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REGIONAL DEVELOPMENT

Transformation and Differentiation of Spatial Development of Belgorod, Voronezh, and Kursk Oblasts in 2010–2021

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Abstract—The aim of the study is to analyze the spatial transformation and differentiation of socioeconomic development of the regions bordering Ukraine as part of the Central Chernozem Economic Area and their regional metropolises. The research results confirmed two types of structures of regional settlement systems in border areas: the Belgorod structure— dual-core and monocentric Voronezh and Kursk; they have different features of reducing nonmetropolitan settlement systems and different vectors of development of municipalities located along the state border with Ukraine. The dynamics of economic modernization of the regions since 2010 indicate significant transformation and differentiation, a change in leader, and the sustainable nature of divergence processes of the regional development. It was revealed that in 2020, the highest rates of economic transformation were achieved by Voronezh oblast, the first signs of stagnation of economic growth were established in Belgorod oblast, where a reduction in investment, a change in the geopolitical situation in 2022, and border location may lead to a decrease in the investment attractiveness of large businesses, a further a drop in the rate of economic growth, and the emergence of instability. It has been established that the shares of metropolises in the socioeconomic development of the regions are declining and a new trend of demonocentricity is emerging. A retrospective analysis of the population increase/decrease rate revealed a persistent trend of population concentration in suburban areas of metropolises versus a continuing population decrease in the interiors of the regions. The territories bordering Ukraine are characterized by different vectors of ekistical and demographic transformation. The study made it possible to find out trends towards uneven spatial development, polarization in the development of regional metropolises and nonmetropolitan and border areas, and attraction of the population to regional capitals and suburban areas. The methodology for studying the spatial development of regions and regional metropolises makes it possible to monitor their transformation, identify priority problems, and make effective administrative decisions.

Keywords: settlement pattern, spatial development, metropolises, population, borderland

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FORMULATION OF THE PROBLEM

The spatial unevenness of socioeconomic development and population distribution in Russian regions is increasing. The lack of official statistical data and imperfect methodological tools for assessing socioeconomic changes (Shubat, 2016) have led to ineffective administrative decisions on regional transformations and incorrect forecast estimates. The situation is complicated by the fact that the economies of Russian regions are monocentric—concentration of socioeconomic activity and demographic potential in one or, less frequently two or three cities; low rates of development (frequently stagnation) of the periphery contribute to disproportions, spatial polarization, further development of regional metropolitan centers, and degradation of the periphery.

Studies by foreign and Russian researchers are devoted to searching for patterns of spatial development and the formation of the general territorial structure of regions, and explaining the structure of the economy. According to (Zyryanov and Mirolyubova, 2014), for socioeconomic geography, the idea of P. Krugman (1998, 1999) about the bifurcation point in the process of regional development is highly regarded, which is a kind of stage in the division of geographical space into two functional zones, differing in socioeconomic characteristics and specialization.

The centers and their surrounding territories are interrelated, but uneven economic growth and spatial polarization processes create disproportions between them (Friedmann, 1966). The center is the engine of development of the system, qualitatively transforming, generating, and introducing innovations and at the same time pumping resources from the periphery. Theoretical schemes and models, created at different times and for different purposes, were aimed at identifying the differentiation of geographical space and its

socioeconomic regionalization. According to A.N. Pilyasov (2009), as a result of the agglomeration economies, the world is becoming more and more "hilly"; socioeconomic disproportions and development features are maturing at the local and regional levels (Rodionova, 2021).

Particularly pronounced processes are manifested in the settlement pattern (Gladky and Olifir, 2017), the concentration of a significant part of the population in the centers of federal subjects and rural municipalities in the zones of their economic and social gravity, what E.E. Leizerovich calls (2008) "metropolitan economic microdistricts." The metropolitan status of a city (Chugunova et al., 2021a; Zubarevich, 2012) and its institutional advantages contribute to exacerbating the uneven development of the country's cities, its "hilliness." Attempts to equalize the levels of socioeconomic development of federal subjects of post-Soviet Russia were not effective, and the most active, educated populations "vote with their feet" in favor of centers—territories with sustainable progressive development, in particular, capitals, indirectly contributing to the degradation of outflow territories.

Methodological approaches to studying and measuring sustainable development of regions are becoming a priority, where the focus is not on economic growth and development of the regional economy, but on indicators of social and economic sustainability that take into account local characteristics (Bobylev, 2007; Krasnoyarova and Sharabarina, 2021; Yakovenko et al., 2021). Since the 1970s, national and local systems of indicators for sustainable urban development have been developed (Pinter, 2005), due to the need to take into account local specifics in close relation with international indicators and the requirement for their adaptation.

The location of the border, potentially providing additional resources for development, and the peripherality effect, which works in the opposite direction (Morachevskaya, 2016), jointly influence the socioeconomic development of most regions of the new Russian borderland. Unfortunately, increasingly acute socioeconomic problems are arising in the new Russian borderland, manifested in the economic periphery of most of its areas (Kolosov, 2016).

Belgorod, Voronezh, and Kursk oblasts of the Central Chernozem Economic Area (CCEA) border on Ukraine: this is the new Russian borderland. This location is reflected in the social, demographic, and economic indicators of municipalities directly adjacent to the border and peripheral with respect to regional centers (with the exception of the Belgorod district of Belgorod oblast—border and suburban). Qualitative differences in peripheral border areas (inequality of development) are becoming quantitative: inequality of economic growth (Katrovsky and Nizhnikova, 2021). The relationship with Ukraine, which has changed since 2014, was noted at the sixth International Scientific and Practical Conference "Strategy for the Development of Border Territories: Traditions and Innovations" (Popkova and Kazakov, 2021).

As our previous studies have shown (Chugunova et al., 2020, 2021b), municipalities bordering on Ukraine have fewer and fewer development resources and are increasingly peripheral.

The main aim of the study is to analyze the spatial transformation and differentiation of socioeconomic development of the regions bordering Ukraine and their regional metropolises as part of the CCEA. In accordance with this aim, the following problems were solved: analysis of changes in regional settlement systems of Belgorod, Voronezh, and Kursk oblasts; determination of the sustainability of development of regions, taking into account their shares in all-Russian indicators; analysis of the shares of metropolises in regional indicators of socioeconomic development; retrospective assessment of the population of the studied areas using GIS technologies.

The information base for the research consisted of official statistics data of the Russian Federation; the main methods were mathematical–statistical, comparative–geographical, cartographic, and systemic–structural approaches.

METHODOLOGY

In determining the methods and indicators of regional development, the author proceeded from the position that indicators should be of a monitoring nature and change over time; in this case, a system of indicators would make it possible to identify the features of development of individual phenomena and the specifics of their manifestation in the studied areas.

The structure of regional settlement systems was calculated as the share of regional metropolises and nonmetropolitan territories in the total population, as well as the share of the population of border territories as part of nonmetropolitan territories.

The share in all-Russian indicators was defined as the arithmetic average of the regions' shares in the country's general economic indicators. Indicators considered: (1) population size; (2) gross regional product; (3) the cost of industrial products; (4) the cost of agricultural products; (5) the cost of fixed production assets; (6) investments in fixed capital.

Share of metropolises was calculated as the arithmetic average of the shares of regional metropolises in the following socioeconomic indicators of their region: (1) population size; (2) the average annual number of employees of organizations; (3) investments in fixed capital; (4) the cost of fixed assets of organizations; (5) the cost of manufacturing products; (6) the cost of construction work; (7) retail trade turnover.

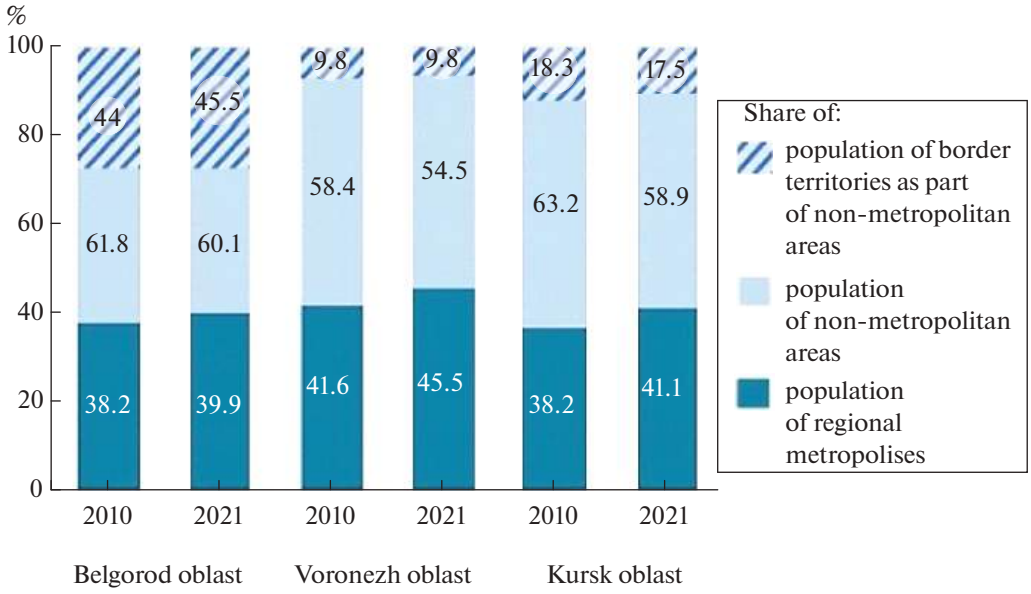

Fig. 1. Structure of regional settlement systems, 2010, 202, %.
Source: calculated according to Regions of Russia. Main Socioeconomic Indicators R32: Stat. Digest, Moscow: Rosstat, corresponding years.

In calculating the *regional population dynamics*, the initial data consisted of the population size for 2010 and 2020, then the increase/decrease rates were determined.

To solve the problems, a multiscale approach was used (Treivish, 2006): metropolises–intraregional settlement systems–regions, which made it possible to identify trends, specifics, and inconsistencies of development at different scale levels, from regional to local–urban. The multidimensional phenomenon of transformation of the socioeconomic space can be explained by analyzing hierarchical spatiotemporal systems (Aksenov, 2011).

RESULTS AND DISCUSSION

Structure of Regional Settlement Systems of the Border Regions of the Central Chernozem Area in 2010–2021

The regional settlement systems of Belgorod, Voronezh, and Kursk oblasts include metropolitan areas (agglomerations)—Belgorod, Stary Oskol–Gubkin, Voronezh, Kursk; urban settlements, represented by cities and urban type settlements of different populations; rural settlements; municipalities actually bordering Ukraine (municipal districts and urban *okrug*s localized along the state border: two in Voronezh oblast, nine in Belgorod oblast, and six in Kursk oblast) with a population of 662 000 people; exometropolises—small central–peripheral systems of oblasts (Chugunova and Narozhnaya, 2020). As of 2021, most cities are represented by the small class; from 39.9 to 45.5% of the population of regions live in metropolises; the differentiation of intraregional settlement structures is significant (Fig. 1).

The Voronezh metropolis has reached the highest population concentration, 45.5% of the region's population, a classic example of demographic monocentricity; Kursk is growing rapidly; in Belgorod oblast, two metropolises account for 39.9% of the population with weak growth rates in the last decade, which was noted earlier (Chugunova and Likhnevskaya, 2019). As part of the nonmetropolitan territories of regional settlement systems, territories bordering Ukraine are distinguished: in Belgorod oblast, nine municipalities (45.5% of the population); in Kursk, six (17.5%); and in Voronezh, two (less than 10%).

Over the past 10 years, Voronezh has been growing and the share of the population of nonmetropolitan and border areas has been decreasing. The continuation of the decrease trend in the share of the population of non-metropolitan and border areas is typical for Kursk oblast. A characteristic feature of the Belgorod settlement system is the increase in the number and share of the population of border municipalities, which gives a false idea of the development of the country's border territories despite their depopulation. Indeed, the population of border areas has increased, but only at the expense of one of nine municipalities—Belgorodsky district, which is a suburban and border area in which 30.6% of the population of the regional border territories live.

Table 1. Share of Belgorod, Voronezh, and Kursk oblasts in all-Russian indicators (2010, 2015, and 2020), %

Indicator	Belgorod oblast			Voronezh oblast			Kursk oblast		
	2010	2015	2020	2010	2015	2020	2010	2015	2020
Population	1.1	1.1	1.1	1.6	1.6	1.6	0.8	0.8	0.8
Gross regional product*	0.9	1.1	1.0	0.9	1.2	1.1	0.5	0.5	0.5
Industrial production	1.4	1.0	1.0	0.7	0.8	1.1	0.6	0.7	0.7
Agricultural production	4.1	4.3	4.5	2.6	3.9	4.1	1.5	35.4	3.0
Fixed assets	0.7	0.8	0.8	0.8	0.9	1.1	0.5	0.4	0.5
Investments in fixed capital	1.2	1.0	0.8	1.3	1.8	1.3	0.5	0.5	0.7

*In 2019.
Source: calculated according to Regions of Russia. Main Socioeconomic Indicators R32: Stat. Digest, Moscow: Rosstat, corresponding years.

Regional Economic Development of Belgorod, Voronezh, and Kursk Oblasts

The levels of socioeconomic development of the studied areas in 2010 varied significantly for a number of reasons, and by 2020, economic growth remained differentiated, despite significant changes in its economic structure, but the leaders changed.

The results of economic development of the regions in the share of the most significant socioeconomic indicators are evidenced by the data in Tables 1 and 2. Belgorod oblast in 2015 ceded first place to Voronezh oblast, which retained it in 2020. Kursk oblast, despite significant economic growth, remained an outsider with an average share in economic development indicators 2.2 times less than Belgorod oblast in 2010 and 1.7 times less than Voronezh in 2020; there is still no convergence.

The growth in the value of agricultural products played a decisive role in changing the contribution of all three oblasts to the country's economy;[1] in Kursk oblast, investments in fixed capital increased (from 0.5 to 0.7%), with a significant reduction in Belgorod oblast (from 1.2 to 0.8%) and instability of investments in Voronezh oblast (1.3, 1.8, and 1.3%). It should be noted that Belgorod oblast is the leader in the CCEA in the value of agricultural products, producing 4.5% of its volume in Russia; its losses in the average share are due to a reduction in investment over the study period from 1.2 to 0.8% of the Russian volume.

Since regional agriculture is based on favorable natural and climatic conditions, in the all-Russian division of labor, it is naturally a branch of specialization in grain and industrial crops, high-intensity pig farming, and poultry farming. However, industrial methods of production penetrated the agriculture of the regions at different times, affecting the dynamics of the volumes and cost of products. In Belgorod oblast, intensive agriculture began (Likhnevskaya et al., 2017) much earlier than in Voronezh and Kursk oblasts: in 2010, the value of agricultural products was RUB 97.7 bln, while in Voronezh oblast, 67.9 bln; and in Kursk, 39.5 bln; in 2020, these were 288.9, 262.1 and 193.2 bln respectively. Dynamically developing high-tech competitive agricultural production created in recent decade owes its results to the brutal expansion of large agricultural enterprises—state-supported agricultural holdings at the federal and regional levels. In 2020, they produced 87% of agricultural products in Belgorod oblast; in Voronezh, 63.4%; and in Kursk, 81.4%.

The situation with the production and cost of industrial products is different: in Belgorod oblast, the share of industrial production decreased from 1.4 to 1.0% of the all-Russian indicator; in Voronezh oblast, it increased from 0.7 to 1.1% (in 2020), which ultimately improved the socioeconomic development indicators of Voronezh oblast .

A similar situation is typical of investments in fixed capital, the structure of which is dominated by investments in machinery, equipment, and vehicles. It is necessary to note the reduction in investments by 2019, particularly notable in Belgorod oblast, which is not yet a trend, but given the change in the geopolitical situation in 2022, a further reduction should be assumed, as well as the potential for instability in economic development. The geography of investments will likely perpetuate the existing economic imbalances between regions.

Table 2. Average share of Belgorod, Voronezh, and Kursk oblasts in all-Russian indicators (2010, 2015 and 2020), %

Region	2010	2015	2020
Belgorod oblast	1.57	1.55	1.53
Voronezh oblast	1.31	1.70	1.71
Kursk oblast	0.73	0.88	1.03

[1] Regions of Russia. Main Socioeconomic indicators R32: Stat. Digest, Moscow: Rosstat, corresponding years.

Table 3. Share of metropolitan cities of Belgorod, Voronezh, and Kursk oblasts in regional development (2010, 2015 and 2019), %

Indicator	Belgorod			Stary Oskol			Voronezh			Kursk		
	2010	2015	2019	2010	2015	2019	2010	2015	2019	2010	2015	2019
Population	23.3	25.0	25.4	14.4	14.3	14.4	41.8	44.2	45.5	45.5	39.6	41.0
Average annual number of employees of organizations	24.4	28.5	27.7	15.3	17.1	16.9	56.6	55.4	54.9	54.9	44.4	43.3
Investments in fixed capital	34.0	20.5	30.4	16.5	n/d	21.6	38.2	35.6	57.9	57.9	35.0	12.9
Fixed assets of the organizations	33.9	40.6	38.3	14.5	14.8	8.1	71.7	67.1	54.4	54.4	38.3	38.9
Manufacturing	14.2	11.9	11.3	33.0	26.0	25.4	47.8	42.2	38.5	38.5	52.9	44.9
Construction	46.8	33.4	28.1	19.7	16.9	15.6	70.8	59.7	44.4	44.4	57.9	39.2
Retail turnover	38.5	40.0	36.6	19.8	19.7	19.6	63.9	63.0	58.7	58.7	66.0	63.8

Source: calculated according to Regions of Russia. Main Socioeconomic Indicators R32: Stat. Digest, Moscow: Rosstat, corresponding years.

Socioeconomic Development of Regional Metropolises

The average share of regional metropolitan areas, calculated based on seven socioeconomic indicators (see research methodology above), has decreased in all areas, but with significant differentiation. The most significant reduction is observed in Belgorod: from 39.7 to 28.3% (Tables 3, 4).

A small decrease is also seen in Stary Oskol, which indicates a decrease in the socioeconomic binary centricity in Belgorod oblast. In Voronezh and Kursk, the average indicators also decreased, but the monocentric development of the regions remained with concentration of socioeconomic potential in the capitals: 50.6 (Voronezh) and 40.6% (Kursk). We can talk about maintaining the division of the socioeconomic space of the regions into two functional zones: metropolitan and nonmetropolitan areas.

Analysis of initial indicators revealed multidirectional processes in the socioeconomic development of metropolises: the population increased in Belgorod, Voronezh, Kursk and remained unchanged in Stary Oskol; the average annual number of employees of organizations decreased only in Voronezh; investments in fixed capital increased significantly in Voronezh (by 52%) and sharply decreased in Kursk (by 3.6 times over 10 years). Noteworthy is the reduction in the shares of the value of fixed assets of organizations (with the exception of Belgorod), manufacturing industry, and retail trade turnover in all metropolises, which may indicate new trends in the transition to polycentric (de-monocentric) development of regions, a change in the vector of socioeconomic development outside the capitals .

Table 4. Average share of metropolitan cities of Belgorod, Voronezh, Kursk oblasts in regional development (2010, 2015, and 2019), %

Metropolis	2010	2015	2019
Belgorod	30.7	28.6	28.3
Stary Oskol	19.0	18.1	17.4
Voronezh	55.8	52.5	50.6
Kursk	49.7	47.7	40.6

Subsequent analysis of the demographic potential of the studied areas revealed the territorial preferences of the population, possible problems in implementing plans for innovation in the socioeconomic development of hinterland municipalities with respect to sociodemographic desertification.

Population Retrospective

A cartogram of population increase/decrease in 2010–2020 by municipality has been compiled (Fig. 2), clearly showing a retrospective of changes: an "area of increase" of the population (Lachininsky and Sorokin, 2021) in suburban areas of metropolises and decrease outside them. The situation—this is a reflection of the prevailing trends in the development of capitals (big cities) and "metropolitan economic microdistricts" (Leizerovich, 2008), patterns of urbanization.

The cartogram clearly demonstrates the preferences of the population regarding areas of residence: the most significant increase in population is in the first suburban areas of the agglomerations of Voronezh, Belgorod, Kursk, Stary Oskol; the most significant decrease is on the periphery. The depth of losses stands out in Kursk oblast and northeast Voronezh, the peripheral areas of which have lost up to a third of their population over the past 10 years. It is known that in depopulation areas, the quality of human potential is significantly deteriorating, difficulties arise in the implementation of innovations and plans for the socioeconomic development of remote areas, and in equalizing the level and quality of life of the population.

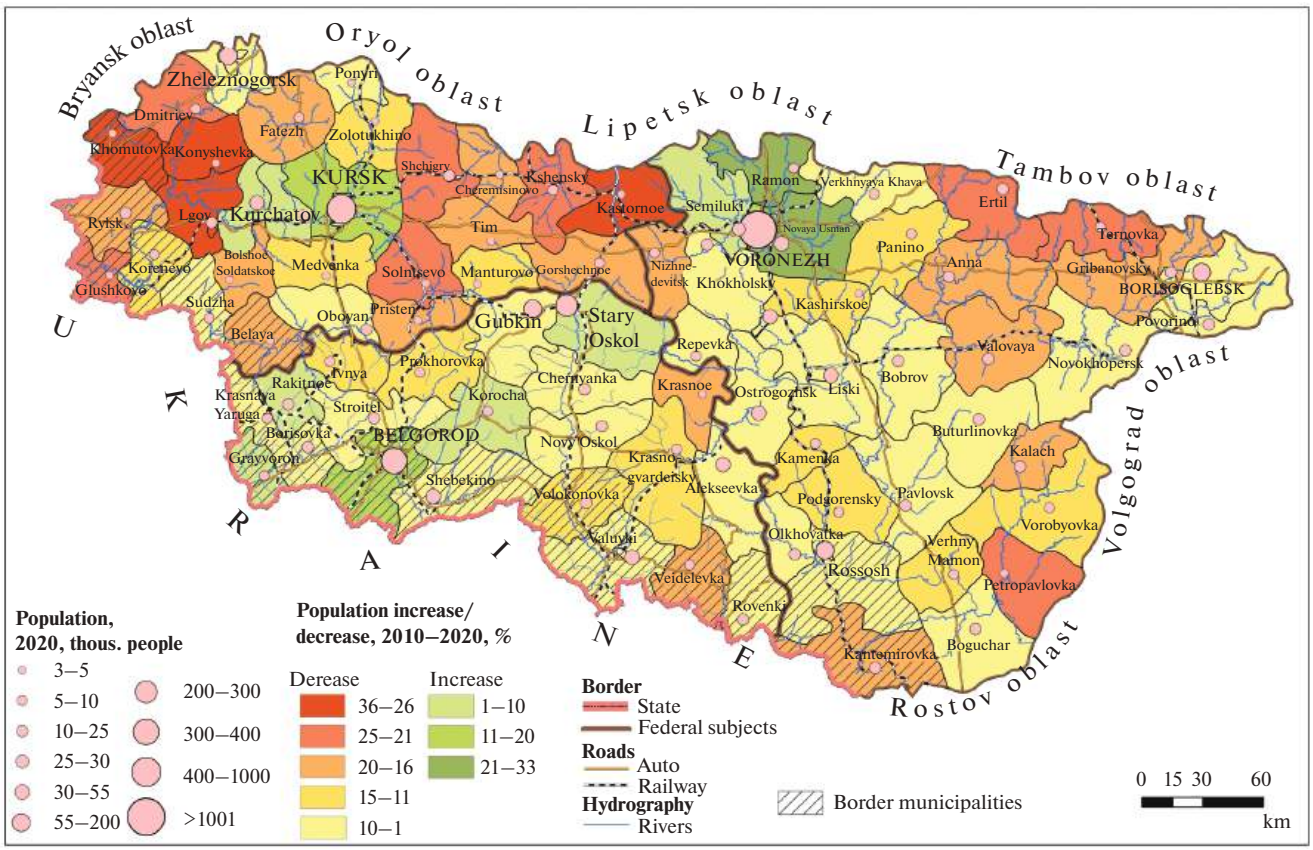

Fig. 2. Population change in 2010–2020, %.
Source: calculated according to Regions of Russia. Main Socioeconomic Indicators R32: Stat. Digest, Moscow: Rosstat, corresponding years.

CONCLUSIONS

The study confirmed the existence of two types of structures of regional settlement systems in border areas: the first is the Belgorod dual-core system with Belgorod and Stary Oskol, showing low population growth rates in the last decade; the second is monocentric, with clear dominance of metropolitan capitals in Voronezh and Kursk oblasts with relatively high population growth rates in metropolises. The share of nonmetropolitan territories has been declining in the last decade with the growth of metropolitan cores, but persistent trends in the processes of suburbanization and patterns of phases (stages) of development of agglomerations will in the future lead to a reversion and an increase in population in suburban areas.

The territories of regions bordering Ukraine are characterized by different development vectors: in the Belgorod settlement system, the demographic potential is increasing as a result of population growth in the largest municipality—border and suburban Belgorod district. In the Voronezh and Kursk settlement systems, trends in the decline in the number of border populations persist. The causes of the crisis in border areas are largely caused by the peripheral nature of the position and growing "hilliness" of the economy, and they are reinforced by the instability of the geopolitical situation in recent years. The share of the border population among the nonmetropolitan population is especially large in Belgorod, to a lesser extent—Kursk and insignificant—in Voronezh oblast.

The results of economic development of regions by share in all-Russian indicators demonstrate three trends: continued significant differentiation of regions, a change in leader, and divergence processes. In 2020, the highest indicators of economic development were achieved in Voronezh oblast, ahead of Belgorod oblast. In Belgorod oblast, the share of investment in fixed capital has decreased since 2014, which indicates possible economic stagnation. Changes in the geopolitical situation in 2022 and the border position may lead to a reduction in investment and a slowdown in the rate of economic development. The instability of the socioeconomic situation is especially likely at the local–border level, which aggravates intraregional imbalances.

The share of metropolises in regional socioeconomic development indicators has decreased. The deterioration of the final indicator in Voronezh and Kursk did not change the monocentricity of the

regions, but a turning point has emerged—de-monocentricity. The reduction in the share of Stary Oskol and Belgorod indicates a decrease in the socioeconomic potential of dual-core centricity in Belgorod oblast and the presence of a trend towards polycentricity.

Differentiation of municipalities by population increase/decrease rate in 2010–2020 revealed continued growth of the population in suburban areas of metropolises and decrease outside them, which reflects the prevailing trends in the development of suburban areas of metropolises versus a persistent decrease in the population of the regions. Depopulation is a long-term trend, which should be considered a basic condition for forming promising scenarios for the development of regions and taken into account in administrative decisions.

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CONFLICT OF INTEREST

The author of this work declares that she has no conflicts of interest.

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