

INTERREGIONAL INTERACTION AS A FACTOR TO REDUCE THE UNEVEN SPATIAL DEVELOPMENT OF THE ECONOMY

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Abstract: *High interregional differentiation in the levels of the well-being of the population and divergence of territories are urgent problems for many countries including Russia, which has experienced serious problems of economic growth in recent years. Thus, according to official statistics, only 5 of the largest Russian regions form about 40% of the country's GRP. As it was noted by many researchers, these difficulties are largely determined by the uneven spatial organization of the territories. It negatively affects the level of innovative development of the country, which determines the pace and quality of economic growth in the modern world. According to the INSEAD calculations, Russia ranks only 45th out of 127 countries present in The Global Innovation Index in 2017. In the experts' view, the most negative factor in this regard is integral index includes the following subindicators: university/industry research collaboration; state of cluster development; etc.*

It is obvious, that the low level of interaction between economic entities has a negative impact on the index of innovation development of our country. Therefore, regulatory influences of the authorities should ensure the development of mutually beneficial ties between the territories.

The purpose of this study is to assess the influence of the intensity of interregional interaction on the uniformity of the spatial development of the economy. Methods of mathematical statistics and cluster analysis, system and hierarchical approaches, methods of visualization of the analyzed data were used to obtain the research results. To assess the strength of interregional interaction, the authors used also a gravitational model.

As the results of the work it is worth to note the following ones: the determination of the factors of the country's spatial development; substantiation of the possibilities to reduce the uneven spatial development of the economy on the basis of intensifying interregional interaction; development of methods for analyzing the effectiveness of interregional interaction; assessment of the impact of interregional interaction on indicators of spatial development of the economy.

Key words: *Interregional interaction, spatial development, the gravity model, interregional differentiation, economic mathematical methods.*

1. INTRODUCTION

Spatial development of the country is a complex process of transforming the spatial organization of its constituent territories. Spontaneous, inertial spatial development can cause serious economic consequences. Therefore, appropriate management decisions based on a scientifically based spatial development strategy are an objective necessity. The main objects of management in this case are the following subsystems: population settlement, distribution of production capacities, location of transport, engineering and social infrastructure.

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Failures in the work of these subsystems lead, firstly, to the uneven distribution of the population; secondly, to the complication of internal mobility of the population; thirdly, to the increase in the economic activity concentration. All of the foregoing objectively leads to a polarization of spatial economic development, to an increase in interregional differentiation in the levels of welfare of the population and divergence of territories.

These problems are relevant for Russia, which has experienced serious problems of economic growth in recent years. As it was noted by many Russian researchers, these difficulties are largely determined by the uneven spatial organization of the territories.

A non-optimal spatial organization causes great contrasts between separate regions of the country, the level of differentiation of which reaches critical values. Thus, according to official statistics, only 5 of the largest Russian regions form about 40% of the country's GRP. It negatively affects the level of innovative development of the country, which determines the pace and quality of economic growth in the modern world.

According to the INSEAD calculations, Russia ranks only 45th out of 127 countries present in The Global Innovation Index in 2017 [2]. In the experts' view, the most negative factors in this regard are: unstable political environment (ranked 100th), inefficient regulatory environment (94th), ecological sustainability (83rd), low level of investments (95th), underdevelopment of intangible assets (87th). Separately we need to mention here the index called "innovation linkages", for this parameter Russia got 105th rank only. Meanwhile, this highly important today integral index includes the following subindicators: university/industry research collaboration; state of cluster development; R&D financed from abroad; number of joint venture–strategic alliance enterprises etc.

It is obvious, that the low level of interaction between economic entities has a negative impact on the index of innovation development of our country. Therefore, regulatory influences of the authorities should ensure the development of mutually beneficial ties between the territories.

The issues of interregional cooperation have been studied by the representatives of many schools of economic thought: within the theory of "core – periphery" (J. Friedmann), theory of production location (A. Weber, W. Laundhart, J. von Thunen), theory of growth poles and development centers (F. Perroux, J. Boudeville) and also theory of innovations' diffusion (T. Hagerstrand). With the development of new directions and tools for the implementation of innovation policy, the attention of scientists is increasingly attracted by research on such areas of interregional interaction as the theory of cluster development [3]-[6], benchmarking of territories [7]-[9], smart specialization [10]-[12].

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The most significant contribution to the formation of the fundamental foundations of the theory of interregional economic interaction is the following:

1. There is a direct relationship between the efficiency of factor placement and productivity.
2. The division of labor is the basis of the wealth of the population.
3. The lower alternative cost of production underlies the competitive advantage of the territory.

The purpose of this study is to assess the influence of the intensity of interregional interaction on the uniformity of the spatial development of the economy.

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2. DATABASE AND METHODOLOGY

The empirical part of the work proceeds from the model of the triple helix, which substantiates three types of interaction between economic subjects (university-industry-government) **Error! Reference source not found..**

To calculate the interaction forces, a system of indicators characterizing the levels of development of the scientific, infrastructural and industrial potentials of individual territories was developed. Thus, the list of indicators of scientific potential includes such indicators as the number of students; the number of personnel engaged in research and development; costs of research and development; volume of innovative goods, works, services, etc. The list of indicators of the infrastructure potential included such indicators as the density of highways with a hard surface; total area of living quarters per inhabitant; emissions of pollutants into the atmosphere, etc. The list of industrial capacity indicators included such indicators as the turnover of small enterprises; investments in fixed assets; coefficient of renewal of fixed assets, etc.

Three integral indexes were calculated based on this system of indicators: the index of scientific, technical and educational potential, the index of quality of life and infrastructure, the index of production potential. All indicators were reduced to a single scale using a linear transformation. Integral indices were obtained by finding the arithmetic mean of the corresponding indices.

We built the interaction force matrixes using the formula (1) for 78 regions of Russia on the base of statistical data for 2015.

$$F_{ij} = G \frac{q_i q_j}{d_{ij}^2} \quad (1)$$

where F_{ij} – the index of the interaction force between the objects i and j , G - the interaction constant; q - a measure of the significance of objects j and i , d_{ij}^2 – the distance between objects i and j .

Formula 1 represents a gravity model that describes the interaction between spatial objects (cities, regions, countries). This model is widely used in regional and spatial analysis of the economy in the study of urbanization processes, industry location, export-import relationships, population migration [14]-[16].

In our study, the application of the gravitational model is based on the assumption that the magnitude of the interaction is proportional to the product of the significance indicators (quantities, quantities) of objects and inversely proportional to the distance between them.

The matrix of the shortest distances D between administrative centers of Russian regions is also used for calculations **Error! Reference source not found..** At the next step we assessed the impact of interregional interaction on the differentiation of territories. At the same time, we took into account the nature of the forces of interaction.

Interregional differentiation is assessed based on the GRP per capita. The integral index of differentiation is calculated by the formula of the coefficient of variation:

$$\vartheta = \frac{1}{N} \frac{\sum(x_i - \bar{x})^2}{\bar{x}} \quad (2)$$

where ϑ – the coefficient of variation, x_i – the GRP per capita value in region i; \bar{x} – the average GRP per capita in the country, N - the number of regions.

Average forces were calculated for each region to build the model, based on the values of interaction force matrices. In Russia in 2015 the level of differentiation was more than 70%. To assess the "contribution" of the region to the integral index of GRP differentiation per capita, it is necessary to calculate the "contribution" of regions to the integral indicator of differentiation:

$$s_i = \frac{1}{N} \left(\frac{x_i}{\bar{x}} - 1 \right)^2 / \vartheta^2 \quad (3)$$

where s_i – estimation of the "contribution" of region i to the integral index of differentiation (coefficient of variation) GRP per capita, ϑ^2 – the square of the coefficient of variation. In this case, it is obvious that $\sum s_i = 1$.

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3. RESULTS

Table 1 presents the results of correlation-regression analysis.

Dependent variable		
"Contribution" of the region to the GRP differentiation per capita	RDR Error! Reference source not found.	
	Model 1	Model 2
Absolute term	-0.0356 (0.0236)	-0.4655* (0.2329)
ln_FID	-0.0088* (0.0042)	
ln_GDP		0.0634** (0.0184)
N	156	156
R2	0.05	0.14

Standard errors in brackets

** p < 0.01, * p < 0.05

Table 1: Results of correlation regression analysis

Model 1 estimates the total influence of forces of interaction of different nature between regions on differentiation (FID). From the evaluation of the coefficients of the model, it can be seen that the overall increase in interactions of different nature will lead to a decrease in differentiation. Further, we assume that a decrease in differentiation will lead to an increase in the spatial development of both the regions separately and the entire national economy.

Model 2 assesses the relationship between the logarithm of GRP per capita and the regional development rating (RDR). The connection is positive, i.e. the increase in GRP will lead to an increase in RDR. However, it should be taken into account that the differentiation of regions is reduced by "smoothing" the GRP per capita value in the regions. That is, the reduction in differentiation will occur only with an increase in GRP per capita in lagging regions. This, in turn, will entail an increase in the economic development potential of the entire country.

The study confirmed the assumption that a productive interregional interaction can reduce the differentiation of territories. During the evaluation of the influence of these positive externalities on the spatial development of the economy, a positive relationship was also established.

The practical significance of the author's methodology lies in the possibility of applying the results obtained in the development of regional policies with a view to improving the spatial organization of the country's economy.

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