“Whirlpools” and “Safe Harbors” in the Dynamics of Industrial Specialization in Russian Regions

Evgeniy Kutsenko
Director, Russian Cluster Observatory, Institute for Statistical Studies and Economics of Knowledge (ISSEK)[a], ekutsenko@hse.ru

Yaroslav Eferin
Analyst, Digital Development Global Practice[b]; Postgraduate Student, ISSEK[a], yeferin@worldbank.org

[a] National Research University Higher School of Economics, 11, Myasnitskaya str., Moscow 101000, Russian Federation
[b] World Bank (Russian Office), 36/1, Bolshaya Molchanovka str., Moscow 121069, Russian Federation

Abstract

This article analyzes sectors of specialization and sectoral dynamics in the regions of the Russian Federation from 2005 to 2015. The study is based on the methodology of the European Cluster Observatory in the 2016 edition as revised by the authors. It proposes a typology of regions depending on the number of specialization industries and the depth of sectoral development: agglomeration, diversification, specialization, and differentiation. Four types of specializations are identified based on the depth of their development and distribution among Russian regions: national leadership, distribution, concentration, and niche development. The authors implemented an approach to study regions through alternative scenarios of sectoral development over a ten-year period: occurrence, strengthening, extinction, and disappearance. The study identifies various structural models that combine the implementation of the described scenarios in relation to various specializations within a particular region. It is shown that the scale and intensity of structural changes largely depends on the region’s proximity to million-strong cities but does not always directly affect economic growth rates. The authors introduce the concepts of “vortexes”, “streams”, and “safe harbors”, which describe the types of regions with a different type of structural changes that occur depending on the presence or proximity of the million-strong city.

Keywords: regional specialization; smart specialization; regional economic policy; sectoral development of the regions; localization coefficient; structural policy; industry diversification.

Citation: Kutsenko E., Eferin Y. (2019) “Whirlpools” and “Safe Harbors” in the Dynamics of Industrial Specialization in Russian Regions. *Foresight and STI Governance*, vol. 13, no 3, pp. 24–40. DOI: 10.17323/2500-2597.2019.3.24.40

Structural changes in the economy is a key element of achieving sustainable economic development and increased wellbeing [*Hidalgo, Hausmann,* 2011; *Boschma,* 2017]. Transformations caused by the development of new sectors and the diversification of national and regional economies' industry structure command the highest interest of researchers [*Hidalgo et al.,* 2007; *Pinheiro et al.,* 2018]. Such transformations may involve not only the emergence of new economic activities, but also their growth, decline, or even disappearance, while these radically different processes may simultaneously arise in the same region.

Regional economies develop unevenly [*Hausmann, Rodrik,* 2003; *Hudson,* 2009]. In Russia, regions have very different resource potentials, territorial characteristics, economic development levels, and wealth. This leads to high socioeconomic inequality [*Zubarevich,* 2010]. This mismatch gives one grounds to expect that Russian regions will face structural changes on different scale and at varying rates.

One of the main objectives of the "Spatial Development Strategy for the Russian Federation Until 2025"[1] was to increase regions' competitiveness by promoting "effective economic specialization". However, relevant efforts are hindered by the lack of targeted studies of Russian regions' specialization industries and their development paths.

For the purposes of this paper, the known methodology for identifying and assessing industry development proposed by the Harvard Business School and the European Cluster Observatory [*Ketels, Protsiv,* 2014] was adjusted to reduce the effects of one-sided concentration and the specialization of industries within specific regions. The created database allows one to analyze regional growth in the following terms:

- the industries that Russian regions specialize in;
- grouping territories by the number of economic sectors represented and the latter's development level;
- particular industries' status in the regional economy: key or niche;
- the nature of structural changes in Russian regions' economy during the ten-year period under consideration (2005-2015);
- the correlation between the actual changes and geographical proximity to major agglomerations.

The paper presents a review of techniques for identifying regions' specialization industries and proposes an original methodology and static and dynamic models of Russian regions' industrial development. On the basis of interpreting the obtained results, recommendations to improve government policies were prepared.

The Methodology for Identifying and Assessing Regions' Industrial Specializations

Over the last several decades, the role of regional factors in national and global economic development has significantly increased [*Toffler,* 2006; *Ohmae,* 2002]. Regions and individual cities are turning into independent actors in economic processes, which leads to increased international competition and creates the need to review existing approaches that do not take into account local specifics [OECD, 2012]. Territorial development largely depends on geographic, demographic, and sociocultural aspects [*Rodrik,* 2003]. Government policies should consider the latter's diversity when designing tools for various regions moving along specific structural development paths [*Barca et al.,* 2012; *Grillitsch, Asheim,* 2018; *Shenoy,* 2018].

Most professionals choose diversification as the preferred regional development model [*Hausmann, Klinger,* 2007; *Boschma,* 2017; *Chen,* 2018], since it makes the strongest impact upon the regional economy [*Hidalgo, Hausmann,* 2009; *Neffke et al.,* 2011]. However, the vector of changes does not always match the territory's current industry profile [*Frenken et al.,* 2007; *Boschma et al.,* 2013; *Pinheiro et al.,* 2018].

Studying the specific features of regional economies and specialization industries remains a major aspect of economic development, important in scientific and practical terms alike [*Leksin, Shvetsov,* 2012; *Liubimov et al.,* 2017]. Drivers of economic growth, conditions, and processes leading to prosperity have been studied for a sufficiently long amount of time. Identifying regions' competitive advantages and specialization industries help one understand the nature of the structural changes, design regional policies, choose the most effective tools for implementing them, and evaluate the results [*Klimanov,* 2007; *Klimenko et al.,* 2015; *Simachev at al.,* 2014]. Given the lack of a generally accepted approach to identifying and analyzing regional specialization industries, a meaningful discourse on territory types and their development models does not seem to be possible. In other words, it would be hard to find empirical evidence to support theoretical constructs and transform them into specific policies and support measures. Choosing an appropriate method is paramount here, one which, among other things, would take into account the specific features of particular territories' statistics.

Various indicators and methods of their calculations are applied in international and Russian practices to identify regions' specialization industries. One of the most popular ones is the localization coefficient [*Fracasso, Marzetti,* 2018; *Kopczewska et al.,* 2017; *Lu et*

[1] Approved by the RF Government instruction No. 207-r of 13.02.2019

al., 2011; *Beaudry, Schiffauerova,* 2009], also known as Balassa-Hoover Index or Hoover Specialization Index [*Hoover,* 1936; *Kim,* 1995]. Other methodologies for identifying industrial diversity and geographical distribution of industries by region apply various other indices including the Gini Concentration Index [*Gini,* 1936; *Devereux et al.,* 1999], Hachman Index [*Sharma,* 2008], Krugman Concentration Index [*Krugman,* 1991; *Bickenbach, Bode,* 2008], Hallet Index [*Hallet,* 2000], Lilien Index [*Lilien,* 1982], Ellison-Glaeser Index [*Ellison, Glaeser,* 1999; *Kominers,* 2008; *Rothenberg et al.,* 2017], and others.

Mainstream techniques for identifying regional specialization industries described in the Russian literature include various coefficients such as the depth of sector development, inter-district marketability, and per capita production [*Gavrilov*, 2002; *Kovalenko*, 2005, *Prokopiev*, 2015], the Herfindahl-Hirschman Index [*Belov*, 2012], and the Localization Coefficient. The latter is used most commonly since it allows one to measure the concentration of particular industries in the region using indicators such as output, number of workers, and investments in fixed assets. In its generalized form, the Localization Coefficient looks as follows:

$$LQ = \frac{\left(I^R/_{I^{TR}}\right)}{\left(I^N/_{I^{TN}}\right)}, \qquad (1)$$

where: *LQ* is the localization coefficient, is regional industry, is national industry; is regional economy, and is national economy. The coefficient's values above 1 indicate specialization, though certain researchers use the threshold range between 0.8-1.25 [*Bergman, Feser,* 1999; *Porter,* 2003; *Kutsenko et al.,* 2011].

The calculation of the localization coefficient is frequently based on the average number of employees [*Ketels, Protsiv,* 2016; *Kutsenko et al.,* 2011; *Pavlov et al.,* 2014; *Pinkovetskaya,* 2015], which is less dependent upon the specifics of national taxation regimes and corporate accounting standards. For example, Moscow's shipped product export statistics give one grounds to conclude that the oil and gas industry is likely to become the capital city's main industry, due to of the residents who in reality do business in other regions [*Kadochnikov, Fedyunina,* 2013].

Several factors impose certain limitations on the localization coefficient. In absolute terms, its high values can be combined with low ones, which is fraught with overestimating the industry concentration in the region under consideration. The opposite situation is also possible, when low values of the coefficient are combined with high ones. This is typical for regions which host large urban agglomerations and thus have a wide range of industries. Finally, the emergence of new technologies and robotization are likely to lead, over time, to reduced employment in a number of industries [*Prokopyev*, 2015]. Introducing additional regional specialization indicators will help to remedy this technique's shortcomings.

An integrated methodology for identifying and mapping specialization industries was suggested by the European Cluster Observatory in 2014 (further on, ECO-2014). Industries were distributed between clusters based on the principle of interconnected, compactly localized activities [*Ketels, Protsiv*, 2014]. The ECO-2014 toolset includes an algorithm for identifying such groups proposed by Michael Porter [*Porter*, 2003]. It involves dividing all industries into two groups: local ones (focused on meeting the needs of the region's population, such as consumer services, retail, etc.), and traded ones (i.e., those oriented towards inter-regional and international trade, such as the automotive industry) [*Delgado et al*., 2014]. According to Porter, the latter group is particularly important since such industries determine the competitiveness of a particular region.

The algorithm for identifying cluster groups adjusted in [*Delgado et al.,* 2016] comprises five sequential stages:

1) Pairwise comparison of industries by region to detect localization patterns, including by building similarity matrices;
2) Identifying inter-sectoral links at the national level;
3) Identifying various clustering forms of the studied objects through specialized analysis;
4) Evaluating the quality of the created cluster groups;
5) Eliminating statistical errors.

Applying this algorithm produces as objective a set of cluster groups as possible, comprising steadily interconnected trading industries.

The Porter model provided the basis for ECO-2014, which was adjusted to reflect the changes in the European classification of economic activities NACE. This methodology was designed not only to identify specialization areas but also to assess the level of their development in the region, using the following criteria:

- Specialization level LQ (localization coefficient);
- Size S (ratio of regional/national employment in the industry);
- Productivity P (average wage in the industry in the region);
- Growth G (ratio of this/last year's employment in the industry in the region).

The ECO-2014 toolset allows one to onedetermine the number of specialization industries in all regions of the studied country or group of countries and their development level. For Russia it was tested in [*Kutsenko et al*. 2019; *Simachev et al*., 2014]. Points ("stars") were used to measure the development level of each sector. A star was assigned to the region if it fell into the top 20% of regions according to the relevant criterion (therefore the maximum number of stars a regional industry could receive was 4). Only the top regions that collectively accounted for 80% of national employment in the industry were considered. This rule was

introduced to exclude specialization industries insignificant on the national scale.

In 2016, the European Cluster Observatory made a number of changes to the ECO-2014 methodology, mainly related to the algorithm for assigning stars. According to the updated approach (ECO-2016), regions were filtered out on the basis of stars assigned in line with the LQ criterion. Additional stars can be assigned to regional specialization industries on the basis of the criteria S, P, or G, the same way as in ECO-2014. Unlike the previous version, however, the ECO-2016 methodology allows one to significantly reduce the total number of regional specialization industries. The new filtration principle helps regions with large economies to focus on the most important industries, while abandoning the old methodology allows one to assign stars to regions with a small workforce.

Our approach combines the two filtering conditions of the ECO-2014 and ECO-2016 methodologies. In our model, to classify an industry as a regional specialization, the region must be one of the top 80% in terms of size (S) *and* have a specialization level star (according to the LQ criterion). This allowed us to exclude regions with one-sided concentration or specialization, while the resulting list was as conservative as possible since the likelihood of errors in determining core industries was reduced to the minimum (Figure 1).

Statistical Typology of Russian Regions' Industrial Development

Adapted for the purposes of our study, the methodology was applied to a sample comprising 80 Russian regions[2] for the period of 2005-2015, using data on the average number of employees and accrued wages by industry[3]. The results were specialization industry lists for 71 Russian regions,[4] with an assessment of their development level.

The regions with the largest number of specialization industries in 2015 included the Vladimir Region (22 specialized sectors), St. Petersburg (16), Moscow, the Yaroslavl, Leningrad, and Perm Regions (15 each). An assessment of the development level of the identified specialization industries provides a different picture. For example, the range of relevant activities in the Vladimir Region is wide, but their development remains relatively low, while for example St. Petersburg shows an inverse situation.

Taking into account the number of specialization industries and their development level in 2015, four types of regions were identified (Figure 2):

- "Agglomeration": a large number of specialization industries and a high level of their development: St. Petersburg, Moscow, Moscow and Leningrad Region, Republic of Tatarstan, etc.
- "Diversification": large number of competency areas but not very impressive progress: Vladimir[5], Yaroslavl, Kirov Regions, etc.
- "Specialization": a narrow range of highly developed specialization areas: Murmansk, Tyumen, Rostov Regions, etc.
- "Differentiation" few specialization industries with a low development level: Republic of Buryatia, Tambov, Astrakhan Regions, etc.

The most common specialization areas in Russian regions include: wood products (16 regions); clothing, telecommunication equipment, meat products, plastic and rubber products, refractory materials (15); oil and gas, heavy mechanical engineering, chemical products, forestry, and pulp-and-paper products (14).[6]

Specialization industries have different overall development level values. For example, 14 regions specialize in the "Oil and gas" cluster group and the progress rate of the respective industries remains among the highest with a total of 45 stars. An opposite example is the cluster group "Heavy mechanical engineering"; 14 regions specialize in it, but the development level of the relevant sectors remains low with only 22 stars in total.

Similar to regions, four types of industries can also be identified (Figure 3):

- "National leaders": high proliferation combined with a high development level: oil and gas, plastic products, business services, ICT, etc.;
- "Proliferation": wide proliferation combined with a low development level: clothing, meat products, heavy mechanical engineering,[7] etc.;
- "Concentration": low coverage with a high development level: leather goods, jewellery, sound recording, etc.;

[2] The Nenets, Khanty-Mansi, and Yamal-Nenets Autonomous Regions were excluded from the sample because they were accounted for in the calculations for the Archangelsk and Tyumen Regions. The Republic of Crimea and the Federal City of Sebastopol were not analyzed due to the lack of compatible data for the period under consideration.

[3] The calculations were based on the All-Russian Classification of Economic Activity Types OK 029-2007 (NACE Rev. 1.1) (OKVED-1), the fourth level of detail for the indicators "Average number of employees during the reporting period, individuals" and "Amount of accrued wages during the reporting period, thousand rubles" as reported in the statistical observation form P-4.

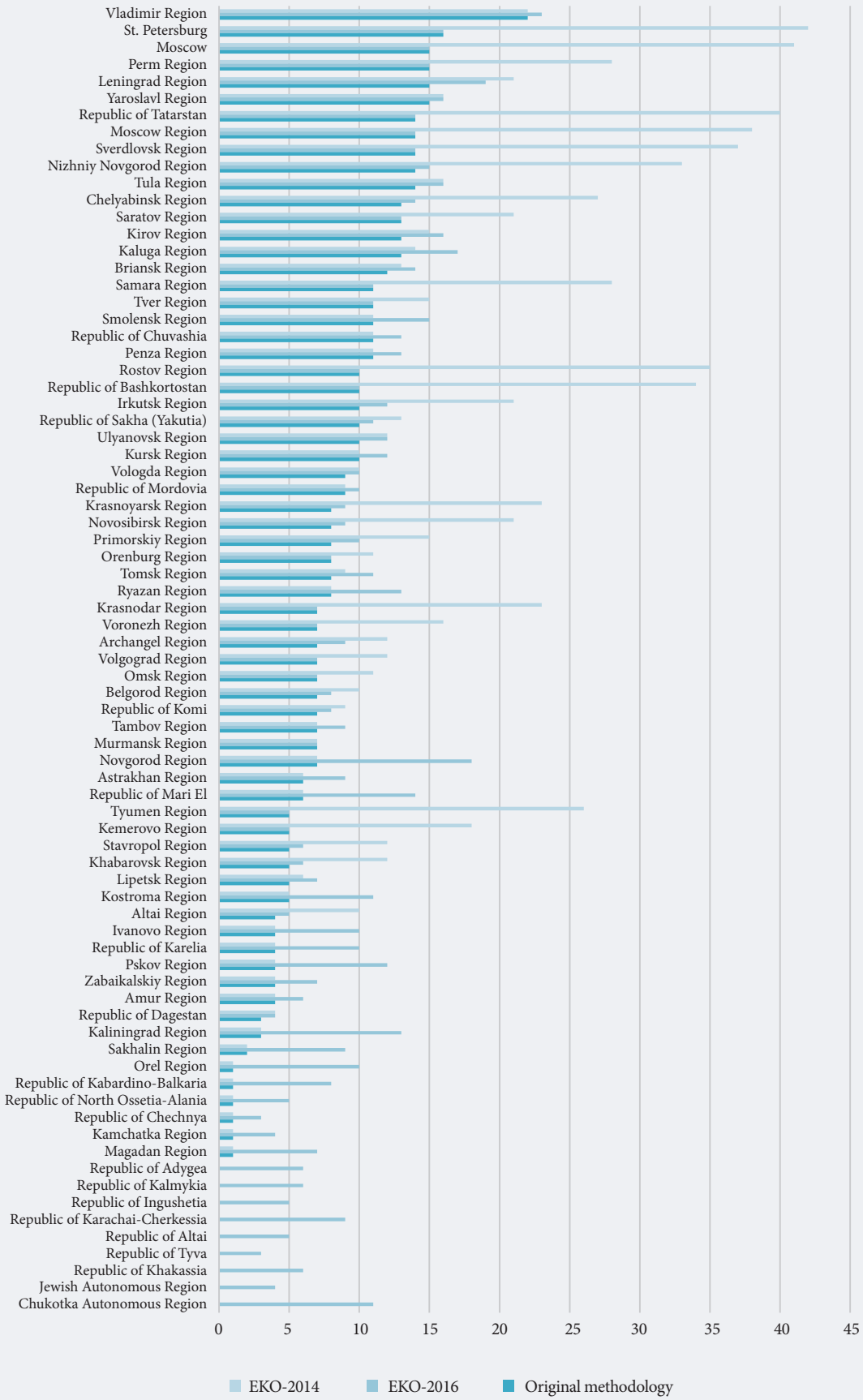
[4] The presented methodology did not reveal a concentration of employment sufficient to definitely identify specialization industries in the following regions: Republics of Adygea, Kalmykia, Ingushetia, Karachai-Cherkessia, Altai, Tyva, Khakassia, the Jewish Autonomous Region, and the Chukotka Autonomous Region.

[5] Interestingly, the largest number of specialization areas were identified in the Vladimir Region, with a relatively low development level. Also, the identified specialization areas were almost exactly the same as in Moscow, especially manufacturing industries. Differences with Moscow were identified in the production of home appliances, wood products, refractory materials and rubber goods (Vladimir Region's specialization), and in industries such as finance, education, R&D, insurance, and film production (Moscow's specialization).

[6] In Porter's study and the European Cluster Observatory's methodologies, certain cluster groups combine industrial and service activities. In particular, telecommunication equipment and services and construction and construction materials.

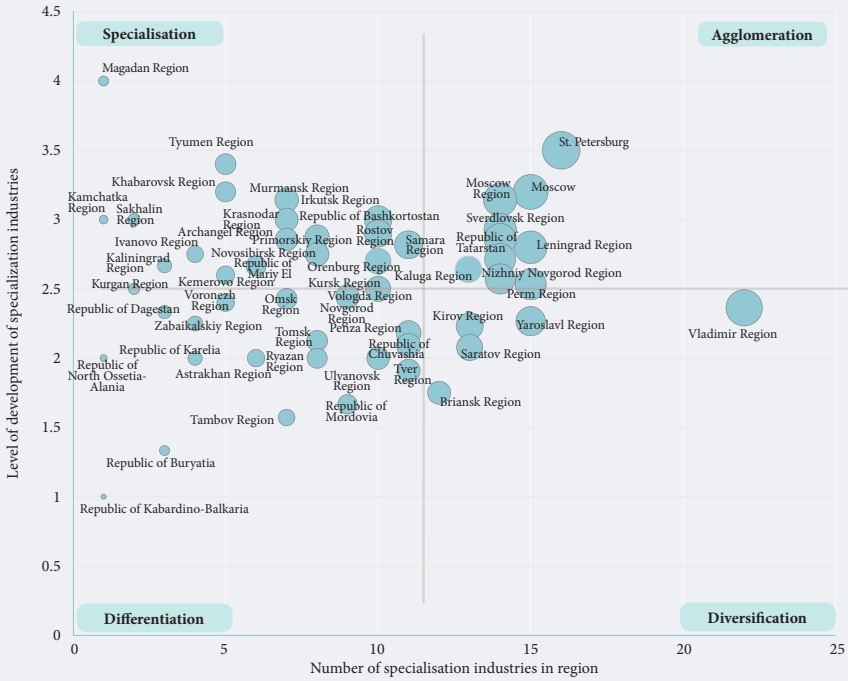
[7] The "Heavy mechanical engineering" cluster group includes the production of railway rolling stock with the highest number of employees.

Figure 1. **Russian Regions' Specialization Industries Identified Using Different Methodologies (*number of sectors*)**



Source: compiled by the authors.

Figure 2. **Distribution of Russian Regions by the Number of Specialization Industries and their Development Level: 2015**

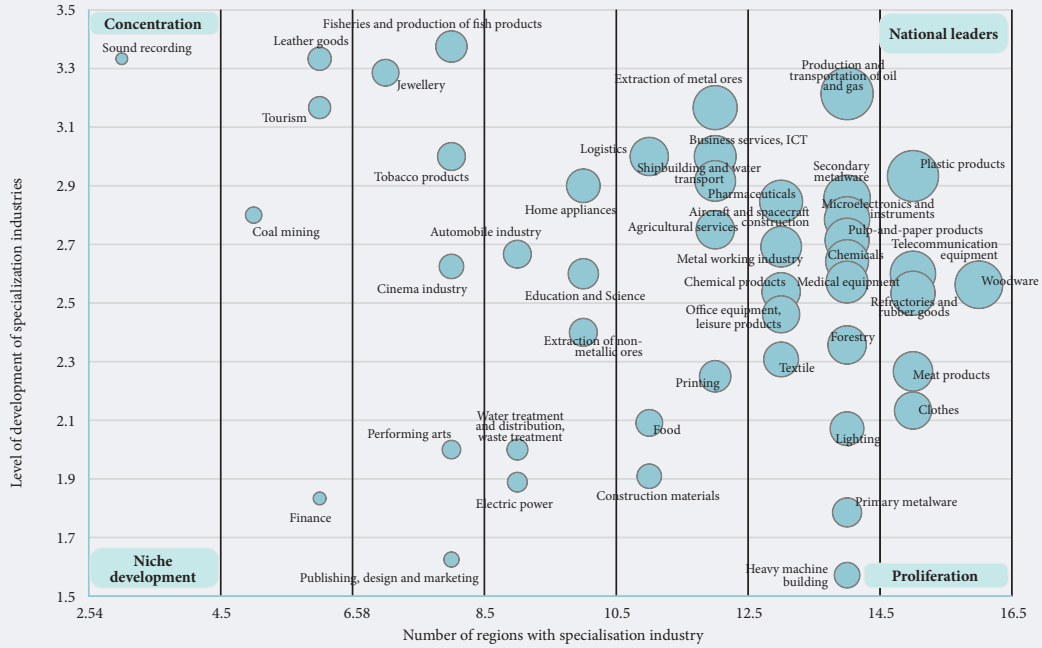


Notes:

1. Number of specialization industries (X axis): the total number of specialization industries in the region
2. Overall development level of specialization industries (circle size): combined development level of all specialization industries in the region
3. Average development level of specialization industries (Y axis): the ratio of the overall development level of specialization industries to their number in the region

Source: compiled by the authors.

Figure 3. **The Distribution of Specialization Industries by Proliferation and Development Level in Russian Regions: 2015**



Notes:

1. Number of regions with specialization industry (X axis): the total number of regions specializing in this industry
2. Overall development level of the specialization industry (circle size): the combined development level of the specialization industry in all regions
3. Average development level of the specialization industry (Y axis): the ratio of the overall development level of the specialization industry to the number of regions specializing in this industry

Source: compiled by the authors.

- "Niche": low proliferation and development level values: performing arts, publishing, finance, etc.

The database we have created allows one to move from static regional development typologies to a more complex, dynamic analysis, to identify relevant models and patterns.

Scenarios and Structural Models of Regions' Industrial Development

Any industry can be described using four possible development scenarios: (a) "Emergence", (b) "Growth", (c) "Fading", and (d) "Deterioration", measured using the proposed methodology (Figure 4). Each model is based on the growth of regional specialization industries (measured in "stars") over the course of the period of 2005-2015.[8]

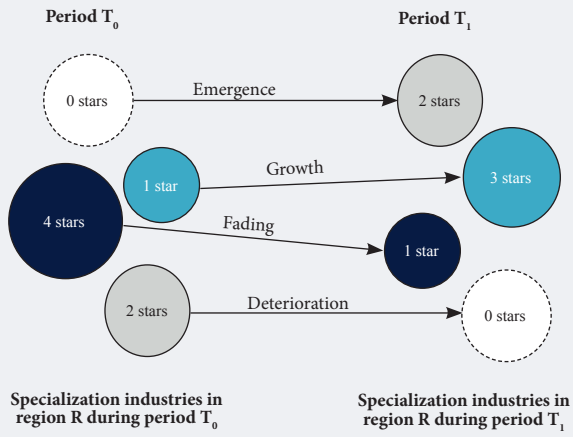
During the decade under review here, new specialization industries most frequently emerged in the Central Federal District (CFD) regions, such as the Vladimir, Bryansk, Tula, Smolensk, and other regions. The Vladimir Region is the leader, with 12 new specialization industries: household appliances, jewelry, pharmaceuticals, furniture, leather goods, business services and ICT, telecommunication equipment and services, footwear, meat processing, medical equipment, publishing, design and marketing, and primary metalware.

St. Petersburg, the Republic of Tatarstan, the Vladimir, Sverdlovsk, Kursk, and other regions are the leaders in the "Growth" scenario. In the first two of the aforementioned Russian regions, eight specialization industries have improved their positions, while only two and one new ones, respectively, have emerged. In St. Petersburg, this is business services and ICT, wholesale trade and e-commerce, education and science, tourism, jewellery and leather goods, medical equipment, and the film industry while in Tatarstan these industries are business services and ICT, telecommunication equipment and services, oil and gas, plastic products, aircraft construction, and chemical products.

The "Fading" scenario most accurately describes the industry portfolios of the city of Moscow, the Moscow, Kaluga, Yaroslavl, and Vologda regions. Note that the "Fading" in Moscow and the Moscow Region was relatively minor, averaging a single star. Interestingly, there has been a slight decrease in industry concentration in the capital city over the past ten years,[9] especially after 2008, which may be explained by the global economic crisis of 2007-2009.

"Deterioration" primarily affected the specialization industries in the Tula, Moscow, Oryol, Volgograd,

Figure 4. **Regional Industrial Development Scenarios**



Source: compiled by the authors.

Novosibirsk, and some other regions. In particular, in the Tula region, the production of heavy machinery, medical equipment, leather goods, textile products, printed materials, office equipment, and leisure products declined over the past ten years.

The four above scenarios can simultaneously unfold in different specialization industries in the same region.[10] Therefore, when analyzing industry growth in regions it would be more correct to speak not about scenarios, but structural models comprising different sets of simultaneously implemented industry development scenarios. This allows one to classify regions based on the scenario set: from no changes in specialization industries to the transformation of all four modalities. This measure of the absolute scale of structural changes can be supplemented by relative coverage or intensity, describing just the affected set (share) of specialization industries.

A comparison of static types and dynamic models of industry development shows that regions with a large number of specialization industries (the "Agglomeration" and "Diversification" types) experience major structural changes. Apparently, this is due to the increased volatility of poorly developed specialization industries (Table 1). In addition, the regions of the "Specialization" or "Differentiation" type show a wide variation in structural models, which needs further explanation.

Possible factors leading to the uneven distribution of structural changes between regions include geography. For example, territories where the most significant

[8] In certain cases, the period between 2006-2015 was used because the growth criterion (G) is based on the ratio between employment in the current and previous year. Therefore, the 2005-2015 period would not allow one to measure the growth in the "fading" model due to the lack of data for 2004.

[9] In 2006, the development level of specialization industries in Moscow was 3.5 and in 2015 - 3.2. The overall share of Moscow's stars in total for all regions was 4% in 2005 and 3% in 2015.

[10] For example, in the Tula Region in 2006-2015 six specialization industries have "deteriorated" (–15 stars), one industry "faded" (–2 stars), three "grew" (+4 stars), and five "diversified" (+13 stars). After such a major restructuring of the regional economy, its total number of stars remained unchanged, while the number of specialization industries decreased by one.

Table 1. **Distribution of Regions by Static Type and Dynamic Industry Development Model**

Static industry development model	Vortex (regions with a million-strong city)	Stream (areas adjacent to regions with a million-strong city)	Safe Harbor (regions with no million-strong cities and not adjacent to areas which do have one)
Agglomeration	St. Petersburg Moscow Republic of Tatarstan Perm Region Nizhniy Novgorod Region Samara Region Sverdlovsk Region	Kaluga Region Tula Region Leningrad Region	—
Diversification	—	Vladimir Region Yaroslavl Region Kirov Region Saratov Region	Briansk Region
Specialisation	Voronezh Region Volgograd Region Rostov Region Republic of Bashkortostan Chelyabinsk Region Krasnoyarsk Region Novosibirsk Region Omsk Region	Belgorod Region Kursk Region Lipetsk Region Orel Region Smolensk Region Tver Region Republic of Komi Stavropol Region Republic of Mari El Republic of Udmurtia Krasnodar Region Orenburg Region Kurgan Region Tyumen Region Altai Region Irkutsk Region Kemerovo Region Republic of Sakha (Yakutia)	Ivanovo Region Kostroma Region Archangel Region Vologda Region Kaliningrad Region Murmansk Region Novgorod Region Pskov Region Republic of Mordovia Kamchatka Region Primorskiy Region Khabarovsk Region Amur Region Magadan Region Sakhalin Region
Differentiation	—	Ryazan Region Tambov Region Astrakhan Region Penza Region Republic of Chuvashia Ulyanovsk Region Tomsk Region	Republic of Karelia Republic of Dagestan Republic of Kabardino-Balkaria Republic of North Ossetia-Alania Republic of Chechnya Republic of Buryatia Zabaikalskiy Region
No model identified	—	Republic of Kalmykia Republic of Tyva Republic of Khakassia	Republic of Adygea Republic of Ingushetia Republic of Karachai-Cherkessia Republic of Altai Jewish Autonomous Region Chukotka Autonomous Region

Source: compiled by the authors.

structural changes took place are concentrated in the western part of Russia (Figure 5). In the eastern part, the opposite situation was noted: in some of the regions no changes were observed at all or specialization industries "deteriorated" (in Kamchatka, the Khabarovsk Region, etc.). The strongest industry dynamics were noted in the regions of the Central (CFD), Volga (VFD), and North-West (NWFD) Federal Districts

Million-Strong Cities' Effect on Structural Changes in the Region

An analysis of the map of structural changes in Russian regions (Figure 5) suggests that the rate of these processes depends upon the proximity of an area to a million-strong city or to regions where such cities are located. To test this hypothesis, we divided the sample of regions into three groups:

1) Regions with a million-strong city;[11]
2) Regions with no million-strong cities but adjacent to territories which do have one;
3) Regions with no million-strong city not adjacent to regions which do have one.

An analysis of structural development models of the three above groups of regions (Table 2) revealed several trends:

- 75% of regions in the first group followed the model "Emergence – Deterioration", with varying intensity; none of the group members completely avoided structural changes;
- Over 80% of regions in the second cluster that experienced the most profound transformation (three- and four-scenario industry development models) were located next to regions with a million-strong city;

[11] The Moscow Region was also included in this group because its geographical location in relation to the capital is similar to that of other regions with million-strong cities in relation to their administrative center.

Figure 5. **Structural Development Models of Russian Regions**

Source: compiled by the authors.

- About 30% of regions in the third cohort did not experience any structural changes over the last ten years.

Let us consider the rate of structural changes (the average number of specialization industries matching a particular industry development scenario) for each of the groups (Table 3). The overall value of this indicator is the highest in the regions of the second group, closely followed by the first one. The "Emergence – Deterioration" model (which describes the changes in the industry structure) is the most common for the second group of regions. Regions with million-strong cities tended to focus on strengthening the industries they were specializing in ten years ago.

Another important parameter in terms of the regions' socioeconomic wellbeing is the industry portfolio's sensitivity to structural changes. For example, in the case of Moscow (15 specialization industries were identified there in 2015), only two new industries appeared and dropped out of the city's portfolio. In other words, structural changes affected only 13% of it. On the contrary, in the Lipetsk Region which has five specialization industries, structural changes affected three, that is, the industry portfolio was transformed by 60%.

Interestingly, in regions with a million-strong city, lower economic growth rates were noted than in the areas adjacent to them (Table 4). Perhaps the observed differences are due to the "low base" effect. At the same time, there is no reason to believe that the success of catch-up development was directly related to structural changes: the third group of regions (with no million-strong cities nearby and a low level and rate of structural changes) is almost as quickly catching up with the first group in terms of economic development. Our preliminary findings are counterintuitive: structural changes are not related to the regional economic growth rate.[12]

To gauge the directions of structural changes, we have divided the list of industries into five categories: traditional industries, high-technology sectors, knowledge-intensive, creative, and traditional services (Table 5).

Let us turn our attention to structural changes in the Central Federal District regions from this perspective. In regions of the second group, the changes primarily affected traditional industries and, to a lesser extent, high-tech industries and knowledge-intensive services. In particular, the "Emergence" and "Growth" of specialization were noted in production of footwear, clothing, furniture, meat products, and business and ICT services. On the contrary, a number of sectors including the food industry, heavy mechanical engineering, and aircraft construction were "Fading" and "Deteriorating" industries (Figure 6). These changes are particularly apparent in the Bryansk, Kostroma, Kursk, and Lipetsk Regions.

The nature of the structural transformation in the CFD regions is typical for most regions of the second group located in the NWFD and the VFD. On average,

[12] The correlation between structural changes and growth rate can be more complex or become apparent only after a lag, which requires special econometric research. Calculating a paired regression revealed a weak connection between the number of new industries and the average annual GRP growth rate in the regions.

Table 2. **The Distribution of Regions by Structural Development Model and Location in Relation to Million-Strong Cities**

Dynamic industry development models	Regions with a million-strong city	Regions with no million-strong cities but adjacent to areas that have one	Regions with no million-strong cities that are not adjacent to areas which do have one
Emergence – Growth – Fading – Deterioration	–	Belgorod Region Kaluga Region Tver Region	–
Emergence – Growth – Deterioration	Nizhniy Novgorod Region Samara Region	Kursk Region Moscow Region Smolensk Region Tambov Region Tula Region Leningrad Region Republic of Udmurtia Ulyanovsk Region	–
Emergence – Fading – Deterioration		Tula Region Kirov Region Saratov Region Tomsk Region	Vologda Region
Emergence – Deterioration	Voronezh Region City of Moscow St. Petersburg Republic of Tatarstan Volgograd Region Chelyabinsk Region Republic of Bashkortostan Sverdlovsk Region Krasnoyarsk Region Novosibirsk Region Omsk Region	Lipetsk Region Ryazan Region Yaroslavl Region Astrakhan Region Republic of Chuvashia Orenburg Region Altai Region Irkutsk Region Kemerovo Region Republic of Sakha (Yakutia)	Primorskiy Region Briansk Region Ivanovo Region Archangel Region Murmansk Region Republic of Dagestan Zabaikalskiy Region
Deterioration – Growth	–	Vladimir Region	Novgorod Region
Deterioration – Fading	Perm Region	–	–
Growth – Deterioration	–	Orel Region Krasnodar Region Republic of Mari El Penza Region	–
Fading – Deterioration	–	–	Kaliningrad Region Kostroma Region
Emergence	Rostov Region	Stavropol Region Tyumen Region	Amur Region Magadan Region Sakhalin Region Pskov Region Republic of Chechnya
Deterioration	–	Republic of Komi Kurgan Region	Kamchatka Region Khabarovsk Region
No model identified	–	Republic of Tyva Republic of Khakassia Republic of Kalmykia	Republic of Altai Republic of North Ossetia-Alania Republic of Karachai-Cherkessia Republic of Kabardino-Balkaria Republic of Ingushetia Republic of Adygea Republic of Karelia Chukotka Autonomous Region Jewish Autonomous Region

Source: compiled by the authors.

significant growth in traditional industries is noted in these districts (first of all in the Leningrad, Pskov, Novgorod, Saratov, Kirov Regions, and the Udmurt and Chuvash Republics). As to this category in other federal districts, the transformation there amounted to the growth of traditional service sectors (wholesale trade, tourism, oil transportation, etc.) with a shift towards creative industries (publishing, sound recording, etc.) in a number of regions. Significant changes were noted in the Irkutsk, Primorsky, Stavropol, and Krasnodar Regions.

A different trend was identified in the regions that did have million-strong cities: the "Growth" of knowledge-intensive services (such as business- and ICT-services) and high-tech industries (telecommunication equipment) (Figure 7).

In all Russian regions structural changes in 2005-2015 primarily affected traditional industries and services and high-tech industries (Figure 8). For example, telecommunications and medical equipment became the leaders in terms of emerging specialization industries, along with electricity generation, meat products, etc.

Table 3. **The Incidence of Various Industry Development Scenarios in Regions in Relation to Million-Strong Cities: 2005-2015 (*number of specialization industries*)**

Industry development scenario	Regions with a million-strong city	Regions with no million-strong cities adjacent to areas that do have one	Regions with no million-strong cities not adjacent to areas that have one
"Emergence"	2.7	**2.93**	1.1
"Deterioration"	2.13	**2.2**	0.82
"Growth"	**3.9**	2.3	0.83
"Fading"	1.5	**1.6**	0.6
Overall rate of structural changes	23.73	**23.83**	17.85

Source: compiled by the authors.

(Figure 9). Traditional manufacturing sectors typically follow the "Emergence" scenario, while traditional service sectors mainly tend to display "Growth" and "Strengthening". This is particularly true for regions with no million-strong cities. Knowledge-intensive and creative services usually change to a lesser extent, and generally are distributed among the Russian regions less evenly. "Emergence" and "Growth" of these sectors is mainly observed in the regions of the first group.

"Vortexes" and "Safe Harbors" in Regions' Industrial Development: Interpretation and Implications for Government Policies

This paper established a correlation between the scale and rate of industry transformation in Russian regions and the region's proximity to a million-strong city. Major structural changes happen in regions where such cities are located, while in areas far from economic centers, these processes tend to be much weaker. Similar to the world-systems analysis theory [*Wallerstein*, 2015], we can identify the core (i.e. regions with a million-strong city), semi-periphery (regions adjacent to such areas), and periphery (regions not bordering such territories). Interestingly, the most significant transformations stemming from the core are concentrated in semi-periphery regions. In other words, in such areas the depth of industrial development and structural changes are determined by external factors rather than by internal effort. For example, in the National Ranking of Investment Climate in Russian Regions 2015[13], the Kaluga and Vladimir Regions were the 2nd and 63rd, respectively. However, radical transformations were observed in 2005-2015 in both these territories, which were largely due to external conditions, that is, their geographical proximity to Moscow.

According to the world-systems analysis theory, the relationship between the core and the periphery is reduced to the exploitation of the latter, whose dependence upon the core only grows over time while the economic gap widens. In this case, it is impossible to draw a full-fledged parallel with Russian regions, if only because according to our calculations, over the past 10 years the gap has narrowed.

Therefore, we propose a different typology of regions, based on the rate of structural change. Figuratively, structural changes in Russian regions are comparable to the mechanics of a whirlpool where water masses rotate at an increasing rate.

The first type is the center of the whirlpool, the "Vortex" which causes accelerated movement and draws in water flows. Similarly, regions with a million-plus city cause structural changes around them "drawing in" the neighboring areas through investments, demand, and internal transformations. Being the center of the whirlpool, vortex regions are more likely to develop and "grow" their current industry portfolio than create a new one.

Table 4. **Average Annual GRP Growth Rate in Regions in Relation to Million-Strong Cities: 2005-2015 (%)**

	Regions with a million-strong city	Regions with no million-strong cities adjacent to areas which do have one	Regions with no million-strong cities not adjacent to areas which do have one
Average annual GRP growth rate in 2005-2015, %	13.5	14.8	14.5
Total GRP, 2005, *million roubles*	9 015 970	4 826 817	1 809 579
Total GRP, 2015, *million roubles*	31 961 006	19 251 681	7 030 102

Source: calculated by the authors based on Rosstat data.

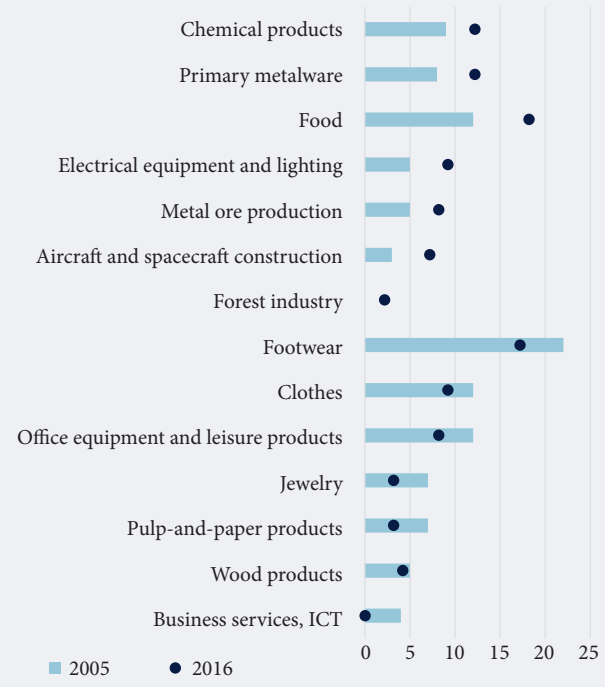
[13] See: https://asi.ru/regions/rating/index_old/ for more; last accessed on 15.06.2019.

Table 5. **Specialization Industry Groups**

Category	Cluster group
Traditional industries	Clothing
	Construction materials
	Chemical products
	Secondary metalware
	Generation and transmission of electricity
	Fisheries and production of fish products
	Food
	Footwear
	Furniture
	Jewelry
	Leather goods
	Meat products
	Pulp-and-paper products
	Plastic products
	Textile
	Tobacco products
Traditional services	Agricultural services
	Wholesale trade and e-commerce
	Water treatment and distribution, waste treatment
	Tourism
	Production and transportation of oil and gas
	Printing
	Transport and logistics
High technology industries	Aircraft and spacecraft construction
	Automobile industry
	Pharmaceuticals
	Telecommunication equipment
	Microelectronics and instruments
	Electrical equipment and lighting
	Medical equipment
	Heavy mechanical engineering
	Office equipment, leisure products
	Shipbuilding and water transport
Creative industries	Publishing, design, marketing
	Sound recording
	Culture
	Film industry
Knowledge-intensive services	Business services, ICT
	Education and R&D
	Financial services
	Insurance

Source: compiled by the authors.

Figure 6. **Changes of the Industry Structure in the CFD Regions Adjacent to Areas with Million-Strong Cities in 2006-2015: the Overall Development Level of Specialization Industries**



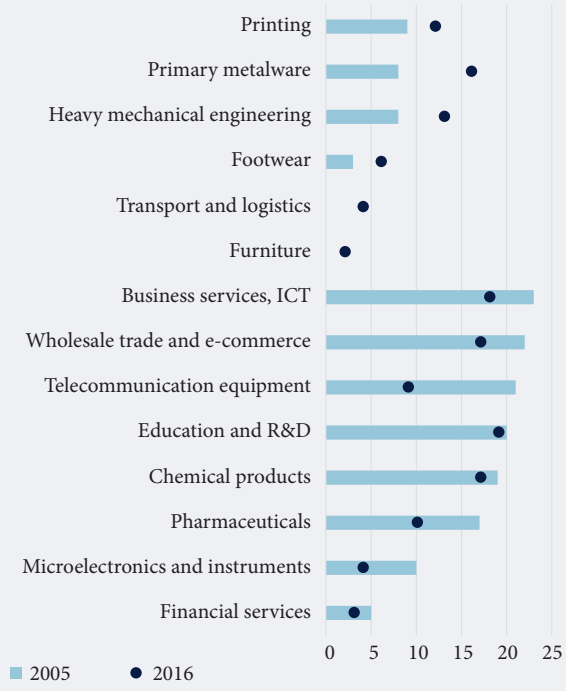
Note: The overall development level of the specialization industry is calculated as the combined development level of the specialization industry in all regions. For each region, the development level of the specialization industry can vary between 0 (the region does not specialize in this industry) and 4 (meets all development criteria).

Source: compiled by the authors.

Russian regions of the second type, that is, those adjacent to regions with a million-strong city, are comparable to the rapid flow of water around the vortex. Such "Streams" experience the greatest structural changes due to external influences, the "Vortexes". Due to their rapid movement around the "Vortex", "Streams" constantly change and display a lack of stability. Radical structural changes in "Streams" are much more evident in their industry portfolios and, accordingly, more strongly felt by the population. This is because "Stream" regions have fewer specialization industries than "Vortexes" do, so the emergence of new competencies and the deterioration of old areas of activity have a stronger effect upon the socioeconomic situation in the region.

The third type are those regions removed from the nearest "Vortex", the ones least susceptible to structural changes: the so-called "Safe Harbots". Industry development processes occur more calmly here in line with prevailing trends. The waves of structural changes generated by the "Vortex" region practically do not reach here and only slightly affect industry portfolios of regions in this group.

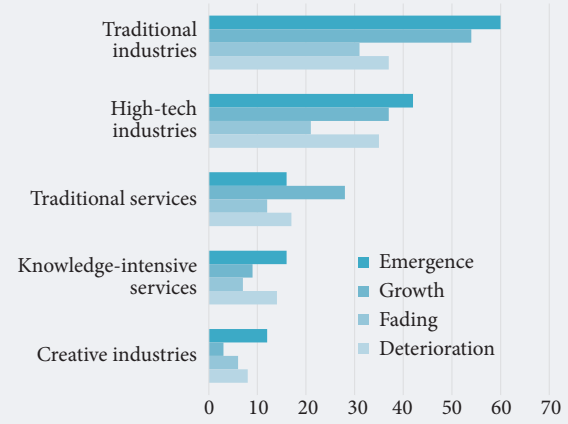
Figure 7. **Changes of Industry Structure in Regions with Million-Strong Cities in 2006-2015: the Overall Development Level of Specialization Industries**



Note: The overall development level of the specialization industry is calculated as the combined development level of the specialization industry in all regions. For each region, the development level of the specialization industry can vary between 0 (the region does not specialize in this industry) and 4 (meeting all the development level criteria).

Source: compiled by the authors.

Figure 8. **Distribution of Development Scenarios by Category of Regional Specialization Industry in 2005-2015 (*number of times scenario was implemented*)**



Source: compiled by the authors.

Geographical proximity to "Vortexes" primarily reduces the "Streams'" sectoral autonomy. In other words, regions that do not have a million-plus city turn out to be dependent upon the industry structure of the neighboring regions which do and upon the demand generated there. There may be a migration of industries from the "Vortex" to the "Stream" zone. In turn, the members of the first group of regions increasingly focus on knowledge-intensive services and high-tech industries.

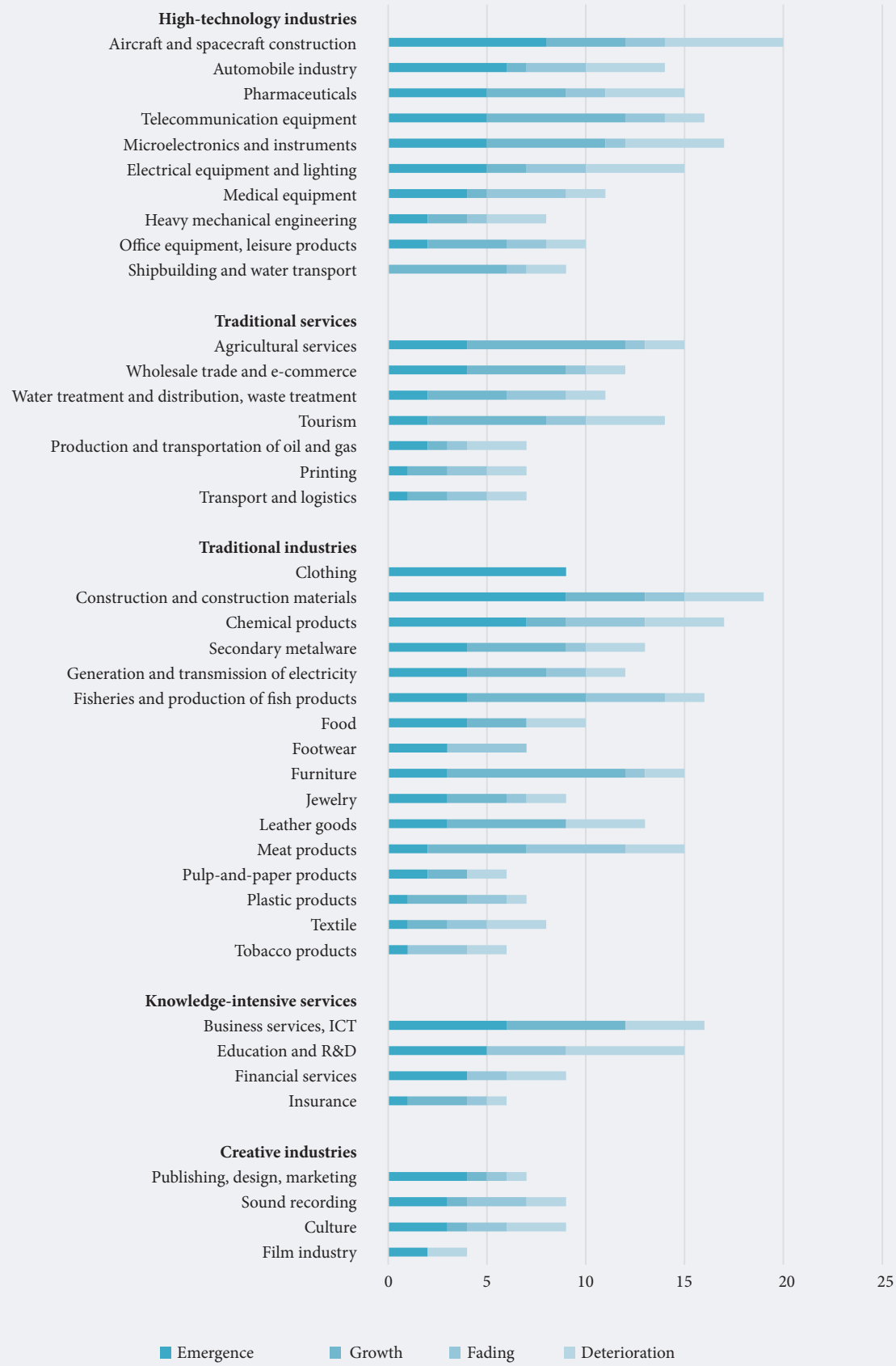
"Stream"-type regions captured by the structural transformations stemming from the "Vortex" begin to focus on traditional manufacturing and service sectors, often abandoning high-tech ones. For example, the Oryol and Kursk Regions have lost their specialization in microelectronics, the Kurgan and Smolensk Regions — in the automotive industry, and the Saratov Region — in electrical equipment and lighting.

It was discovered that high-tech production, knowledge-intensive and creative services are proliferating much more slowly, remaining the prerogative of major economic centers. Probably "Stream" regions use the potential left over from the Soviet period, restructuring the available capacities to meet consumer demand from the nearest million-plus cities. Attracting additional investments, including foreign ones, plays a significant role here.

It takes more than just strategic vision and efforts by the public and private sectors, science, and education to successfully implement structural changes. The region's location is also important: whether it happens to be in a "Vortex", "Stream", or "Safe Harbor" zone. However, there are no grounds to speak about fate, dependence, or pressure. Compared to "Vortexes," structural changes in "Stream" regions are much more pronounced, since the latter have a smaller population, are engaged in fewer activities, and have a smaller GRP. They tend to be more highly specialized, with "Emergence" and "Deterioration" models dominating. As a result, structural transformations in such regions are more tangible for the economy and the population, who have to adjust to new economic realities imposed from the outside more often than people in other regions do. Furthermore, the rate of such changes is not always connected with the wellbeing of the population and economic growth. Apparently, "Stream" regions do not always fully benefit from the changes taking place in them due to external factors, primarily the proximity to large economic centres.

When designing approaches to planning the territorial development of a country, compiling a list of promising regional specialization sectors and developing socioeconomic strategies, it is important to take into account the macro-regional logic of industry dynamics described in this paper. For example, as was already noted, the federal Spatial Development Strategy comprises a list of

Figure 9. **Distribution of Development Scenarios by Specialization Industry in Regions in 2005-2015 (*number of times scenario was implemented*)**



Source: compiled by the authors.

"effective economic specializations" whose development should strengthen the competitiveness of regional economies. However, implementing the current objectives requires more than just a list: an integrated approach is in order, regularly verified and updated, and impartial in relation to the authorities.

In our opinion, the verification of regional development priorities in terms of specialization industries should involve not only a comparison with the list of current specialization areas, but also being aware of and understanding the region's type and structural model. The scale and rate of structural changes play an important role here as does their impact upon the current industry portfolio. Knowledge of these factors allows one to clarify the requirements and support measures for specific territories. In some cases, additional incentives to promote change provided by the federal center will turn out to be meaningless., while in others redoubled efforts will be required. For example, unlike in "Safe Harbor" regions, major transformations occur in "Vortex" and "Stream" areas. It makes sense to revise the list of effective specialization industries there more often. In "Vortexes", experiments with launching new industries can be carried out on a particularly large scale due to their highly diversified economy which reduces the population's sensitivity to possible failures. In contrast, "Stream" regions need additional social support due to their economies' high sensitivity to structural change. Promoting the development of major agglomerations has a powerful impact upon the development of the neighboring regions.

Finally, the new data allows us to clarify the requirements for regional authorities in the structural development field, in particular choosing new specialization areas. In some cases, a region is "squeezed" by objective limitations related, for example, to geographical and logistical factors. In others there may be significant scope for shaping the industry structure of the regional economy, which is not always used effectively, not by far.

Conclusions

Identifying specialization industries is fundamental to the socioeconomic evolution of the Russian regions. The results of our study indicate the need to understand not only the composition of such sectors, but also the level of their development and the dynamics of structural change.

Over the past decade, the regions in the western part of the country have been affected by structural changes more than others. For example, a full-scale transformation occurred in the CFD: increased production of goods and services to meet consumer demand, and reduced output of products for industrial application. Such changes are typical of regions located in geographic proximity to million-plus cities whose demand sets directions for sectoral restructuring, and for the profiling of the neighboring territories.

In our opinion, the dynamics of structural changes in Russian regions is comparable to the rapid flows of water in a whirlpool, which are changing the structure of the economy and affect the well-being of the population and economic growth in different ways. As in the epicenter of a maelstrom, regions with a million-strong city focus on promoting the development of their current specialization industries, first of all knowledge-intensive services and high-tech industries. The neighbouring territories fall into the turbulent flows of structural change streaming from the center and promote the development of traditional services and industries. Last of all, the changes affect regions removed from major economic centers. These are comparable to "Safe Harbors" where structural transformations occur at a much slower rate, with no evidence of sharp bursts.

This proposed approach provides a theoretical basis for fine-tuning measures to support industry development in regions that vary not only in terms of welfare and economic development, but also in the rate of structural transformation, sensitivity to changes in the industry portfolio, and territorial proximity to major agglomerations.

This article was prepared as part of a research project on the topic: "Analysis and modelling dynamics of science and technology development with the use of statistical indicators", performed by the HSE in 2019. The authors are grateful to Vasily Abashkin and Kirill Tiurchev — staff members of the Russian Cluster Observatory of the Institute for Statistical Studies and Economics of Knowledge of the National Research University Higher School of Economics for their contribution to discussing the methodology for identifying and evaluating regional specialization industries.

References

Barca F., McCann P., Rodríguez-Pose A. (2012) The Case for regional development intervention: Placed-based versus place-neutral approaches. *Journal of Regional Science*, vol. 52, no 1, pp. 134–152.

Beaudry C., Schiffauerova A. (2009) Who's right, Marshall or Jacobs? The localization versus urbanization debate. *Research Policy*, vol. 38, no 2, pp. 318–337.

Belov A.V. (2012) K voprosu o prostranstvennom razmeshchenii faktorov proizvodstva v sovremennoi Rossii [On Spatial Distribution of Production Factors in Contemporary Russia]. *Prostranstvennaya ekonomika* [Spatial Economics], no 2, pp. 9–28 (in Russian).

Bergman E., Feser E. (1999) Industrial and Regional Clusters: Concepts and Comparative Applications. *The Web Book of Regional Science* (ed. S. Loveridge), Morgantown, WV: West Virginia University. Available at: http://www.rri.wvu.edu/WebBook/Bergman-Feser/contents.htm, accessed 28.03.2019.

Bickenbach F., Bode E. (2008) Disproportionality measures of concentration, specialization, and localization. *International Regional Science Review,* vol. 31, no 4, pp. 359–388.

Boschma R. (2017) Relatedness as driver of regional diversification: A research agenda. *Regional Studies,* vol. 51, no 3, pp. 351–364.

Boschma R., Asier M., Mikel N. (2013) The emergence of new industries at the regional level in Spain: A proximity approach based on product-relatedness. *Economic Geography,* vol. 89, pp. 29–51.

Chen J. (2018) Interpreting economic diversity as the presence of multiple specializations (RRI Working Paper 2018-02), Morgantown, WV: West Virginia University.

Delgado M., Bryden R., Zyontz S. (2014) Categorization of traded and local industries in the US economy (Discussion Paper). Available at: https://clustermapping.us/sites/default/files/files/page/Categorization%20of%20Traded%20and%20Local%20Industries%20in%20the%20US%20Economy.pdf, accessed 31.03.2019.

Delgado M., Porter M.E., Stern S. (2014) Clusters, convergence, and economic performance. *Research Policy,* vol. 43, no 10, pp. 1785–1799.

Delgado M., Porter M.E., Stern S. (2016) Defining clusters of related industries. *Journal of Economic Geography*, vol. 16, no 1, pp. 1–38.

Devereux M., Griffith R., Simpson H. (1999) *The Geographic Distribution of Production Activity in the UK* (IFS Working Paper 26/99), London: Institute for Fiscal Studies.

Ellison G., Glaeser E. (1997) Geographic concentration in US manufacturing industries: A dartboard approach. *The Journal of Political Economy*, vol. 105, no 5, pp. 889–927.

Fracasso A., Marzetti G.V. (2018) Estimating dynamic localization economies: The inadvertent success of the specialization index and the location quotient. *Regional Studies,* vol. 52, pp. 119–132.

Frenken K., van Oort F., Verburg T. (2007) Related variety, unrelated variety and regional economic growth. *Regional Studies,* vol. 41, no 5, pp. 685–697.

Gavrilov A.I. (2002) *Regionalnaya ekonomika i upravlenie* [Regional Economics and Management], Moscow: UNITY-DANA (in Russian).

Gini C. (1936) On the Measure of Concentration with Special Reference to Income and Wealth. *Proceedings of the Cowles Commission Research Conference on Economics and Statistics, July 6–August 8,* Colorado College Publications, General Series, no 208, Colorado Springs, CO: Colorado College, pp. 73–80.

Grillitsch M., Asheim B. (2018) Place-based innovation policy for industrial diversification in regions. *European Planning Studies,* vol. 26, no 8, pp. 1638–1662.

Hallet M. (2000) *Regional Specialisation and Concentration in the EU*, Brussels: European Commission.

Hausmann R., Hidalgo C.A. (2011) The network structure of economic output // Journal of Economic Growth, vol. 16, no 4, pp. 309–342.

Hausmann R., Klinger B. (2006) *Structural transformation and patterns of comparative advantage in the product space* (CID Working paper 128), Cambridge, MA: Harvard University Press.

Hausmann R., Rodrik D. (2003) Economic development as self-discovery. *Journal of Development Economics*, vol. 72, no 2, pp. 603–633.

Hidalgo C.A., Hausmann R. (2009) The building blocks of economic complexity. *Proceedings of the National Academy of Sciences (PNAS),* June 30, 2009, vol. 106, no 26, pp. 10570–10575. Available at: https://doi.org/10.1073/pnas.0900943106, accessed 18.02.2019.

Hidalgo C.A., Klinger B., Barabasi A.-L., Hausmann R. (2007) The product space conditions the development of nations. *Science*, vol. 317, pp. 482–487.

Hoover E.M. (1936) The measurement of industrial localization. *The Review of Economic Statistics*, vol. 18, no 4, pp. 162–171.

Hudson R. (2009) Life on the edge: Navigating the competitive tensions between the 'social' and the 'economic' in the social economy and in its relations to the mainstream. *Journal of Economic Geography,* vol. 9, no 4, pp. 493–510. Available at: https://doi.org/10.1093/jeg/lbp005, accessed 18.02.2019.

Kadochnikov S., Fedyunina A. (2013) *Export Diversification in the Product Space and Regional Growth: Evidence from Russia* (Working Paper in Series: Evolutionary Economic Geography (PEEG) no 1327), Utrecht: Utrecht University.

Ketels C., Protsiv S. (2014) *Methodology and Findings Report for a Cluster Mapping of Related Sectors*, Stockholm: Stockholm School of Economics.

Ketels C., Protsiv S. (2016) *European Cluster Panorama*, Stockholm: Stockholm School of Economics.

Kim S. (1995) Expansion of Markets and the Geographic Distribution of Economic Activities: The Trends in U.S. Regional Manufacturing Structure, 1860–1987. *The Quarterly Journal of Economics*, vol. 110, no 4, pp. 881–907.

Klimanov V.V. (2007) Reformirovanie regionalnykh finansov i strategii razvitiia sub'ektov RF [Reforming Regional Finance and Development Strategies of Subjects of the Russian Federation]. *Biudzhet* [Budget], no 9, pp. 42–45 (in Russian).

Klimenko A.V., Korolev V.A., Dvinskikh D.Yu., Slastikhina I.Yu. (2015) O garmonizatsii dokumentov gosudarstvennogo strategicheskogo planirovaniya [On the harmonization of state strategic planning documents], Moscow: HSE (in Russian).

Kominers S.D. (2008) *Measuring Agglomeration* (Discussion Paper for Harvard Urban and Social Economics Seminar). Available at: http://www.scottkom.com/articles/measure_agglomeration.pdf, accessed 18.02.2019.

Kopczewska K., Churski P., Ochojski A., Polko A. (2017) *Measuring Regional Specialisation: A New Approach*, Cham, Switzerland: Palgrave Macmillan. ISBN 978 3 319 51505 2.

Kovalenko E.G. (2005) *Regionalnaya ekonomika i upravlenie* [Regional Economics and Management], Saint-Petersburg: Piter (in Russian).

Krugman P. (1991) *Geography and Trade,* Cambridge, MA: MIT Press.

Kutsenko E.S., Abashkin V.L., Islankina E.A. (2019) Fokusirovka regional'noi promyshlennoi politiki cherez otraslevuyu spetcializatsiyu [Focusing regional industrial policy via sectorial specialization]. *Voprosy Ekonomiki*, no 5, pp. 65–89 (in Russian).

Kutsenko E.S., Kiselev A.N., Karnaukh A.P. (2011) Opredelenie prioritetnykh napravlenii dlya formirovaniia i razvitiya klasterov malykh i srednikh predpriyatii v regional'noi ekonomike (na primere goroda Moskvy) [Determination of priority areas for the formation and development of clusters of small and medium-sized enterprises in the regional economy (as exemplified by the city of Moscow)]. *Setevoi biznes i klasternye tekhnologii* [Network business and cluster technologies] (eds. V.P. Tretiak, M.Yu. Shereshev), Moscow: HSE, pp. 279–302 (in Russian).

Leksin V.N., Shvetsov A.N. (2012) *Gosudarstvo i regiony. Teoriya i praktika gosudarstvennogo regulirovaniya territorial'nogo razvitiya* [State and regions. Theory and practice of state regulation of territorial development], Moscow: Librokom (in Russian).

Lilien D.M. (1982) Sectoral shifts and cyclical unemployment. *The Journal of Political Economy*, vol. 4, pp. 777–793.

Liubimov I.L., Gvozdeva M.A., Kazakova M.V., Nesterova K.V. (2017) Slozhnost' ekonomiki i vozmozhnost' diversifikatsii eksporta v rossiiskikh regionakh [Economic Complexity of Russian Regions and their Potential to Diversify]. *Journal of the New Economic Association*, no 2 (34), pp. 94–122 (in Russian).

Lu Z., Flegg A.T., Deng X. (2011) Regional specialization: A measure method and the trends in China (MPRA Paper 33867), Munich, Germany: University Library of Munich. Available at: https://mpra.ub.uni-muenchen.de/33867/, accessed 24.02.2019.

Neffke F., Henning M., Boschma R. (2011) How Do Regions Diversify over Time? Industry Relatedness and the Development of New Growth Paths in Regions. *Economic Geography,* vol. 87, no 3, pp. 237–265.

OECD (2012) *Promoting Growth in all Regions,* Paris: OECD.

Ohmae K. (2002) *Triad Power,* New York: Simon and Schuster.

Pavlov K.V., Rastvortseva S.N., Cherepovskaya N.A. (2014) Metodicheskie osnovy identifikatsii potentcialnykh klasterov v regional'noi ekonomike [Methodical bases for the identification of potential clusters in the regional economy]. *Chasopis ekonomichnikh reform* [Bulletin of Economic Reforms], no 1, pp. 129–139 (in Russian).

Pinheiro F.L., Hidalgo C.A., Alshamsi A., Hartmann D., Boschma R. (2018) Shooting High or Low: Do countries benefit from jumping into unrelated activities? (The MIT Media Lab Paper 1801.05352). *arXiv.org,* revised version of March 2018. Available at: https://arxiv.org/abs/1801.05352, accessed 17.04.2019.

Pinkovetskaya Yu.S. (2015) O lokalizatsii okazaniya uslug predprinimatel'skimi strukturami v regionakh [On Localization of Entrepreneurial Units Services in the Regions]. *Ars Administrandi,* no 4, pp. 139–152 (in Russian).

Porter M.E. (2003) The economic performance of regions. *Regional Studies,* vol. 37, pp. 549–578.

Prokopyev E.A. (2015) K voprosu o vybore dannykh dlia opredeleniya spetcializatsii regiona [On the choice of data to determine the specialization of the region]. *Drukerovskii Vestnik* [Drucker Bulletin], no 2, pp. 236–245 (in Russian).

Rodrik D. (2003) *In Search of Prosperity: Analytic Narratives on Economic Growth*, Princeton, NJ: Princeton University Press.

Rothenberg A.D., Bazzi S., Nataraj S., Chari A.V. (2017) *Assessing the Spatial Concentration of Indonesia's Manufacturing Sector: Evidence from Three Decades* (RAND Labor & Population Working Paper), Santa-Monica, CA: RAND Corporation.

Sharma R.K. (2008) *Measuring Economic Diversification in Hawaii*, Honolulu: Government of Hawaii. Available at: http://files.hawaii.gov/dbedt/economic/data_reports/EconDiversification/Economic_Diversification_Report_Final%203-7-08.pdf, accessed 21.04.2019.

Shenoy A. (2018) Regional development through place-based policies: Evidence from a spatial discontinuity. *Journal of Development Economics,* vol. 130, pp. 173–189.

Simachev Y., Kuzyk M., Kuznetsov B., Pogrebnyak E. (2014) Russia Heading Towards a New Technology-Industrial Policy: Exciting Prospects and Fatal Traps. *Foresight-Russia*, vol. 8, no 4, pp. 6–23.

Toffler A. (2006) *Revolutionary Wealth,* New York: Knopf.

Wallerstein I.M. (2015) *The modern world-system: Capitalist agriculture and the origins of the European world-economy in the sixteenth century,* New York: Academic Press.

Zubarevich N.V. (2010) *Regiony Rossii: Neravenstvo, krizis, modernizatsiya* [Regions of Russia: Inequality, Crisis, Modernization], Moscow: Independent Institute for Social Policy (in Russian).