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Economic-geographical position as a factor of regional development in Russia

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Economic-geographical position as a factor of regional development in Russia

Introduction

“Economic-geographical position” (EGP) is one of the basic categories of regional studies in Russia. Moreover, we can assume that this is one of the few concepts that originally appeared and developed in Russia, and it is rarely used in other countries.

Numerous recent studies of regional inequality (e.g. [1-3]) refer to significant differences between the Russian regions in their geographical position. Even the strategies of socio-economic development in some regions have a special item about their geographical position. These documents mainly provide a qualitative characteristic of a "favourable" or "unfavourable" economic-geographical position of a region; favorable location means the proximity to the region's major markets, transportation routes, etc. However, there is still a lack of a formal model for a quantitative assessment of the category.

Nowadays, the costs for interactions among economic agents are rapidly falling as transport and information technology development has accelerated [4, 6]. Nevertheless, there is still strong differentiation in living conditions within regions and countries; moreover, remote and underdeveloped areas are still less attractive to migrants and investors [5]. One of the factors of spatial differentiation is EGP.

An economic-geographical position of a region is *a historically evolved, but varying set of spatial relationships between economic agents of this region and external factors potentially influencing regional development*. The spatial relationship between two objects in this case is primarily associated with the distance between them.

Any object as a part of the space-time continuum is able to change its position, striving to achieve the most favourable location in space. In other words, it is trying to reach the point, where the potential positive impact of external conditions would be the most favourable for its development. The actions of the object can be modelled as a movement in a phase space to a certain stable point, which is called an *attractor*. In this case, a favourable EGP is an attracting set of economic agents' positions in space, where influences of external factors is optimal. Thus, a regional EGP is a dynamic category.

Changes of an object location may have a significant impact on it. Novosibirsk was founded on the intersection between the Trans-Siberian Railway and the Ob River and became the largest city in Siberia due to the substantial gains of the location on the route between the European part of Russia and the Far East [7]. As a modern example, the new

automobile factories in Russia are located in Kaluga, Leningrad regions close to the largest and growing in 2000s regional consumer markets (Moscow and St. Petersburg, respectively). Poor development of some distant Russian regions, as the Republic of Altai and the Tuva Republic, is related to their unfavourable landlocked position away from the main traffic flows and major economic centres. It is common for other large countries, e.g. in China, economic activity is concentrated mainly in the coastal zone, where export costs are lower.

The aim of this work is to formalize the EGP category and assess the (potential) benefits of economic-geographical position in its relation to regional development in Russia.

“EGP” is a probabilistic category, and its potential benefits can be realized depending on the regional policy, development of infrastructure, and other factors. In fact, it is important to assess the locational advantages of a particular region for economic agents: firms, employees, regional economies as a whole, etc. First, these advantages are associated with the proximity and availability of large markets.

An empirical assessment of a region’s EGP potential should consider dynamic features. An EGP of a particular region depends on the dynamics of economic processes outside this region: for example, changes in traffic and trade flows because of the construction of new roads. Giving a dynamic component to the concept will significantly expand the scope of its application.

Theoretical basis

According to one of the authors of the term, Baranskiy, economic-geographical position is "*an attitude of any place, area or city to other outside regions, which have a particular economic significance... It is extremely important for a country (or region, or city) to be within a short distance of the main roads, markets, and large centres (industrial, commercial, administrative, cultural)*" [10, p. 129]. Baranskiy categorized EGP as having three levels [10]: micro- (within the region, city), meso- (within the country) and macrolocation (between countries). Initially, the concept was applied to studies of cities’ position at the meso level. This work is devoted to the research of meso- and macro locations of Russian regions.

Maergoiz [11-13], Saushkin [14], Mashbits [15], Leizerovich [16, 17], and many other Soviet and Russian scientists [18] have made significant contributions to the concept.

“Geographical position” as a qualitative characteristic of an object can be central, peripheral and neighbour [11]. A central position of an object within a larger territorial system

brings additional economic and social benefits: lower transport costs, trade and migration flows concentration, and so on. Moscow's position in the centre of the transport and the settlement system of the European part of Russia is a good example. In contrast, the peripheral position of regions, which are deep and remote from a centre, generally carries additional costs.

A central position in this case is rather a number of potential connections than a location in the geographical centre of any territory. The historical development of many cities along the Volga River in Russia was determined by their advantageous position in the bend of the river. Convex portions of any river (Fig. 1), *ceteris paribus*, are more profitable for a city, because such positions are able to serve a vastly bigger territory, and therefore have a greater number of potential connections. During the period of water transport dominance, this location was one of cities' competitive advantages. Subsequently, cities were founded almost on every bend of the Volga River.

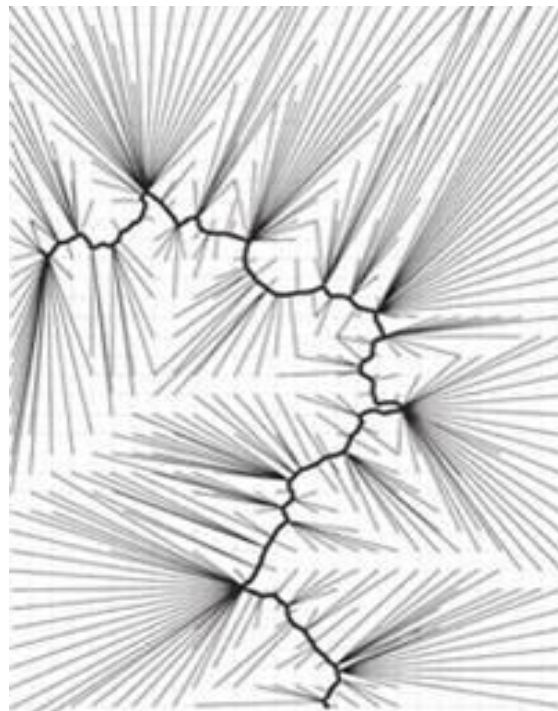


Fig. 1. Scheme of the major channel bends of the Volga river with straight lines that indicate the potential interaction zones [19]

The rarely used, but highly formalized method of geographical position analysis, is a technique from the theory of central places, developed by Kristaller and Lössch (see [9, 20]), which allows to determine a position of a city in the hierarchy of a settlement system.

A neighbouring position of two territorial systems, *ceteris paribus*, usually acts as a favourable factor for their development. Proximity to a larger neighbour can bring benefits of cooperation, economic transfer and new technologies diffusion, e.g. location of shopping centres in the Moscow region near Moscow [21].¹

However, this proximity may inhibit the development of various sectors of weaker neighbours. Less developed regions in this case can be converted into agrarian and raw material appendages and suppliers of labour resources. A classic example is the inner periphery with low population density between Moscow and St. Petersburg [7, 22]. It is important to distinguish neighbours [12] of the first (direct), the second (neighbours of neighbours) and subsequent orders.

We can classify “geographical position” by its functions [15]: geodesic, environmental, economic-geographical (EGP), politico-geographical, geopolitical, etc. In this paper, we examine only the economic component as a first step. An EGP itself can be divided into market-, transport-, industrial-, agricultural-geographical position, and so on. An EGP of a region is associated with its proximity to markets, traffic flows, industrial centres and other facilities, which are potentially able to exert influence on it.

“Proximity” as a category can be estimated using various distance measures² [23]. The simplest is a measurement of the geodesic distance in a straight line. More economically viable is to measure the actual distance by the length of railways, motor roads, navigable rivers, etc. In addition, the distance can be measured based on the time interval, which are widely used in maps of isochrones [21].

The transport-geographical position (TGP) is measured when the benefits of geographical position are related to the remoteness or proximity of a region to main routes, the position of a region in a transport system and associated costs for goods and people delivery [23]. A significant number of works are dedicated to TGP studies of regions and cities (e.g. [17, 24]). One of the most operational and developed methods of a TGP assessment is to measure economic distance in terms of transport costs (tariffs) [25 - 27].

Topological distance is an often-used method to assess an object’s centrality in a transport network, where distance is measured by the sum of the Koenig numbers from one centre to all others: the lower the number of edges connecting the centre with others, the more neutral and the more favourable position it has in a system. There are many other applied

¹ Moscow and the Moscow region, Saint Petersburg and Leningrad region are different regions in Russia

² Not only geographical, but also institutional, organizational, cognitive and other types of proximity [38]

methods of the graph theory [28, 29]. However, these estimations not always provide information on potential economic benefits.

Many empirical works about the EGP concept in Russia are devoted to studies of cities [11, 12, 30-32], and most of them are descriptive and insufficiently formalized [33-35]. In [36, 37], a method for an EGP potential calculation, associated with a proximity to major innovation centres, was proposed.

Many studies have used gravity models, which serve to analyse potential social and economic interactions and assess the benefits of a geographical position. A prerequisite for this model usage comes from laws of physics, which state that an interaction between two objects depends on their size and degree of closeness [39-43].

Applications of gravity models include an assessment of market [42-50], demographics [32, 51-57], innovation potential [58-59], trade [60-67], and migration flows [68-73]. The following relation may describe the basic model:

$$V_{ij} = \sum \frac{P_i^\alpha \times P_j^\beta}{R_{ij}^a} \quad (1),$$

where V is the number of potential interactions between regions i and j , P is a size of a region, for example, gross regional product, population, number of scientists, etc., R_{ij} is the distance between regions, α , β are empirical coefficients, a is a coefficient of proportionality, showing the speed of interaction decrease between regions caused by an increasing distance between them.

C.Harris developed the classical model of cooperation between two regions [43]:

$$V_{ij} = \frac{MV_j}{R_{ij}} \quad (2),$$

where V_{ij} is trade turnover between regions i and j ; MV_j is a market volume indicator, such as gross regional product (GRP) in a j -th region; R_{ij} is distance between regions. However, this form does not allow for "multilateral resistance" [60; 67], when trade between two regions is affected by the market of all other regions.

We classify all the described research methods into four main approaches (Table 1).

Table 1. Basic approaches to EGP analysis

Approach	Methods	Disadvantages
Analysis of location in space or network	Topological distance, proximity matrix, methods of the theory of the central places	The approach do not give quantitative characteristics of potential economic benefits. ‘Centrality’ is not always beneficial.
Calculation of economic distances	Calculation of transport costs, isochronous	The approach considers transportation costs, but does not take into account potential benefits of cooperation
Calculation of an integral index	Construction of indices	The subjective evaluation of a set of variables and weights. The approach assesses relative capacities of EGP.
Calculation of potential interactions	Gravity models	The approach often fail to take into account the actual distance, and specific types of positions (such as coastal)

Methods and data

In this paper, we used the last of approaches as shown in in Table 1. Gravity models allow us to take account of the potential benefits for economic agents from possible interactions. Our approach is based on formula 2. The calculation of the EGP potential (EGP) of a region includes an assessment of the potential of interregional, or national (EGP^{Reg}), and international, or external (EGP^{World}), geographical position:

$$EGP^{All}_i = EGP^{Reg}_i + EGP^{World}_i = \sum_{j=1}^n \frac{MV_j}{R_{ij}^a} \quad (3),$$

where MV_j is gross regional product of a region j , or gross domestic product of a country j ; R_{ij} is actual distance between the capital of a region i and capitals in other regions or countries j ; a is an empirical coefficient, showing the speed of potential socio-economic interaction decrease between regions as the distance increases between them. The higher the EGP potential, the more intensive interactions can be and the higher benefits for economic agents in regions will be.

The calculations required to determine the value of the coefficient a , it will be different within Russia and between countries. Unfortunately, an accurate estimation of the coefficients for interregional and international trade cannot fully reflect the EGP potential. It will include the effects of trade barriers and other factors, which is undesirable for the basic model. Obtaining such estimations is time-consuming [67]. Besides, a favourable EGP

includes externalities of many economic relations, not only trade. That is why we propose another approach.

Let us assume there is a critical distance $Dist_{crit}$, after which an interaction between two regions becomes insignificant, and δ is the threshold number of interactions, for example, a single interaction. P is an equivalent of market potential.

$$\frac{Mean(P_j)}{\delta} \leq Dist_{crit}^a \quad (4),$$

$$a \geq \frac{\ln\left(\frac{Mean(P_j)}{\delta}\right)}{\ln Dist_{crit}} \quad (5).$$

Here is an example of the coefficient calculation based on average GRP in Russia during 1998-2012: average GRP was nearly 64 billion roubles (approximately 2,06 billion USD based on 2012 exchange rates) (Appendix 1) The average transport distance of one tonne of goods by rail (the most commonly used transportation method in Russia) in 2012 was 1.5 thousand km. If we assume that the minimal interaction in any given year between two distant regions, situated at a distance of 8000 km from each other (for example, the distance between Amur and Arkhangelsk regions) is 1000 roubles, then $a = \frac{\ln 64597810}{\ln 8000} \approx 2$.

If we calculate this for the countries in the same period, average GDP was 10 trillion roubles (approximately 320 billion USD based on 2012 exchange rates), and the maximum distance, which still allows the carriage of goods by sea (the main form of transport for international trade) is about 25 thousand km (for example, from Dudinka in the Russian Arctic to Melbourne). If we assume that a minimum product at this distance should cost about one million roubles, then $a = \frac{\ln 10779445}{\ln 25000} \approx 1,6$.

We calculated the potential of an interregional EGP by the following formula:

$$EGP^{Reg}_i = \sum \frac{GRP_j}{R_{ij}^2} \quad (6),$$

where i – is a region, GRP is gross regional product (calculated by the index of physical volume) (million roubles), j is other regions (83), R is a distance (km) by rail; for regions where there are no railways, we used data on automobile road and river routes.

We have identified nine Russian regions where foreign trade activity is concentrated to calculate the potential international EGP. These are regions (p) with non-freezing major ports, which are connected to other regions by year-round infrastructure: Arkhangelsk, Kaliningrad,

Leningrad (St. Petersburg is a centre), Murmansk, Rostov-on-Don, St. Petersburg, Krasnodar and Primorsky (Vladivostok is a centre) regions (Fig 2). Other Russian regions may carry out foreign trade relations with distant countries mainly through these regions. This does not exclude the possibility of foreign trade with neighbouring countries.

Economic ties on land are less intense than ones on the sea due to higher transport costs [78]. Therefore, the coefficient a is lower for international relations than for inter-regional. The general formula for calculating the potential of an external EGP:

$$EGP^{World}_i = \sum \left(\frac{GDP_q}{\min(R_{i,p}^2 + R_{p,q}^{1,5})} \right) + \sum \left(\frac{GDP_n}{(R_{i,e}^2 + R_{e,n}^2)} \right) \quad (7),$$

where i is a region; GDP is gross domestic product (million roubles); q is a distant country (170); $R_{i,p}$ is a distance from a region i to the Russian port region p (km); $R_{p,q}$ is the distance from a port region p to the distant country q (km); n is a border country: economic interrelations with n are carried out mainly by land through the regions e (Table 2).

Table 2. Countries and regions, which are preferential for land interaction

Country (n)	Regions (e)
Armenia	The Republic of North Ossetia - Alania
Azerbaijan	The Republic of Dagestan
Belarus	Smolensk and Pskov regions
Estonia	Pskov and Leningrad oblast
Finland	The Republic of Karelia and Leningrad region
Georgia	The Republic of North Ossetia - Alania
Kazakhstan	Orenburg and Astrakhan region
Kyrgyzstan	Orenburg and Astrakhan region
Lithuania	Smolensk region
Latvia	Smolensk and Pskov regions
Mongolia	The Republic of Buryatia
Tajikistan	Orenburg and Astrakhan region
Turkmenistan	Astrakhan region
Ukraine	Kursk, Bryansk and Belgorod region
Uzbekistan	Orenburg and Astrakhan region

Compiled by the authors according to the Federal Statistical Service of Russia

We used data from the Russian Federal Statistics Service for calculations. We also collected data on GDP by purchasing power parity from statistics of the International Monetary Fund³.

Results

1. Assessment of the potential of economic-geographical position of Russian regions

The maximum interregional potential of EGP in 2012 (Fig. 2) was in regions near the largest agglomerations in Russia: Moscow and St. Petersburg. The EGP potential decreases the further the regions from these two agglomerations, in all directions. We see some increase in the Ural regions (Yekaterinburg, Perm, Ufa, Chelyabinsk agglomerations) and in the highly profitable Tyumen region. The Russian Far East (Magadan, Yakutsk, Kamchatka regions), the most remote from the largest markets, have the least potential for interregional cooperation.

The EGP potential is an estimate of possible benefits (in terms of value), which regional economy can receive due to proximity to other major markets through inter-regional interactions: exchange of goods, services, investment, etc. This natural advantage of a particular region is not directly related to activities of economic agents in that region.

For interpretation reasons, we assumed that there is a company with revenues of 64 billion roubles per year (average GRP in Russia) in the Moscow region. It could earn by exporting products to neighbouring regions 484 million roubles per year more than the same company located in the Chukotka Autonomous District (the north-eastern region of Russia) only because of its location. The benefit from the EGP will be 0.75% of the revenue of the enterprise, but small and medium enterprises can realize their EGP more easily, and this proportion may be higher.

If we assume that all enterprises located in the Moscow region will concentrate in one conventional point, and Moscow region's GRP is 4.3 times more than average GRP, then the absolute value of the benefits of economic agents can be more than 2 billion roubles per year. However, the potential of EGP is calculated for the capital city of each region, and the economic agents are located in different settlements. Therefore, the combined effect may be a

³ <http://www.imf.org/>

little lower for Moscow region as this region contains businesses that are far from Moscow city.



Fig. 2. Potential of interregional EGP of Russian regions in 2012

There was regional divergence in 1998-2012 (Fig. 3). If the potential in a region *i* in 1998 was 1% higher than it is in region *j*, region *i* had 0.4% higher rate of potential increase during the period. The interregional EGP potential grew by more than 2.5 times in St. Petersburg, Moscow, Leningrad, Novgorod, Moscow, Tver regions due to the growth of GRP of the two largest agglomerations and in the Krasnodar region due to the significant growth of GRP of the North Caucasian republics. The lowest growth rates (less than 1.8 times) were observed in Sverdlovsk (the city of Yekaterinburg), Novosibirsk, and Omsk regions due to the high base effect and low growth of GRP in Siberian oil and gas producing regions.

According to our methodology, there are two main reasons of EGP potential dynamics: growth of GRP in the neighbouring regions or GDP of neighbouring countries and the construction of highways and port facilities that give access to foreign markets. For example, if the plan to build the Northern latitudinal line between Tomsk and Khanty-Mansiysk, had been implemented in 2012, the potential interregional EGP of Tomsk region would have increased from 3.05 up to 5 million roubles i.e. an increase of 60%.

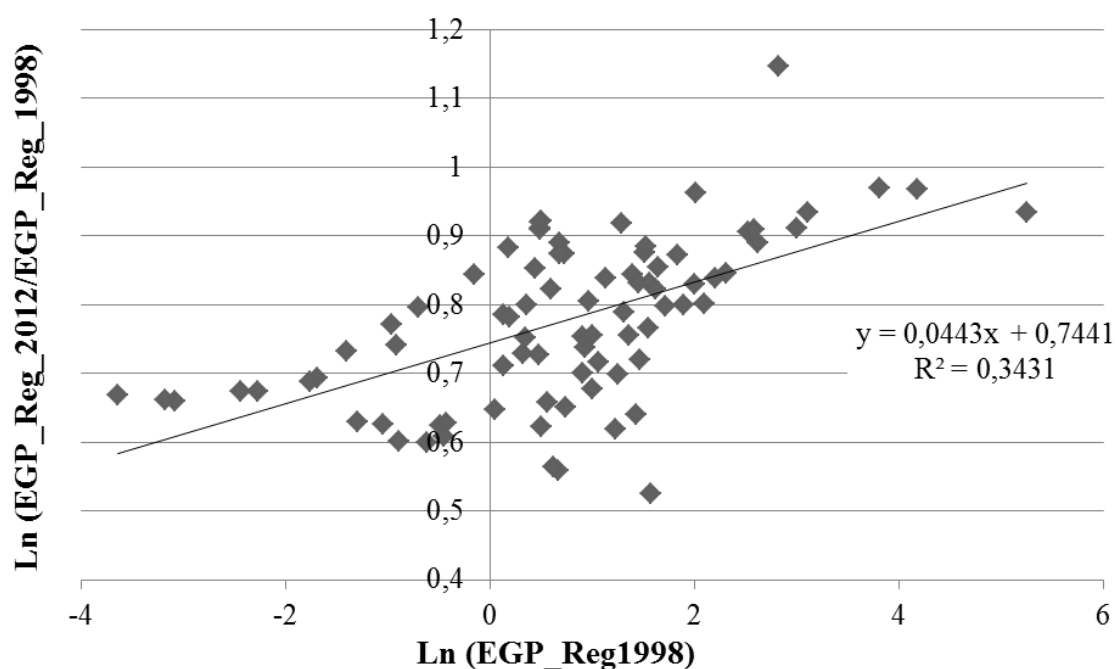


Fig. 3. Relationship between the potential of an interregional EGP in 1998 and its growth over the period 1998-2012

The maximum potential international EGP (more than 10 billion roubles) is concentrated in the regions of the Baltic Sea (Kaliningrad and Leningrad region, St. Petersburg), the Black Sea (Krasnodar Territory and Rostov Region), the Sea of Japan (Primorsky region) and in regions in close proximity to them (Novgorod region). Regions with the lowest international EGP (capacity less than 50 million roubles) are Chukotka Autonomous District and the Republic of Tyva.

The maximum international EGP potential growth (more than 3.5 times) was observed in the southern regions of the Far East: Primorsky and Khabarovsk regions and the Jewish Autonomous Region. The uniqueness of the Russian Far Eastern regions position is that they are on periphery of economic activity in Russia (Figure 3) but close to the rapidly growing markets of Asia-Pacific countries [13, 80]. The lowest growth rates (less than 2.5) were demonstrated by the regions close to the slow-growing Nordic countries: St. Petersburg, Leningrad and Kaliningrad regions.

The potential of an interregional EGP increased by 2.2 times in 1998-2012, and the potential of an international EGP – by 3 times. In other words, it was more profitable for economic agents to focus on a foreign trade in this period.

The total potential of EGP comprises interregional and international components (Fig. 4). The total potential is mainly concentrated near the major port centres of Russia. The

leaders in 2012 were Primorsky, Krasnodar, Leningrad, Rostov region and St. Petersburg. Moscow region, the leader by interregional EGP potential, ranks only in 21th place for total potential.

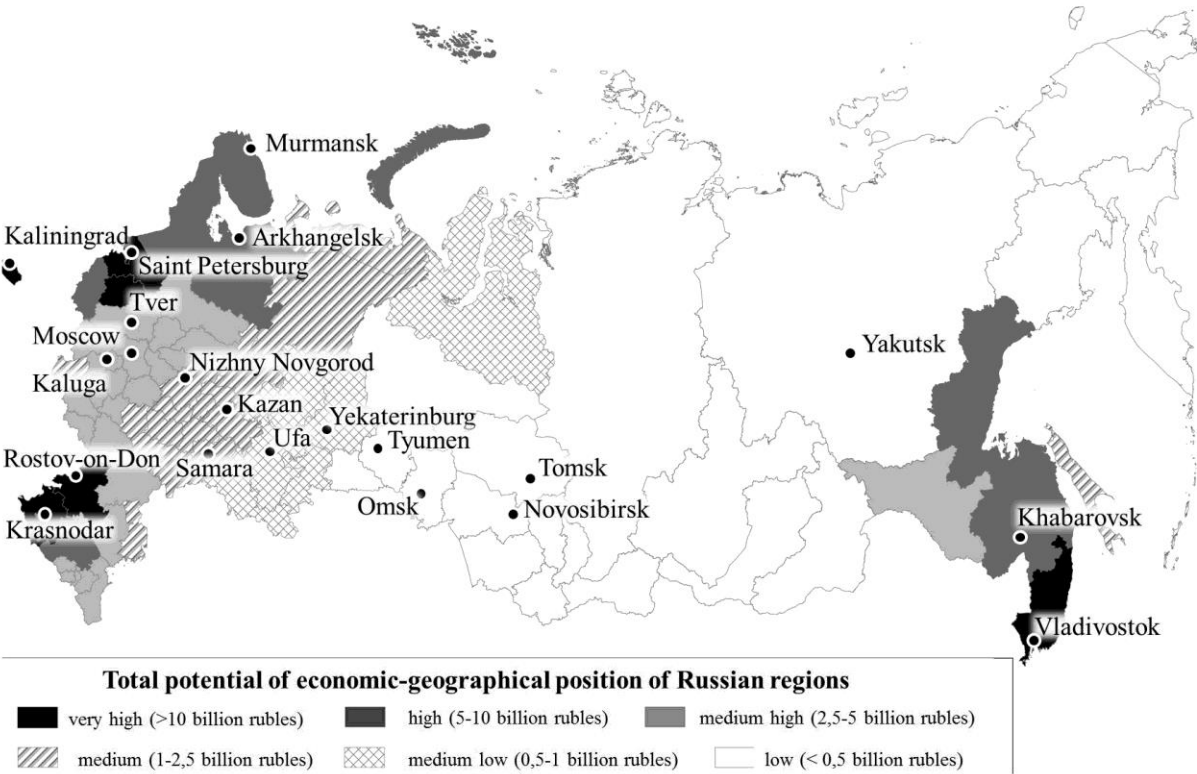


Fig. 4. Total potential of interregional and international EGP of Russian regions in 2012

There is a weak convergence of the total EGP potential (Fig. 5) with a strong division of trends between the Far Eastern regions and the regions of the European part of Russia. If the first is characterized by divergence – the higher the capacity in 1998, the faster it will grow due to increased economies of Asia-Pacific countries, the situation is reversed for the second – regions with smaller potential grew slower. In the southern regions of the European part of Russia, EGP potential has increased more significantly despite the negative trends in the economies of the southern countries of the European Union (EU).

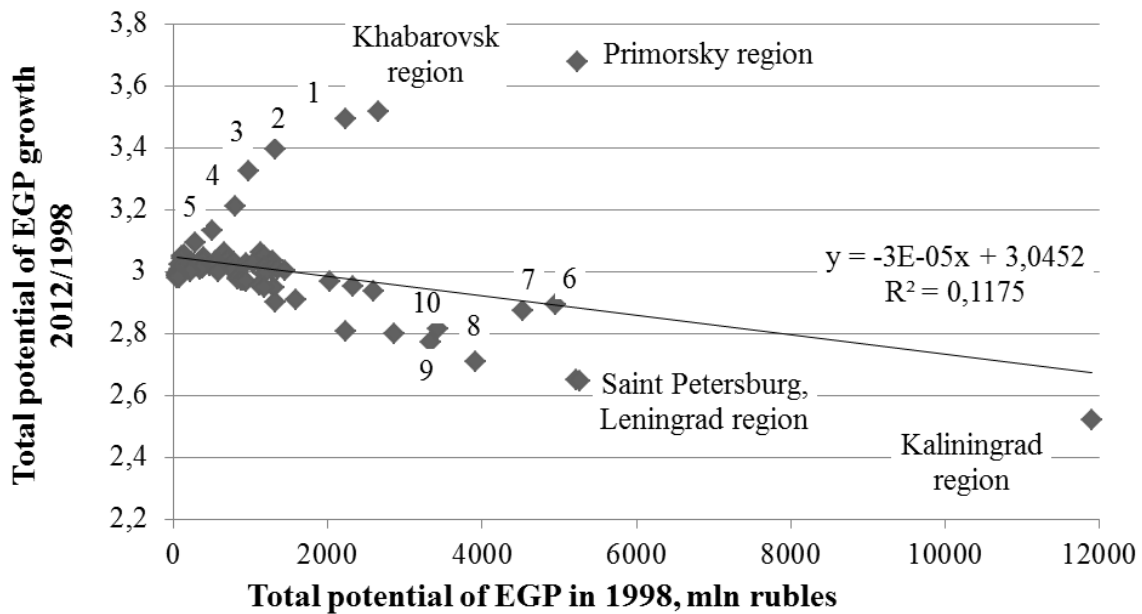


Fig. 5. Relationship between the total potential of EGP in 1998, the base and its growth over the period 1998-2012

Note: The numbers on the graph shows 1 - Jewish Autonomous Region, 2 - Orel region, 3 - Republic of Dagestan, 4 - Amur Oblast, 5 - Sakhalin region, 6 - Krasnodar region, 7 - Rostov region, 8 - Novgorod region, 9 - Murmansk region, 10 - Arkhangelsk region

Comparing the total EGP potential with existing GRP of regions can show how they realize the advantages of their positions (Fig. 6). The potential benefits of economic cooperation with other regions and countries for the Republic of Ingushetia, the Jewish Autonomous Region, the Republic of Kalmykia, the Kaliningrad region, the Karachaevo-Circassian Republic are higher than their real GRP. The Republic of Ingushetia (North Caucasus) underutilized benefits from its position near the port facilities in the Krasnodar region and the main traffic arteries in the Caucasus because of the weak development of the economy, institutional and social barriers, and poor infrastructure. Kaliningrad region is located near the largest European market, but its EGP potential is not fully realized because of high trade barriers and isolation from the rest of Russia.

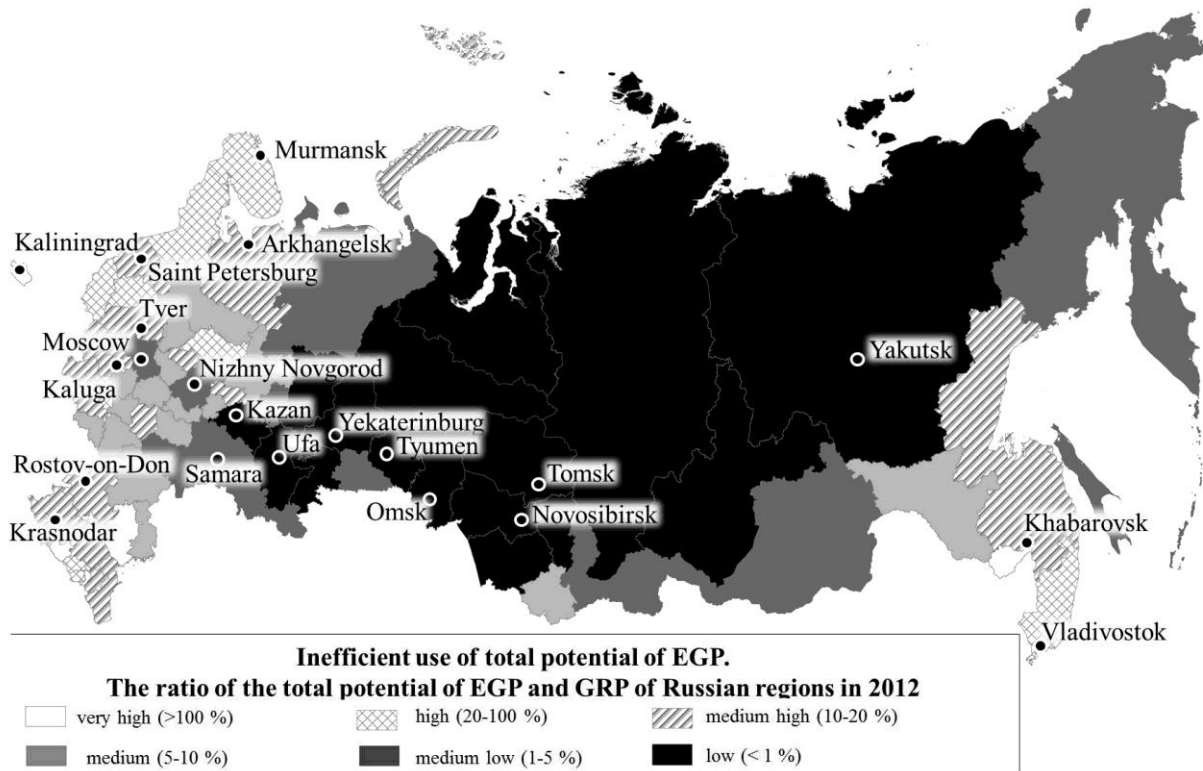


Fig. 6. Ratio of the total potential of EGP and GRP of Russian regions in 2012

The total EGP potential of Kaluga region amounted to about 2.6 billion roubles, or about 20% of the GRP. Despite rapid growth of its automobile industry cluster, the EGP potential is not fully used.

At the same time, regions of Siberia, the Urals, the Republic of Tatarstan and Bashkortostan, as well as Moscow and St. Petersburg, almost fully utilized their potential.

2. Correlations between the EGP potential and indicators of socio-economic development of regions

To test the hypothesis about the influence of the EGP potential on socio-economic development of Russian regions, we calculated the correlation coefficients with a number of indicators (Table. 3, Fig. 7-8).

The higher the total EGP potential in a region, the higher the proportion of imports in GRP, as well as volume of technology import, number of enterprises per 1,000 employees, share of employment in trade, mobile communication and the Internet development. The high interregional EGP potential is related to higher population density, GRP, investment, including FDI, and export of goods and technologies.

Table 3. Correlation coefficients between the EGP potentials and indicators of socio-economic development of Russian regions (1998-2012)

Indicators of socio-economic development of the Russian regions	Total potential of EGP, million roubles	Potential of interregional EGP, million roubles
GRP, million roubles		0,21
Growth of GRP, %	0,06	
Investments in fixed assets, million roubles	0,14	0,33
Ratio of fixed investment to GRP, %	0,15	
Export, million roubles		0,18
Ratio of imports to the GRP, %	0,56	0,18
Foreign direct investments, million roubles		0,33
Number of enterprises per 1,000 employees	0,24	0,2
Share of employment in wholesale and retail trade, %	0,24	0,15
Population density, persons per km ²	0,11	0,41
Urbanization, %	0,07	0,16
Net migration, migrants per 10 thousand citizens	0,11	0,16
Technology export, million roubles	0,1	0,24
Technology and technical services import, million roubles	0,23	0,23
Number of mobile phones per 1000 citizens	0,26	0,18
Number of personal computers with Internet access per 100 employees	0,22	0,12

Note: all the coefficients are significant at the 5% p-value

The correlation coefficients between the EGP potential and other indicators changed over time (Fig. 7-8).

In the early period, the proportion of people employed in trade was significantly higher in regions with high total EGP potential that is close to the foreign markets in period of “shuttle” trade⁴ but then connection with the potential of interregional EGP grew up. In 1998, the migration indicator was higher in regions with high total EGP potential, but regions of the European part of Russia with a high potential of interregional EGP became more attractive due to their economic development in the 2000s. In 2010-2012, the implementation of large investment projects in seaside regions (Sochi Olympic games 2014, APEC Summit 2012 and others) led to an increase in the correlation coefficient between the total EGP potential and shares of investments in the GRP.

⁴ The period of 1990s in Russia, when many people were involved in spontaneous trade

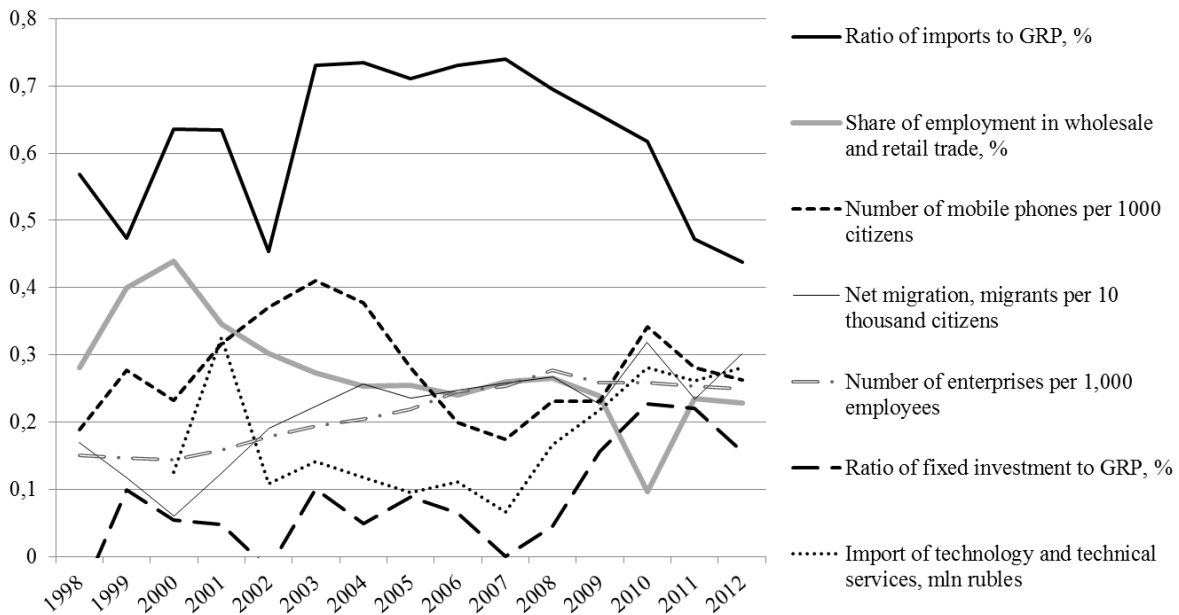


Fig. 7. Dynamics of the correlation coefficients between the potential of an interregional EGP and several indicators of socio-economic development of Russian regions

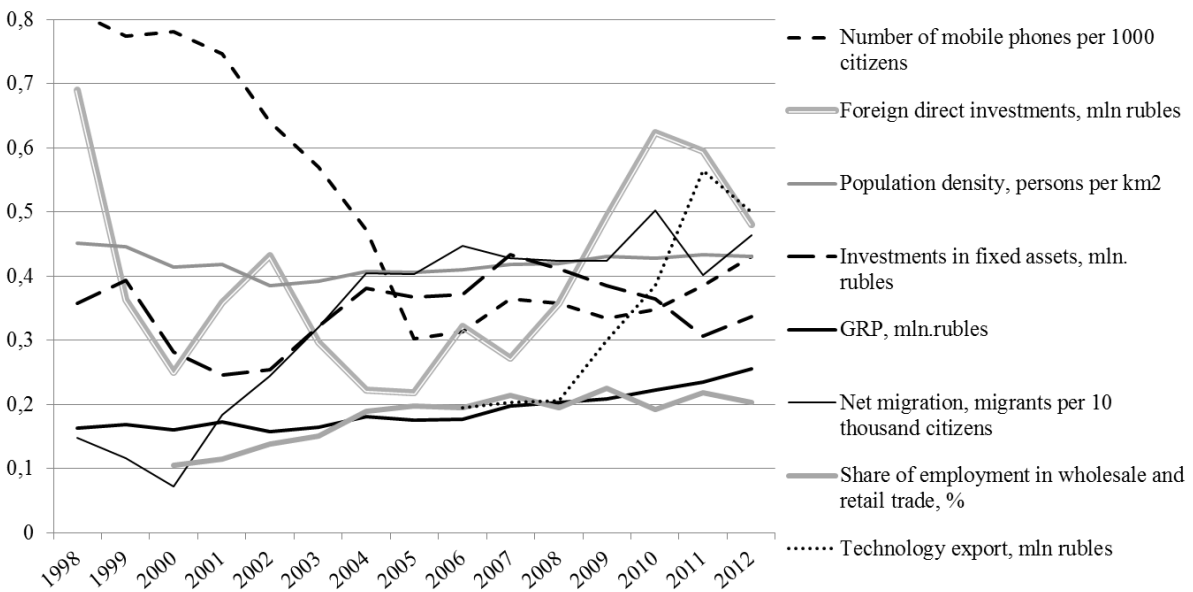


Fig. 8. Dynamics of the correlation coefficients between the total potential of EGP and several indicators of socio-economic development of Russian regions

3. EGP potential as a factor of Russian regional development in 1998-2012

Both in theory and practice, economic growth in large, developing countries (for example, China, India, Brazil, and Mexico) is based on cross-country interactions via trade, technology transfer, and migration, and is accompanied by sharp increases in regional

differentiation [1]. Regions-exporters, as well as regions with an advantageous geographical position (border and coastal regions) have higher rates of growth, and they eventually achieve higher levels of development.

In the last stage of our research, we identified the main driving forces of regional development in Russia, including an assessment of EGP potential influence.

From the late 1990s to the end of Medvedev's presidential term in 2012, the majority of Russia's regions became much wealthier in terms of gross regional product (GRP) purchasing power parity per capita, reflecting Russia's shift to a middle-income country driven largely by high global oil and gas prices. Yet at the same time, regional disparities in economic structure increased.

We operationalize regional development as GRP per capita in 2012 relative to 1998 ($GRP\ per\ capita_{2012/1998}$) and carried out a series of regression estimates, using several logged independent variables (Table 4).

$$\begin{aligned}
 GRP\ per\ capita_{2012/1998\ i} &= const + \alpha \times \ln(GRP\ per\ capita_{1998}) + \beta_1 \times \ln Invest_i + \beta_2 \\
 &\times \ln Population_i + \beta_3 \times \ln EGP_i + \beta_i \times \ln factors_i + \varepsilon_i
 \end{aligned}
 \tag{8}$$

where i – is a region, $const$ is a constant, $Invest$ is an arithmetic mean of investment per GRP in 1998-2012, %; $Population$ is a growth of economically active population (2012/1998), %; EGP is a total potential of economic-geographical position (EGP) in 1998, million roubles, $factors$ – other variables, ε – residues.

Our models seem to go some way in identifying the factors of regional development, with an adjusted R-squared of between 0.6-0.8.

The total potential of economic-geographical position of a region in 1998 seems to be a significant factor of economic development through the period as well as average total potential of EGP per GRP during the period. The closer a region was to the largest market in 1998, the higher rate of regional development it has. The greater was the difference between the amount of available markets (EGP potential) and the volume of GRP (in fact, the volume of its own market), the higher the growth rate were. Proximity to major markets in the region enables enterprises an opportunity to export their products to the market, but also provides better access to the markets of goods, services, labor and technology of the other countries, the opportunity to set up joint ventures with foreign partners, etc.

Table 4. Estimated results of regressions

	1	2	3	4	5
const	3.9 (0.64)***	5.3 (0.29)***	5.6 (0.39)***	6 (0.23)***	4.44 (0.66)***
GRP per capita in 1998, million roubles	-0.08 (0.03)***	-0.08 (0.02)***	-0.14 (0.03)***	-0.1 (0.02)***	-0.08 (0.02)***
Average investment per GRP, %	0.33 (0.06)***	0.23 (0.03)***	0.26 (0.07)***		
Growth of active population (2012/1998), %	0.24 (0.1)**				0.3 (0.02)**
Export growth (2012/1998), %		0.07 (0.01)***	0.09 (0.01)***	0.05 (0.007)***	0.05 (0.008)***
Average import of equipment per GRP, %			0.04 (0.01)***		
Total potential of economic-geographical position (EGP) in 1998, million roubles				0.026 (0.015)*	
Average foreign direct investment per GRP, %				0.03 (0.02)*	0.04 (0.02)**
Average total potential of EGP per GRP, %					0.02 (0.01)*
R-squared	0.6	0.68	0.65	0.79	0.81
Adjusted R-squared	0.58	0.66	0.62	0.78	0.8
Schwarz criterion	348.6	387.8	335.9	351.5	353.9

P-value: * - 0,1; ** - 0,05; *** - 0,01

We found that the main factors of regional development are the extensive growth of physical capital and labour using the region's available natural resources and geographical positions. Fourth, factors of 'second nature' (such as human capital and innovation) are insignificant in the majority of regions, with the exception of technological imports.

Conclusions

We formalized, based on a review of the literature, the category of economic-geographical position (EGP). This is a historically evolved but varying set of spatial relations among economic agents in a region and external factors, potentially influencing the regional development.

The method we developed to assess EGP potential based on gravity models can be widely used in regional studies to explore the benefits of the spatial location of countries,

regions, cities, firms, etc. We have assessed the potential of the international EGP of the Russian regions in 1998-2012 for the first time.

These calculations for the Russian regions showed significant spatial differentiation. Regions located near the agglomerations of Moscow and St. Petersburg have the maximum potential of interregional EGP, and the potential decreases uniformly as we go east. The maximum potential of international EGP is concentrated in the regions on the coast of the Black Sea, the Baltic Sea, and the Sea of Japan.

The total EGP potential of Kaliningrad region is 5.6 times higher than in the distant inland region of the Republic of Tyva. In other words, it is 5.6 times more profitable for economic agents to be located on the Baltic coast near the large EU market than within the continent away from the sea and major markets.

A significant change in the total EGP potential was found during 1998-2012. It shifts towards the southern regions of the Far East due to the growth of the economies of the Asia-Pacific region. There is a divergence of the potential of the interregional EGP, while the potential of the international EGP has two trajectories for the Far Eastern regional group characterized by divergence, and other regions with weak convergence.

We identify regions with high and low utilization of its EGP comparing the total EGP potential with the existing GRP. The Kaliningrad region and the North Caucasus republics have more opportunities to build the regional economy by harnessing the benefits of their position. Regions in Siberia, the Urals, the Republic of Tatarstan, and Bashkortostan, as well as Moscow and St. Petersburg, almost completely used their EGP potential.

The favourable EGP is one of the factors of GRP, investment, foreign trade growth, migration increase, and diffusion of new technologies. In addition, in terms of future policy to improve regional development policy making in Russia, we conclude that international linkages such as exporting, importing, foreign direct investment, and economic-geographic position are very important and hence should be the focus of policy making.

The proposed formalization of the EGP concept enables it to be used as a method for evaluating the externalities of infrastructural projects. Moreover, it is useful to predict the spatial changes in the socio-economic development of Russia.

Our study shows the high importance of external economic relations to regional development in Russia. This is a very important result, because in today's Russia ideas about the need to improve self-sufficiency (autarky) and benefits of sanctions pressure are dominated.

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Appendix 1. Exchange rates. Rouble/dollar

1998	1999	2000	2001	2002	2003	2004	2005
9,7	24,62	28,14	29,17	31,35	30,69	28,81	28,3
2006	2007	2008	2009	2010	2011	2012	
27,17	25,58	24,86	31,83	30,36	29,39	31,08	