Artículo de investigación

Specialization and concentration of small and medium enterprises employees: Russian data

Специализация и концентрация работников малых и средних предприятий: российские данные

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Abstract

Goal of study is to assess the current level of industry concentration and regional specialization small and medium enterprises in Russia using Krugman indices. The study uses official statistics for 2016, describing the number of enterprises employees located in 80 regions and specializing in 13 types of economic activity. In this research they determine the indices values of enterprises industry concentration and regional specialization. Authors also carry out comparative analysis of changes in the values of these indices for the period from 2010 to 2016. They also establish the patterns characteristic of industry concentration and regional specialization.

Keywords: Small and medium enterprises, Regional specialization, Industry concentration, The Krugman índices.

Аннотация

Целью исследования является оценка текущего уровня отраслевой концентрации и региональной специализации малых и средних предприятий России с использованием индексов Кругмана. В исследовании используется официальная статистика за 2016 год, описывающая численность работников предприятий, расположенных в 80 регионах и специализирующихся на 13 видах экономической деятельности. В данном исследовании определены значения индексов отраслевой концентрации и региональной специализации. Приводится сравнительный анализ изменений значений этих показателей за период с 2010 по 2016 год. Установлены закономерности, характерные для концентрации производства малых и средних предприятий и их территориальной специализации.

Ключевые слова: малые и средние предприятия, региональная специализация, отраслевая концентрация, индексы Кругмана.

Introduction

Small and medium enterprises (SMEs) have been developing in Russia since 1991. Until that time, in the USSR, economic activity was carried out only by the state and cooperative enterprises. There are currently 5.6 million SMEs in Russia, employing 18 million people. SMEs produce about 20% of Russia's gross domestic product. The development strategy of this economy sector for 2030 (Strategy for the Development of Small and Medium Entrepreneurship, 2016) predicts

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the 40% increase in the SMEs` share in the country`s gross domestic product. Thus, modern Russia sees a significant need for the accelerated development of SMEs.

The criteria characterizing SMEs in Russia are defined in the Federal Law (July 24, 2007 № 209) "Development of Small and Medium Enterprises in the Russian Federation". It stipulates that small and medium enterprises are both legal entities and individual entrepreneurs with no more than 100 employees (small enterprises) and from 101 to 250 people (medium enterprises).

As shown by the European Union and the USA experience, one should note that small and medium enterprises constitute one of the main factors of regional development, especially in economically underdeveloped regions, and create conditions for the restructuring of their economies (Acs et al., 2008; Baumol, 2004; Decker et al., 2014; Novikov, 2018; Pinkovetskaia et al., 2019). In addition, there is a significant differentiation of SMEs production amounts, depending on their industry specialization (Minakir and Demianenko, 2010; Novikov and Veas Iniesta, 2018). In order to facilitate the SMEs development, it is vital to comprehend how these enterprises are distributed among the country regions and the types of economic activities they are oriented to.

Consequently, in recent years the study of the distribution of SMEs by region and type of economic activity has become one of the most relevant issues in the development of the business sector in the regions, especially in the context of transformation processes.

Literature Review

One of the first publications dealing with the spatial concentration and dispersion of production in the regions was Isard (1960). In his study he proposed concentration as an indicator for assessing the level of spatial distribution. In 1991 in his work Krugman (1991) suggested using indices to describe the specialization and concentration of production and gave examples of the corresponding calculations for the four regions of the United States and the economies of four major European countries. In a later book (Fujita et al., 1999), written in collaboration with M. Fujita and A. Venables, the author analyzed the issues of the economy spatial structure. Problems of regional specialization and sectors concentration were dealt with by a number of researches (Cornett, 2002; Ezcurra et al., 2006;

Hallet, 2002; Marelli, 2007) in the context of analyzing the process of economic convergence and its consequences in different countries.

The following publications (Aiginger and Rossi-Hansberg, 2006; Economic Integration, 2012; Midelfart-Knarvik et al., 2002) provide calculations of the concentration level and specialization of production by region and individual countries. The article by Escurra and Arzoz (Escurra and Arzoz, 2007) shows the evolution of territorial disproportions in production activities in 39 countries of Central and Eastern Europe from 1992 to 2001. The results of the analysis shows the tendency to reduce the existing imbalances over the specified period. Krieger-Boden, Morgenroth and Petrakos (Krieger-Boden et al., 2008) analyze the impact of regional European integration on structural changes, based on an assessment of the laws of relative specialization and concentration according to the Krugman index.

As noted by Mongelli, Reinhold and Papadopoulos (Mongelli et al., 2016), the European Union countries have high concentration of industrial enterprises, while a substantially lower concentration is characteristic of the service sector. Sudekum (2006) presents an analysis of the production concentration and specialization in Germany after country`s re-unification. Goschin, Constantin, Ileanu (Goschin et al., 2009) measure sectoral concentration and regional specialization on the basis of gross value added data by industry and region, presented by the official statistics of Romania. Other Romanian authors (Moga and Antohi 2013) cover the issues of concentration and specialization in a more specific sense, namely, the case of agricultural production. The study by Ma, Steinbach and Wu (2014) is devoted to evaluating the regional specialization of production in China (2003-2011). It concludes that the growth of economic freedom, accompanied by increased internal and external competition, encourages Chinese regions to change the structure of agricultural production based on the expected increase in efficiency. The research carried out by O. Neagu and M. Neagu (2016) proves that the measurement of regional specialization and sectoral concentration based on the Krugman indices is able to provide a complete picture of the production distribution in the regional and sectoral aspects. Suedekum (2006) compares nine different indices of specialization, their properties, strengths and weaknesses. At the same time, the work concludes that the use of

relative Krugman indices makes it possible to compare different regions.

Russian authors also address the issues of industry concentration and regional specialization, the relevant researches include the following publications: in paper (Animitza et al., 2014) discuss academic concepts that expound the production development in time and space. The authors propose two research approaches. The first direction is based on the study of the regional production distribution, which is the result of multiple geographical, natural, demographic, ethnographic, geopolitical and other factors. The second direction considers distribution of production in terms of organization and implementation of economic activity.

In the article (Minakir and Demianenko, 2010) deals with the role of economic agents, which form the productive forces in specific regions of Russia and determine their social and economic development in the process of interaction with various institutions.

Belov (2012) and Kazakov (2010) discuss some aspects and methods of developing models that describe patterns of concentration and specialization, and also analyze possible modeling tools.

Rastvortseva and co-authors conduct calculations on concentration and specialization (Rastvortseva et al., 2012; Rastvortseva and Kuga, 2012). They focus on the sectoral concentration and regional specialization of industrial enterprises.

In general, the analysis of academic works shows the feasibility of using the Krugman indices when conducting assessments of industry concentration and regional specialization. According to most researchers, the advantages of these indices are the completeness of information about the objects of study and the possibility of their implementation for comparative analysis by type of economic activity and various regions.

One should note that until recently unreasonably insufficient attention has been paid to the concentration and specialization of small and medium enterprises in Russia, given the significance of this issue. Only works by Sharigin, Krotov (2014) and Pinkovetskaia (2016) can be mentioned in this regard.

Research methodology, design and data

The aim of the study, which results are presented in this article, is to assess the levels of SMEs sectoral concentration and regional specialization using the corresponding Krugman indices. The research completes the following objectives:

a) determining the sectoral concentration values indices for all kinds of economic activity typical for the economy`s small and medium enterprises;
b) defining the indices values of SMEs regional specialization in all regions of Russia; conducting the comparative study of changes in the values of concentration and specialization indices in 2016 compared to those of 2010;
c) establishing the patterns that are characteristic of SMEs industry concentration and regional specialization in our country.

The level of sectoral concentration reflects the distribution of SMEs specializing in a specific type of economic activity across different regions. A high sectoral concentration of SMEs occurs when the considered type of economic activity is common in a small number of regions. Low sectoral concentration is observed in cases when specific activity SMEs are evenly distributed among most regions.

The level of regional specialization describes how the distribution of local SMEs by type of economic activity coincides with the overall distribution in the country. High specialization is characteristic of the regions where the sectoral structure of SMEs substantially differs from their country`s overall sectoral structure. Accordingly, a low level of sectoral specialization occurs in regions where the share of various economic activity SMEs closely coincides with similar overall shares in the country.

The method of assessing the levels of regional specialization and industry concentration depends on the study purpose, the availability of input data and the specific indicators properties. The Krugman indices are used in this study as relative indicators that allow comparative assessment of SMEs in various regions and types of economic activity. The study is based on the use of regional data for each type of economic activity.

The Krugman indices can be calculated by SMEs indicators such as the number of employees, the number of enterprises, the production volume

and the value of fixed assets. One should note that the use of some indicators seems inappropriate. Thus, the number of SMEs is affected by the level of regions` social and economic development. The SMEs production volume depends on wages, which considerably vary by region. The cost of SMEs fixed assets relies upon the transportation distances for equipment, machinery and building materials. Therefore, to ensure comparability of calculated indices, the preferred indicator is the number of employees in small and medium enterprises.

The study uses data from official statistics Federal service of state statistics (2016; 2010) of the Russian SMEs activity in 2016 and 2010. The databases include a large array of information on the activity of legal entities and individual entrepreneurs. The study is based on the data obtained from 80 Russian areas (republics, territories, regions) and provides data on all types of SMEs economic activity.

The research evaluates the values of the Krugman's concentration index (KDIC) for measuring the concentration level of SMEs in various economic activities and the Krugman specialization index (KDIS) for measuring the level of specialization in particular regions of Russia. The calculation formulas for these two indices are as follows:

$$KDIC_j = \sum_{i=1}^{80} \left| s_{ij}^c - s_i \right| = \sum_{i=1}^{80} \left| z_{ij}/z_j - z_i/z \right|, \tag{1}$$

$$KDIS_i = \sum_{j=1}^{13} \left| s_{ij}^s - s_j \right| = \sum_{j=1}^{13} \left| z_{ij}/z_i - z_j/z \right|, \tag{2}$$

i - region (1 to 80);

j - type of economic activity (1 to 13);

s_{ij}^c - - share of SMEs employees of the j - activity type located in region i, the total number of SMEs employees of the j - activity type in Russia as a whole;

s_i - share of SMEs employees located in region i, the total number of SMEs employees in Russia;

s_{ij}^s - share of SMEs employees specializing in the j - activity type and located in region i, the total number of SMEs workers in this region of Russia;

s_j - share of SMEs employees specializing in the j - activity type, the total number of SMEs employees in Russia;

z - number of employees in all small and medium enterprises in Russia, thousand people;

z_j - number of SMEs employees specializing in the j - activity type in Russia, thousand people;

z_i - number of SMEs employees located in region i, thousand people;

z_{ij} - number of SMEs employees located in region i specializing in the j - activity type, thousand people.

As stated above, the KDIC and KDIS indices values are relative indicators, they can be used for inter-sectoral and regional comparison. Note that the KDIC and KDIS values range from zero to two.

Results of the sectoral concentration indices calculation

Table 1 shows the values of 2016 and 2010 Krugman concentration indices for SMEs related to various types of economic activity.

Table 1
The Krugman concentration indices by economic activity

Type of economic activity	Value of the Krugman concentration index		Change (increase, decrease)
	2016	2010	
Agriculture, hunting and forestry	0.54	0.54	0.00
Fishing, fish farming	1.13	1.08	0.05
Mining	0.65	0.80	-0.15
Manufacturing industries	0.22	0.20	0.02
Production and distribution of electricity, gas and water	0.43	0.53	-0.10
Construction	0.13	0.13	0.00
Wholesale and retail	0.09	0.07	0.02
Hotels and restaurants	0.15	0.13	0.02
Transportation and communication	0.14	0.14	0.00
real estate transactions, rent	0.21	0.21	0.00
Education	0.25	0.26	-0.01
Health care and social services	0.19	0.25	-0.06
Other community, social and personal services	0.15	0.16	-0.01
Average value	0.33	0.35	-0.02

Table 1 data analysis shows that in 2016 the highest concentration of SMEs is observed in such activities as fishing and fish farming. It reaches 1.13, that is, a little more than half of the maximum possible value equal to 2. The values of the concentration index above the national average (0.33) are noted in such sectors as agriculture, hunting and forestry, mining, production and distribution of electricity, gas and water. All these four industries are connected to the production of goods. The obtained results, showing a high level of industry concentration in these industries, confirm the conclusion that was made in the study carried out by Devereux, Griffith and Simpson (2004). The authors of this study proved the link between the high industry concentration and the low level of technology development.

The values of the Krugman concentration index for nine types of economic activity in 2016 is less than the national average (0.33). Note that eight of these nine activities belong to the service sector. This trend is caused by the fact that the volume and structure of the services provided by SMEs is determined by population demands and is not associated with the characteristics of certain regions. The smallest index value, equal to 0.09, occurs in the wholesale and retail trade. This seems logical, since it is trade that is most characteristic of SMEs located in all regions of Russia.

Index values less than 0.2 are observed in the SMEs related to such economic activities as construction, hotels and restaurants, transport and communications, health care, as well as other community, social and personal services. These activities are typical for SMEs in most regions of our country. Interestingly, for the 2010-2016 period, health care is come in to the number of typical activities types, which indicates the spread of this activity type across the regions.

A comparison of the concentration index values for 13 types of economic activity according to the 2016 and 2010 data shows that there is an increase in the index values for 4 types of activity. The decrease in values is typical for 5 types of activity, the values did not change in 4 types. At the same time, there is the insignificant increase and decrease in the indices values for the period. Consequently, it is impossible to see the presence of stable trends towards a change in Russian SMEs concentration.

Results of regional specialization indices calculation

Table 2 shows the values of 2016 and 2010 Krugman specialization indices for SMEs located in each region of the country.

Table 2
The Krugman specialization indices for SMEs in Russian regions

Russian Federation Region	The Krugman specialization index value		Change (increase, decrease)
	2016	2010	
Belgorod Region	0.16	0.14	0.02
Bryansk Region	0.14	0.21	-0.07
Vladimir Region	0.22	0.18	0.04
Voronezh Region	0.26	0.17	0.09
Ivanovo Region	0.30	0.25	0.05
Kaluga Region	0.17	0.15	0.02
Kostroma Region	0.30	0.23	0.07
Kursk Region	0.19	0.17	0.02
Lipetsk Region	0.15	0.13	0.02
Moscow Region	0.25	0.20	0.05
Orel Region	0.18	0.19	-0.01
Ryazan Region	0.18	0.16	0.02
Smolensk Region	0.19	0.12	0.06
Tambov Region	0.29	0.32	-0.02
Tver Region	0.16	0.13	0.03
Tula Region	0.12	0.12	0.00
Yaroslavl Region	0.13	0.10	0.03
Moscow	0.57	0.36	0.21
Republic of Karelia	0.18	0.18	0.00
Komi Republic	0.19	0.18	0.01
Arkhangelsk Region	0.13	0.11	0.03
Vologda Region	0.16	0.13	0.03
Kaliningrad Region	0.13	0.14	-0.01
Leningrad Region	0.22	0.17	0.05
Murmansk Region	0.21	0.21	0.00
Novgorod Region	0.15	0.14	0.01
Pskov Region	0.18	0.17	0.01
St. Petersburg	0.36	0.22	0.15
Republic of Adygeya	0.24	0.21	0.03
Republic of Kalmykia	0.57	0.60	-0.03
Krasnodar Territory	0.30	0.11	0.19
Astrakhan Region	0.11	0.16	-0.05
Volgograd Region	0.13	0.12	0.01
Rostov Region	0.18	0.10	0.08
Republic of Daghestan	0.46	0.47	-0.01
Republic of Ingushetia	0.55	0.39	0.16
Kabardino-Balkarian Republic	0.37	0.31	0.06
Karachayevo-Circassian Republic	0.30	0.26	0.04
Republic of North Ossetia – Alania	0.18	0.19	-0.01

Chechen Republic	0.47	0.52	-0.05
Stavropol Territory	0.21	0.15	0.06
Republic of Bashkortostan	0.20	0.14	0.06
Republic of Mari El	0.28	0.28	0.00
Republic of Mordovia	0.19	0.20	-0.01
Republic of Tatarstan	0.15	0.15	0.00
Udmurtian Republic	0.22	0.21	0.01
Chuvash Republic	0.19	0.16	0.03
Perm Territory	0.09	0.05	0.04
Kirov Region	0.27	0.19	0.08
Nizhny Novgorod Region	0.13	0.10	0.03
Orenburg Region	0.18	0.18	0.00
Penza Region	0.18	0.19	-0.01
Samara Region	0.12	0.10	0.02
Saratov Region	0.12	0.14	-0.02
Ulyanovsk Region	0.19	0.14	0.05
Kurgan Region	0.25	0.21	0.04
Sverdlovsk Region	0.18	0.15	0.03
Tyumen Region	0.32	0.23	0.09
Chelyabinsk Region	0.13	0.10	0.03
Republic of Altai	0.38	0.34	0.04
Republic of Buryatia	0.27	0.16	0.11
Republic of Tuva	0.42	0.28	0.14
Republic of Khakassia	0.18	0.14	0.04
Altai Territory	0.25	0.21	0.04
Trans-Baikal Territory	0.32	0.26	0.06
Krasnoyarsk Territory	0.13	0.11	0.02
Irkutsk Region	0.15	0.12	0.03
Kemerovo Region	0.16	0.13	0.03
Novosibirsk Region	0.10	0.10	0.00
Omsk Region	0.09	0.07	0.02
Tomsk Region	0.09	0.06	0.02
Republic of Sakha (Yakutia)	0.30	0.32	-0.02
Kamchatka Territory	0.27	0.28	-0.01
Primorye Territory	0.28	0.20	0.08
Khabarovsk Territory	0.21	0.19	0.02
Amur Region	0.26	0.18	0.08
Magadan Region	0.39	0.21	0.18
Sakhalin Region	0.35	0.24	0.11

The obtained values of the Krugman specialization indices are approximated using the normality distribution density function. The computational experiment shows that the data distribution for 2016, shown in table 2, is depicted by the following function:

$$y(x) = (5.57/0.1 \times \sqrt{2\pi}) \times e^{-(x-0.23)^2/(2 \times 0.1 \times 0.1)}, \qquad (3)$$

x - value of the regional SMEs specialization index.

Checking how well the normality distribution function (3) approximates the data in Table 2 is based on the use of the Kolmogorov-Smirnov, Pearson and Shapiro-Wilk tests. These tools allow comparing the empirical distribution of the studied indicator with the theoretical one given in the respective tables. Tests demonstrate the level of empirical data deviation from the specified functions. The calculated statistics value for the Kolmogorov-Smirnov test is from 0.130, which is less than the table value of 0.152 at a significance level of 0.05. The estimated value of the Pearson test is 7.90, which is less than the table value of 9.49. The estimated value of the Shapiro-Wilk test is 0.94, which is more than the table value of 0.93 at a significance level of 0.01. Thus, function (3) proves to be of high quality in all tests.

Based on the formula (3) one can draw the following conclusions: the average value of the specialization index is 0.23; the standard deviation is 0.10. The interval of change of the specialization indices, characteristic of the SMEs located in most (68%) regions of Russia, ranges from 0.13 to 0.33.

The highest values (from 0.33 to 0.56) of the specialization indices are observed in the following regions: the cities of Moscow, St. Petersburg, the republics of Altai, Tyva, Dagestan, Kabardino-Balkaria, Chechen, Ingushetia, Kalmykia, Crimea, Sakhalin and Magadan regions. Accordingly, the specialization of these regions` SMEs is most different from the overall specialization in Russia. It should be noted that even the maximum value of 0.56 (in the Republic of Kalmykia) is 3 times less than the maximum possible value (2). As we already noted, the average index of specialization is 0.23 in all regions. This is almost 9 times less than the maximum possible value. For a number of regions, the typical values of specialization indices are less than 0.13. These regions include the Perm and Krasnoyarsk Territories, the Tomsk, Omsk, Novosibirsk, Astrakhan, Saratov, Samara, Tula and Yaroslavl regions. The specialization of SMEs in these areas is as close as possible to the average in Russia.

The comparison of the Krugman specialization indices for 78 subjects of Russia according to the data for 2016 and 2010 shows that an increase in the indices values is observed in 57 regions. The decrease in values is typical for 14 regions, while the values do not change in 7 regions. At the same time, the increase in the specialization indices values by more than one and a half times took place in such Russian areas as the Magadan region, the Republic of Tyva, the Republic of Buryatia, the Krasnodar Territory, St. Petersburg, Moscow, and the Voronezh Region. The greatest decrease in the specialization index (about 30%) is noted only in two regions: Astrakhan Oblast and the Republic of Kalmykia. In general, it is possible to see the trend towards the SMEs specialization increase in 2016, which is typical for most regions of Russia as compared to 2010. In our opinion, this trend is caused by the territorial, natural, cultural and other peculiarities of certain regions.

Conclusion

The article presents the relevant and original results of the assessment of SMEs industry concentration and regional specialization SMEs based on the Krugman indices and using employment data in the economy`s business sector in Russia. They include the following:

- confirmation of the Krugman indices expediency, calculated on the basis of data on employment in the field of entrepreneurship, assessment of the existing levels of SMEs industry concentration and regional specialization;
- the highest level of concentration is observed in such types of activity as fishing. The substantial concentration also occurs in SMEs specializing in mining, production and distribution of electricity, gas and water, agriculture, hunting and forestry. The sectoral SMEs concentration in these types of activity (related to goods production) is drastically higher than the one in the service sector SMEs.
- trade has the lowest concentration level, i.e. small and medium enterprises of this type are widely developed in all regions of Russia;
- change in the concentration index values for the period from 2010 to 2016 is insignificant, i.e. there are no stable trends towards a change in the industry concentration of Russian SMEs;
- the indices values of SMEs regional specialization are relatively small, namely, in all regions the average values of this

index are 0.23, in 10 regions this indicator is less than 0.13, and its maximum value does not exceed 0.56. This indicates that in most regions the distribution structure of the SMEs employees number is not critically different from the overall average sectoral structure in Russia, i.e. the development of most activity types in the regions is relatively even;

–   identification of the Russian regions which are characterized by relatively high and low values of specialization indices.

Comparison of the specialization indices values show that in the period from 2010 to 2016 there was an increase in the SMEs specialization in most regions of Russia.

The results of this study can be used in subsequent research on the SMEs distribution by region and industry. 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, as well as in improving the skills of employees related to entrepreneurial activities.

The practical significance of the research results is connected to the possibility of expanding the role of SMEs in regional economies taking into account the peculiarities of the sectoral diversification. The results can be useful to the federal and regional authorities in developing policies related to supporting the small business development in various Russian regions and different economy sectors to facilitate the appropriate allocation of resources. Policymakers should pay particular attention to enterprise development efforts in sectors and regions where SMEs do not make sufficient progress.

There is a need of further studies to assess the concentration and specialization of SMEs located in the municipalities of each Russian region.

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