ANALYSES OF REGIONAL SPECIALIZATION AND GEOGRAPHICAL CONCENTRATION OF INDUSTRY IN RUSSIA

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ABSTRACT

The goal of the research is to analyze the spatial economic dynamics by evaluating specialization of the Russian regions and concentration of manufacture in the country. In order to reach the set goal I studied the theoretical basis of the scientific problem, defined methodical instrument and gave an estimate of the regional specialization and geographical concentration of industry in Russia, shaped the corresponding conclusions. To analyze the concentration of industrial production I used Herfindahl-Hirschman index, Gini index, Krugman and CR3 and CR4 concentration indices. The research is supported by the grant of the RF President. Project No. 1107.2014.6

Keywords: Regional Specialization, Geographical Concentration, Russian Regions

Introduction. Development of the Russian economy during the last years is characterized by the growing competition among the regions for the industrial factors, which *a priori* are limited. So, for the period of 2001-2010 the annual decrease in population of Russia reached 487.7 thous. people per year (Calculated by: [[15]]) on the average at a high level of interregional labor migration, for example, in 2010 it constituted 874.7 thous. people. The amount of direct foreign investments coming into the economy of Russia, today was reduced twice compared to the year 2007. The regions also compete for budget financing, obtaining state orders, using up-to-date technologies and so on. In the most successful regions the processes of economic activity concentration are observed, and the companies get a chance to receive agglomeration effects from allocation of production facilities.

In general, such state of affairs causes the growth of regional differentiation by the level of social and economical development. The efficient industrial policy capable of reacting to the changing economical conditions can't be carried out without the analysis of regional specialization and concentration of production in the country.

The goal of the research is to analyze the spatial economic dynamics by evaluating specialization of the Russian regions and concentration of manufacture in the country. In order to reach the set goal I think it is necessary to study the theoretical basis of the scientific problem, define methodical instrument and give an estimate of the regional specialization and geographical concentration of industry in Russia, shape the corresponding conclusions. As a period of research let me take years from 2002 to 2010.

Theoretical background and bibliography. Issues of specialization and concentration of spatial economy were considered in three scientific courses: neoclassical theory, new trade theory and New Economic Geography.

The factors that explain regional specialization of production can be divided into two groups: primary (physical geography and natural resources) and secondary (geographical distance between economical agents) [[11],[13]]. The neoclassical theory

emphasizes the role of primary factors. Economical activity is concentrated in the regions in accordance with the presence of production factors, natural resources and technologies. These types of economy specialize in manufacturing products based on their comparative advantages (*Ricardo*) or availability of production factors (*Heckscher-Ohlin*). However, the growth theory predicts a lesser specialization in the long-term period due to tendency of narrowing the profits via alignment of the factor productivity. The postulates of economic theory in this sphere became significantly more complicated in 1980s, when the model of monopoly competence was applied to the theory of trade and economic geography.

The new theory of trade unites such primary factors of regional specialization as market size (size of work force in the country), if the immobility of labor is suggested; and the secondary factor is the geographical distance between economical agents. If the trade expenses decrease, the industry aims to concentrate in the region with the high market potential ("core") in order to realize manufactured goods to other regions in the future ("periphery"). The new trade theory, where at construction of models the externals from the technological development and human capital are taken into account, explains the specialization by the self-intensifying effects from the externals. In these models the trade integration leads to exchange of knowledge and technologies.

The New Economic Geography evaluates the allocation of production based on the ratio of two powers: agglomeration ones (such as the scale effect and direct and reverse connections) and de-agglomeration ones (such as trade expenses and difference in prices for the production factors) [[3]]. The differences in the interregional demand are considered as endogenous [[1]]. If there is a growing return and trade expenses the companies and workers are trying to concentrate in the vicinity of major markets. In its turn, the major market is the market on which a large number of companies and workers operate [[2],[7]]. The New Economic Geography models the agglomeration processes based upon the interregional mobility of the workforce [[5]] and the mobility of the companies having demand for the intermediate goods [[12]].

The absolute and relative concentration should be discerned. The sector of industry is absolutely concentrated, if several countries regardless of their sizes have large enough shares in the total amount of the given production [[6]]. The sector of industry is relatively concentrated, if any one type of activity differs from those that are averagely widespread within the amount of production in the countries. The neoclassical theory usually deals with the relative concentration, the New Economic Geography deals with the absolute concentration, the new trade theory considers both types mentioned above.

3. Research methodology. Prior to starting the analysis let me introduce the main notions. The concentration is defined in relation to the kind of economic activity, a sector, a subsector, a production group and so on and means the degree of concentration or sparseness of industrial production within the specific territory. Specialization is considered in relation to the region, namely, its occupation structure, and reveals the situation, when some kinds of production in the region dominate, or the production equals the diversification.

To analyze the concentration of industrial production I am going to use Herfindahl-Hirschman index, Gini index, Krugman and CR_3 and CR_4 concentration indices. The regional specialization will be evaluated by calculation of Krugman index (table 2).

Table 2. Methodological tools for assessment of the geographic concentration and regional industry specialization

Index	Calculation	Notation conventions
1	2	3
Evaluation indicators of the geographic concentration		
Herfindahl–Hirschman Index of industrial concentration (*HHI*)	$$HHI = \sum_{i=1}^{n} x_i^2$$	x_i - share of region *i* in total population size
Krugman Concentration index *CONC_i*	$$CONC_i = \sum_j \left| s^C_{ij} - s_j \right|$$ где $$s^C_{ij} = \frac{E_{ij}}{E_i} = \frac{E_{ij}}{\sum_j E_{ij}},$$ $$s_j = \frac{E_j}{E} = \frac{\sum_i E_{ij}}{\sum_i \sum_j E_{ij}}$$	E - the number of employed in the economy; s^C_{ij} - the share of employed in the industrial sector in the region *j* in the total number of employed in the industrial sector in the country i; s_j - the share of total employed in the economy in the region i among the employed in the economy; i - the industrial sector; j - region.
Concentration index *CR_3*	$$CR_{3i} = \sum_{j=1}^{3} s_{ij}$$	i – the industrial sector; j – region (one of three or four) with the highest share of employed in the sector i; s_ij – the share of employed in the region j in the total number of employed in the sector i.
Concentration index *CR_4*	$$CR_{3i} = \sum_{j=1}^{4} s_{ij}$$	
Evaluation indicators of regional specialization		
Krugman specialization index (*SPEC_j*)	$$SPEC_j = \sum_i \left| s^S_{ij} - s_i \right|$$ где $$s^S_{ij} = \frac{E_{ij}}{E_j} = \frac{E_{ij}}{\sum_i E_{ij}},$$ $$s_i = \frac{E_j}{E} = \frac{\sum_j E_{ij}}{\sum_i \sum_j E_{ij}}$$	E – the number of employed in the economy; s^S_{ij} - - the share of employed in the industrial sector in the region *j* in the total number of employed in the industrial sector in the country i; s_j - the share of employed in the industrial sector i in the total number of employed in the country's economy i - the industrial sector; j - region.

Source: [[11],[14]].

4. Geographical concentration of industrial production in Russia.
For calculation of Herfindahl-Hirschman index as initial indicators, which will be used for evaluation of concentration, let me define the volume of industrial production, amount of investments into the capital stocks and the number of employed ones in the economy (fig. 1).
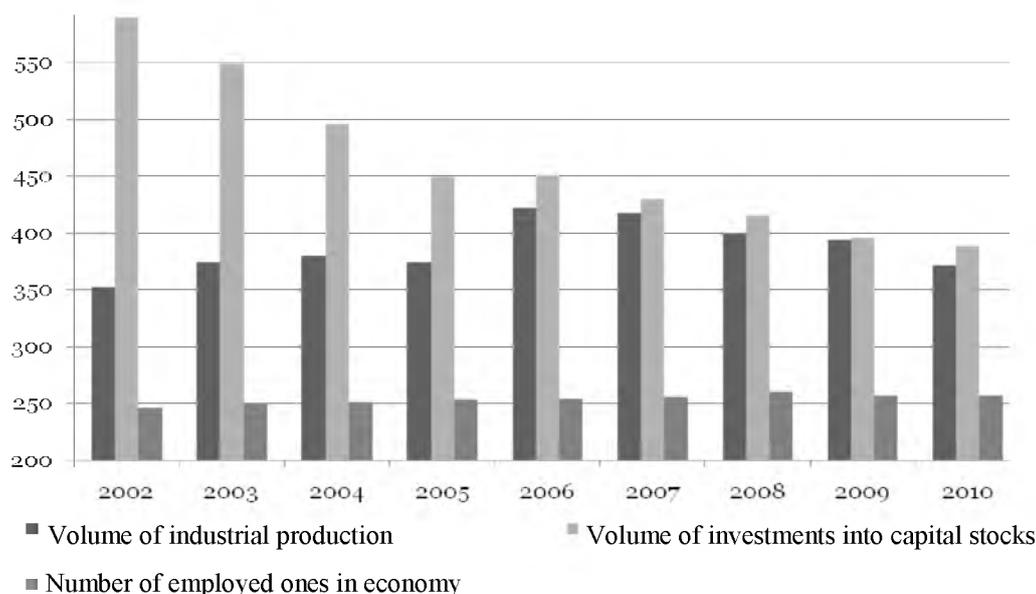
Fig. 1 Dynamics of Herfindahl-Hirschman index calculated by volume of industrial production, amount of capital stock investments and number of employed ones in economy in 2002-2010

As shown in Figure, the concentration of industrial production by output volume and number of employed ones in the economy is stably increasing, while the investments into the capital stock become more diversified.

Gini index, calculated for the analyzed period (by the number of employed ones in the industrial production), shows the growth of concentration up to 2008 (from 48.18% to 50.29%) and further stable decrease to 48.95%. In my opinion, this proves that the crisis phenomena enhance the production diversification among the Russian regions.

The Krugman index provides evaluation of concentration by certain types of the processing industry. Concentration in certain sectors can be discussed, when the significant part of production is realized in a small number of regions. The higher is the index, the higher is the level of concentration in the given sector of industry [[14]]. Let me consider the dynamics of Krugman index in more details by the types of activity of the processing industry (fig. 2).

I see that the lowest degree of concentration is in the food industry, as well as in production of nonmetallic mineral products. The high concentration is in the production of leather, leather products and footwear, in the wood processing industry and in production of the wooden articles. The significant reduction of concentration degree for the analyzed period is observed in the cellulose and paper production, publishing and printing activity, production of rubber and plastic articles, metallurgical production and production of the finished metal articles.

The process industry enterprises should concentrate only in case they get additional profits from such concentration. The main profit emerging from the process of agglomeration is a scale effect expression (or of scale economy) at different stages of manufactured products life cycle. The level of the scale effect depends directly on the production specifics.
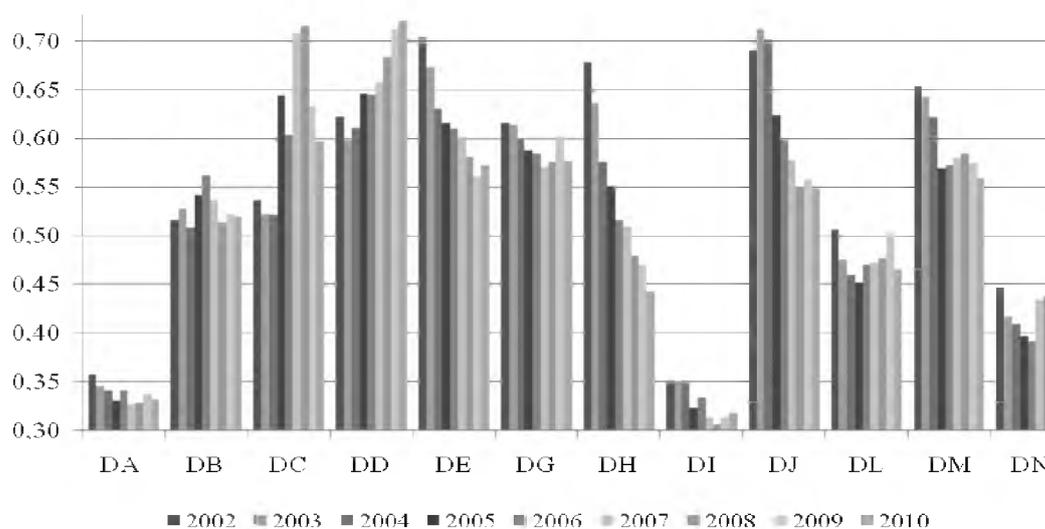
DA – production of food, including drinks and tobacco; DB –textile and garment production; DC – production of leather, articles of leather and footwear; DD – wood processing and manufacturing of wood articles; DE – cellulose and paper production, publishing and printing activity; DG –chemical industry; DH – production of rubber and plastic articles; DI –production of other nonmetal mineral products; DJ – metallurgical production and manufacture of finished metal articles; DL –production of electrical equipment, electronic and optical equipment; DM – production of transportation means and equipment; DN – other types of production.

Fig.2. Concentration of industrial production by types of activity in the Russian regions in 2002-2010, Krugman index (Source [[9]]).

Let me divide 97 types of activity of processing industry in Russia into three groups by the degree of scale effect (as per Pratten [[8]]). 47 sectors of production constituted a group with a high level of scale effect. These are certain sub-branches of machine-building industry (highest scale effect is expressed in the automotive industry, both at the stage of production, and at the promotion stage), chemical industry (at the stage of manufacturing, and in the pharmaceutical industry – also at the stage of research and development), cellulose and paper industry, publishing and printing industry, metallurgy and so on. In the group of branches with the average level of scale effect (34 sectors of production industry) practically all kinds of food industry were included (tobacco production having a low scale effect as per Pratten classification was an exception), certain types of production of non-metallic mineral products (except for cement and sheet glass, that have a high scale effect), textile industry (except for the goods with the long production cycle), rubber and plastic articles and so on.

Included in the group of production with the low scale effect (16 sectors of industrial production) was production of footwear, furniture, leather articles, tobacco, construction and repair of vessels, production of motorcycles and bicycles, as well as wood processing and production of articles of wood and so on.

Dynamics of the mean Krugman concentration index by groups was represented in figure 3. CR_3 and CR_4 indexes show, which share of workers in the production sector is concentrated in three or four largest regions of this indicator. The share of three largest regions by production volume in any of subsectors of industry does not exceed 35%. It is logical to suppose, that in those subsectors, where the production concentration is high, CR_3 index will also be high. I am not going to separately provide the dynamics of

CR_4 index, I only indicate, that it slightly exceeds CR_3: averagely by 4.6 points (from 3.54 points in food industry to 6.2 points in chemical production).
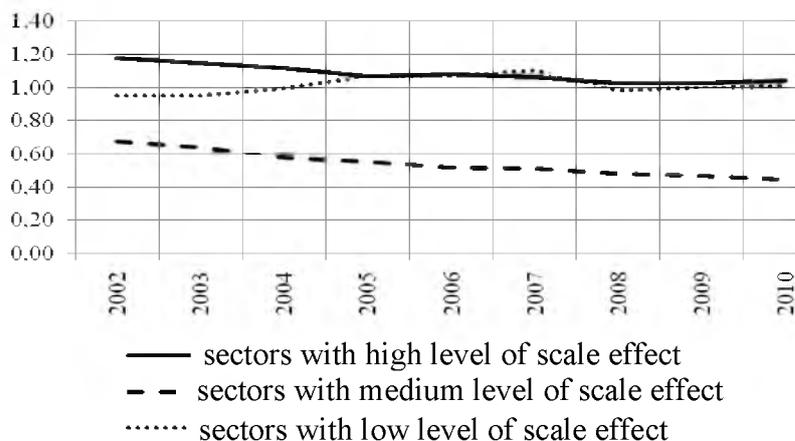
Fig.3. Dynamics of average Krugman concentration index by groups depending on scale effect level in 2002-2010

——— sectors with high level of scale effect
– – sectors with medium level of scale effect
······ sectors with low level of scale effect

Therefore, I observe the highest level of production concentration in the industrial groups with the high level of scale effect and with the low level of scale effect.

5. Regional specialization of industry in Russia. In this part of research I will try to answer the following questions. How are the Russian regions specialized or diversified? What changes in the regional specialization took place during the period analyzed? Is there a connection between specialization of the region and economic efficiency?

In general, for the analyzed period the reduction of specialization index took place in 78.5% of regions, in three regions there were no changes, in the remaining regions the growth is observed. Averagely the highest level of specialization was noticed in 2003 (0.61), and the lowest one – in 2008 and 2010 (0.55).

Among all the regions let me highlight two groups with the high index (over 0.75 for 5 years and over) and the low index (less than 0.35 during 5 years and over). Attributed to the group of more specialized regions can be 14 regions, and to the group of less specialized regions – only 11. Therefore, the remaining 53 regions have an average level of specialization. Let me calculate by two groups such indicators as the Gross Regional Product (GRP) calculated per capita, labor efficiency (as ratio of GRP to the number of workers employed in the economy), the average nominal wages and the unemployment rate.

I found out, that in the regions with a high degree of specialization such indicators and GRP per capita, wages and unemployment rate slightly exceed the average values in the country, and the labor efficiency is close to the average level in Russia. Thereby I know that of 14 regions of this group in seven regions the mining industry is actively developing. Based on this fact I guess that the group with high index of specialization should be divided into two subgroups: regions with the strong mining sector of economy (I subgroup) and other regions (II subgroup). The results of analysis are represented in table 3.

Drawing the conclusions on this section of research I can say that the narrow specialization in some sector of industry "can be afforded" only by the regions providing for the development of their economy due to the mining industry. In other cases the deep specialization of the Russian regions is inefficient.

Table 3. - Average indicators of the most and least specialized Russian regions during the years 2002-2010

№	Region	Krug-man speciali zation index, index	Index of GRP per capita, rub. per person	Labor productivit y, rub. per person.	Average monthly nominal wages, thousand rub.	Unemp loymen t rate,%
	Russian Federation	**0,58**	**145059**	**305 623,0**	**11 806,7**	**7,5**
	Regions with the highest level of specialization					
	I subgroup - regions with a strong mining sector					
1	Chukotka Autonomous Okrug	1,28	397 360,7	538 225,0	28 553,8	4,2
2	Arkhangelsk region	1,04	155 025,7	320 306,2	12 857,5	7,1
3	Kamchatka Krai	1,03	155 586,5	285 825,3	20 188,9	9,6
4	Sakhalin Oblast	0,96	408 924,1	725 167,5	20 440,7	7,8
5	Magadan Oblast	0,87	180 408,8	320 779,2	19 977,2	7,1
6	Komi Republic	0,81	199 032,8	401 901,0	15 255,1	10,8
7	Sakha Republic	0,77	211 335,1	419 924,5	17 472,7	8,6
	Average value of the subgroup I	0,97	243 953,4	430 304,1	19 249,4	7,89
	Subgroup II – other regions					
8	Altai Republic	0,85	55 913,9	126 677,8	8 065,8	11,2
9	Adygea Republic	0,85	51 158,0	147 648,2	7 135,8	12,1
10	Kalmykia Republic	0,84	45 503,4	113 553,1	6 421,3	17,1
11	Lipetsk Oblast	0,79	134 458,0	287 843,4	9 157,0	4,9
12	Jewish Autonomous Oblast	0,86	90 127,6	202 826,5	10 829,0	8,8
13	Tuva Republic	1,01	49 019,4	144 202,0	9 709,8	20,3
14	Ivanovo Oblast	0,98	50 108,4	110 339,8	7 158,5	6,3
	Average value of the subgroup II	0,9	68 041,3	161 870,1	8 353,9	11,5
	Average value of the group	**0,94**	**155997,3**	**296 087,1**	**13 801,7**	**9,7**
	Regions with the lowest level of specialization					
1	St. Petersburg	0,24	185 234,4	349 786,6	14 900,0	2,9
2	Moscow Oblast	0,27	138 613,5	328 561,8	14 065,6	3,5
3	Bashkortostan Republic	0,28	107 614,8	241 388,7	9 471,2	7,5
4	Rostov Oblast	0,29	79 183,1	177 078,0	8 507,1	8,8
5	Novosibirsk Oblast	0,29	102 706,9	217 279,3	10 372,7	8,7
6	Nizhny Novgorod Oblast	0,33	105 109,1	202 667,8	9 150,5	6,5
7	Chuvash Republic	0,34	68 948,8	149 092,5	7 290,8	9,5
8	Kaluga Oblast	0,34	90 229,3	189 525,6	9 705,9	5,9
9	Tatarstan Republic	0,35	148 866,1	311 833,2	9 840,6	6,3
10	Tver Oblast	0,35	86 990,2	197 351,8	9 005,0	5,6
11	Bryansk Oblast	0,35	59 580,1	130 731,9	7 064,4	7,8
	Average value	**0,3**	**106643**	**226 845,2**	**9 943,1**	**6,6**

Therefore, in my works I performed the analysis of the spatial economic dynamics by evaluating specialization of the Russian regions and concentration of manufacture in the country. It was discovered, that evaluation of concentration is expedient when using the number of employed workers in the economy as a criteria indicator. Herfindahl-Hirschman index, Gini index, CR_3 and CR_4 indexes prove stable increase in concentration of production in the Russian regions up to 2008 and insignificant decrease during the post-crisis period. The highest concentration is present in production of leather, leather goods and footwear. The insignificant concentration is observed in food industry and production of non-metallic mineral products. It is proved, that the highest level of concentration is present in the production groups with high and low manifestation of scale effect.

The analysis of specification of the Russian regions showed that the deep specialization is efficient only in the regions with the strong mining sector of the economy.

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