HOW TO ATTRACT HIGHLY SKILLED MIGRANTS INTO THE RUSSIAN REGIONS

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How to Attract Highly Skilled Migrants into The Russian Regions

Vera Barinova¹, Sylvie Rochhia², Stepan Zemtsov³

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Abstract. In this work, we examine the factors and patterns of attracting highly skilled migrants by the Russian regions. Attracting such specialists is particularly relevant for large developing countries with territories actively losing qualified personnel, and, accordingly, opportunities for long-term development. The results of an econometric study show that there are a number of objective factors that are poorly modifiable but have a significant positive effect on staff recruitment: the demographic potential of neighbouring regions, the size of accessible markets, and the natural comfort of living. Adverse socio-economic conditions in the region, such as high unemployment, negatively affect the possibility of emigration. However, there are factors that the regional authorities and the federal government are able to influence in the medium term. One of the most important determinants remains the income of highly qualified specialists and the availability of housing. Highly qualified specialists also strive to move to regions with a high level of education and a good healthcare system. The creation of favourable conditions for entrepreneurship has a positive effect on attracting active migrants, providing opportunities for new firms’ establishments. As recommendations for regional policy, in particular, attracting highly qualified specialists to the Russian rare-populated Far East, efforts are needed to develop rental housing and zero-interest mortgages, create high-performance jobs, especially in education, science and medicine, as well as general improvement of institutional conditions for conducting business.

JEL classifications: P23, J61, P36, R23.

Keywords: Russian regions, migration, gravity model, market access, institutions, human development index, regional policy, high-tech sector

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Introduction

The presence of highly qualified personnel is one of the most important resources for the formation of technological entrepreneurship in the new economy and, accordingly, regional development in the long run (Moretti, 2012; Joo et al., 2013; Wuebker et al., 2010). The more people are employed in the high-tech sector in the region, the more opportunities it has for the development of new technologies and new firms. Creativity is becoming the main driving force in high-tech and regional development. R. Florida argues that the world passes from competition among firms for markets and workforce to the competition of cities and regions for creative professionals (Florida, 2000). A particular set of living conditions is significantly more important for the creative class than for others (Florida, 2000). Therefore, they are most demanding of the environment of their surrounding communities, they are much more mobile, but at the same time, creative professions based on symbolic knowledge are much more strongly incorporated into the local environment (Martin, Moodison, 2011).

The policy aimed at attracting highly skilled migrants to the regions is quite popular (Parsons et al., 2018). To take the advantage of highly qualified workforce, regional authorities should pay attention to the ability of the region to attract and retain human resources, create conditions for self-realization of people, including entrepreneurs as a creative class. Special regional projects are often used to create a comfortable environment for information technology professionals. This policy is especially important for developing countries characterized by brain drain and high territorial heterogeneity (Simanovskiy, Straubhaar, 1996; Straubhaar, 2000).

During 2000th, the majority of the Russian regions became much wealthier in terms of gross regional product (GRP) per capita, reflecting Russia’s shift to a middle-income country driven largely by high global oil and gas prices (Zemtsov, Smelov, 2018). Public spending on innovation activities was increasing, and Russian regions created a significant number of policy instruments for promoting innovation and infrastructure facilities (Zemtsov, Barinova, 2016). Yet there is a strong differentiation between regions in their technological results, which depend greatly on the availability of highly qualified and educated workforce (Zemtsov et al., 2015; Zemtsov, Kotsemir, 2019). Besides, it is especially difficult to measure high-qualified personnel migration. In Russia, like most transition countries (Filer et al., 2001), the geographical mobility is not high due to serious administrative barriers and underdevelopment of housing markets. Attracting the best personnel could be the driving force to the regional development.

There are widespread underdeveloped Far Eastern territories in Russia that are actively losing population. The government is striving to create conditions for attracting business, and, accordingly, workers to the actively developing Asia-Pacific region. In Vladivostok, on the shores of the Pacific Ocean, in 2012, a Asia-Pacific Economic Cooperation summit was held. New
university campus and new airport were built, and transport infrastructure was improved. However, so far this policy has not been successful, especially in terms of a highly skilled workforce. Identification of the migration factors of such specialists will make it possible to propose new tools for regional migration policy.

**The goal** is to identify factors that contribute to attracting highly qualified and educated workforce at a regional level on the example of the Russian regions, and to formulate appropriate recommendations.

The article has the following structure. At the beginning, the previous theoretical and empirical studies of the factors determining the migration of highly qualified specialists are discussed. The second part discusses the methodology of econometric research and data. The third part discusses the results. In conclusion, a number of recommendations are made for the regions of developing countries.

**Modelling interregional high-skilled migration**

While migrating, people compare utility differentials across different alternative locations and these utility differentials are a function of both economic and non-economic factors. Florida (2002, 2003, 2005) has insisted on the positive impact of urban amenities and on criteria related to the quality of place on the attraction of talents (Ferguson et al., 2007).

Different aspects of attracting highly qualified and educated personnel have been studied thoroughly. Today there is still no complex theory of high skilled migration (Triandafyllidou, Gropas, 2014).

According to the theoretical foundations of neoclassical microeconomics (Borjas 1990), migrants calculate and compare the costs of migration with the benefits from it, both economic and non-economic. For example, from moving to another country they may expect to receive socio-economic benefits (income growth, better career prospects, better quality of life, etc.), but they understand that they will incur costs: economic (costs of moving), social (break in social networks) and psychological (family and friends left behind, nostalgia). Note that the analysis of costs and benefits is subjective and depends on the preference function of each individual. The opportunity to earn good money may attract high quality human resources to developing economies, but other conditions may overcome this advantage.

The other basis for the theory of highly skilled migration is the theory of human capital (Triandafyllidou, Gropas, 2014), which argues that migrants can be motivated by a desire to improve their skills, so called ‘occupational upgrading’, rather than just taking a job with higher wages. (Liebig, 2003) states that highly skilled migrants will prefer to move to an area with
educational facilities, high-standard training schemes and overall long-term professional prospects.

Network theory can also be reflected in the comprehensive theory (Triandafyllidou, Gropas, 2014). It describes the importance of interpersonal ties (kinship, friendship, and shared origin) which connect migrants, former migrants, and non-migrants in countries of origin and destination. It is believed (Massey et al., 1993) that such networks increase the likelihood of migration because they help to find work, accommodation and integrate at a destination region. However, it is worth noting that the network strategies of highly skilled migrants are very different from economically disadvantaged migrants. In the case of highly skilled migration, such networks also cover professional and business networks, including contacts established during prior stays in a potentially receiving region (for study or work purposes).

Concept of relative deprivation (Massey et al., 1993; Stark, Taylor, 1991) can also be included in the general theory. This concept argues that a change in the local social hierarchy has a stronger impact on those who used to live better and who notice a decline in their relative standard of living. At the same time, those who are actually the poorest in society may not feel their “relative deprivation” so much. Here we are talking about the migrants’ assessment of how other people live in their society and about their own expectations and plans for the future. This estimate obviously affects the likelihood of a decision to emigrate. It is especially important for the Russian case where the highest decrease in incomes (every year after 2014) and living standards (decrease of Russian ruble exchange rate) was in middle class, and because of institutional failures the gap with the richest Russian oligarchs was increasing.

Thus, we examined four theoretical foundations that should become the basis for a future comprehensive theory of migration: neoclassical microeconomics (cost-benefit analysis), theory of human capital (occupational upgrading), network theory (interpersonal ties, professional and business networks), and new economic theory of migration (relative deprivation).

Skilled migration can be categorized by motivation (Iredale, 2001): “brain drain” from underdeveloped regions with low standards of life and no career opportunities; government induced or government stimulated in accordance with its spatial priorities; ethical immigration from regions with human rights infringement and week institutions (Simanovsky et al., 1996), etc. (Stahl, 1993) defined recent tendency of skilled emigration from post-industrialized regions to less developed ones in order to monitor contract fulfilment or became self-employed consultant as “capital-induced” migration.

There are several channels of migration (Findlay, Garrick, 1989): through companies with interregional contracts; interregional recruitment agencies (Ewers, 2007), through government
contracts (especially for military staff), ethnic networks (Findlay et al., 1996, Xiang, 2001) and recruitment through the Internet (Cornell, 2001).

Two main approaches to modelling migration process can be identified (Korepina, 2017): based on traditional methods (gravity models, regression models, Markov chain models, and optimization models) and based on modern ones (neural networks and simulation models).

The first models of migration flows were based on the Ravenstein’s observation that the scale of migration flows positively correlates with the number of residents between regions and negatively with the distance between them (Lifshits, 2016; Greenwood, Hun, 2003). This is the basis for the gravitational models development (Stewart, 1941; Greenwood, Hun, 2003). In 1946, Zipf evolved this idea and proposed a gravitational model of migration based on the assumption that the migration flow between the two territories is directly proportional to the total population of the regions and inversely proportional to the square of the distance between them (Greenwood, Hun, 2003). Later Lee (1966) proposed a theory of migration factors. According to it, each migration flow is characterized by factors of the destination region, origin region, external «interfering» factors (for example, the distance between cities), and factors related to the individual characteristics of migrants. At one time, theory served as a watershed in modelling migration (Korepina, 2017). To build Lee's model, methods of correlation-regression and factor analysis are used. In Markov chain model, migration is viewed as a simple process whereby inter-regional population groups undergo changes according to a set of movement or transition probabilities (Hirst, 1976). Modern methods of modelling migration processes such as neural network (Svarc, 2005) and simulation allow researchers to solve the problem of insufficient information for traditional modelling.

There are a number of models, which explain the self-selection of immigrants by their level of skills. Borjas (1987) upgraded Roy’s model and suggested that there is a skill-distribution of individuals in both the destination and the source countries. Individuals’ migration decisions are governed by the relative returns to their skills in both locations, as well as the migration costs they face. Grogger and Hanson (2013) emphasize that immigrant selection and sorting are important features in the high-skilled migration phenomenon. Selection refers to how migrants are chosen from the skill distribution of the origin country, and sorting is about how these migrants choose among potential destination countries (Kerr et al., 2017).

Various groups of factors can thus influence the decision to move to a specific location like the general economic factors, the labour market conditions, the housing-market variables\(^4\), the

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\(^4\) Some factors are of course strongly related to each other; economic factors with housing market or labor market; the quality of housing market with environmental conditions, etc.
environmental conditions or the political regulations (Burkert et al., 2008). If job opportunities remain important or even decisive, intangible assets also matter. These assets, such as services, social cohesion or social capital, are partly area-specific highlighting the role of local institutions (Nifo, Vecchione, 2014). The studies on skilled migrations tend to bring out variables more related to individuals or their relationship to work (Jaeger et al., 2010; Gibson & McKenzie, 2011) and specially to living conditions in the region of destination (Florida, 2002; Mushi, 2003; Cebula, 2005; Van Dalen, Henkens, 2007; Burkert et al, 2008). For certain factors, such as the quality of air, the leisure facilities or the education facilities, there is high disparity between regions (Burkert et al., 2008; Nifo, Vecchione, 2014). So, “‘Creative young people’ often migrate not only to have better chances of employment and higher wages, but also to live in cities where the environment is overall more amenable, living and working conditions are better, and professional and social opportunities more interesting, chiefly thanks to a better quality of local institutions which define the level and quality of essential services such as health, security, legality, transport and culture” (Nifo, Vecchione, 2014, 1631-1632). Investigation in Italian provinces has confirmed the importance of the institutional quality, notably of three of its dimensions: the rule of law, the effectiveness of regional policies and the social capital.

There are also many papers, which access the influence of migration on development of regions (Straubhaar, 2000; Moretti, 2004; Bell et al., 2015). Not all of these effects are positive. The paper of Fratesi and Riggi (2007) presents that skill-selective migration can, in some cases, lead to increasing income per capita disparities and, for this reason, policy makers need to be cautious when attempting to narrow regional disparities by easing interregional migration. As for Borjas (2005), his work explores the impact on labour markets of the arrival of graduate students who come to study in the US and then stay there to work. A 10 percent immigration-induced increase in the supply of doctorates lowers the wage of competing workers by about 3 percent.

**Methods to identify regional factors for attracting highly qualified personnel**

In order to assess the most important factors that influence the regional attractiveness for highly qualified and highly educated personnel in Russia we took an extended version of the widely used gravity model (Lee, 1966; Korepina, 2017; Andrienko, Guriev, 2004; Dotti et al., 2013), which shows the potential social and economic interactions and helps to assess the benefits of a regional geographical position. The basic form of the model is the following:

\[ V_{ij} = \sum P_i^\alpha \times P_j^\beta \times R_j^\gamma \] (1)

\( V_{ij} \) is the number of migrants from region \( i \) to region \( j \), where region \( i \) is supposed to be a “donor” \( P_i \) is the population of region \( i \),
\( P_j \) is the population of region \( j \),

\( R_{ij} \) is the distance between region \( i \) and region \( j \).

\( \alpha, \beta \) are empirical coefficients, \( \delta \) is a coefficient of proportionality, showing an interaction speed decrease between regions, caused by increasing distance between them.

In other words, the larger and closer are donor regions, the higher is migration. The number of inhabitants of a certain host region determines its potential market size, and, accordingly, the demand for migrants. The number of the donor region residents form a number of potential migrants to the recipient regions. Small distance between regions implies lower travel costs, as well as proximity to cultures and institutions. The settlement structure in Russia is very uneven with high variations between its European part, Siberia and Far East. The regions of the eastern part of the country are poorly populated and far removed from the regions of the European part of the country - the main demographic and economic centres.
<table>
<thead>
<tr>
<th>Determinant</th>
<th>Short name</th>
<th>Indicator</th>
<th>Data source</th>
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<tr>
<td></td>
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<td>Dependant variable</td>
<td></td>
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<tr>
<td></td>
<td>migr</td>
<td>number of highly qualified employees (with higher education) who moved to a region</td>
<td>The Russian federal statistical service. Migration in Russia</td>
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<td></td>
<td></td>
<td>Independent variables</td>
<td></td>
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<tr>
<td>Supply</td>
<td>demo</td>
<td>sum of the number of people in other Russian regions, divided by the distance to them from the capital of the region ( i ) by rail roads</td>
<td>Authors calculations based on data from the Russian federal statistical service. The Russian regions. Indicators of socio-economic development</td>
</tr>
<tr>
<td>Demand</td>
<td>market</td>
<td>volume of available markets (the amount of GRP of the region, GRP of other regions and GDP of other countries divided by the distance to them), trillion rubles (Zemtsov, Baburin, 2016)</td>
<td>Authors calculations based on data from the Russian federal statistical service. The Russian regions. Indicators of socio-economic development</td>
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<tr>
<td></td>
<td>urbc</td>
<td>number of citizens in the regional centre</td>
<td>The Russian federal statistical service. The Russian cities. Indicators of socio-economic development</td>
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<td></td>
<td>GRP</td>
<td>gross regional product (regional GDP), million rubles</td>
<td>Authors calculations based on data from the Russian federal statistical service. The Russian regions. Indicators of socio-economic development</td>
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<tr>
<td></td>
<td>htempl</td>
<td>number of the employees in the high-tech sector</td>
<td>Authors calculations based on data from the Russian federal statistical service. Unified interdepartmental information system</td>
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<tr>
<td>Life Quality</td>
<td>unempl</td>
<td>unemployment, %</td>
<td>The Russian federal statistical service. The Russian regions. Indicators of socio-economic development</td>
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<tr>
<td></td>
<td>income</td>
<td>average annual income, rubles</td>
<td>The Russian federal statistical service. The Russian regions. Indicators of socio-economic development</td>
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<td></td>
<td>inc_min</td>
<td>ratio of income to the subsistence minimum, %</td>
<td>Authors calculations based on data from the Russian federal statistical service. The Russian regions. Indicators of socio-economic development</td>
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<td></td>
<td>wage_min</td>
<td>ratio of salary to the subsistence minimum, %</td>
<td>Authors calculations based on data from the Russian federal statistical service. The Russian regions. Indicators of socio-economic development</td>
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<tr>
<td>wage</td>
<td>average monthly salary, rubles</td>
<td>Authors calculations based on data from the Russian federal statistical service. The Russian regions. Indicators of socio-economic development</td>
<td></td>
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<tr>
<td>wage_house</td>
<td>ratio of salary to the cost of one-room apartment, %</td>
<td>Authors calculations based on data from the Russian federal statistical service. The Russian regions. Indicators of socio-economic development</td>
<td></td>
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<tr>
<td>house</td>
<td>ratio of housing area to population, square meters per person</td>
<td>Authors calculations based on data from the Russian federal statistical service. The Russian regions. Indicators of socio-economic development</td>
<td></td>
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<tr>
<td>HDI</td>
<td>human development index</td>
<td>Human development report. Russia</td>
<td></td>
</tr>
<tr>
<td>temp</td>
<td>actual temperature in January in regional centre</td>
<td>The Russian federal statistical service. The Russian regions. Indicators of socio-economic development</td>
<td></td>
</tr>
<tr>
<td>crime</td>
<td>number of registered crimes per 100 thousand people (Barinova et al., 2018)</td>
<td>Authors calculations based on data from the Russian federal statistical service. The Russian regions. Indicators of socio-economic development</td>
<td></td>
</tr>
<tr>
<td>entr</td>
<td>number of small firms per 100 thousand working force (Barinova et al., 2018)</td>
<td>Authors calculations based on data from the Russian federal statistical service. The Russian regions. Indicators of socio-economic development</td>
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For the purposes of our research, we need to estimate the number of migrants, obtained by the certain regions, that is, its attractiveness. For empirical purposes, we transform the equation using logarithms.

\[ \ln Migr_{i,t} = \text{const} + \alpha \ln Supply_{i,t} + \beta \ln Demand_{i,t} + \gamma \ln LQ_{i,t} + \delta \ln Institut_{i,t} + \varepsilon_{i,t} \]  

(2)

\( Migr_{i,t} \) is the number of highly qualified employees who moved to the region \( i \) over a year \( t \); \( \alpha, \beta, \gamma, \delta \) - empirical coefficients that evaluate the influence of the factor; \( \varepsilon \) – residue; \( Supply \) is a potential supply of highly qualified employees from other Russian regions; \( Demand \) is a potential market size, and, accordingly, the demand for migrants of a certain region; \( LQ \) stands for various related characteristics, which emphasis quality of life in a region: wages, housing affordability, climate, etc. \( Institut \) stands for institutional features of the region, determining opportunities for self-realization (such as entrepreneurship).

We use absolute values in the model; our dependant variable is a number of highly qualified migrants in a region. It is correct to calculate this way because of the high concentration of production and employment in the capital cities of the Russian regions. For each variable, we use several indicators for verification purposes (table 1).

As can be clearly seen in the figure 1, the leading regions in the number of highly skilled migrants attracted in 2008-2016 were the largest agglomerations: Moscow and St. Petersburg, but we cannot say that they dominated the struggle for brains. The Moscow region, located around Moscow, attracted more than 10% of all highly skilled migrants from other regions. Migrants have an opportunity to work in Moscow, but live in a region with a lower rent for housing. In the coastal Krasnodar Territory, located in the south of Russia, the most comfortable living conditions have been held in recent years, a number of iconic international sporting events have been held there (Sochi Olympic Games, the World Cup), which allowed to improve infrastructure and create jobs for creative professionals. The Ural regions - the Sverdlovsk region and Bashkortostan - are major centers of the manufacturing industry with the country's largest agglomerations. In the Republic of Tatarstan, located in the Volga region, similar conditions in the capital of the region of Kazan in recent years have hosted the Universiade and the World Cup. The region’s leadership is pursuing an aggressive policy to attract highly qualified migrants, including supporting the high-tech sector, creating a separate city for IT professionals - Innopolis. In the Rostov region, located in the south and having access to the sea, one of the largest agglomerations in Russia with a developed high-tech sector was formed. The Leningrad Region, located around St. Petersburg, has a favourable geographical position on the Baltic Sea coast near the European Union. In recent years, the region has actively developed high-tech industries, including attracting international automobile concerns. In the large industrial centre, Krasnoyarsk region, located in Eastern Siberia, high salaries in metallurgy and mechanical engineering should be considered as the main attracting
factor. Here are the largest Russian multinational companies ‘Norilsk Nickel’ and ‘Rusal’, as well as the largest manufacturers of space satellites (ROSCOMOS). The combination of favourable natural conditions, access to large and diversified labour markets are significant factors in attracting specialists.

![Pie chart showing the dynamics of the leading Russian regions in the number of highly qualified employees who moved to the region](image)

*Figure 1. Dynamics of the leading Russian regions in the number of highly qualified employees who moved to the region*

The overall dynamics of the number of attracted migrants for the period 2008-2016 is positive in Russia. The number of migrants in 2016 increased by almost 2.3 times compared with the value for 2008 (Fig. 2). The number of migrants significantly increased - more than three times – in several regions. In recent years, the low growth rates of the Russian economy have predetermined the intensification of inter-regional migration to few growth centers (mainly raw materials) and large agglomerations. These are the regions near the largest markets (St. Petersburg and Leningrad region, Republic of Adygea near Krasnodar region, Kaliningrad region near European Union) and mining centers (Chukotka Autonomous Okrug, Nenets Autonomous Okrug, Arkhangelsk region, Murmansk region, Sakhalin Oblast, Yamal-Nenets Autonomous Okrug).
To assess the potential supply side, we estimated the amount of population available in other regions, adjusted to the distance to them, according to the gravity model (Andrienko, Guriev, 2004).

\[
\text{Demo}_{i,j} = \sum \frac{P_{j,j}}{R_{j}^{2}} \quad (3),
\]

The greatest demographic (or rather demo-geographic) potential is possessed by the regions near the largest agglomerations: Moscow region, Tver, Kaluga, Vladimir, Ryazan, Ivanovo, Oryol, Yaroslavl, Kostroma, Tula regions near Moscow, and Leningrad and Novgorod regions near St. Petersburg.

We also assumed that the demand on highly skilled migrants depends on the size of a regional market and its nearest economies, in other words, market potential. It was calculated as follows (see more: Zemtsov, Baburin, 2016).

\[
MP_{i} = GRP_{i} + \sum \frac{GRP_{j}}{\alpha \times d_{ij}} + \left( \sum \left( \frac{GDP_{q}}{\min(\alpha \times d_{i,p} + \beta \times d_{p,q})} \right) + \sum \left( \frac{GDP_{n}}{\alpha \times d_{i,e} + \beta \times d_{e,n}} \right) \right)
\]

where
- \( i \) - the analysed region;
- \( j \) - other regions of Russia;
- \( p \) - port regions of Russia;
\( e \) - border regions, interacting with the other countries overland;
\( q \) - border seaside regions, interacting with the other countries by sea;
\( n \) – border countries, interacting with the Russian regions overland;

\( GRP \) - gross regional product, mln rubles (measured in prices of 1998, adjusted regarding the inter-regional price index);

\( GDP \) - gross domestic product, mln rubles (calculated in regard with the purchasing power parity, with the International Monetary Fund data (http://www.imf.org/). To convert the dollar into ruble we used the official ruble exchange rate of the Central Bank).

\( d \) - distance between regions and countries\(^5\)

\( \alpha = 0.01 \) – proportion coefficient, showing how the distance to foreign markets affects their potential domestic capacities’ decrease. We assume that if the distance to the regional market is 1,000 km, it 10 times reduces its potential capacity.

\( \beta = 0.1 \) – proportion coefficient for other countries’ markets. We assume that higher institutional barriers reduce the potential market capacity 100 times, for the markets at a distance of 1000 km.

In fact, we take into account the volume of regional market, markets of neighbouring regions (distance weighted) and countries (distance weighted). As a result, we assessed total market potential referred to the regional capital cities; a region was considered a point (figure 3).

![Market potential in Russia in 2014](image)

**Figure 3. Market potential in Russia in 2014**

\(^5\) The railway distance is used as \( d \). If there’s no railway in the region, we used auto and river routes.
To assess demand, we also used the number of citizens in the regional centre (as a proxy for the large market), and its gross regional product. The largest agglomerations tend to have the highest concentration and diversification of human capital (Rauch, 1993) and innovation agents: universities, firms, R&D-centres, etc. Accordingly, the intensity of interaction between them is higher in big cities (Zemtsov, Kotsemir, 2019). The agglomeration benefits from its access to specialized production factors and to specific knowledge and competencies. The effects of urbanization can be determined by high concentration (density) and diversification of agents. The new technologies’ formation outside the cities is possible, but very limited. Large markets create a number of new jobs in various fields, so they are most attractive to highly qualified specialists. In addition, in the Soviet period, the healthcare and education system was largely determined by the position of the city in the political hierarchy, so the largest cities have the best medical facilities and the largest universities in Russia, which also increases their attractiveness.

In a recent papers (Darchen, Tremblay, 2010; Hansen, Niedomysl, 2008) it was shown, that the quality of living in a certain place is not as important as its career opportunities. We used the number of citizens in the regional centre also as a proxy for agglomeration effects, including a variety of activities. In addition, the size of the city was used as a control variable for the size of the region, which is important for estimates that use the dependent variable in absolute values.

A large number of specialists employed in the high-tech sector can be used as an indicator of the diversity of activities in the region. The presence of highly qualified personnel is one of the most important resources for the formation of technological entrepreneurship in the new economy. The more people are employed in the high-tech sector in the region, the more opportunities it has for the development of new technologies, new firms in the future. However, the presence of human potential does not indicate the possibilities of its involvement in the activities of existing or potentially interested firms. It is important how people are willing to retrain, what is the cost of labor, are there vacancies for highly qualified specialists, what are the living conditions, climate.

In many studies (Andrienko, Guriev, 2004) it is stated, that the migration flow positively depends on the purchasing power in the region of arrival. Labour migrations relate to the geography of real wage differentials (Crozet, 2004). That is why, we used several different indicators of income and quality of life. High differences in the cost of living between the regions do not allow to use only the values of income and wages, without taking into account these differences, so one indicator is the ratio of income and subsistence minimum. In Russia, the rental housing market is poorly developed in many regions, and financial instruments and mortgages are not well developed, so housing is not widely available. The ability to purchase it (income per cost of housing) should be a significant factor in attracting even highly qualified migrants.
We also tried to estimate capabilities for human development (Folloni, Vittadini, 2010), which we measure by human development index (HDI), that assesses the economic conditions in the region, the level of education and life expectancy, and accordingly the quality of medicine and the development of universities. Creative professionals strive to move to regions with better economic conditions, advanced medicine and access to quality education. In addition, in regions with high HDI, tolerance is generally higher (Florida, 2003).

Institutional conditions in the host region are extremely important for the relocation of highly qualified specialists. Very often, specialists strive to leave an unfavourable region, since it is impossible to realize themselves in it because of corruption and nepotism, it is impossible to create your own company because of the high administrative burden and raids (Barinova et al., 2018). In the south of Russia, in particular in the North Caucasus, the institutional conditions for entrepreneurs and creative professionals are generally less favourable, therefore, their outflow to the largest agglomerations where these conditions exist is observed. Tolerance is one of the possible indicators for attracting creative class (Florida et al., 2008), in our case the number of crimes can be a proxy.

Interregional job matches by less-skilled individuals are mainly determined by interregional differentials in job opportunities and wages (Arntz, 2010). The latest US evidence suggests that non-economic factors such as natural amenities (Partridge, Rickman, 2006; Berger et al., 2008), e.g. climate, are also an important factor. Nevertheless, it is not proved in other papers (Cheshire, Magrini, 2006; Ferguson et al., 2007). However, for Russia it can be highly important due to the fact that a large number of residents live in northern regions. In comparison with Canada, during the Soviet period artificial conditions were created (forced labour, high salaries) in the northern regions for the development of natural resources. With increasing efficiency in the extraction of raw materials, a large number of residents leave these regions for the past 30 years (Hill, Gaddy, 2003). Temperature in winter is important for us, since summer temperatures in Russia do not differ significantly between regions. It is the severity and duration of winter that largely determines the comfort of living.

**Econometric results and discussion**

We checked all the hypothesis and none of them was proved wrong (table 2). Full results are in the appendix. All the factors can be divided into two groups (Krugman, 1996). Objective factors of ‘first nature’, based on historical development or environmental conditions that cannot be changed fast (geographical position, climate). Factors of the second nature were formed by human activity and can be changed by proactive regional policy (agglomeration effects, human capital concentration, institutions).
Regions near densely populated centres have objectively more favourable conditions and wider opportunities for attracting highly qualified specialists, since migrants often move over short distances. It is economically much cheaper to move to a neighbouring region than to another part of such a large country as Russia. In addition, in a large region in terms of population, the number of highly qualified specialists is greater as well as potential migrants. If the number of people in surrounding regions is 1% higher, than the number of potential high-skilled migrants is 2.16-2.47% higher.

Another objective geographical factor is the accessibility of markets, since it is important for migrants to relocate to a region where there are more opportunities, and large markets for goods and services most often suggest better employment conditions. A large and diverse labour market is usually formed in the largest agglomerations, as well as in the border and coastal regions, where there are higher opportunities for interaction with foreign countries. Thus, it becomes clear why Moscow (the largest domestic market), St. Petersburg, the Kaliningrad region, the Krasnodar Territory, located on the coast, are actively attracting highly qualified specialists (fig. 1-2). However, it is not playing a crucial role. If the GRP or GDP of surrounding regions and countries is 1% higher, there is 0.07-0.08% more emigrants.

Socio-economic factors still play a decisive role in attracting specialists in the Russian regions. The most significant positive factor is the potential income after moving (considering price differentiation between regions) (Andrienko, Guriev, 2004). If income in a receiving region is 1% higher, then the number of migrants in it is 0.42-0.45% higher. If the region has a high unemployment rate, most likely there are no jobs in it (Andrienko, Guriev, 2004), the economic situation is difficult, therefore, an increase in the unemployment rate by 1% leads to a decrease in the number of highly skilled migrants by 0.25%. Another significant factor is housing affordability: if the ratio of potential wages to the cost of housing in the host region is 1% higher, then the number of migrants is higher by 0.28%.

Also for highly skilled migrants, opportunities for self-realization are significantly important. If in the region the density of entrepreneurial activity is 1% higher, then in this region there are 0.13% more highly skilled migrants. Crime rate is not significant, in (Andrienko, Guriev, 2004) estimates were mixed. But human development index is one of the most important factors. In regions, where incomes and educational rate are higher, and life expectancy is longer (Andrienko, Guriev, 2004), the number of migrants is greater.
Table 2. Results of the final models

Fixed-effects, using 747 observations Included 83 cross-sectional units Time-series length = 9 Dependent variable: \( l_{\text{migr}} \) Robust (HAC) standard errors

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<td>2.37** (1.08)</td>
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<td>0.42** (0.17)</td>
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<td>0.28** (0.11)</td>
<td>0.27** (0.11)</td>
</tr>
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<td>10.18*** (1.47)</td>
<td>9.93*** (1.5)</td>
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For Russia, as already explained, climatic conditions are significant, as the population migrates en masse from the Arctic, Northern and Eastern regions to the south and to the European part of the country. In recent years, migration to the south has intensified in connection with the holding of numerous iconic sports and other events in the Krasnodar Territory and the Rostov Region. If the temperature in January is 1 degree higher, that is, less severe winter conditions, then there are 1.9% more migrants.

Interesting case for Russia is negative correlation with a share of high-tech employees. The majority of these employees in budget health care and educational organizations. In the least developed (and least attractive) regions more than half of all employment in this sphere.

In some models, we also checked control variables for the size of the region, for example GRP (see appendix). It plays a significant positive role. However, the models are worse than the final ones (table 2). What is more important that all our estimation are quite similar.

At the second stage, in accordance with the aim of the study, we repeated the calculations, but used the values of the variables standardized with the linear scaling formulas (minimum - maximum). We consistently proved the significance of our variables, choosing models with the best explanatory power. We also tested the finally selected models by applying the random effects method. These tests confirmed the previously found interrelations between variables and their influences on each other, therefore could additionally prove the variables’ selection. Based on the results obtained, we developed an integral index. It consists of the most significant independent variables; weights for variables are selected taking into account their coefficient in the regression (11 model)

\[ \text{Index} = 0.45 \times \text{demo!BM2} + 0.4 \times \text{urbc!BM2} + 0.1 \times \text{income!BM2} + 0.01 \times \text{wage\_house!BM2} + 0.03 \times \text{entr!BM2} + 0.01 \times \text{temp!BM2} \]

We replaced the GRP by the size of the central city as a more relevant indicator for Russia, and the correlation coefficient between the number of migrants (migrants) and our index increased from 0.62 to 0.68.

The resulting index of attractiveness for highly qualified personnel takes into account the most valuable factors, determining migration to the region:

- The potential number of highly qualified personnel in neighbouring regions;
- The access to quality services and the development of the labour market in a large city (logarithm of the population of the central city, thousand people);
- The ability to earn money (income, taking into account the interregional price index);
- Housing security (wage per cost of an apartment);
- The opportunities for self-realization and creativity (entrepreneurial activity);
• Climate comfort (actual air temperature in January, °C).

The index allows us to choose the most attractive regions for highly skilled migrants. The most attractive regions are (Figure 4 below): the Moscow region, the Republic of Tatarstan, St. Petersburg, Voronezh, Belgorod, Tyumen, Lipetsk, Leningrad, Nizhny Novgorod and Moscow regions (see below). Note that the attractiveness of Moscow has decreased significantly since 2007 (the index fell from 0.84 to 0.71 in 2016) and continues to decline due to a sharp drop in the income ratio and living wage from 4.5 in 2007 to 2.68 in 2016 (the region moved from 3rd to 40th place). In other words, Moscow is no longer the most attractive centre for earning. This could not but affected the number of migrants with higher education: if in 2008 the capital was on the second place among all the factors (it brought 4.6% of all highly qualified migrants), in 2016 it was already on the 10th place (1.98%). Undoubtedly, the described tendencies give the chance to other regions to entice cadres by the organization of new manufactures, creation of a proper infrastructure, increase of availability of habitation and comfort of residing.

![Figure 4. Regional attractiveness index](image)

**Conclusion and policy recommendations**

We evaluated the factors and patterns of attracting highly skilled migrants by the Russian regions. The number of highly qualified personnel attracted in the region depends on the supply side on number of potential employees in the neighbouring regions and market access (Market) (see table 2). The quality of life, reflected by the indicators of unemployment, income and housing
availability in a considered region, is another important factor. For highly qualified personnel, an ability for self-realization is significantly important, shown by the HDI and entrepreneurship development. As we expected, the climate turned out to be a determinant because of overpopulation in northern regions in Soviet period.

Based on our calculations, we have developed a regional attractiveness index, which should allow regional authorities to monitor the conditions for attracting specialists and change their policies accordingly. The most attractive Russian regions are Moscow region, Tatarstan, St. Petersburg, Voronezh, Belgorod, Tyumen regions.

Some general regional advantages are natural (weather, geographical position, externalities from other activities like welcoming cosmopolitan activities, …), others have to be built. This can be part of the policy of regional development, mainly through the building of transport and telecommunication infrastructures. Unfortunately for most of the Russian regions, general advantages are often a necessary condition to the emergence or construction of specific advantages, to the attraction of resources and the viability of the policy. Other advantages, so called ‘second nature’ (Krugman, 1997) are agglomeration effects, human capital concentration and institutional conditions, can be changed by proactive regional policy.

Good examples of a proactive policy for attracting creative professionals are high-tech clusters: Sophia Antipolis in France, Silicon Valley in the USA, Gounghou in China. The building of ‘second nature’ advantages is a continuous effort clusters have to sustain taking opportunities offered by the regional, national or international institutions, as they remain a pivotal element of attractiveness of firms and human resources, talents. In France, for instance, the aim of the policy was not only to help lagging regions but also to decentralize facilities from Paris – Ile de France. The same goals can be found in Russia and other developing countries.

Labour market with high qualified human resources is a necessary condition for attracting migrants and regional growth. The public investment in higher education institutions is certainly pivotal to the success of high-tech clusters and related attractiveness, migration of talents. Higher education institutions have to fulfil their traditional missions (teaching and research) but in addition a ‘third mission’, contributing to regional development; public investment in education and research is the key factor of the viability of public policy constructed clusters. Moreover, it is required from regional authorities to keep the continued focus on these resources. Despite the fact that the regional authorities in Russia are not responsible for universities, special educational programs and initiatives are needed to support "Third mission of universities". Tomsk region is one of the best examples of performing this mission in Russia: an integrated ecosystem of innovations is created, including key universities – National Research Tomsk State University, Tomsk Polytechnic University, Tomsk State University of Control Systems and Radioelectronics.
Each of them has produced dozens of technological start-ups. Another case is St. Petersburg, where the ITMO University is the most active in promoting interaction with high-tech companies.

Regional administrations should play a significant role in the creation of regional programs for youth entrepreneurship. Interaction with universities, their integration with high-tech activities are carried out through the cluster initiatives formation and through the involvement in expert councils. In addition, regional administrations need to support initiatives to form the so-called entrepreneurial universities with mandatory diploma defence in the form of a company created, in accordance with the Digital Russia program (as it is being done in the Far Eastern Federal University in Primorsky Krai).

An important area of regional policy should be to improve the comfort of living in the region, in order to attract qualified personnel and the creative class specialists. A successful example is the formation of a private technopolis in the city of Gusev, Kaliningrad region, where the rental housing market and a favorable urban environment are being developed, as well as projects of the INO Tomsk (Tomsk region), InnoKam and Innopolis (Tatarstan).

As recommendations for attracting highly qualified specialists to the Russian rare-populated Far East, efforts are needed to develop rental housing and zero-interest mortgages, create high-performance jobs, especially in education, science and medicine, as well as general improvement of institutional conditions for new businesses creation. In general, these recommendations are suitable for attracting high-skilled migrants from other regions as well as from other countries.

**Literature**

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Appendix

Table 3. Results of econometric calculations in logarithms

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<tr>
<th>Fixed-effects, using 747 observations Included 83 cross-sectional units Time-series length = 9</th>
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### Table 4. Results of econometric calculations in logarithms

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Fixed-effects, using 747 observations. Included 83 cross-sectional units. Time-series length = 9
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