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SPATIAL CONCENTRATION OF THE MANUFACTURING INDUSTRY: EVIDENCE FROM RUSSIA

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Spatial concentration of the manufacturing industry in Russia during the period of 2005-2015 was analyzed in the article. The analysis includes 83 Russian subjects, which are united in 8 federal districts. The Herfindahl-Hirschman index, the Theil index and the coefficient of variation by the production volume, the number of employees and the fixed assets volume were used to estimate the scale and tendencies of the spatial concentration of the manufacturing industry. The analysis has revealed an increase in the spatial concentration of the manufacturing industry in Russia as a whole against the backdrop of multidirectional concentration-dispersion processes in the regions and districts. Production redistribution has been revealed: the east of the country is dominated by the deconcentration of production and the western part is dominated by the concentration of production. The strong localization of certain sectors of the manufacturing industry (chemical and electronic industry, and transport vehicles production) under the influence of agglomeration forces has been established.

Key words: Spatial concentration, Manufacturing industry, Agglomeration process, Russia, The Herfindahl-Hirschman index, The Theil index, The coefficient of variation

INTRODUCTION

Spatial concentration or agglomeration of production activity reflects its uneven distribution throughout the territorial units. The location of a certain industry in a small number of regions indicates a high spatial concentration of that industry; on the other hand a more even distribution of a certain industry enterprises throughout the territorial units indicates its dispersion.

Spatial concentration is made manifest through the concentration of firms, people, capital, technology, innovations in certain places, which provides higher profits, low transactional costs, and increasing returns to scale. The benefits of concentrated accommodation are so great that further attraction of production factors, people, investments to a certain area take place, i.e. the agglomeration effect is displayed. Regions with high concentration of production activity achieve higher economic growth due to the agglomeration effect. Other regions, which have no obvious advantages for the production placement, lose in the struggle for production factors and therefore cannot ensure a high economic growth. As a result there is an uneven regional development, which leads to spatial inequality. An explanation of the spatial concentration influence on interregional differentiation is well described in the scientific literature (Kim, 2008) [10].

New Economic Geography (NEG) founded by Paul Krugman (1991) provides the theoretical basis that explains the origin of the agglomeration effect [13, 14]. NEG has been further developed in the works of Kim (1995), Fujita et al. (1999), Puga (1998, 2001) [09, 05, 20, 21].

The agglomeration effect provides economic benefits due return to scale. Enterprises of the same industry are localized in one region because return to scale, which include established technological chains and relationships with suppliers and consumers, a large labour market with a certain qualification, accumulation and dissemination of knowledge, access to resources and technologies. Geographic proximity brings certain benefits to enterprises of different industries which can actively evolve in parallel due to the size of the market and high density of labour force. Places of production concentration attract new enterprises further increasing agglomeration effects and contributing to the regional development.

Foreign researches of industrial concentration are quaint numerous. The most authoritative study, generalizing empirical studies, was conducted by the World Bank economists (2009) [25].The processes of increasing the production activity concentration were identified. Due to the regional policy of cohesion enacted by the “new” EU countries, agglomeration processes are especially noticeable in the capital cities, which “attract” firms, labour force, capital, and technology.

Structural changes have occurred in post-socialist countries in the process of economic transformation. The spatial concentration of industry has increased in the countries of the Visegrad Group: Hungary, Slovakia, Czech Republic (with the exception of Poland) (Hegyi-Kéri, 2013) [08]. The sectors of industry became more concentrated while the regions became less specialized in Romania (Goschin et al., 2009) [07]. In Serbia, there is a concentration of firms in the higher-performing sectors of the economy (Lijesen, 2004; Dondur et al., 2011; Spasojević-Brkić et al., 2012) [16, 03, 27].

The purpose of the study is to determine the trend of spatial concentration in the manufacturing industry in Russia during the period of 2005-2015.

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Objectives:

- analysis of spatial concentration in the manufacturing industry in Russia during the Soviet and post-Soviet periods;
- an assessment of the dominant tendencies of concentration-dispersion of the manufacturing industry during the period of 2005-2015.

SPATIAL DISTRIBUTION OF MANUFACTURING INDUSTRIES IN THE SOVIET PERIOD

Economic growth in Russia is impossible without an efficient industry [02]. There is an economic downturn in Russia in recent years. Production volume of the manufacturing industry in 2015 went down by 5.4 % versus the previous year. There are several main reasons for the decline in industrial production: economic crisis, unfavourable world market prices for hydrocarbons, international isolation of Russia due to a geopolitical interest conflict between Russia and the West, decrease in investments and enterprises' limited access to the credit resources. In this regard, the perspectives of economic growth in Russia are seen in the implementation of balanced industrial policy that takes into account concentration-dispersion processes of production activity throughout the regions of the country. On the other hand, a reduction of interregional differentiation is one of the state regional policy directions. In this context, the identification of the production concentration tendencies (as a factor contributing in the increase or decrease of spatial disparities) is important when developing the country's spatial development strategy.

We will review the research results of the manufacturing industry concentration in Russia, beginning with the Soviet period. Spatial placement of industry in Russia is largely a legacy of the Soviet era. Localization of the enterprises has been performed on market principles in the West; in Russia there was a command-administrative planning system that took into account not only economic viability, but also other non-economic factors, for example, geopolitical interests. Development priorities were established in favour of defence-industrial enterprises. The priority of industry placement has shifted from the West to the East: enterprises were created beyond the Urals in regions with low population density and unfavourable climate. Single-industry cities with a single city-forming enterprise have appeared, and decisions to establish enterprises on the territories of the backward regions were made to equalize their economic development. Production dispersion processes prevailed over concentration processes. Excessive specialization of regions and insufficient spatial concentration of industry are peculiar to the Soviet model of the production placement [01]. Kofanov, Mikhailova, Shurygin (2015), referring to Dyker, have identified the basic rules of the placement of Soviet industry: "construction of the enterprises to be as close to the sources of raw materials or to the consumers as possible; an even distribution of economic activity throughout the country; rational distribution of labour force between economic regions and comprehensive economy development of each region; increase in the economic and cultural level of the backward areas up to the level of more developed regions; elimination of the differences between urban and rural areas; strengthening of the country's defence potential" [04, 12].

The analysis of spatial concentration of Soviet industry according to the 1989 data (Kofanov and Mikhailova, 2015; Mikhailova, 2016) has revealed that industry concentration in Russia was lower than in the countries of Western Europe and approximately the same level as in Canada, that is close to Russia in terms of natural conditions and population density [11, 17]. These results are consistent with the NEG provisions about production dispersion taking into account high transportation expenses, which is typical for Russia and its huge territory size. Spatial picture of the industry placement has shown its greatest concentration in the European densely populated part of Russia, in the regions of the Southern Ural (Perm Krai, Sverdlovsk, Chelyabinsk, Kurgan Oblasts and the Republic of Bashkortostan), in the south of Siberia (Tomsk, Novosibirsk, Kemerovo Oblasts, Altai and Krasnoyarsk Krais) near the Trans-Siberian railway.

The localized industries include textile industry, mechanical engineering industry, computer equipment and food products.

Low concentration is characteristic of chemical industry, metallurgy and metalworking, electronics and transport equipment despite the fact that the high concentration of such high-tech industries has obvious agglomeration advantages.

SPATIAL PLACEMENT OF INDUSTRY IN THE POST-SOVIET PERIOD: LITERATURE REVIEW

According to Lapo (2005), the Volga region and the Urals have become significantly more important in the regional structure of Russian industry after the disintegration of the Soviet Union and liberalization of 1992 [15]. Positions of the old industrial regions have lost ground slightly, investments in fixed capital in the regions of Siberia and the Far East have decreased, and spatial concentration during the period of 1990-1999 has increased.

Golovanova (2008) has made following conclusions: in 1998-1999 spatial concentration has increased in the industries with a relatively small share in the country's industrial production, in 2000-2004 spatial concentration could be observed in the largest sectors of Russian industry [06]. A total of 205 industrial sectors are analyzed: in 26 industrial sectors, among which processing industries of the fuel and energy complex, chemical industry and heavy engineering industry, automotive industry and some light and food industries, an increase in spatial concentration can be observed; the situation is reversed in 10 industrial sectors (production of consumer goods and sectors with a small share in Russian industrial production): there is a decrease in spatial concentration.

Belov (2012) has detected an increase in spatial concentration during the period of 2000-2009 [01]. Rastvortseva et al. (2012) have stated the growth of industrial production concentration in terms of output and employment in the economy in 2002-2010, at the same time investments in fixed capital has become more diversified [22]. Rastvortseva and Kuga (2012) noted that a higher concentration took place in the production of leather, leather goods and footwear, wood processing and production of wood products, metallurgical production; insignificant concentration could be observed in the food industry and the production of non-metal mineral products [23]. During the analyzed period a significant decrease in the degree of concentration could be observed in the pulp and paper production, publishing and printing activities, rubber and plastic goods production, metallurgical production and production of finished metal products. Mityakov and Mityakova (2015) have discovered a significant increase in the level of regional differentiation in industrial production after the 2008 crisis [19]. Mikheeva (2013) noted that diversification tendencies of Russian industry in the regions during the period of 2000-2011 were multidirectional: there was an increase in diversification in half of the regions and decrease in the remaining regions [18]. Rastvortseva и Ternovskii (2016) concluded that spatial concentration of industry by industrial production volume has increased during the period of 1991-2013 [24].

The growth of industry spatial concentration in conditions of the market liberalization that was caused by agglomeration effect could be observed in the post-Soviet Russia as a whole. Centripetal forces of the large cities attraction has significantly manifested themselves and determined where new manufactures would be placed.

MEASUREMENT METHODS OF SPATIAL CONCENTRATION AND DATA

An overview of domestic and foreign studies on the research of industry spatial concentration has revealed a diversity of the instruments used in them. Summarizing the practice of empirical research in this area, we can note several indicators: Dispersion indicators, the Herfindahl-Hirschman index, the spatial Gini, Entropy indices, the Ellison-Glaeser index, Spatial Concentration index, Krugman Dissimilarity index, the Concentration Rate indices CR3 and CR4, the Duranton-Overman index, Moran's Index and the Getis-Ord statistics.

The most popular indices such as the Herfindahl-Hirschman index (1), the coefficient of variation (2), (3), the Theil index (4) were used for the objectives of the research.

The Herfindahl-Hirschman index reflects an uneven distribution of production in the region; it can range from 1/n to 1. The value is equal to one when there is a maximum concentration of industry in one region; and when there is an even distribution of industry concentration throughout the country it equals 1/n, where n is the number of the regions. All these factors demonstrate sensitivity of this index to quantity of the studied units. In addition, the index depends on the scale of the region and is biased towards larger regions (1).

$$HHI_j = \sum_k z_{ij}^2 \quad 1)$$

where HHIj – the Herfindahl-Hirschman index; z_{ij}–a share of the j^{th} sector of the i^{th} region in the all-Russian indicator of the j^{th} sector.

The coefficient of variation for assessment of spatial concentration represents a relative measure of dispersion and reflects a deviation from a regional average (2), (3). Zero coefficient of variation corresponds to an even distribution of manufacturing industry throughout regions; and it is positive if there is a concentration of manufacturing industry.

$$CV = \frac{\sigma}{\bar{Y}} \cdot 100\% \quad 2)$$

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(y_i - \bar{Y})^2} \quad 3)$$

where *CV* – the coefficient of variation; σ – standard deviation; *i* – region number; *N* – number of the regions; y_i – sector indicator in the i^{th} region; $\bar{Y}$ – the average indicator of the sector throughout the regions.

The Theil index belongs to the family of entropy indicators for measuring inequality and is convenient for assessment of spatial concentration (4). Zero Theil index corresponds to an even distribution of production throughout the regions; and if it is positive then there is a higher concentration of production in some regions. The Theil index ranges from 0 to logN.

$$I_T = \frac{1}{N}\sum_{i=1}^{N}\frac{y_i}{\bar{y}} log \frac{y_i}{\bar{y}} \quad 4)$$

where I_T – the first Theil index; *i* – region number; *N* – number of the regions; y_i – sector indicator in the i^{th} region; $\bar{Y}$ – the average indicator of the sector throughout the regions.

According to the Russian Classification of Economic Activities (OKVED) the manufacturing industry is reflected in the consolidated form of economic activity "manufacturing industries". Three indicators of the manufacturing industry were used for the analysis: production volume (the volume of locally produced and shipped goods), number of employees, the value of fixed assets.

The information basis of the research constituted the statistical data of Russian Federal State Statistics Service for the period of 2005-2015 [26]. The 2005 concentration indices were calculated without the Chechen Republic due to the lack of statistical data. Since 2012, Khanty-Mansi Autonomous Okrug – Yugra, Yamalo-Nenets Autonomous Okrug (as part of the Tyumen Region) and Nenets Autonomous Okrug (as part of the Arkhangelsk Region) were separately included in the calculations.

The analysis includes 83 Russian subjects (with the exception of the Republic of Crimea and the city of Sevastopol), which are united in 8 federal districts (Figure 1,Table 1).

RESULTS AND DISCUSSION

Russian manufacturing industry has a multi-branch structure; distribution throughout the regions of the country is uneven (Table 2).

The Central and Volga Federal Districts located in the European part of Russia are the most developed in industrial production, make up 54.4 % in the structure of production volume and 46.9 % in the number of employees. The Far Eastern, Southern and North Caucasian Federal Districts are the least industrialized. Manufacturing industry is distributed unevenly throughout the country's districts. The district's specific weight in total production exceeds the district's specific weight in population in four old industrial districts with a high population density and a high level of human potential (Central, North-Western, Ural and Volga). Moderate concentration is observed in the resource-producing regions of Siberia with not very favourable climatic conditions. Low concentration is observed in the regions of southern Russia with a warm climate and favourable conditions for agriculture and in the Far East with low population density, remoteness from markets and high transport costs in the Far Eastern, Southern and North Caucasian Federal Districts (Table 2).

The highest production growth of 48-51 % between 2010 and 2015 was observed in three industrially undeveloped districts (Far Eastern, Southern and North Caucasian). The "low base" effect was probably a reason. The average growth was observed in the Volga (43 %) and the Ural (38 %); in other districts, as well as on average across Russia, production grew by 20 %. The Central, North-Western, Southern and North Caucasian Federal Districts have increased their shares in the output of industrial products during the studied period; and all other districts have decreased their shares.

Figure 1: Map of federal districts of Russia

Table 1: Federal Districts of Russia

Federal district		Regions	Area, km²	Population, K people (01.01.2016)	Administrative center
	Central	18	38.438.600	39.104	Moscow
	North-Western	11	13.583.800	13.854	Saint Petersburg
	Volga	14	29.900.400	29.674	Nizhny Novgorod
	Southern	8	16.141.100	14.045	Rostov-on-Don
	North Caucasus	7	9.496.800	9.718	Pyatigorsk
	Ural	6	12.082.700	12.308	Yekaterinburg
	Siberian	12	19.254.300	19.324	Novosibirsk
	Far Eastern	9	6.291.900	6.195	Khabarovsk

The Far Eastern, North-Western and Volga Districts were most strongly hit by the 2013 crisis; their indicators have respectively been reduced in 2015 in comparison with 2014 by 8.9 %, 5.6 % and 3.5 %.

Estimation of the spatial concentration, based on the Herfindahl-Hirschman index (IHH), the coefficient of variation (CV), the Theil index (IT) by the production volume, the number of employees and the fixed assets volume during the period of 2005-2015, are presented in Table 3.

The concentration indices show the similar dynamics: a growth is noticeable by all production and the fixed assets value indices; and employment indices are quite stable, which can be explained by the low population mobility. This feature of Russia is noted in many works on the subject of spatial concentration. The spatial concentration increases in the all-Russian scale.

There is a concentration of manufacturing industries in some Russian regions and its dispersion in other regions. Table 2 shows that the production structure has changed somewhat during the period under study: the share of regions in the eastern part of the country (the Ural and Siberian districts) and the Volga District has decreased, while the share of the regions in the western part of the country with the exception of the Volga District (Central, North-Western, Southern and North Caucasian Districts) has increased. The largest growth of specific weight in the structure of manufacturing industry (more than 1 %) is noted in Moscow city, St. Petersburg, the Republic of Tatarstan, the largest decrease (more than 1 %) is in the Samara region and the Republic of Bashkortostan. Agglomeration effect within the framework of New Economic Geography can very well explain the reasons of the manufacturing industry concentration in the largest cities with a million population.

Table 2: Structure of manufacturing industry across federal districts

Federal districts	District share in the manufacturing industry, %			District share in the country's population, %			The increment of production in 2015/2014, %
	2005	2010	2015	2005	2010	2015	
Central	29.2	30.3	33.5	26.6	26.9	26.7	97.4
North-West	12.4	14.4	13.6	9.6	9.5	9.5	94.4
South	5.9	6.0	6.4	9.7	9.7	9.6	103.1
North Caucasus	5.9	6.0	6.4	6.3	6.6	6.6	104
Volga	23.9	21.9	20.9	21.3	20.9	20.2	96.5
Ural	13.5	13.1	12.3	8.5	8.5	8.4	98.9
Siberian	12.7	11.5	10.5	13.6	13.5	13.2	97.5
Far East	1.5	1.6	1.7	4.5	4.4	4.2	91.1

Table 3: Spatial concentration dynamics of the manufacturing industry

Years	Concentration indices								
	by production volume			by employment			by the fixed assets value		
	IHH	CV	IT	IHH	CV	IT	IHH	CV	IT
2005	0.037	1.44	0.303	0.025	1.03	0.189	0.036	1.413	0.233
2010	0.037	1.46	0.307	0.024	1.00	0.181	0.055	1.898	0.318
2011	0.038	1.47	0.314	0.024	1.00	0.181	0.053	1.853	0.313
2012	0.038	1.48	0.315	0.024	0.99	0.179	0.055	1.908	0.323
2013	0.041	1.56	0.321	0.024	0.98	0.179	0.057	1.942	0.326
2014	0.043	1.62	0.328	0.024	0.99	0.178	0.056	1.944	0.330
2015	0.043	1.61	0.320	0.024	1.00	0.181	0.053	1.881	0.322

The termination of directive planning, based on the even distribution of production throughout the country, has led to a redistribution of production from east to west under the influence of market forces. The calculation of the Herfindahl-Hirschman index by the production volume, the number of employees and the fixed assets volume has confirmed the conclusions drawn (Table 4). Since 2010, there are steady tendencies of change by all three indicators: deconcentration takes place in the eastern regions and in the Volga Federal District, production concentration is observed in other regions.

The distribution of the manufacturing industry within the federal districts is uneven (Table 4). There is a high spatial concentration within the districts in the Southern, North Caucasian, Ural and Far Eastern Districts. Therefore it can be concluded that in these districts manufacturing industry is concentrated only in a small number of regions. The distribution of manufacturing industry in the rest of the country is more even.

The analysis of the manufacturing industry placement by regions made it possible to identify regions with a very high and very low level of spatial concentration relative to the average Russian level. The regions, in which a specific weight in total production volume exceeded 4 %, in total employment exceeded 3 % and in fixed assets exceeded 2.5 %, have been classified as regions with a high concentration. The regions, in which a specific weight in total production volume was less than 0.1 %, in total employment was less than 0.5 % and in fixed assets – less than 0.1 %, have been classified as regions with a low concentration. Moscow city, Moscow Oblast, St. Petersburg, the Republic of Tatarstan, Sverdlovsk Oblast (the Central, North-Western, Volga and Ural Districts' regions) belong to the group of regions with a high spatial concentration. The Republic of Adygea, the Republic of Kalmykia, the Republic of Ingushetia, the Kabardino-Balkar Republic, the Karachay-Cherkess Republic, the Republic of North Ossetia-Alania within the Southern and North-Caucasian Districts, which are depressed territories, belong to the group of regions with a low spatial concentration. Depressed regions fell into a trap: development is impossible without the concentration of industry and industry concentration does not occur under the influence of market mechanisms. In this situation, state regional policy for the development of industry in underdeveloped regions are necessary.

The Herfindahl-Hirschman index detailed down to four-digit directions in economic activity according to available statistics was used to analyse the spatial concentration dynamics within the federal districts (Table 5). Textile industry (fabrics production), pulp and paper production (production of wood pulp and pulp made from other fibrous materials, paper production), excavators production, production of washing machines and television receiving equipment have the highest levels of spatial concentration. The high spatial concentration of the textile industry is also observed in the Western European countries. Localization of the textile industry enterprises in certain regions was brought about by historically rooted conditions and positive externalities of the agglomeration process. Concentration of the textile industry in Russia is in the Central Federal District (Ivanovo Oblast). Pulp and paper industry enterprises are concentrated in the North-Western District, which accounts for about 60% of the pulp and paper production. Concentration of the industry producing transport vehicles and equipment occurs in the Central and North-Western Districts, which have highly qualified personnel and scientific potential. The enterprises producing cement, non-refractory ceramic bricks, precast reinforced concrete structures and items are relatively dispersed.

There are dissimilar trends of spatial concentration in different sectors of manufacturing industry. In total 25 detailed directions of economic activity were analyzed: there is concentration in 14 directions and dispersion – in 10 directions. Production of knitted products, hosiery knitted products, footwear, timber, mineral or chemical fertilizers, plastics, tyres, rubber tubes, cement, non-refractory ceramic bricks, production of precast reinforced concrete structures and items, steel, tractors, excavators, television receiving equipment have become more geographically concentrated. Production of fabrics, plywood, pulp, paper, cardboard, steel pipes, machine tools, tractors, passenger cars, refrigerators and freezers have become more evenly distributed throughout the federal districts.

SUMMARY AND CONCLUSION

The post-Soviet period in Russia was marked by the increase in the spatial concentration in the manufacturing industry. In comparison with the Soviet period, when the manufacturing industry was dispersed throughout the country, its concentration in certain regions occurs, which leads to spatial compression. With regional concentration in Russia being dominant, there are parallel dispersion processes: there is deconcentration in the eastern regions and the Volga Federal District and concentration – in the regions of the Central, North-Western, Southern and North-Caucasian Districts. Production is redistributed from east of the country to west under the influence of market forces. The group of regions with a high spatial concentration includes the regions with cities with a million population (Moscow city, Moscow Oblast, St. Petersburg, the Republic of Tatarstan, Sverdlovsk Oblast), in which positive externalities of the agglomeration process generate centripetal attraction. The geography of manufacturing industry is dispersed in the depressed national republics of southern Russia.

Considerable disparities of the manufacturing industry placement are well noticeable in four federal districts: in the Southern, North Caucasian, Ural and Far Eastern Districts. The distribution of manufacturing industry throughout the regions is more even in other districts.

Table 4: Spatial concentration dynamics of the manufacturing industry within the federal districts

Federal districts	2005	2010	2011	2012	2013	2014	2015
The Herfindahl-Hirschman index by output volume							
Central	0.205	0.190	0.187	0.185	0.215	0.228	0.231
North-West	0.191	0.280	0.300	0.321	0.290	0.287	0.252
South	0.306	0.301	0.302	0.307	0.303	0.309	0.308
North Caucasus	0.354	0.446	0.432	0.380	0.401	0.425	0.471
Volga	0.126	0.123	0.126	0.124	0.126	0.123	0.120
Ural	0.305	0.279	0.288	0.288	0.262	0.267	0.258
Siberia	0.171	0.162	0.163	0.162	0.158	0.164	0.161
Far East	0.227	0.237	0.250	0.259	0.276	0.277	0.257
The Herfindahl-Hirschman index by number of employees							
Central	0.108	0.106	0.107	0.103	0.102	0.103	0.106
North-West	0.192	0.168	0.173	0.176	0.179	0.180	0.182
South	0.280	0.285	0.283	0.284	0.283	0.290	0.296
North Caucasus	0.256	0.258	0.254	0.244	0.238	0.228	0.224
Volga	0.092	0.091	0.091	0.090	0.091	0.090	0.090
Ural	0.361	0.350	0.352	0.353	0.351	0.346	0.347
Siberia	0.134	0.128	0.128	0.127	0.126	0.126	0.126
Far East	0.260	0.252	0.248	0.244	0.244	0.245	0.250
The Herfindahl-Hirschman index by the fixed assets volume							
Central	0.251	0.367	0.359	0.384	0.393	0.395	0.384
North-West	0.145	0.155	0.159	0.160	0.161	0.163	0.164
South	0.277	0.268	0.270	0.275	0.294	0.303	0.306
North Caucasus	0.307	0.263	0.260	0.266	0.261	0.268	0.272
Volga	0.098	0.101	0.107	0.101	0.101	0.101	0.102
Ural	0.713	0.773	0.751	0.772	0.766	0.761	0.757
Siberia	0.120	0.125	0.126	0.127	0.126	0.125	0.128
Far East	0.167	0.168	0.183	0.204	0.191	0.188	0.195

A more detailed analysis revealed features of manufacturing industry enterprises placement. Textile industry is historically predominantly localized in the Central District, pulp and paper production – in the North-Western District, some transport vehicles and electronic equipment industry – in the North-Western and Central Districts with a high scientific potential and large labour market. The trend of spatial concentration growth is revealed in the clothing industry, chemical production, transport vehicles production and electronics industry. Russia repeats the Western countries tendency, where high-tech industries (chemical or electronic industry) are usually highly localized in order to make the most of the agglomeration advantages.

Manufacturing industry in modern Russia has undergone serious transformations related to the growth of spatial concentration nearly to the level of European countries and strong localization of separate sectors of manufacturing industry (chemical and electronic industry, and transport vehicles production) under the influence of agglomeration forces.

Further research in this sphere will be expanded and devoted to the spatial concentration of economic activity in Russia. The results of research are important for designing an effective state industrial policy and determining measures to reduce spatial interregional inequality.

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Table 5: Spatial concentration dynamics of the manufacturing industry on detailed directions of economic activity

	2010	2011	2012	2013	2014	2015
Textile and clothing industry						
Fabrics production	0.617	0.580	0.585	0.560	0.567	0.595
Knitted products production	0.195	0.208	0.236	0.250	0.251	0.268
Hosiery knitted products production	0.371	0.358	0.374	0.389	0.373	0.378
Leather, leather goods and footwear production						
Footwear production	0.240	0.254	0.247	0.264	0.261	0.246
Wood processing and production of wood products						
Timber production	0.248	0.241	0.237	0.260	0.258	0.259
Production of plywood consisting only of wood sheets	0.260	0.255	0.241	0.246	0.250	0.252
Pulp and paper production, publishing and printing activities						
Production of wood pulp and pulp made from other fibrous materials	0.462	0.467	0.472	0.467	0.469	0.458
Paper production	0.455	0.436	0.440	0.432	0.440	0.440
Cardboard production	0.417	0.418	0.411	0.424	0.412	0.387
Chemical production						
Mineral or chemical fertilizers production	0.360	0.364	0.334	0.348	0.378	0.364
Rubber and plastic goods production						
Production of plastics in primary forms	0.351	0.342	0.365	0.340	0.368	0.356
Tyres and new rubber tubes production	0.245	0.257	0.269	0,276	0,267	0,256
Production of other non-metal mineral products						
Production of Portland cement, aluminous cement, slag cement and similar hydraulic cements	0.166	0.166	0.166	0.170	0.174	0.173
Production of non-refractory ceramic bricks	0.184	0.192	0.190	0.190	0.195	0.198
Metallurgical production and production of finished metal products						
Production of precast reinforced concrete structures and items	0.192	0.193	0.201	0.202	0.201	0.194
Steel production	0.230	0.232	0.239	0.241	0.242	0.241
Production of finished rolled ferrous metal products	0.234	0.238	0.239	0.238	0.236	0.234
Steel pipes production	0.247	0.243	0.257	0.243	0.243	0.243
Manufacture of machinery and equipment						
Machine tools manufacture	0.353	0.421	0.393	0.394	0.342	0.333
Transport vehicles and equipment production						
Production of agriculture and forestry tractors	0.570	0.557	0.418	0.351	0.304	0.324
Excavators production	0.294	0.444	0.445	0.510	0.715	0.751
Passenger cars production	0.372	0.332	0.320	0.309	0.322	0.354
Electrical, electronic and optical equipment production						
Production of household refrigerators and freezers	0.463	0.485	0.508	0.485	0.438	0.353
Production of household washing machines	0.624	0.680	0.695	0.724	0.708	0.666
Production of television receiving equipment, including video monitors and video projectors	0.495	0.503	0.517	0.514	0.500	0.504

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