 % of the average VFD regions level form semi-periphery. The periphery covers a continuous belt of seven agro-industrial regions, in which 30 % of the macro-region’s population lives. No regions with a positive growth trend were revealed among the peripheral regions. Although the Republic of Mordovia has shown growth in the last 2 years, most likely this is a consequence of the FIFA World Cup and not an objective result. Peripheralization continues. The questions of the limitations and development possibilities of the periphera...

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References
[1] Wallerstein I 2006 Changing Geopolitics of the World-System, 1945-2025. Economics Issues [Voprosy ekonomiki – in Russian] 4 67 https://doi.org/10.32609/0042-8736-2006-4-57-83
[2] Friedmann J 1966 Regional Development Policy: A Case Study of Venezuela (Cambridge: The M.I.T. Press)
[3] Prebisch R 1978 Socio-economic Structure and Crisis of Peripheral Capitalism. CEPAL Review 6 159
[4] Krugman P 1998 Space: The Final Frontier. J. of Economic Perspectives 12(2) 161 https://doi.org/10.1257/jep.12.2.161
[5] Copus A 2001 From core-periphery to polycentric development: Concepts of spatial and aspatial peripherality. European Planning Studies 9(4) 539 https://doi.org/10.1080/713666491
[6] Keeble D, Owens P and Thompson C 1982 Regional accessibility and economic potential in the European community. Regional Studies 16 419
[7] Spiekermann K, Aalbu H 2004 Nordic Peripherality in Europe Nordregio Working Paper (Stockholm: Nordregio)
[8] Schürmann C, Talaat A 2000 A European Peripherality Index Final Report for General Directorate XVI Regional Policy of the European Commission (Dortmund: Universität Dortmund)
[9] Pezzi M, Urso G 2016 Peripheral areas: conceptualizations and policies. Editorial note. Italian J. of Planning Practice 6(1) 19
[10] Tagai G, Uzzoli A, Koys B, Ortega-Reig M and Alcazar H 2017 PROFECY – Processes, Features and Cycles of Inner Peripheries in Europe Final Report (Luxembourg: ESPON)
[11] Ketova N P, Ovchinnikov V N 2014 Development institutions in multistructural economies of peripheral regions. Studies on Russian Economic Development 25(2) 158
[12] Preobrazhenskiy Y V 2016 The Approaches of a Center and Periphery Determination Bulletin of Saratov University. New Series. Series: Earth Sciences [Izvestiya Saratovskogo universiteta. Novaya seriya. Seriya: Nauki o Zemle – in Russian] 16(4) 216
[13] Matveeva L G, Chernova O A 2017 Institutional Measures to overcome innovation inertia of peripheral regions in Russia. The Manager [Upravlenec – in Russian] 5(69) 2
[14] Treivish A I 2017 Geographical factors of society modernization: some lessons from the world and Russia's history XIX-XX ages Moscow University Bulletin. Series 5, Geography [Vestnik Moskovskogo Universiteta. Seriya 5. Geografiya – in Russian] 6 3
[15] Anokhin A A, Kuzin V Yu 2019 Approaches to the allocation of periphery and peripheralization in the spatial development of modern Russia. Bulletin of the Russian Geographical Society [Izvestiya russkogo geograficheskogo obshchestva – in Russian] 151(1) 3
[16] Kazakov M Yu 2018 General constitutive signs of peripheral territories in the economic space of agro-industrial regions *Bulletin of Banzarov Buryat State University. Economics and management* [Vestnik Buryatskogo gosudarstvennogo universiteta. Ekonomika i menedzhment – in Russian] 149 doi: 10.18101/2304-4446-2018-1-48-55

[17] Kazakov M Yu 2019 gravitational Interaction between the Center and the periphery in an Agro-Industrial region: Diagnostics of spatial and economic drift of territories *Regionology* [Regionologiya – in Russian] 27(1) 30 https://doi.org/10.15507/2413-1407.106.027.201901.030-057

[18] Egorenko S 2018 *Regions of Russia. Social and Economic Indicators* (Moscow: Rosstat)