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**DO INFRASTRUCTURE FACTORS INFLUENCE SOCIAL AND
ECONOMIC DEVELOPMENT OF RUSSIAN REGIONS?**

A.E. Serkova (a)*, E.D. Ignatyeva (b), O.S. Mariev (c), V.A. Lee (d)

*Corresponding author

(a) Ural Branch of the Russian Academy of Science, 29 Moskovskaya str., Yekaterinburg, Russia, 620014, Ural Federal University, muccio@bk.ru, +7 343 371-04-11

(b) Ural branch of Russian Academy of science, Yekaterinburg, Russia, elen_i99@mail.ru +7 343 371-04-11

(c) Ural Federal University, Ural branch of the Russian Academy of science, Yekaterinburg, Russia, olegmariev@mail.ru +7 343 371-04-11

(d) Ural Branch of Russian Academy of Science, Ural State Economic University, Yekaterinburg, Russia, leevalentina@yandex.ru, +7 343 371-04-11

Abstract

This article is devoted to an assessment of the influence of infrastructure on social and economic development of the Russian regions. Various approaches to the treatment of concept of infrastructure are considered, especially chosen are industrial and functional approaches. According to the first of them, the infrastructure is considered as the set of the industries and kinds of activity that are providing activity conditions on an area of the country or the region. According to the second, it is considered as the set of the certain functions that are directed to the solution of organizational, economic and social challenges. Types of infrastructure – social, economic and financial – are theorized. Authors formed the list of the indicators representing financial, social, economic infrastructures and the real sector of economy. The relation has been investigated between the elements of infrastructures and the social and economic development of the Russian regions. The results of the econometric analysis were defined the elements which influenced the social and economic development of the regions. There are investments into fixed capital, resources mining, public catering, deposits of the population, the number of hospital beds. Five defined groups of the regions with typical problems were identified in the cluster analysis.

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1. Introduction

The motivation for research was to identify the relation between the infrastructure's influence on the social and economic development of the regions. We worked out the methodological approach to an assessment of this influence and considered a row of questions, which concerned the essence of infrastructure. Actuality of infrastructure in the development of the regions has been marked out by many authors. In particular, it is specified that the infrastructure factor is an important determinant of the economic growth, welfare and living standards. It creates conditions for favourable development of business and satisfaction of the population needs. Novelty of this study is the methodological approach to the analysis of how the economic, social and financial infrastructures influence the social and economic development of the Russian regions.

The theoretical research and empirical calculations prove the relation between the infrastructure and the economic and social development of the regions. The accumulated infrastructure capital and investments stimulate the economic development and growth of the well-being of the country. At the same time, separate components of infrastructure make rather bigger or smaller impacts on the economic growth. Infrastructure expenses can directly or indirectly influence the gross regional product, stimulate investments in the private sector, promote economic growth, employment, increase the labour productivity and the export expansion. Dewit G. assumes that the developed infrastructure attracts foreign direct investments (Dewit, Hynes, & Leahy, 2018). The infrastructure is the allocation factor of productive forces, a participant of space territorial processes, the instrument of the regional policy.

2. Problem Statement

The subject of infrastructure can be explained through its elements and functions. A number of authors treat infrastructure as a set of instruments allowing economic subjects to achieve their purposes. In a wide sense, the infrastructure is considered as a complex of conditions, which provide the activity of people and development of the economy.

In the economic literature, different approaches to consideration of components and different kinds of infrastructure have taken place. The infrastructure creates favorable conditions for economic activity and has important functions. We define economic, financial, and social functions of the infrastructure. These functions were defined accordingly to economic, financial and social infrastructures (Ignatieva, Mariev, & Serkova, 2016).

The infrastructure is a part of fixed capital which is determining the economic growth. It has been considered in many articles. In some of them, the positive effect on growth has been advocated since infrastructure acts as fundamental facilities for the private sector and improves the productivity of existing resources (Aschauer, 1989; Banister & Berechman, 2001; Mazzola, Cascio, Epifanio, & Giacomo, 2018).

In particular, the level of completeness and complexity of infrastructure influences the grade of urban amenities in the region. If the infrastructure is insufficiently developed, it negatively affects the development of manufacturing forces; it increases extra expenses for creation of essential manufacturing basis. Existence in the region of the developed economic and social infrastructure promotes an inflow of new investments, increases efficiency of production industry, and stimulates providing of the enterprises with labor recourses.

At the same time, results of the conducted empirical research indicate ambiguity in infrastructure's influence of the characteristics of the social and economic development of the regions. Besides, investments into development of infrastructure are part of a state policy and are quite often subject to the distortions connected with lobbying of interests of certain territories or industrial groups. Some researchers tried to estimate infrastructure's influence on economic growth (Henderson & Kumbhakar, 2006; Shi & Huang, 2013; Nadiri & Mamuneas, 1994; Morrison & Schwartz, 1996).

3. Research Questions

It is possible to draw a conclusion that infrastructure is able to influence development of economy in regions. It creates the favorable conditions for the economic growth if the infrastructure's elements have been balanced.

The existence of developed financial infrastructure is one of the most important factors for attraction of investments in the regions, its effective consumption and, correspondingly, ensuring of economic development of territory. Financial infrastructure is able to improve the investment climate, to optimize consumption of resources and to increase the competitive ability of enterprises.

Social infrastructure of the region represents a complex of industries (health care, education, physical culture and sport, culture and art) which functioning promotes sustainable social and economic development of the region, improves quality of life and the rational organization of activity of the population.

The high level of development of economic infrastructure creates the possibility to use overall production potential, to reduce time of manufacturing materials in the process of production and to accelerate delivering of goods in distribution, delivering of commodities to the consumer and to satisfy demand.

4. Purpose of the Study

We want to know how social, economic and financial infrastructures influence the economic and social development of the Russian regions.

Many works have been devoted to study how **financial infrastructure**, being a set of financial and credit institutes, instruments and resources, influences development of regions. Financial infrastructure creates conditions for realization of financial function. Different authors focus attention on the different aspects of this influence. We assume that there is a dependence of social and economic development of Russian regions between the population deposits, which are an important source of stimulation of domestic demand which, in turn, is a powerful development factor of economy. However, we note that the financial market kindly affects the real sector, if it actively turns savings into investments that are very problematic, as the standard of profitability in the financial market is much more, than profitability of the real sector. Besides, the financial market of the region is the least territorially localized in comparison with other sectors of regional economy. Therefore the development of infrastructure of financial market, increasing of networks of regional banks is necessary that will allow the rising degree of profitability of the real sector of economy and investment inflow in the regions.

Social infrastructure includes such branches as public health service, education, public utility sector, service industry, the cultural industry, public catering, etc. Functioning of social infrastructure creates conditions for satisfaction of welfare requirements of the population and reproduction of labor potential of territory.

Underestimation of a role of social infrastructure can serve as the key moment of emergence of social tension, decreasing the incentives of the population and business to the activity. Besides, a lag in development of infrastructure is the factor which slows down the arrival of new economic agents to the region and does not create the effective communications with other regions. Soars H. et al. insist that a high level of corruption associated with lower expenditures on fixed capital. These underdeveloped infrastructural components will be considered as the dysfunctions of social infrastructure (Soares, Sequeira, Marques, Gomes & Ferreira-Lopes, 2018).

Economic infrastructure should provide inflow of investment and efficiency of production, including maximizing profit and minimization of transaction costs. The appearance of economic infrastructure is a result of development of productive forces of society and distribution of labor recourses.

It includes: cargo transport, wholesale trade, electro, gas and water supply, warehouse economy, communication, information service, the sphere of business services and export. The link between exports and economic growth has been widely explored in the literature (Awokuse, 2008; Balassa, 1978; Feder, 1983; Frankel & Romer, 1999).

If one is unable to solve the problems of economic infrastructure, it will have inevitable losses at all stages of production and distribution of products and it has a lag of development of infrastructure from progress in the main production industry. However, the highway road infrastructure suffers from insufficient maintenance and creating inefficiencies such as increased travel times and an increase of accidents (Mazzola, Cascio, Epifanio & Giacomo, 2018). In addition, the construction and maintenance of road networks can generate employment for local dwellers (Li, Liu & Peng, 2018; Won, Cho, & Kim, 2015).

The list of assessing indicators. Further we will provide the grouped indicators of different infrastructures. It could be proposed that the indicator of social and economic development is gross regional product per capita in roubles. Indicators of **economic** infrastructure: a) density of rails, km. per 10000 sq. m. of area; b) density of roads with a hard coating, km per 1000 sq. m. of area; c) transport loads turnover, mln. tons per km. per capita; d) production and distribution of electric power and gas and water per capita, in roubles, e) volume of communication service per capita, in roubles. Indicators of **financial** infrastructure: a) deposits of legal entities and individuals in the credit organizations per capita in roubles (dep); b) deposits of legal entities and individuals in the credit organizations in foreign currency per capita in roubles (dep); c) fixed investments per capita in roubles (cap); d) foreign direct investments per capita in USD. Indicators of **social** infrastructure: a) turnover of retail per capita, in roubles; b) public catering turnover per capita, in roubles (ctr); c) number of hospital beds per 10 000 inhabitants (hbd); d) number of out-patient and hospital organizations per capita; e) number of universities and colleges per capita. Indicators of the **real sector** of economy: a) oil and gas mining per capita, in roubles (extr); b) the volume of building constructive works, in roubles; c) the volume of agriculture production per capita, in roubles; d) number of occupied persons in economy in thousands of people.

Thus, on the basis of the analyzed existing theoretical and empirical research, we proposed a hypothesis about the influence of infrastructure on the social and economic development of the regions. As a result of study, we want to prove or disprove this hypothesis.

5. Research Methods

The panel regression and cluster analysis are chosen as methods of research. The panel regression analysis was made for the identification of important elements of social, economic and financial infrastructures. Panel data give more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency. A panel data regression differs from a regular time-series or cross-section regression in that it has a double subscript on its variables, i.e.:

$$Y_{it} = \alpha + x_{it}'\beta + u_{it}, \quad i=1, \dots, N; t=1, \dots, T \quad (1)$$
 with i denoting regions and t denoting time.

The i subscript, therefore, denotes the cross-section dimension whereas t denotes the time-series dimension, α is a scalar, β is $K \times 1$ and X_{it} is the it that is the observation on K explanatory variables. Most of the panel data applications utilize a one-way error component model for the disturbances with $u_{it} = \mu_i + v_{it}$ (2), where μ_i denotes the unobservable individual specific effects and v_{it} - the remainder disturbance (Baltagi, 1995). All indicators were standardized with max and min formula.

Then we made the cluster analysis by the Kohonen's Self Organizing Map, which included all indicators of infrastructure, but the significant indicators were taken with higher weight equal to "2". The Kohonen's Self Organizing Map is a type of unsupervised network, which has the ability to learn without being shown correct outputs in sample patterns.

These networks are able to separate or map data into a specified number of categories. There are only two layers: an input layer and an output layer, which has one neuron for each possible output category. The maximum number of outputs can be categorized when selecting network architecture options by entering that number of neurons in the output layer. The training patterns are presented to the input layer, then propagated to the output layer and evaluated. One output neuron is the «winner». The network weights are adjusted during the training. This process is repeated for all patterns for a number of epochs chosen in advance. We classified all regions into 5 groups. We wanted to define types of regions with typical problems; that is why we made both panel regression and cluster operations consequently (Ignatieva, Mariev & Serkova, 2016)

6. Findings

For implementation of the above-described scheme, the base of the initial indicators was created; data were presented in the form of the panel of 249 supervisions with 83 Russian regions for 3 years from 2012 to 2014. All cost indicators are corrected by inflation index and brought to the price level of 2014. So, inflation was taken into account by the authors. The principle of comparability of data is not broken. Panel data are completely balanced and have no missing data. The explanatory variable is a gross regional product (GRP or grp) per capita, in roubles. According to the data, the model appears as a GRP is a function of 20 indicators (the list of indicators). Gross Regional Product is one of the important indicators to analyze the economic conditions in regions during a certain period of time.

Further step-by-step selection of variables were made, where not all considered indicators were statistically significant, the total model with only statistically significant variables was chosen from a set of the estimated regression models. We considered two options of model: with random and with fixed effects. As the test of Hausman's specification shows, a choice has to be made in favor of a model with the fixed effects; the determinants make about 95% of reliability that testifies to a model significance, and 5% of the other factors which were not considered in regression. Coefficients were found with a method of the least squares and are significant with probability of 95%, reliable estimators are well-founded. R-square within is 0,8364. It has no heterogeneity, autocorrelation and endogeneity problems, and it has the following appearance:

$$\text{grp} = 260,9 + 0,543\text{cap} + 0,722\text{extr} + 12,72\text{ctr} + 0,193\text{dep} - 1723,04\text{hbd}.$$

Results of the econometric analysis formed a basis for carrying out the following stage of a technique – an estimate of elements of infrastructure and manufacturing sector. Further realization of a technique consists in that it is necessary to construct summary indicators, which are, in turn, based on rated private indicators for each type of infrastructure and real sector.

Construction summary and rated private indicators are defined on a basis of the following algorithm, which was aforementioned. The clustering by Kokhonen's method was carried out after the creation of estimates with the formulas given in the above-described algorithm.

Moscow, St. Petersburg, the Nenets Autonomous Area, the Republic of Tatarstan, the Moscow region were excluded from the repeated cluster analysis as atypical regions. The listed regions differ in high rates of all types of infrastructure and development of manufacturing sector, only the Nenets Autonomous Area is allocated with low development of economic infrastructure. The Karachay-Cherkess Republic, the Republic of Ingushetia, the Chechen Republic appeared as a group with atypically low indicators describing economic, social, financial infrastructure and development of manufacturing sector.

Let us stop on the detailed analysis of 5 identified groups of the regions in the second stage of the cluster analysis. Regions – leaders are regions of group 5 and regions – outsiders are regions of group 2. Group 3 has little better indicators than outsiders have.

Groups 1 and 4 have the low indicators of all types of infrastructure and manufacturing sectors. But groups 1 and 4 are located between the leaders and the outsiders. Their indicators are better than indicators of group 2 and 3. The indicators of the economic infrastructure of the group 3 are better than the same indicators of group 2.

7. Conclusion

As a result of the analysis, we identified the next significant elements of infrastructure: investments into fixed capital, resources mining, consumer sector and volume of the population savings. These elements influence the social and economic development of the regions and these elements have the relation between the types of infrastructures and the social and economic development of the regions. Therefore it is very important to look for ways to attract and increase infrastructure investments which are the priority instrument of social and economic development of economy and creation of new workplaces. To provide long-term economic growth, it is necessary to redirect monetary and labour sources to modernization and technical reconstruction of branches of mechanical and electronic engineering, metallurgy and chemical

industry. According to M. Zandi (Zandi, 2008, Other options, para.2), each dollar invested in infrastructural projects causes multiplied effect of 1, 59 dollars. Improvement of infrastructure, reduction of transport and communication costs, expenses on power and water supply, etc. stimulate also private investments.

Meanwhile search for an optimum ratio of investments into various branches of infrastructure is necessary for ensuring long-term economic growth in each state. Now in Russia there is an opinion that the situation in the country became rather favorable for foreign investors. Actually this is a very controversial statement as in practice there are huge real risks which are difficult to avoid. One group of risks is connected with corruption and an inefficiency of making of bureaucratic decisions. We suppose that as a result of corruption and bureaucratic obstacles construction costs are overvalued. For example, the cost of construction of one kilometer of the modern highway in Russia is higher than in the USA, in Brazil and even in China. Other group of risks are connected with the inflation threat. If you pour money in infrastructural sector, at first you face an increase of inflation and only in the second turn increase of the economic activity.

So, we have proved the economic, social and financial infrastructures influence the social and economic development of the Russian regions. We explored the most significant infrastructural elements and the relation between the infrastructural elements and the social and economic development of the regions. The conducted analysis allowed one to identify the Russian regions with the typical challenges. To solve these problems, it is necessary to create the appropriate directions of infrastructural development of Russian regions. The well-developed financial, social and economic infrastructures will stimulate the economic growth, improve the quality living and the social and economic development of the Russian regions.

Russia has used to change the strategy of the infrastructural development of the regions to exit from an infrastructural trap; otherwise, the national economy will not be able to grow further. However, it takes a long time for modernization of the Russian infrastructure and these troubles will follow our nation for many years to come.

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