Author's version. For citation: *Zemtsov S., Baburin V. (2016).* Does economic-geographical position affect innovation processes in Russian regions? // GEOGRAPHY, ENVIRONMENT, SUSTAINABILITY, 4 (9), 14-33. DOI: 10.15356/2071-9388_04v09_2016_02. URL: https://www.rgo.ru/sites/default/files/upload/gi416_web_0.pdf

S. Zemtsov, V. Baburin

Does economic-geographical position affect innovation processes in Russian regions?

Abstract

A favourable economic-geographical position (EGP) of regions and cities is one of the factors of their socio-economic development. Economic agents can take advantages of their proximity to the major markets of goods and services, thereby reducing their transport costs and increasing their profitability. In the sphere of innovation, proximity to the innovation centres may also significantly affect the creation of new knowledge and technologies, due to the existence of tacit knowledge and knowledge spillovers. The authors propose the term 'innovation-geographical position' by analogy with EGP. It has been demonstrated that location matters to regional innovation output. If there is 1% more new technologies in neighbouring regions, there are approximately 0.35-0.58% more newly created technologies in the target region. Proximity to the world centres of new technologies has even greater impact.

Keywords: innovation-geographical position, knowledge spillovers, Russian regions, innovation, R&D, market access

Introduction

"Economic-geographical position" (EGP) is one of the key categories in the area of regional studies in Russia. It is one of the few concepts originally emerged and developed in the national science; it has been rarely used outside of the Russian-speaking academic community[1].

Modern studies of factors of regional development and inequality in Russia [Lugovoy et al., 2007; Grigoriev et al., 2008] point to the link between the geographical location of the regions and their socio-economic characteristics[2]. At this, mainly in literature, there exists a qualitative assessment of a "favourable" or "unfavourable" regional EGP.

Several authors [Cairncross, 2001; Smirnyagin, 2012] believe that given the acceleration of the development of communication technologies, the cost of interaction between economic agents is rapidly falling, therefore, the category "position" itself is no longer so important. The category "place," is much more significant because it preserves a strong differentiation in the living conditions of the population, according to their capacity to create and implement new technologies. Remote and underdeveloped areas are still less attractive to migrants, investors and innovators.

The previous authors' works [Zemtsov, Baburin, 2016; Baburin et al, 2016.; Zemtsov, Baburin, 2016] have demonstrated that there are high correlation coefficients between economic-geographical position of Russian regions and cities and their economic output growth, increase in investment, volumes of foreign trade, migration growth, and diffusion of new technologies.

Thereby, advantageous EGP of regions and cities can be considered one of the factors of their socio-economic development. But does it matter for regional innovation output whether it is nearby other innovative regions or centres of new technologies?

The aim of this work is the application of methodology for assessment of regions' EGP potential to calculate the possible benefits from their proximity to the major centres of production and diffusion of new knowledge and technologies.

[1]In the English literature, a widely accepted term is "market access" [Krugman, 1991]

[2]Geographical location also includes natural characteristics of a region, thus, often EGP is associated with agro-climatic resources, coastal location, and availability of natural resources, which is inconsistent with the original understanding of considered category

Approaches to assessment of the economic-geographical position potential

Economic-geographical position of the region is a historically established, but a changing set of potential spatial relationships between economic agents of the region and external factors influencing the regional development [Zemtsov, Baburin, 2016a]. Primarily, the spatial relationships between objects are determined by the distances between them. The object is able to change its position striving to achieve the most favourable location in space, i.e., to reach the point at which the potential impact of external conditions would be most beneficial for its development. For example, Orenburg changed its location three times. However, the ability of large territorial systems (e.g. regions) to move is limited. In this case, change in the EGP potential of specific areas within the region affects the economic agents that, through moving, transform the internal structure of the region. That is, the regions are optimizing their territorial structure.

Problems of EGP were discussed by a number of economic geographers. N.N. Baranskiy, gave the classical definition of EGP [Baranskiy, 1980, p. 129]. A significant contribution to the development of the concept was made by I.M. Maergoiz [Maergoiz 1986], Yu.G. Saushkin [Saushkin, 1973], E.E. Leizerovich [Leizerovich, 2006], A.I. Treyvish [Treyvish, 2009], L.I. Bezrukov [Bezrukov, 2008], and other scientists.

The geographical location as a qualitative characteristic of an object can be central, peripheral, or neighbouring. To assess centrality of the object in the transport network, the topological distance method is often used. Neighbouring position of the two territorial systems, other things being equal, usually is a favourable factor for their development. The proximity of a large neighbour can bring the benefits of cooperation, relocation of businesses, diffusion of new technologies, etc.

The work by [Zemtsov, Baburin, 2016] gives a detailed overview of the theoretical and methodological approaches to the assessment of economic- geographical position in Russia and abroad. There are two main methodological approaches: metric (distance from a major centre, market, etc.) and topological (neighbouring position, location in a settlement system, etc.).

Assessment of transport-geographical position (TGP) includes estimates ofthe benefits associated with a city’s distance to the main transport arteries, its position in the transport system, and the costs to deliver goods and people [Bugromenko, 1981; Tarkhov, 2010]. One of the most developed methods of TGP assessment is to measure the economic distance, i.e., the distance of cities in terms of transport costs [Rakita, 1983; Blanutsa, 2010].

Many authors use gravity models for assessment of favourable position of regions and cities. A prerequisite for the use of this type of model is the law borrowed from physics on the dependence of the interaction of two objects on their size and degree of closeness [Lukermann, Porter, 1960; Harris, 1954]. A region can potentially interact with other regions; ceteris paribus, interaction is higher if two regions are closer and bigger.

The classical model of interaction between the two regions was developed by C. Harris [Harris, 1954]:

$$V_{ij} = MV_j / R_{ij} \quad (1),$$

where V_{ij} − the trade flow between regions j; MV_j − the market potential, such as gross regional product (GRP) in the *j-th* region; and R_{ij} − the distance between the regions.

The areas of applications of gravity models include assessment of the market [Hanson, 2005; Head, Mayer, 2010], demographic [Stewart, 1947; Isard, 1960], and innovation potential [Baburin, Zemtsov, 2013] and assessment of trade [McCallum, 1995; Kaukin, Idrisov, 2013] and migration flows [Andrienko, Guriev, 2003]. However, it is widely thought that the existing approaches to the construction of a formal model or an empirical evaluation of the EGP potential of the Russian regions have not been yet well developed.

Why geographical position is important for innovation

The important features of knowledge as a public good are indivisibility, ability to use knowledge an unlimited number of times and in various fields of activity (non-rivalrous), and inability to prevent other agents from its use [Nelson, 1959]. Therefore, innovation activity of one agent generates positive externalities for other agents – knowledge spillovers [Audretsch, Feldman, 2004; Jaffe et al, 1992]. The agents are not necessarily interacting directly; they can use, for example, open data.

Knowledge spillovers are processes, when "knowledge created by a company may be used by another company without compensation or with a compensation lower in value than this very knowledge" [Synergy of space ..., 2012]. The higher the volume of knowledge flows, the more new technologies are created in the region, ceteris paribus. In this case, we are talking not only about the territorial aspect of knowledge spillovers but also about the inter-sectoral. The innovation activity of the enterprise in a specific sector is positively influenced by external effects of knowledge coming from other sectors. The role of knowledge flow in high-tech clusters has been demonstrated by successful examples in the United States (Silicon Valley, Seattle), in Canada (Montreal), and in other countries.

The intensity of knowledge spillovers depends on the proximity of parties; other types of proximity are also important in addition to spatial[3] [Boschma, 2005]:

- Cognitive − degree of proximity of the parties' knowledge.
- Organizational − degree of governmental bodies unity.
- Social − degree of trust between the parties.
- Institutional − degree of institutional unity.
- Process − degree of compatibility of technologies.

Geographical proximity alone does not necessary lead to knowledge spillovers; cognitive proximity is necessary. Rather, the spatial proximity plays a role of an indicator of other types of proximity.

Innovations, being the result of human activities, include formalized knowledge that can be transmitted in the form of papers using formulas, graphs, etc., and non-formalizable knowledge possessed by only the innovator. The latter is called tacit knowledge [Polanyi, 1967]. This fact is crucial for regional studies, since tacit knowledge is concentrated in locations of scientific schools and major research centres, and the transfer of such knowledge is possible in a geographically limited area.

With the acceleration of the development of information and communication technologies (ICT), capabilities of remote interaction, distance education, remote co-writing of papers, etc., are rapidly evolving. There is a feeling that eventually distance will cease to be a significant factor for knowledge creation. However, the conditions of human living environment continue to vary considerably and they differ strongly for the creation of new technologies, which are concentrated in large cities, metropolitan areas, and science towns.

The process is known as glocalization, when the routine functions of the city spread around the world, while the unique (the most high-tech) functions are concentrated. The paper by [Glaeser, Ponzetto, 2007] examines a theoretical model in which industrial cities (such as Chicago) in the new conditions of reduced transport costs lose in comparison with those which initially focused on the new economy (e.g., New York or San Francisco). Industrial production can be placed almost everywhere, but the knowledge is still concentrated. And the cities are increasingly competing for innovators, including creative class [Florida, 2005].

[3] The concept of proximity of firms has an apparent analogy with the economic-geographical position of large territorial units (cities, regions, and countries)

In addition, knowledge is cumulative; it takes time for its *embeddedness* in social systems, and consequently, even emigration of innovators may not always lead to the desired increase in new knowledge creation without proper institutions. "Embeddedness of innovation" refers to the formation of networks of interaction of innovative agents, forming the cultural environment that is open to new ideas, community interest in innovations, and innovators' high prestige [Oerlemans et al., 2001]. Then *embeddedness* is the intensity of the involvement of regional communities in the innovation process.

By analogy with the economic-geographical position of regions, we should be talking about the differences in the innovation-geographical position (IGP) of various regions, where some of them are closer to the centres of generation of new knowledge (or contain these centres within), which accelerates the process of technology transfer and diffusion of innovations. And it is not only geographical, but the institutional, cultural, and other proximities. Such regions may have more favourable factors for the import and export of technology, attraction of foreign innovators, etc.

This IGP, as well as the EGP, is a category that has the potential (probabilistic) character; that is, its benefits may be realized or not.

Bottatsi L. and G. Perry [Bottazzi, Peri, 2003] conducted a study based on data on patent activity and the costs of innovation in the regions of Eastern Europe in 1984-1995 to define the maximum distance after which the effect on expenditures for R&D in neighbouring regions ceases to be meaningful:

$$\ln(Patent_i) = \beta + \varepsilon_0 \ln(RnD_i) + \varepsilon_1[m_{0-300} \ln(RnD)] + \varepsilon_2[m_{300-600} \ln(RnD)] + \\ + \varepsilon_3[m_{600-900} \ln(RnD)] + \varepsilon_4[m_{900-1300} \ln(RnD)] + \varepsilon_5[m_{1300-2000} \ln(RnD)] + D \times Country_i + u_i \quad (2),$$

where *Patent* – the number of national patents per employee in R&D; RnD_i – expenditures for R&D in the region *i*, mln euros; $m_{xy}ln(RnD)$ – average expenditures for R&D of the regions located at a distance over *x* or less than *y* km; and *Country* – country dummy variables that reflect the quality of institutions and infrastructure in individual countries. It is shown that research funding in the surrounding areas (at distances less than 300 km) has a positive effect on innovation activity in the target region.

The paper by [Von Proff, Dettmann, 2013] has shown that the distance between the inventors, who participated in the creation of patents in Germany, remained virtually unchanged over the past 15 years: 170 km − for public research and 190 km − for business.

The work by [Keller, 2002] showed that the distance of 1200 km from the nucleus of innovation leads to a significant reduction in the processes of diffusion of new technologies. That is, the proximity is important not only for the creation, but also for the dissemination of new knowledge and technologies.

The work by [Crescenzi, Jaax, 2015] on the patent activity in Russia used international patent applications as the dependent variable. The authors have also identified importance of knowledge spillovers from other regions, calculated using the distance-weighted expenditures for R&D of neighbouring regions.

The papers by [Zemtsov et al., 2016; Baburin, Zemtsov, 2016] calculated the patent potential of the Russian regions. It was impossible to measure the patent knowledge spillovers using Russian data, since available information about patent citing is unavailable, but it was possible to estimate the amount of potential external effects associated with high density and proximity of patent centres. It is known that the number of mutual citations by inventors drops dramatically with increasing distance (more than 200 km) between the places of registration of patents [Audretsch, Feldman, 2004; Jaffe et al., 1992]. Therefore, we assumed that the greater the distance between the regional centres, where in most cases patent activity is concentrated[4], the lower the probability of interaction between researchers and, consequently, the lower the interregional knowledge spillovers. The patent potential of the regions [Baburin, Zemtsov, 2012] by analogy with the market potential (V_j) was calculated using the following specifications of the gravity model

$$V_j = \sum P_i / D^n{}_{ji}, \qquad (1),$$

where P_i – the number of patents granted per 100 thousand residents in region (– regional centre) i; D_{ji} – distance from region j, whose potential we are trying to define, to region i, km; n – coefficient of proportionality, showing the rate of decline in the intensity of interaction between the inventors as the distance between them grows.

The patent potential is highly concentrated near Moscow metropolitan area and major regional centres: St. Petersburg, Nizhny Novgorod, and Kazan. The patent potential naturally decreases rapidly towards the eastern, less densely populated, and more remote from each other regions. It is an indicator of favourable innovation-geographical position. For example, the Kemerovo region does not have the high levels of patent activity, but due to its proximity to the Tomsk and Novosibirsk regions, it has an average patent potential. This may increase the intensity of interregional interactions between inventors and subsequently new knowledge creation.

The work by [Baburin, Zemtsov, 2016] identified the main factors of patent activity: human capital, expressed in terms of the proportion of employees with higher education, and expenditures for R&D. However, with the introduction of the patent potential into the model, it becomes the most significant variable. In the papers by [Zemtsov et al., 2016; Baburin, Zemtsov, 2016] it was demonstrated that the increase in patent activity in neighbouring regions by 1% leads to an increase in the number of patent applications in the region by 0.5-0.56%. This result indicates the presence of interregional innovation clusters, including Moscow, St. Petersburg, Volga, Siberia, and Ural, where patenting activity increases simultaneously; the mechanisms of this interaction require research that is more thorough.

The potential interregional knowledge spillovers can be measured either by the characteristics of the innovation potential in neighbouring regions (expenditures for R&D, number of researchers, etc.), or by mutual citation of patents and the number of joint papers and inventions. The number of joint patents, papers, and patent citations decreases rapidly with increasing distance. The analysed studies showed that above the distance of 120-150 miles, researchers hardly cite each other's patents and, therefore, do not interact either actually or virtually. For Russia, the distance may be lower due to lesser mobility and greater isolation of scientific schools.

Methodology of assessment of the innovation-geographical position of regions

The calculation of the IGP potential of the region i included the assessment of the interregional potential (IGP^{Reg}) and the international potential (IGP^{World}) according to the procedure described in [Zemtsov, Baburin, 2016]:

$$IGP^{All}{}_i = IGP^{\mathrm{Reg}}{}_i + IGP^{World}{}_i = \sum_{j=1}^{n} \frac{MV_j}{R_{i,j}{}^a} \qquad (2),$$

where MV_j – the number of international Patent Cooperation Treaty (PCT) applications in the region or country j; R_{ij} – the actual distance between the capital of the target region i and the capitals of other regions or countries, j, n – the total number of regions and countries, a – the empirical coefficient.

[4]The patent activity may be high in a region due to the location there of a large science town; often, restricted-access territorial entities were created in the USSR within 50 km from the regional center

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All parameters were calculated based on statistical data "Regions of Russia. Socio-economic indicators data". Data for PCT-patent applications were taken from the official website of the Organization for Economic Cooperation and Development (OECD).

The calculation of IGP^{Reg}, i.e., its position in relation to the Russian regional centres of new technologies, was conducted according to the formula (Figure 1):

$$IGP^{\mathrm{Re}\,g}{}_i = \sum \frac{PatPCT_j}{R_{i,j}{}^2} \qquad (3),$$

where i is the target region; $PatPCT$ is the number of PCT-patent applications; j is other regions of Russia (in all, 83 regions, without taking into account the Republic of Crimea and Sevastopol due to lack of data); and R – distance from the centre of region i to another Russian region j (km).

We used the distance by rail; for regions where there are no railways, we used data on road and river routes.

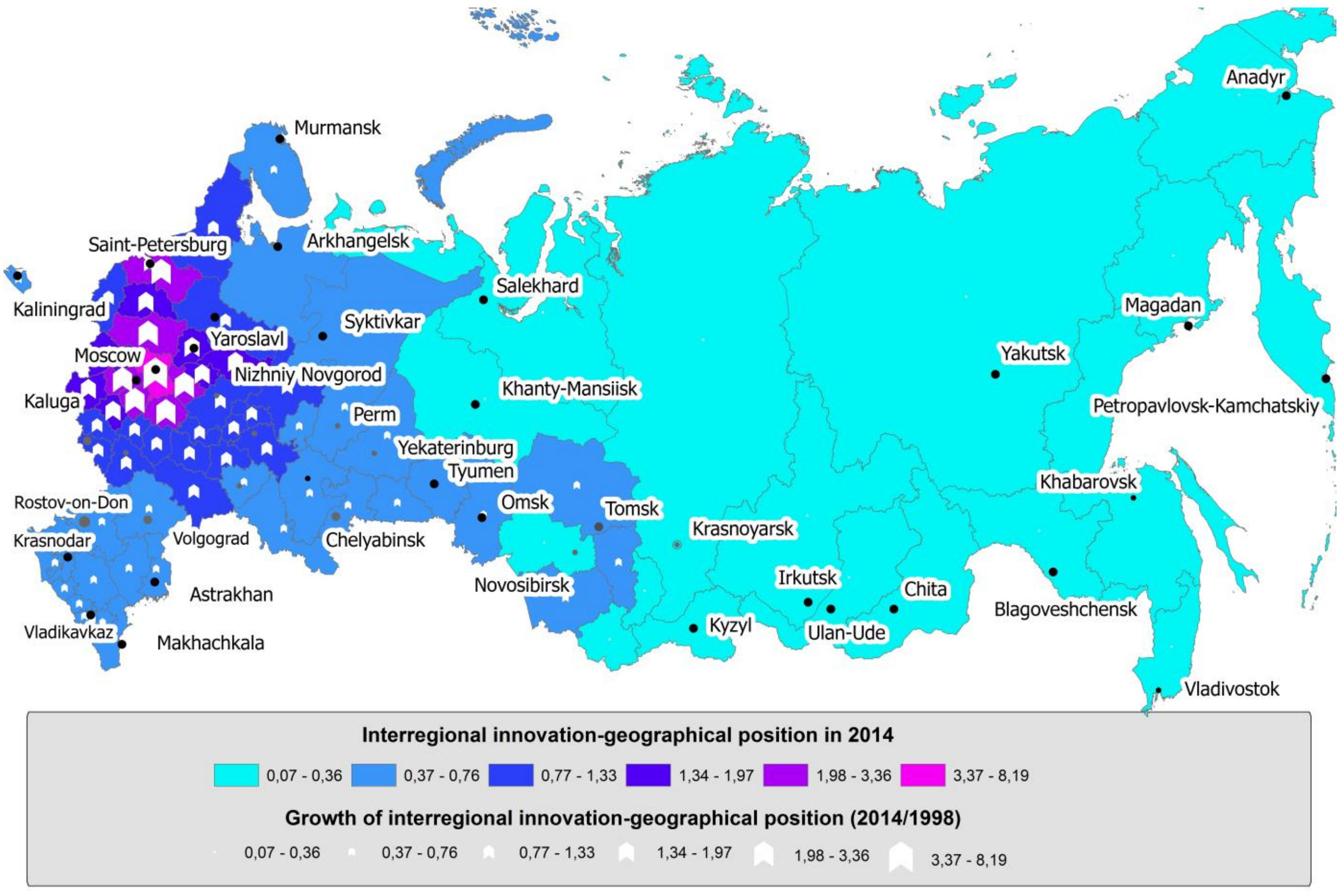

Figure 1 – Interregional innovation-geographical position of Russian regions and its dynamics

Economic ties by land are less intense than by sea due to higher transport costs. Therefore, coefficient *a* in the denominator for sea interaction is lesser than for interregional relations. The general formula for calculating the capacity of the external IGP^{Reg}[5] (Figure 2):

[5]IGP, measured by the proposed method, conditionally allows one to calculate the potential amount of joint research, joint patents, and patent citations in the case of the maximum development of scientific infrastructure

$$IGP^{World}{}_i = \sum\left(\frac{PatPCT_q}{\min(R_{i,p}{}^2 + R_{p,q}{}^{1,5})}\right) + \sum\left(\frac{PatPCT_n}{(R_{i,e}{}^2 + R_{e,n}{}^2)}\right) \qquad (4),$$

where q – foreign countries, with which cooperation is mostly carried out through the Russian seaports; $R_{i,p}$ – distance from the target region i to the port region of Russia p (km), $R_{p,q}$ – distance from the port region of Russia p to a country q (km); n – countries with which the regions of Russia have the border and foreign economic activity is carried out mainly by land through regions e.

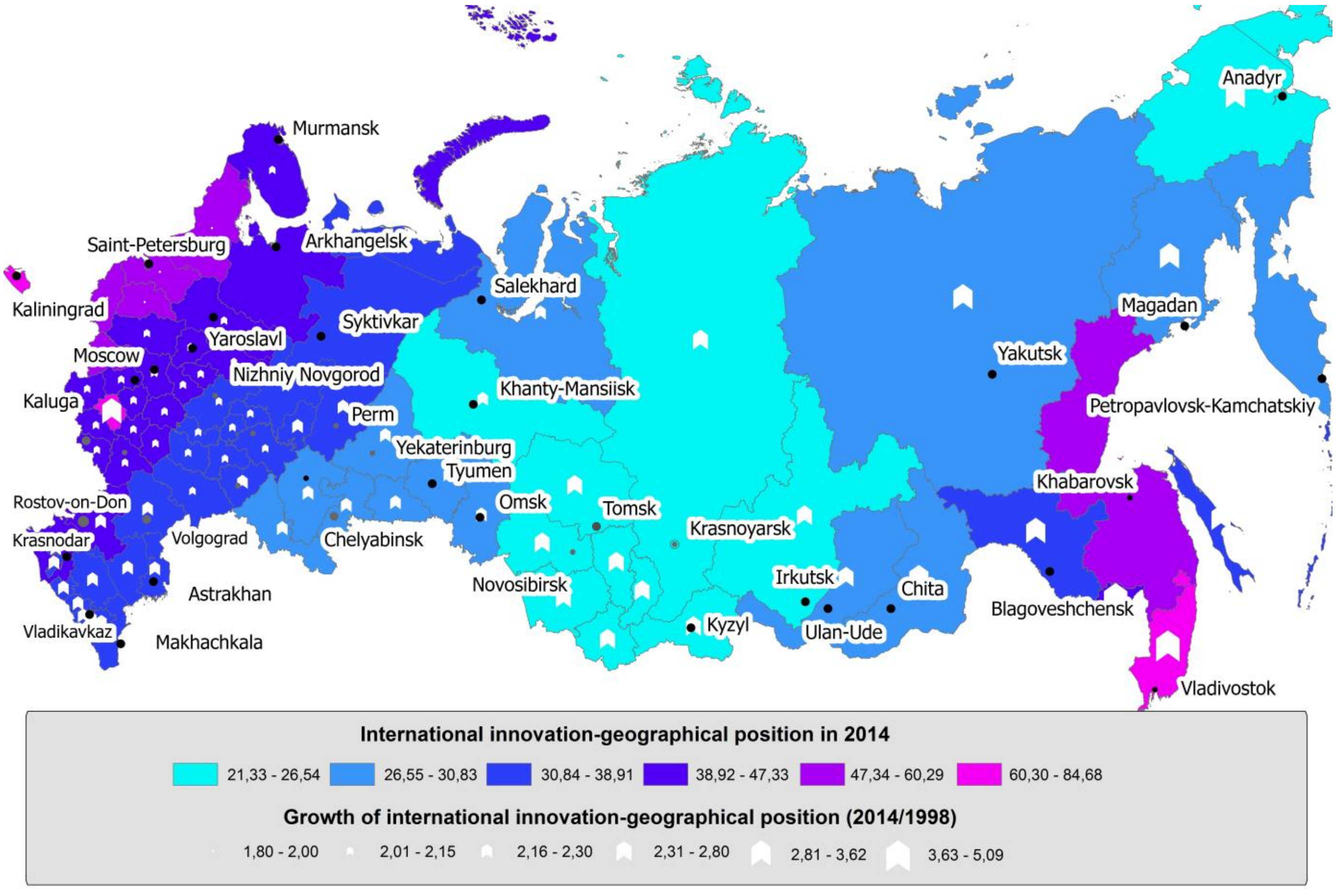

Figure 2 – International innovation-geographical position of Russian regions and its dynamics

In the 2000s, the international IGP of the regions has changed substantially, i.e., their position in relation to large world centres of creation of new technologies (Figure 3). In 1998, the best situation was a characteristic of the western Russian regions, while in 2012, it became the feature of the Far-Eastern regions due to a substantial enhancement of innovation activity in China, South Korea, and Japan. Unfortunately, because of the cultural, institutional, geopolitical, and other barriers, these changes had almost no effect on the activity of the Russian Far East[6].

Appendix 1 contains information on various types of IGP and their dynamics for all regions of Russia.

[6]Quite a large volume of work done in preparation for the summit of the Asia-Pacific Economic Cooperation (APEC), including the construction of a new campus of the Far Eastern Federal University. In the future, these actions should encourage technology transfer from APEC

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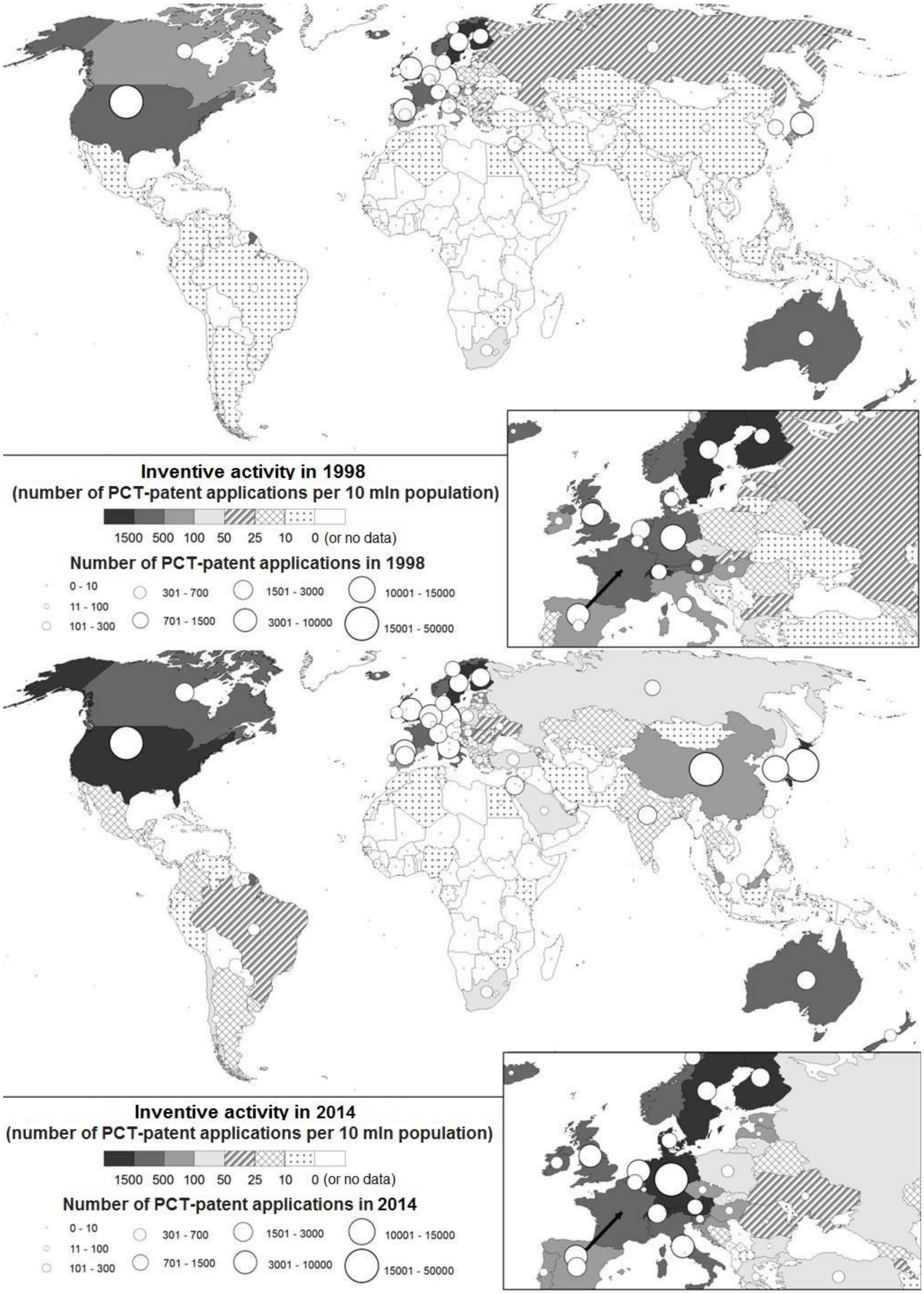

Figure 3 – International innovation-geographical position of Russia

Source: World Bank. URL: data.worldbank.org/

The model for assessment of the impact of innovation-geographical position on regional innovation output

Table 1 shows how location, in relation to major regions that create new technologies, affects the number of new PCT-patent applications and export of technologies. Proximity to the major world centres of new technologies is associated with the total (aggregated interregional and international) potential of EGP and the diffusion of new technologies (mobile, internet, technology imports).

Table 1 – The correlation coefficient between IGP, number of indicators of innovation sphere, and EGP in 1998-2012

Indicator	Interregional IGP potential	Total IGP potential
Total EGP potential	0.12	**0.72**
Interregional EGP potential	**0.86**	0.26
Interregional IGP potential	1	**0.44**
Number of PCT-patent applications	**0.31**	0.14
Number of cellular phones per 100 persons	0.23	**0.6**
Share of organizations with internet access, %	0.12	**0.4**
Export of technologies, mln rubles	**0.21**	0.12
Import of technologies, mln rubles	0.23	**0.23**

Our goal was to understand if regions' IGP affects their ability to create new technologies and to what extent.

The panel regression with fixed effects was chosen as the basic model based on the fact that the sample is not random . The model has the form:

$$\begin{aligned}\ln(Innov_{i,t}) &= \alpha + \beta_1 \times \ln(Rnd\_any_{i,t}) + \beta_2 \times \ln(Hum\_Cap_{i,t}) + \\ &+ \beta_3 \times \ln(KSpill_{i,t}) + \beta_4 \times \ln(X_{i,t}) + \varepsilon_{i,t}\end{aligned} \quad (5),$$

where i – a Russian region in time-period t, *Innov* – indicators of innovation output, *RnD_any* –R&D expenditures , *Hum_Cap* – indicators of human capital, *KSpill* – indicators of potential knowledge spillovers, X – indicators of other factors.

The Russian regions in general are characterized by low share of commercialized national patents, which in the 2000s did not exceed 7%. Data on PCT-patent application may be a more reliable measure for assessment of the level and character of inventive activity. However, its shortcoming is a low patent activity for most of the regions.

Because of disadvantages of the data, we have introduced a new parameter, which reflects the number of potentially commericalizable patents (*Innov*):

$$Innov = 0{,}08 \times Pat\_rus + 0{,}5 \times Pat\_PCT \quad (6),$$

where *Pat_rus* – the number of national patent applications, *Pat_PCT* – the number of PCT-patent applications. The coefficients in this case reflect degree of commercialibility of different types of patents. It does not exceed 8% for Russian and about 50% for international patents, on average.

The hypotheses about the importance of expenditures for R&D according to the classical production function of knowledge [Griliches, 1979], human capital [Romer, 1990], international and interregional IGP and embeddedness of innovation systems (the number of technologies used previously) were tested. Table 2 shows the results of model estimation.

Table 2 – The results of the innovation output modelling (*Innov*)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	0.88 (0.18)***	-0.12 (0.15)	-1.06 (0.19)***	1.18 (0.29)***	0.16 (0.17)	0.91 (0.31)***
Actual expenditures for R&D, mln rubles	0.12 (0.04)***	0.04 (0.02)*	0.008 (0.02)	0.02 (0.02)	0.01 (0.2)	0.004 (0.87)
Number of employed urban residents with higher education, thousand people		0.72 (0.07)***	-0.01 (0.12)	0.28 (0.11)**	0.44 (0.10)***	0.31 (0.01)***
Total IGP potential			0.76 (0.1)***			
Interregional IGP potential				0.58 (0.11)***		0.35 (0.01)**
Cumulative number of utilized patents from 1994					0.11 (0.04)***	0.07 (0.08)*
LSDV R^2	0.91	0.92	0.92	0.92	0.92	0.92
Within R^2	0.02	0.09	0.13	0.11	0.14	0.15
Schwarz's Bayesian Criterion (BIC)	2663	2575	2522	2553	2061	2058

Note: LSDV − least square dummy variable model (LSDV) provides a good way to understand fixed effects. Within R^2 is the R-squared from the mean-deviated regression. Significance of the coefficients in the regressions: * — 10%; ** — 5%; *** — 1%. Standard errors in brackets.

The models have quite similar parameters explaining the total variance, but poorly explain the patent output for a specific region (Within R^2). The best model was the one that simultaneously considered parameters of human capital, interregional IGP, and embeddedness. Calculation results of the econometric models show that the increase in the number and quality of human capital by 1% leads to an intensification of the innovation output by 0.3 - 0.4%, on average. At the same time, funding increase by 1% increases output of new technologies by only 0.12%. If a region's cumulative use of patents is up by 1% compared to other regions, there are 0.07 - 0.11% more potentially commercializable patents. If there are by 1% more new technologies in neighbouring regions (interregional IGP), there are approximately 0.35-0.58% more newly created technologies in the target region. The use of total IGP in models decreases the significance of other factors; its increase by 1% in this case leads to an increase in the issuance of new technologies by 0.76%.

Conclusion

The paper has demonstrated the importance of the geographical position in relation to major centres of new technologies development. Interregional innovation-geographical position is important for creation of new technologies due to the presence of knowledge spillovers, while for the diffusion of new technologies, proximity to major innovation centres has greater impact.

Employed urban population with higher education is a more significant factor of patent activity compared to R&D expenditures because financing may vary from year to year and may not be effective.

The process of regional innovation systems formation is long-term, because knowledge has a cumulative nature.

Potential interregional knowledge spillovers are significant in the models despite large distances between regions in Russia, and due to the concentration of patent activity in several regional clusters, between which active formal and informal knowledge exchange is taking place: Moscow, St. Petersburg, Siberia, Volga, and Ural.

References

1. Andrienko Yu., Guriev S. (2003). Determinants of interregional mobility in Russia: evidence from panel data // William Davidson working paper. 7.
2. Audretsch, D.B., & Feldman, M.P. (2004).Knowledge spillovers and the geography of innovation. Handbook of regional and urban economics, 4, 2713-2739.
3. Baburin V.L., Zemtsov S.P. Factors of patent activity in the regions of Russia // World of Science and Control (Vestnik NSU. Series: Socio-economic sciences). 2016. Vol 16. N 1., pp.86-100.
4. Baburin V.L., Zemtsov S.P. Geography of innovation processes in Russia // Vestnik. Mosk. Univer. Ser. 5. Geography. 2013. N 5. pp. 25-32.
5. Baburin V.L., Zemtsov S.P., Kidyaeva V.M. Methodology of evaluating the potential of the economic-geographical position of Russia's towns // Vestnik Moskovskogo Unviersiteta, Seriya Geografiya, 2016, № 1, c. 39-45
6. Baranskyi N.N. Economic-geographical position // Evolvement of Soviet economic geography. – M.: Mysl. 1980. pp. 128-159.
7. Bezrukov I.A. The continental-oceanic dichotomy in international and regional development. Novosibirsk: 'Geo', 2008.
8. Blanutsa V.I. Postal and geographical location: the concept, the measurement algorithm (for example, the postal network in Siberia in the early XXth century) // Geography and natural resources. 2010. N 4. pp.14-22.
9. Boschma, R. (2005). Proximity and innovation: a critical assessment. Regional studies, 39(1), 61-74.
10. Bottazzi L., Peri G. Innovation and spillovers in regions: Evidence from European patent data //European economic review. – 2003. – Vol. 47. – N 4. – pp. 687-710.
11. Bugromenko V.I. Economic valuation of transport-geographical position of economic objects // Bulletin of the Academy of Sciences of the USSR. 1981. N 5. p.66.
12. Cairncross, F. (2001). The death of distance: How the communications revolution is changing our lives. Harvard Business Press.
13. Crescenzi R. et al. Innovation in Russia: the territorial dimension. – Utrecht University, Section of Economic Geography, 2015. – №. 1509.
14. Florida, R. (2005). Cities and the creative class. Routledge.
15. Glaeser, E., Ponzetto, G. (2007). Did the Death of Distance Hurt Detroit and Help New York? (No. w13710). National Bureau of Economic Research.
16. Grigoriev L., Zubarevich N., Urozhaeva Yu. Scylla and Charybdis of Regional Policy // Questions of economy. 2008. N 2. pp. 83-98.
17. Griliches Z. Issues in assessing the contribution of research and development to productivity growth //The bell journal of economics. 1979. pp. 92-116.
18. Hanson, G.H. (2005). Market potential, increasing returns and geographic concentration.Journal of international economics, 67(1), 1-24.
19. Harris, C.D. (1954). The, Market as a Factor in the Localization of Industry in the United States.AnnalsoftheassociationofAmericangeographers, 44(4), 315-348.
20. Head, K., & Mayer, T. (2010).Gravity, market potential and economic development // Journal of Economic Geography, lbq037.

21. Isard, W. Methods of Regional Analysis; an Introduction to Regional Science. Cambridge: Published jointly by the Technology Press of the Massachusetts Institute of Technology and Wiley, New York. 1960.

22. Jaffe, A. B., Trajtenberg, M., & Henderson, R. (1992).Geographic localization of knowledge spillovers as evidenced by patent citations (No. w3993).National Bureau of Economic Research.

23. Kaukin A.S., Idrisov G.I. The gravity model of foreign trade in Russia: the case for a country with large area and long border // Economic policy. N 4. 2013. pp. 133 - 154

24. Keller W., Geographic Localization of International Technology Diffusion, The American Economic Review, Vol. 92, No.1, 2002, pp. 120-142

25. Krugman, P.R., 1991. Geography and Trade. Massachusetts Institute of Technology, Cambridge

26. Leizerovich E.E. Basic components of economic and geographical position of countries and regions // Bull. Russian Academy of Sciences. Ser.geogr. 2006. N 1. pp. 9-14.

27. Lugovoi O., Dashkeev V., Mazaev I., Fomchenko D., Polyakov E., Hecht A. Economic-geographical and institutional aspects of economic growth in the regions. Publications of Concortium for Applied Economic Research. M.: IET, 2007. 164 p.

28. Lukermann F., Porter P. Gravity and potential models in economic geography //Annals of the Association of American Geographers.– 1960.– T. 50. – №. 4. – C. 493-504.

29. Maergoiz I.M. Research issues of the economic and geographical postiion // The territorial structure of the economy. Novosibirsk: Nauka. 1986. Vol 7.

30. McCallum, J. (1995). National borders matter: Canada-US regional trade patterns. The American Economic Review, 615-623.

31. Nelson, R. (1959). The simple economics of basic scientific research // Journal of Political Economy 67 (3):297–306.

32. Oerlemans L., Meeus M., Boekema F. On the spatial embeddedness of innovation networks: an exploration of the proximity effect //Tijdschrift voor economische en sociale geografie. 2001. T. 92. №. 1. C. 60-75.

33. Polanyi M. The tacit dimension. 1967.

34. Rakita S.A. uantitative assessment of the transport and geographical position of the North Asian areas: technique and results of mapping // New types of cmaps. The methods of their creation. M.: University Press, 1983. pp. 116-129.

35. Romer P. Endogenous technological change. // Journal of Political Economy. 1990. №98 (5). P. 71 102.

36. Saushkin Yu.G. Economic geography: history, theory, methods, and practice. M.: Myls. 1973.

37. Smirnyagin L.V. Position instead of location? (A shift in the fundamental concepts of geography) // Geography and territorial structure: in memory of I.M. Maergoiz, Series: Social Space – Moscow, 2012: Novyi Khronograph. pp. 421-456.

38. Stewart J.Q. Empirical Mathematical Rules Concerning the Distribution and Equilibrium of Population // Geographical Review. 1947. – Vol. 37. – pp. 461-486.

39. Synergy of space: regional innovation systems, clusters, and knowledge spillovers / A.N. Pilyasov (Ed.). Smolensk: Ecumene, 2012. 760 p.

40. Tarkhov S.A. Evolutionary morphology of transport networks: topological methods of pattern analysis. M.: Academy of Sciences, Institute of Geography, 1989.

41. Treyvish A.I. City, region, country and the world: the development of Russia through the eyes of country geographer [Gorod, rayon, strana i mir: razvitiye Rossii glazami stranoveda]. M.: The new chronograph, 2009. 376 p.

42. Von Proff S., Dettmann A. Inventor collaboration over distance: a comparison of academic and corporate patents //Scientometrics. 2013. T. 94. N 3. pp. 1217-1238.

43. Zemtsov S., Muradov A., Wade I., Barinova V. Determinants of regional innovation in Russia: are people or capital more important? // Foresight-Russia. 2016. №2. pp. 29 – 42.

44. Zemtsov S.P., Baburin V.L. Assessing the Potential of Economic-Geographical Position for Russian Regions // Ekonomika regiona [Economy of Region], 2016, Vol. 12, Issue 1. pp. 117-138

45. Zemtsov S.P., Baburin V.L. How to assess advantages of economic-geographical position for Russian regions? // R-Economy. 2016. Vol 2. N 3. pp. 385-401.

Appendix 1 – Characteristics of innovation-geographic position of Russia's regions

Region	Interregional IGP in 2014	Growth of interregional IGP (2014/1998)	International IGP in 2014	Growth of international IGP (2014/1998)	Total IGP in 2014	Growth of total IGP (2014/1998)
Kaliningrad region	0.58	1.6	84.68	1.89	85.27	1.89
Oryol Region	1.5	1.65	76.53	3.12	78.03	3.06
Primorsky Krai	0.1	1.84	76.54	5.09	76.65	5.07
The Republic of Karelia	0.88	1.52	60.29	1.8	61.17	1.79
Leningrad region	3.36	1.25	57.27	1.94	60.63	1.89
Saint Petersburg	0.96	1.71	57.27	1.94	58.23	1.94
Pskov region	1.19	1.49	54.3	2	55.49	1.98
Novgorod region	1.56	1.42	52.87	1.97	54.43	1.95
Moscow region	8.19	1.57	43.75	2.06	51.93	1.96
Khabarovsk region	0.12	1.7	50.74	4.03	50.86	4.02
Smolensk region	1.42	1.6	49.07	2.03	50.49	2.01
Tver region	3.2	1.57	44.57	2.05	47.77	2.01
Jewish Autonomous Region	0.12	1.61	47.33	3.92	47.45	3.9
Kaluga region	2.9	1.58	44.08	2.06	46.98	2.02
Bryansk region	1.55	1.59	44.91	2.06	46.46	2.04
Vologda Region	1.27	1.62	44.47	2.07	45.74	2.05
Moscow	1.97	1.6	43.75	2.06	45.71	2.04
Tula region	2.35	1.59	43.17	2.07	45.53	2.04
Yaroslavl region	1.84	1.61	42.97	2.08	44.81	2.06
Arkhangelsk region	0.63	1.67	44.13	2.12	44.76	2.11
Murmansk region	0.41	1.64	43.96	2.11	44.36	2.1
Vladimir region	2.41	1.61	41.41	2.09	43.82	2.06
Ryazan Oblast	2.32	1.61	41.34	2.09	43.66	2.06
Rostov region	0.63	1.79	42.9	2.17	43.53	2.16
Kursk region	1.16	1.7	42.14	2.1	43.3	2.09
Kostroma region	1.56	1.68	41.6	2.09	43.16	2.07
Ivanovo region	1.93	1.65	41.14	2.1	43.06	2.07
Krasnodar region	0.55	1.73	42.43	2.19	42.98	2.18
Belgorod region	0.95	1.62	41.77	2.11	42.72	2.1
Lipetsk region	1.23	1.66	40.26	2.11	41.5	2.09
Voronezh region	1.12	1.64	39.91	2.12	41.03	2.11

Tambov Region	1.28	1.66	39.53	2.11	40.8	2.09
Nizhny Novgorod Region	1.33	1.69	38.59	2.12	39.93	2.1
Stavropol region	0.53	1.74	38.89	2.2	39.42	2.19
Amur region	0.12	1.78	38.91	3.62	39.04	3.61
Republic of Adygea	0.52	1.77	38.39	2.2	38.91	2.19
Karachay-Cherkess Republic	0.53	1.79	38.04	2.2	38.57	2.19
The Republic of Mordovia	1.17	1.78	36.88	2.13	38.05	2.12
Volgograd region	0.7	1.73	37.02	2.19	37.72	2.18
Penza region	0.99	1.74	36.66	2.13	37.64	2.12
Kirov region	0.84	1.76	36.72	2.14	37.57	2.13
Saratov region	0.86	1.77	36.03	2.15	36.88	2.14
Kabardino-Balkar Republic	0.48	1.83	35.91	2.2	36.38	2.2
Republic of Kalmykia	0.45	1.77	35.87	2.21	36.32	2.2
The Republic of Ingushetia	0.58	2.09	35.66	2.2	36.24	2.2
Chuvash Republic	0.95	1.83	35.26	2.14	36.22	2.13
Republic of Tatarstan	0.94	1.83	35.09	2.14	36.04	2.13
Republic of North Ossetia - Alania	0.52	2.03	35.51	2.2	36.02	2.2
Sakhalin region	0.1	1.76	35.55	3.5	35.65	3.49
Mari El Republic	0.93	1.91	34.58	2.15	35.51	2.14
Chechen Republic	0.44	1.76	35.04	2.21	35.48	2.2
Ulyanovsk region	0.9	1.85	34.52	2.15	35.43	2.14
Komi Republic	0.55	1.73	34.84	2.17	35.39	2.16
The Republic of Dagestan	0.45	1.97	34.09	2.21	34.54	2.21
Samara Region	0.76	1.87	33.63	2.16	34.39	2.15
Udmurt republic	0.75	1.93	33.03	2.17	33.78	2.17
Astrakhan region	0.54	1.81	33.14	2.2	33.68	2.19
Perm Krai	0.68	1.94	32.87	2.17	33.55	2.16
Nenets Autonomous Okrug	0.34	1.68	33.03	2.21	33.37	2.2
Orenburg region	0.59	1.87	30.83	2.18	31.42	2.17
Sverdlovsk region	0.61	2.07	30.68	2.2	31.29	2.19

Republic of Bashkortostan	0.61	1.95	30.43	2.19	31.04	2.18
Kamchatka Krai	0.08	1.76	30.07	3.48	30.15	3.47
Chelyabinsk region	0.59	2.1	29.55	2.22	30.14	2.22
Tyumen region	0.55	2.05	29.27	2.23	29.82	2.23
Kurgan region	0.59	2.2	29.18	2.24	29.77	2.24
The Republic of Buryatia	0.19	1.94	29.08	2.8	29.27	2.79
Transbaikal region	0.17	1.88	28.85	3.07	29.02	3.06
Yamalo-Nenets Autonomous Okrug	0.34	1.72	28.64	2.22	28.98	2.21
Magadan Region	0.08	1.77	28.3	3.4	28.38	3.39
Omsk region	0.46	2.27	27.6	2.3	28.06	2.3
The Republic of Sakha (Yakutia)	0.11	1.83	27.42	3.17	27.54	3.16
Novosibirsk region	0.35	2.15	26.54	2.41	26.89	2.4
The Republic of Khakassia	0.29	2.18	26.38	2.6	26.67	2.6
Irkutsk region	0.21	2.06	26.34	2.8	26.55	2.8
Tomsk region	0.43	2.63	25.99	2.45	26.42	2.45
Altai region	0.49	2.84	25.8	2.4	26.29	2.41
Kemerovo region	0.45	2.73	25.84	2.43	26.29	2.44
Krasnoyarsk region	0.3	2.26	25.95	2.55	26.25	2.55
Khanty-Mansi Autonomous District - Yugra	0.33	1.97	25.05	2.25	25.38	2.25
Altai Republic	0.36	2.42	24.9	2.4	25.26	2.4
Tyva Republic	0.24	2.08	24.81	2.58	25.05	2.58
Chukotka Autonomous Okrug	0.07	1.79	21.33	3.06	21.4	3.05