

Artículo de investigación

Specialization and concentration of investments in fixed assets of enterprises: information from Russia

Специализация и концентрация инвестиций в основной капитал предприятий:
информация из России

Especialización y concentración de inversiones en activos fijos de empresas:
información de Rusia

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Abstract

The purpose of this study was to assess the current levels of sectoral concentration and regional specialization of investments in Russia using Krugman's Indexes of concentration and specialization. The study used data from the official statistical observation of activities of all Russian enterprises for the year 2014, representing 78 Russian regions and 14 types of economic activity. 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. A high level of concentration was observed in hospitality, fishing and aquaculture sectors. The regional specialization is relatively small in Russia. These results could be of interest to entrepreneurs when choosing the type of sectors. The economic models developed in this study can be widely applied to monitor and diagnose the level of investment, as well as to transform the national policy in order to increase the return on fixed capital investment of enterprises. 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.

Аннотация

Целью настоящего исследования явилась оценка современных уровней отраслевой концентрации и региональной специализации инвестиций в России с использованием индексов концентрации и специализации Кругмана. В исследовании использованы данные официального статистического наблюдения за деятельностью всех российских предприятий за 2014 год, представляющих 78 регионов России и 14 видов экономической деятельности. Рассчитанные на основе отраслевого и регионального анализа инвестиций показатели позволили оценить сложившийся уровень инвестиционной дифференциации, выявить наиболее значимые вклады в отраслевую концентрацию и региональную специализацию, а также провести сравнительный анализ инвестиционных потоков. Высокий уровень концентрации наблюдался в таких видах деятельности, как гостиницы и рестораны, а также рыболовство. Региональная специализация в России относительно невелика. Эти результаты могут быть интересны предпринимателям при выборе вида экономической деятельности. Разработанные в данном исследовании экономические модели могут найти широкое применение для мониторинга и диагностики уровня инвестиций, а также для трансформации

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Keywords: investment, sectoral concentration, regional specialization, types of economic activity, enterprises.

национальной политики с целью повышения отдачи от инвестиций в основной капитал предприятий. Методологическая значимость данной работы заключается в разработке инструментария описания инвестиционных процессов в России, а также в оценке современного уровня их территориальной и отраслевой дифференциации.

Ключевые слова: инвестиции, отраслевая концентрация, региональная специализация, виды экономической деятельности, предприятия.

Resumen

El propósito de este estudio fue evaluar los niveles actuales de concentración sectorial y la especialización regional de las inversiones en Rusia utilizando los índices de concentración y especialización de Krugman. El estudio utilizó datos de la observación estadística oficial de las actividades de todas las empresas rusas para el año 2014, que representan 78 regiones rusas y 14 tipos de actividad económica. Un análisis sectorial y regional de inversiones calculado a partir de índices nos ha permitido evaluar el nivel alcanzado de diferenciación de inversiones, identificar las contribuciones más significativas a la concentración sectorial y la especialización regional, así como realizar un análisis comparativo de los flujos de inversión. Se observó un alto nivel de concentración en los sectores de hostelería, pesca y acuicultura. La especialización regional es relativamente pequeña en Rusia. Estos resultados podrían ser de interés para los empresarios a la hora de elegir el tipo de sectores. Los modelos económicos desarrollados en este estudio pueden aplicarse ampliamente para monitorear y diagnosticar el nivel de inversión, así como para transformar la política nacional a fin de aumentar el rendimiento de la inversión de capital fijo de las empresas. La importancia metodológica de este trabajo consiste en el desarrollo de herramientas que describen los procesos de inversión en Rusia, así como en la evaluación del nivel actual de su diferenciación territorial y sectorial.

Palabras clave: inversión, concentración sectorial, especialización regional, tipos de actividad económica, empresas.

Introduction

This paper deals with the current structure of investments in fixed assets of enterprises, as broken down by constituent regions of the Russia and types of economic activity. Such study should improve the management of economic development and optimize the distribution of investments across the Russian economy. Russian economic policy investments in fixed assets of enterprises regulates the Federal Law (1999). Structure of fixed capital investments in enterprises 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%). At present, there is an urgent need for the distribution of investments to be optimized. Taking into account the different sizes of regions, the existing climatic conditions, the objective and subjective specificity of the development of individual industries, it is imperative to analyze

the peculiarities of fixed capital investment distribution enterprises.

The purpose of the study is to assess the current levels of sectoral concentration and regional specialization of investments in fixed assets of enterprises in the developing market economy of Russia with the use of Krugman Indexes. Understanding regional and activity concentration can help policy development in relation to the promotion and regulation of investments in fixed assets of enterprises.

This paper comprises of six sections. The literature review section synthesizes foreign and Russian studies on regional concentration and sectoral specialization. In the third section, the paper describes indexes developed by Krugman for the evaluation of industry concentration and sectoral specialization. This section also explains the data sources that were used in this paper. In section four presents the results of the analyses

conducted using the Krugman indexes of investments in fixed assets of enterprises. Discussion of results presents in section five. The conclusion section summarizes the results, highlights implications of the results and proposes future research relating to the study.

Literature review

The issues of regional specialization and industry concentration are explored by researchers in the context of analyzing the process of economic convergence and its effects in different countries (Hallet, 2002; Cornett, 2002; Marelli, 2007; Ezcurra et al., 2006).

Isard (1960) published a seminal paper on the spatial location of production. Fie proposed an indicator of concentration level. Fujita et al. (1999) describe the problems of the spatial structure of the economy. Animitza et al. (2014) discuss various approaches to the processes of development of productive forces in time and space proposing two approaches. The first approach is based on the distribution of productive capacity according to geographic, economic, ethnographic, geopolitical, and other conditions. The second approach examines the distribution of productive capacity from the standpoint of economic activity.

Minakir and Demianenko (2010) examine the role of economic agents, which according to the authors determine the character, scale, and dynamics of regions' development. They explain the important role played by economic agents in interacting with various institutions.

Belov (2012) and Kazakov (2010) discuss methodological issues of modeling for processes of concentration and specialization, as well as how analytical tools can be used.

Specific analyses of concentration and specialization are published in several papers. Some studies (e.g., Rastvortseva et al., 2012; Rastvortseva & Kuga, 2012) discuss the concentration and specialization of industrial production. Others present examples of analyses by regions and individual countries (e.g., Aiginger & Rossi-Hansberg, 2006; Kuroiwa, 2012; Midelfart-Knarvik et al., 2002; Goschin et al., 2009). Ezcurra and Arzoz (2007) document the evolution of territorial disproportions in the activities of 39 regions of Central and Eastern Europe in the period from 1992 to 2001. Their results show an overall reduction in regional inequality over the study period. Suedekum (2006) provides an analysis of concentration and specialization in Germany after its unification in

1990. Goschin et al. (2009) measured the concentration of industries and regional specialization by the gross value added data. Mongelli et al. (2016) established that in European countries specialization is high in the manufacturing enterprises and substantially lower in the case of services.

Moga and Antohi (2013) discuss issues of concentration and specialization of agricultural production in Romania. Ma et al. (2014) examined the directions of regional specialization of China's agricultural production for 2003-2011 and found that growing economic freedom, accompanied by intensified internal and external competition, has driven the regions in China to adjust agricultural production structures according to comparative advantages. Neagu and Neagu (2016) conclude that Romanian regions become less specialized, while industries become slightly more concentrated.

Palan (2010) compared nine specialization indexes, discussing their properties, strengths and weaknesses. He explains that the relative specialization measured by the Krugman Dissimilarity Index enables a comparison of regions, and it is the best among the indexes he compared. Krieger-Boden et al. (2008) provide an assessment of regional specialization and concentration patterns in European countries based on Krugman's index for relative specialization and concentration. In paper Kiseleva et al. (2019) studied the level of industry concentration and regional specialization small and medium enterprises in Russia.

In recent years in Russian research specific attention has been paid to the problem of investment formation. In particular, we can point out the studies conducted by a think tank operating under the Government of the Russian Federation (Dynamics of investment activity, 2015), as well as the articles (Utkin, 2016; Novikov and Prosvirina, 2019). They provide a comparative analysis of the existing rates of investments in Russia, the dynamics of investments by industry and region. The article (Lygina et al., 2015) 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 (Berezinskaya, 2017), 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. However, concentration

and specialization of investments in fixed assets of enterprises, in Russia have not been considered until recently in scientific publications, despite the significance of this topic. To promote the development of investments in fixed assets, it is necessary to understand how investments are distributed among the regions and types of economic activity. So far, such an analysis has not been carried out.

Research methods and design

An analysis of regional specialization highlights the distribution of fixed capital investments in enterprises according to types economic activity that enterprises engage in within a given region. The sectoral concentration reflects the distribution of fixed capital investments in enterprises across different regions. A region is considered to be highly specialized if that region has a dominant of investments in enterprises working in one or few types of economic activity. High sectoral concentration investments corresponds to the cases where enterprises a given type of economic activity occurs in a small number of regions. A low sectoral concentration occurs when investments in enterprises involved in a given type of activity shows a more or less equal distribution among the majority of the regions.

The methods of analyzing regional specialization and sectoral concentration to be used in a study depend on the purpose of the investigation, input data availability and specific properties of the indicators.

This study adopts the Krugman dissimilarity index for analyzing regional specialization and sectoral concentration of investments in enterprises. As the Krugman's concentration and specialization Indexes provides relative measures of the underlying constructs, they enable comparative evaluation investments of various regions and types of economic activity. The analyses are conducted using regional data separately for each type of economic activity. Krugman (1991) created an index based on data on specialization in four US regions and four large European countries for the analyses of regional concentration. This index can be used effectively for the comparative analysis of economic activities and regions. The Krugman index can be calculated on such indicators as number of employees, number of enterprises, the volume of production and the value of investments in fixed assets.

In our calculations, we used the investments in fixed assets, grouped by regions and sectors.

The study uses data on the official statistical observation of activities in all Russian enterprises in 2014 (Federal service of state statistic, 2016). The database includes a large array of different information on the activities of businesses. The study is based on data on 78 regions of Russia and all types of economic activity (14).

The article deals with investments in fixed assets of enterprises engaged in both the production of goods and the provision of services in the following sectors:

- 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).

This study uses Krugman concentration index (KDIC) to measure the level concentration all types of economic activity and Krugman specialization index (KDIS) to measure the level of specialization of fixed capital investments in enterprises within regions of Russia. The two indexes are defined

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

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

where, i - region (from 1 to 78);

j - type of economic activity (from 1 to 14);

s_{ij}^c - concentration ratio: the share of the region i in the total national investments in enterprises of type economic activity j ;

S_{ij}^s - specialization ratio: the share of the type economic activity j in the total investments in enterprises of region i ;

S_i - share of the region i in the total national investments in enterprises;

S_j - share of the type economic activity j in the total national investments in enterprises;

Z_{ij} - investments in enterprises in the region i and type of economic activity j ;

Z_i - total investments in enterprises in the region i ;

Z_j - national investments in enterprises in type of economic activity j ;

Z - total investments in all Russian enterprises.

KDIC and KDIS are relative indicators and can be used for inter-sectoral and regional comparisons. The lowest values of KDIC and KDIS is zero and occurs in cases where the structures of sectoral concentration and regional specialization are identical to the mean value for the country. The highest values of the indexes is two.

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.

During the research the following tasks were solved:

- official statistics describing the volume of investments in fixed assets all Russian enterprises by various types of economic activity and regions;
- indices of sectoral concentration of investments in fixed assets enterprises were defined;
- indices of regional specialization of investments in fixed assets were defined;
- current concentration of investments in fixed assets of enterprises operating in various types of economic activity was comparatively analyzed;
- specialization of investments in fixed assets of enterprises operating in regions was comparatively analyzed;
- contributions to the concentration and specialization indices were analyzed.

Results calculation of KDIC and KDIS

The calculation of KDIC concentration was carried out according to the formula (1). The results of this calculation are shown in Table 1.

Table 1. Krugman's concentration indices by type of economic activity

Type of economic activity	KDIC
hospitality (hotels and restaurants)	1.23
fishing, aquaculture	1.19
mining	1.03
agriculture, hunting and forestry	0.91
construction	0.78
public administration	0.72
wholesale and retail trade	0.71
financial operations	0.71
manufacturing	0.67
production and distribution of electricity, gas and water	0.57
real estate operations, rent	0.49
education	0.48
healthcare and social services	0.46
transport and telecom	0.43
Average	0.74

On the basis of the indices' values given in table 1, a comparative analysis of the concentration of investments in fixed assets of enterprises 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 - 1.23, fishing and aquaculture - 1.19 (Korneyko et al, 2018). 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 representing such 5 types of economic activity as construction, manufacturing, wholesale and retail trade, financial operations and public administration are close to the national average. The concentration indices of other 5 types of economic activity are lower than the national average. This seems reasonable, since it is the enterprises 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 regions. 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 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 regions. 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 calculation of the KDIS was performed for each of the 78 regions of the Russia in accordance with the formula (2). Table 2 lists the values of the KDIS calculated for investments in fixed assets of enterprises all regions.

Table 2. Krugman's specialization index by regions

Region of Russia	KDIS	Region of Russia	KDIS	Region of Russia	KDIS
Belgorod region	0.41	Pskov region	0.87	Samara region	0.50
Bryansk region	0.81	St-Peterburg	0.32	Saratov region	0.47
Vladimir region	0.62	Adygeya republic	0.76	Ulyanovsk region	0.58
Voronezh region	0.73	republic of Kalmykia	1.21	Kurgan region	0.62
Ivanovo region	0.36	Krasnodar territory	0.69	Sverdlovsk region	0.62
Kaluga region	0.91	Astrakhan region	0.77	Tyumen region	0.93
Kostroma region	0.57	Volgograd region	0.67	Chelyabinsk region	0.64
Kursk region	0.61	Rostov region	0.61	Altai republic	0.80
Lipetsk region	0.61	republic of Dagestan	0.76	republic of Buryatia	0.36
Moscow region	0.57	Ingush republic	1.04	republic of Tuva	0.88
Orel region	0.52	Kabardino-Balkar republic	0.93	republic of Khakassia	0.82
Ryazan region	0.73	Karachay-Cherkess republic	0.65	Altai territory	0.57

Smolensk region	0.62	republic Of North Ossetia – Alania	0.96	Zabaikalsky territory	0.77
Tambov region	0.49	republic of Chechnya	1.16	Krasnoyarsk region	0.32
Tver region	0.64	Stavropol territory	0.50	Irkutsk region	0.29
Tula region	0.84	republic of Bashkortostan	0.30	Kemerovo region	0.64
Yaroslavl region	0.62	republic of Mari El	0.76	Novosibirsk region	0.56
Moscow	0.76	republic of Mordovia	0.58	Omsk region	0.53
republic of Karelia	0.41	republic of Tatarstan	0.64	Tomsk region	0.53
republic of Komi	0.92	Udmurt republic	0.55	republic of Sakha (Yakutia)	0.53
Arkhangelsk region	0.87	Chuvash republic	0.58	Kamchatka territory	0.58
Vologda region	0.60	Perm region	0.55	Primorsky territory	0.51
Kaliningrad region	0.62	Kirov region	0.64	Khabarovsk territory	0.45
Leningrad region	0.71	Nizhny Novgorod region	0.63	Amur region	0.74
Murmansk region	0.75	Orenburg region	0.59	Magadan region	1.04
Novgorod region	0.72	Penza region	0.41	Sakhalin region	1.06

The average value of the KDIS for the regions – 0.41. Ten largest values of the KDIS in regions: Kalmyk republic (1.21); Chechen republic (1.16); Sakhalin region (1.06); Magadan region (1.04); Ingush republic (1.04); republic of North Ossetia-Alania (0.96); Kabardino-Balkaria republic (0.93); Tyumen region (0.93); Komi republic (0.92); Kaluga region (0.92). Ten smallest values of the KDIS in regions: Irkutsk region (0.29); Bashkortostan republic (0.30); St. Petersburg (0.32); Krasnoyarsk territory (0.32); Buryatia republic (0.36); Ivanovo region (0.36); Belgorod region (0.41); Penza region (0.41); Karelia republic (0.41); Khabarovsk territory (0.45).

The highest values of regional specialization indices are observed in two cases. The first one is due to the fact that in a relevant region most investments are made in enterprises representing one certain industry. For instance, investment in transport 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 0.91) 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 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 (as shown in the fourth column of Table 2) occur in those federal municipalities where the sectoral structure of investments is similar to the national one. The lowest index values are observed in regions indicated in the third column of Table 2. 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.

Discussion of results

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 reason most investments are made in one sector (Tyumen, Kaluga, Sakhalin, Magadan regions and the Republic of Kalmykia).

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.

Conclusion

The article presents the relevant and original results of the assessment of industry concentration and regional specialization based on the Krugman indices using data of fixed capital investments in enterprises in the

economy's in Russia. They include the confirmation of the Krugman indices expediency, calculated on the basis of fixed capital investments in enterprises, assessment of the existing levels of industry concentration and regional specialization.

The results of this study can be used in subsequent research on the distribution investments in enterprises by regions and industries. In addition, the obtained information can be of interest to entrepreneurs (especially beginners). On its basis, businesspeople can conclude which types of activities prevail in a particular region, as well as choose the industry in which they intend to produce goods or provide services. The research findings can be used in the educational process of higher education institutions. The results can be useful to the federal and regional authorities in developing policies related to supporting the investments in enterprises development in various Russian regions and different economy sectors to facilitate the appropriate allocation of resources.

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 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. 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. Further study should be based on the data describing investments at the local municipality level.

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