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ABSTRACT. A calculated indices based sectoral and regional analysis of investments has enabled us to assess the achieved level of investment differentiation, to identify the most significant contributions to the sectoral concentration and regional specialization, as well as to perform a comparative analysis of investment flows. In order to address this wide range of topical issues, as studies have shown, we may use the methodology proposed by Mr. P. Krugman. The economic and mathematical models developed in this study can be widely applied to monitor and diagnose the level of investment in regions and industries, as well as to transform the national policy in order to increase the return on fixed capital investment of enterprises and organizations. The methodological significance of this work consists in the development of tools describing the investment processes in Russia, as well as in the assessment of the current level of their territorial and sectoral differentiation. We believe that further study should be conducted based on the data that characterize investments at the local municipality level.

KEYWORDS: investment, sectoral concentration, regional specialization, types of economic activity, enterprises and organizations.

INTRODUCTION

In view of the need to create a new model of economic growth in Russia, i.e. a one not based on oil and gas revenues [16], it is imperative that a study of the laws of distribution of investment flows in various industries and regions be conducted now. Such study should improve the management of economic development and optimize the distribution of investments across the Russian economy. This paper deals with the current structure of investments in fixed assets of enterprises and organizations, as broken down by constituent entities of the Russian Federation (hereinafter referred to as "federal municipalities") and types of economic activity (hereinafter referred to as "industries").

Federal law No. 39-FZ dated 25.02.1999 "On investment activity in the Russian Federation carried out in the form of capital investments" regulates the national economic policy regarding investments in fixed assets of enterprises and organizations.

Certain attention has been paid to the problem of investment formation in recent years. In particular, we can point out the studies conducted by a think tank operating under the Government of the Russian Federation [3], as well as the article [17]. They provide a comparative analysis of the existing rates of accumulation (i.e. investment) in Russia and foreign countries, the dynamics of investments by industry and region. The article [18] addresses some of the factors hindering the growth of domestic and foreign investment. The analysis of investment dynamics in recent years, as shown in the study [19], suggests the presence of stagnation and its deterrent effect on the growth of the Russian economy, as well as underscores the importance of studying the structural features of investment processes.

The current structure of fixed capital investments in enterprises and organizations shows that in 2014 most of the investments in Russia were made in such industries as transport and telecom (21.2%), mining (19.8%) and manufacturing (17.3%). Such federal municipalities as Tyumen region with its autonomous districts (15.5%), the city of Moscow (9.7%) and the Moscow region (4.9%) accounted for the bulk of such investments.

At present, there is an urgent need for the distribution of investments to be optimized. Taking into account the different sizes of federal municipalities, the existing climatic conditions, the objective and subjective specificity of the development of individual regions and industries, it is imperative to analyze the peculiarities of fixed capital investment distribution.

One of the pioneers in the research of economic geography was W. Isard [4]. He proposed to consider production geography in terms of spatial concentration. The theory of spatial economy is expounded in the book [12]. A number of studies carried out by domestic scholars should also be noted. For instance, the article [1] addresses the scientific principles and views essential for characterizing the processes of distribution of productive forces in time and space. It points out two approaches to research. The former focuses on the distribution of productive forces in a territory based on its natural-geographical, economic, ethnographic, geopolitical and other conditions. The latter considers the placement of productive forces in terms of explaining the reasons why a particular economic entity has chosen to operate in a particular location, as well as in terms of describing the conditions that prompted it to make such choice.

The article [6] examines the role of economic entities which, in the opinion of its authors, define the nature, scope and dynamics of regional development. Besides, the essential role of their interaction with various institutions is pointed out.

In the works [2, 5] some questions regarding the methodology for modeling concentration and specialization processes, as well as the analysis tools used for such modeling, are dealt with.

Particular calculations of concentration and specialization are also reflected in the works of domestic and foreign authors. The domestic works include the articles published by S.N. Rastvortseva [7, 8], which focused on the concentration and specialization of industrial production. Among the foreign works we may note the articles [10, 11, 15], where these problems were analyzed through the case study of large regions and individual countries.

However, despite their significant relevance, the issues related to assessment of the level of sectoral concentration and regional specialization of investment flows in fixed assets have not been given sufficient attention in scientific publications.

The hypothesis of a study, the results of which are presented in this paper, is the existence of differentiation between the current levels of sectoral concentration and regional specialization of investments in fixed assets of enterprises and organizations. The study was aimed at analyzing the current levels of sectoral concentration and regional specialization of investment flows in fixed assets of enterprises and organizations operating in different industries and located in different regions of the Russian Federation.

The following was accomplished during the study:

- official statistics describing the volume of investments in fixed assets by various industries and federal municipalities were accumulated;

- indices of sectoral concentration of investments in fixed assets were defined;

- indices of regional specialization of investments in fixed assets were defined;

- the current concentration of investments in fixed assets of enterprises and organizations operating in major industries was comparatively analyzed;

- specialization of investments in fixed assets of enterprises and organizations operating in federal municipalities was comparatively analyzed;

- contributions to the concentration and specialization indices were analyzed.

MATERIALS AND METHODS OF RESEARCH

The article deals with investments in fixed assets of enterprises and organizations engaged in both the production of goods and the provision of services. However, the paper focuses investments in the following major industries:

- agriculture, hunting and forestry (1);

- fishing, aquaculture (2);

- mining (3);

- manufacturing (4);

- production and distribution of electricity, gas and water (5);

- construction (6);

- wholesale and retail trade, repair of motor vehicles, motorcycles, household goods and personal items (7);

- hospitality (hotels and restaurants) (8);

- transport and telecom (9);

- financial operations (10);

- real estate operations, rent (11);

- public administration (12);

- education (13);

- healthcare and social services (14);

RESULTS OF THE STUDY

The study was based on the concentration and specialization dissimilarity indices proposed by P. Krugman [13, 14]. As the current experience demonstrates, these indices can be effectively used for comparative analysis of industries and regions, respectively. His dissimilarity indices for concentration and specialization can be determined based on various indicators: investments, headcount (number of employees), gross output, main production facilities.

Krugman's dissimilarity indices for concentration (KDIC) and specialization (KIDS) regarding capital investments are relative indicators and can be used for comparing intersectoral and spatial (regional) rates of investment, respectively. The following formulas were used for calculating these indices, which characterize investments in fixed assets of enterprises and organizations from 14 key industries and federal municipalities:

$$KDIC_j = \sum_{i=1}^{r} \left| s_{ij}^c - s_i \right| = \sum_{i=1}^{r} \left| \frac{z_{ij}}{z_j} - \frac{z_i}{z} \right|, \qquad (1)$$

$$KDIS_i = \sum_{j=1}^{m} \left| s_{ij}^s - s_j \right| = \sum_{j=1}^{m} \left| \frac{z_{ij}}{z_i} - \frac{z_j}{z} \right|, \qquad (2)$$

where i - region

r - total number of regions;

j - industry;

m - total number of industries;

s_{ij}^c - investments per j industry and i region, % of country's total investments in relevant industry;

s_i - investments per i region, % of country's total investments;

s_{ij}^s - investments per j industry in i region, % of total investments in relevant region;

s_j - investments per j industry, % of country's total investments;

z - country's investments, bRUB;

483

z_j - country's investments per j industry, bRUB;

z_i - investments per i region, bRUB;

z_{ij} - investments per j industry in i region, bRUB.

Krugman's dissimilarity index for concentration (KDIC) enables to determine the rate of concentration of investments in enterprises and organizations operating in various industries. Thus, this index is calculated for each industry. It represents the totality of all elements, each of which describes how the share of investments made in fixed assets of enterprises and organizations located in each region and operating in a particular industry differs from the share of investments the relevant region accounts for in the country's total investments. The value of this element is minimal (close to zero), when the values of s_{ij}^c and s_i are similar, i.e. the share of investments in fixed assets of enterprises and organizations operating in the relevant industry in a particular region is similar to the national average. And, conversely, the highest values of these elements occur in cases where the share of investments in enterprises and organizations operating in the relevant sector in a particular region to a maximum extent differs from the national average.

Krugman's dissimilarity index for specialization (KDIS) allows to determine the rate of specialization of investments in fixed assets of enterprises and organizations, which is typical for each region of Russia. This index shows the extent to which the share of investments in different industries of a particular region differs from the share of investments made in the relevant industries countrywide. It represents the totality of elements describing how different s_{ij}^s and s_j are.

In consideration of the foregoing, the lowest values of KDIC and KDIS can be close to 0 in cases when the structure of sectoral concentration and regional specialization is identical to the national one. The highest values of KDIC and KDIS can be close to 2 if the investment structure in an industry (region) is absolutely different from the national one.

The data sets accumulated during the research were based on statistical information on 14 industries in each federal municipality. The information about aggregate investments made in fixed assets in 2014, which is presented in the report "Russian regions" published by the Federal

state statistics agency [9], was used as source data. Investments in fixed assets of enterprises and organizations were considered without taking into account small enterprises and private entrepreneurs (i.e. self-employed individuals, cf. sole traders), since their share in the overall investments is not large (less than 1%).

For the avoidance of double counting, data on the autonomous districts was not used. A fragment of the source data set reflecting investments in fixed assets by four industries in the country as a whole and 6 regions is presented in table 1. The industries in Table 2 are listed in the numerical order assigned to them above.

Table 1

Fixed capital investments in Russia and its regions, mRUB

	Total	Including by industry				
		1	2	3	4	…
Russian Federation	10376821,0	330442,9	11575,4	2054152,2	1798140,3	…
Belgorod region	74745,8	0,12713	0	0,02892	0,05683	…
Bryansk region	49783,4	0,49025	0	0	0,03641	…
Vladimir region	53859,8	0,00008	0	0,19317	0,25321	…
Voronezh region	161718,5	0,06284	0	0,19619	0,01178	…
Ivanovo region	18590,1	0,01151	0	0	0,04251	…
Kaluga region	79957,5	0,02685	0	0,19531	0,42670	…
…	…	…	…	…	…	…

Source: Federal State Statistics Agency.

The first part of this study is devoted to the assessment of sectoral concentration

Krugman's concentration indices were calculated per 14 industries according to the formula (1). The calculation results are presented in Table 2.

Table 2

Krugman's concentration indices by industry

Number	Industry	Index value
1	agriculture, hunting and forestry	0,91
2	fishing, aquaculture	1,19
3	mining	1,03
4	manufacturing	0,67
5	production and distribution of electricity, gas and water	0,57
6	construction	0,78
7	wholesale and retail trade, repair of motor vehicles, motorcycles, household goods and personal items	0,71
8	hospitality (hotels and restaurants)	1,23
9	transport and telecom	0,43
10	financial operations	0,71
11	real estate operations, rent	0,49
12	public administration	0,72
13	education	0,48
14	healthcare and social services	0,46
	Average	0,74

Source: This table and further tables have been developed by the author hereof.

On the basis of the indices' values given in Table 2, a comparative analysis of the concentration of investments in fixed assets of enterprises and organizations for each of the considered industries was carried out.

The highest level of concentration of investments in fixed assets is observed in such industries as hospitality (hotels and restaurants) (1.23), fishing and aquaculture (1.19). The indices above the national average are observed in such industries as mining (1.03), as well as agriculture, hunting and forestry (0.91). It is these 4 industries that are characterized by the highest levels of concentration of investments in fixed assets.

Krugman's concentration indices for investments in fixed assets of enterprises and organizations representing such 5 industries as construction, manufacturing, wholesale and retail trade, financial operations and public administration are close to the national average. The concentration indices of other 5 industries are lower than the national average. This seems reasonable, since it is the enterprises and organizations representing such industries as transport and communications, healthcare and social services, education, real estate operations, as well as the generation and distribution of electricity, gas and water that have become most prevalent in the vast majority of Russian federal municipalities.

Apart from comparing concentration indices by industry, analyzing regional contributions to the indices for certain industries is of considerable interest. The highest contributions to the concentration index for investments in fixed assets of enterprises and organizations related to fishing and aquaculture are observed in Murmansk region (0.49) and Sakhalin region (0.16). Investments in Tyumen region (0.36) provide a significant contribution to the mining index. The highest contribution to the concentration index for investments in hospitality industry (hotels and restaurants) is typical for Krasnodar region (0.52). Thus, the high level of concentration inherent to investments in such industries as hospitality (hotels and restaurants), fishing and aquaculture, as well as mining, was ensured in 2014 by investments in the abovementioned federal municipalities. However, for such industries as fishing and aquaculture, as well as hospitality (hotels and restaurants), the relevant contributions amounted to more than a half of the indices, whereas for mining industry – more than a third.

It should be noted that significant contributions to the concentration indices for construction industry take place in the city of St. Petersburg (0.18) and Leningrad region (0.12).

For other industries, regional contributions to the concentration indices are not large.

The second part of this study deals with regional specialization

Krugman's specialization indices (KDIS) were calculated for federal municipalities according to the formula (2). Based on the obtained index values, a comparative analysis of the level of specialization of investments in fixed assets of enterprises and organizations in each of the federal municipalities was carried out.

Table 3 below shows 10 highest and 10 lowest values of Krugman's specialization indices for federal municipalities.

Table 3

A fragment of the specialization index calculations (KDIS)

Federal municipality	KDIS	Federal municipality	KDIS
Kalmyk Republic	1,20720	Irkutsk region	0,29306
Chechen Republic	1,15934	Bashkortostan Republic	0,30189
Sakhalin region	1,06101	St. Petersburg	0,31588
Magadan region	1,03714	Krasnoyarsk region	0,32413
Ingush Republic	1,03526	Buryatia Republic	0,36060
Republic of North Ossetia-Alania	0,96238	Ivanovo region	0,36167
Kabardino-Balkaria Republic	0,93242	Belgorod region	0,40593
Tyumen region	0,92798	Penza region	0,41267
Komi Republic	0,91509	Karelia Republic	0,41399
Kaluga region	0,91272	Khabarovsk region	0,45382

The highest values of regional specialization indices are observed in two cases. The first one is due to the fact that in a relevant federal municipality most investments are made in enterprises and organizations representing one certain industry. For instance, investment in transport and telecom in the Republic of Kalmykia is 0.54 of the total index value of 1.21. In the index for Sakhalin region, which is 1.06, the investment in fixed assets for mining is 0.52. A similar trend is observed in Magadan region (0.41 out of 1.04) and Tyumen region (0.46 out of 0.93). A significant contribution (0.43 out of 0.92) is typical for investments in manufacturing in Kaluga region. In addition, the specialization index has a high value in regions with small investments in enterprises and organizations across several industries. Examples include Komi Republic, Chechen Republic, Ingush Republic, North Ossetia-Alania, Kabardino-Balkaria.

Small values of the indices of specialization of investments in fixed assets of enterprises and organizations (as shown in the fourth column of Table 3) occur in those federal municipalities where the sectoral structure of investments is similar to the national one. The

lowest index values are observed in the federal municipalities indicated in the third column of Table 3.

The indices of regional specialization in other regions of Russia range from 0.45 to 0.91. However, in some regions there are significant contributions to the indices for certain industries. For instance, specialization of investments in agriculture and forestry is observed in Bryansk and Pskov regions, as well as in the Republic of Mari El. In the Republic of Khakassia there is a high level of investment in power generating enterprises.

It should be noted that the indices of regional specialization in the regions are not very high, since even the highest value (1.21) in the Republic of Kalmykia is below the maximum possible value of 2.

CONCLUSION

By and large, the analysis confirmed the existence of differentiation of the current levels of sectoral concentration and regional specialization of investments in fixed assets of enterprises and organizations, that is to say, the hypothesis was validated.

Sectoral and regional analysis of investments based on the calculated indices allowed to assess the achieved level of differentiation of investments, to identify the most significant contributions to sectoral concentration and regional specialization, as well as to perform a comparative analysis of investment flows. As the studies have shown, this wide range of topical issues may be addressed by using the methodology proposed by P. Krugman.

The study results containing scientific novelty are as follows:

- we have analyzed the existing levels of sectoral concentration and regional specialization of investments in fixed assets of enterprises and organizations across key industries and federal municipalities;

- it is shown that the highest level of concentration is observed in industries such as hospitality (hotels and restaurants), as well as fishing and aquaculture. A significant concentration of investments also takes place among mining and agricultural enterprises and organizations;

- it is shown that in such industries as transport and telecom, health and social services, education, real estate operations, as well as the generation and distribution of electricity, gas and water, the level of concentration is the lowest, i.e. enterprises and organizations operating in these industries are prevalent in all federal municipalities;

- the high values of regional specialization indices occur for two reasons: 1) in some federal municipalities (Tyumen, Kaluga, Sakhalin, Magadan regions and the Republic of Kalmykia) most investments are made in certain sectors, as well as 2) insignificant investments are made in a number of industries (the Republic of Komi and the Republic of the North Caucasus Federal District).

Consequently, the following suggestions and recommendations may be formulated:

- it seems reasonable to use the calculation of concentration and specialization indices when monitoring investments in fixed assets of enterprises and organizations by regions and industries;

- the study of year-on-year dynamics of sectoral concentration and regional specialization is of interest;

- the proposed methodology can be used to assess the level of concentration and specialization in local municipalities as well.

The economic and mathematical models developed in this study can be widely used to monitor and diagnose the level of investment in regions and industries, as well as to transform the national policy in order to increase the return on fixed capital of enterprises and organizations. The methodological significance of this study consists in the development of tools describing the investment processes in Russia, as well as in the assessment of the current level of their territorial and sectoral differentiation. Further study should be based on the data describing investments at the local municipality level.

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