

GCPMED 2020
**Global Challenges and Prospects of the Modern Economic
Development**

**METHODS FOR ASSESSING THE HETEROGENEITY OF LIFE
QUALITY OF RUSSIAN FEDERATION SUBJECTS**

E. V. Fakhrutdinova (a), E. R. Valeev (b), D. A. Akopyan (c)*, P. Zhelev (d)

*Corresponding author

(a) Kazan Federal University, Butlerova Str., 4, Kazan, Russia, Efahr@mail.ru

(b) Kazan Federal University, Butlerova Str., 4, Kazan, Russia, emilv@mail.ru

(c) Samara State University of Economics, Soviet Army Str., 141, Samara, Russia, diakopyan@yandex.ru

(d) Institute of Technology and Business, Okružní 517/10, České Budějovice, Czech Republic, pzhlev@unwe.bg

Abstract

The study presents a statistical analysis of the heterogeneity of the regional development of Russia in terms of the quality of life of the population. The initial dataset is formed from the values of key indicators of the rating of Russian regions "Quality of life" for the period from 2015 to 2019. To identify and assess the heterogeneity of socio-economic, institutional, environmental and demographic factors in Russian regions, the analysis of the variation in the values of key indicators of the current state of the subjects of the Russian Federation in each of the 11 groups of factors of the quality of life rating was carried out. It is proved that for most factors there is an asymmetric distribution of subjects of the Russian Federation in statistical samples. The largest asymmetric distribution was found for the following indicators: GRP per capita, the absolute volume of investment in fixed assets, the coefficient of natural growth/loss of population, emissions of pollutants into the atmosphere from stationary sources, the number of dispensary and health organizations, the capacity of dispensary and health organizations. The obtained statistical distributions are mostly shifted from the center of distribution to the left, i.e. most subjects of the Russian Federation are characterized by a lower factor potential for quality of life than the average for the Russian Federation.

2357-1330 © 2021 Published by European Publisher.

Keywords: Asymmetry of distribution, coefficient of imbalance, heterogeneity of development, quality of life



1. Introduction

Heterogeneity and asymmetry of territorial development at the meso-level is a pattern of socio-economic dynamics of the Russian Federation (RF), due to the geographical specifics and scales of the country's territory. Natural and climatic conditions that differ in diversity, the remoteness of most regions from the European center, the historical stability of peripheral territories and administrative hierarchy determine the spatial specifics of the development of domestic regions. The objective circumstance of unbalanced and uneven development of the subjects of the Russian Federation is the demographic situation. It is clear that the Chukotka Autonomous District's with the population in 2018 of 50 thousand people, square of 721481 sq. km. and, for example, Moscow region, with a population of 7599 thousand people and a square of 44329 sq. km. are not comparable on many characteristics of the socio-economic development and quality of life. In a country like Russia, the assessment of interregional gaps cannot be made by comparing simple quantitative indicators of individual territories.

The difficult task of reducing territorial imbalances is compounded by the lack of a unified methodological approach to assessing the level of socio-economic imbalances in domestic regions. The generally accepted methodology at the state level, which will be able to form an objective picture of the ranking of regions, will, in our opinion, allow us to determine the current trends in the polarization of territories, which in turn will allow to form a package of measures and impacts that can level them. The relevance of this task was determined by the objectives of this study.

2. Problem Statement

Based on the results of statistical analysis, only five key indicators can be identified that have a relatively normal distribution. These include: the total area of residential premises, which falls on an average per inhabitant; the number of hospital beds per 10,000 people; the provision of pre-school children with places in organizations that carry out educational activities under pre-school educational programs, supervision and care for children; the share of paved roads in the total length of public roads; the crime rate.

For the rest of the key indicators, there is an asymmetric distribution of the subjects of the Russian Federation in the statistical samples. Among the latter, the largest asymmetric distribution is shown by samples of the following indicators: GRP per capita, the absolute volume of investments in fixed assets, the coefficient of natural growth/loss of population, emissions of pollutants into the atmosphere from stationary sources, the number of dispensary and health organizations, the capacity of dispensary and health organizations. Moreover, the obtained distributions are mostly shifted from the center of the distribution to the left, i.e. most subjects of the Russian Federation show lower values of key indicators compared to the average value for the full sample. In particular, significant risks for further improvement of the quality of life in most regions of the Russian Federation are identified. This conclusion is made on the basis of an asymmetric distribution of indicators of the group "Provision of health facilities", such as: infant mortality per 1000 live births, the capacity of dispensary and health clinics, the number of dispensary and health clinics, the number of hospital beds per 10,000 people. As well as indicators of the group "Development of the territories and development of transport infrastructure" in terms of the density of public roads with hard surface.

If we take into account that the critical value of the coefficient of unevenness of the statistical distribution is 23%, then for most key indicators, starting with the infant mortality rate per 1000 live births, the quality of life in the subjects of the Russian Federation is significantly heterogeneous. The greatest impact on the heterogeneity of the development of the Russian Federation subjects in terms of life quality is shown by the coefficient of natural population growth / loss per 1000 people. It is followed by an indicator of the density of public railway tracks. However, note that the high level of heterogeneity of subjects of the Russian Federation in this parameter obtained in the statistical data series, from which were excluded the zero value of this indicator in the following regions: the Nenets Autonomous District, Magadan region, Kamchatka Region, the Chukotka Autonomous District.

3. Research Questions

Within the framework of this study, tasks were set to ensure the achievement of its goal. As mentioned earlier, the relevance of the study is due to the need to reduce the imbalance of regions. Therefore, the authors have chosen the parameters that need to be evaluated in the analysis of this issue. In the framework of the study, it was intended to answer three basic questions:

1. By statistical calculations to confirm the heterogeneity of the regional development of the Russian Federation subjects.
2. As a result of the conducted study, to prove the asymmetric distribution of the subjects of the Russian Federation in statistical samples for most factors.
3. To determine that the majority of subjects of the Russian Federation has a lower factor potential for quality of life than the average for the Russian Federation.

4. Purpose of the Study

The main purpose of this study can be defined as the study of methods for assessing the heterogeneity of the quality of life of the Russian Federation subjects. In order to assess the quality of life of the population of each of the subjects, it is necessary to evaluate many parameters. At the same time, it should be understood that not all parameters have the same regulatory values in each of the regions. This is primarily due to the specifics of production located on the territory of a particular region, the level of remuneration and many other factors. This confirms the importance of modernizing existing methods, taking into account the characteristics of each individual region. In order to effectively assess and respond to changes in the quality of life of the population, it is important to determine as accurately as possible its level and key aspects that require monitoring. That is why we can say that the purpose of the study is currently relevant.

5. Research Methods

When evaluating the parameters of statistical distribution, many studies use the statistical coefficient of variation as a criterion for interregional inequality and heterogeneity. The development of methods for assessing the quality of life, including at the meso-level, the definition of measurement tools and key indicators in a transforming institutional and socio-economic environment, is a multi-level task. The development of appropriate methodological tools will contribute not only to the relevant assessment of the

quality of life, but also ensure the systematization of various behavioral factors that determine the parameters of the development of a quality living environment of the population and determine methods for predicting the main directions of development of regional systems for ensuring a relatively homogeneous quality of life in the subjects of the Russian Federation. For the econometric analysis, we used the Gretl software package.

The key characteristic of the quality of life in domestic regions is the rating of Russian regions "Quality of Life". This rating is developed by the rating agency "RIA Novosti", the methodology consists in a comprehensive accounting of seventy indicators that show the real situation of the subjects of the Russian Federation on such an indicator as quality of life (RIA, 2020). It is necessary to state that the majority of the estimated indicators characterizing the quality of life in the subjects of the Russian Federation. Thus, in the explanatory note to the rating for 2019, it is noted that "the unemployment rate in the fourth quarter of 2019 changes from 1.5% in Moscow to 26.3% in the Republic of Ingushetia, the accrued salary in November 2019 changes from 106.9 thousand rubles per person in the Chukotka Autonomous District to 26.6 thousand rubles in the Republic of Dagestan, the total area of residential premises, falling on average per inhabitant - from 32.7 square meters per person in the Moscow area to 14.1 square meters per person in the Republic of Tyva. The difference in life expectancy in Russian regions exceeds 18 years. The infant mortality rate and many other indicators vary significantly in the regions".

6. Findings

The existing differentiation of regions in terms of quality of life has remained virtually unchanged over the past five years, 2015 to 2019 (Table 1). This is evidenced, in particular, by the standard deviation measure calculated from the series of values of the life quality index (σ) and the coefficient of imbalance (variation). On all-time series, the coefficient of variation exceeds the critical value determined at the level of 23 %. The optimal value of the imbalance coefficient should not exceed 5% (Studopedia, 2014). Therefore, the combination of all 85 subjects of the Russian Federation, analyzed by the quality of life, cannot be considered homogeneous or uniform. Earlier, we calculated the rating points of Russian regions for the quality of life for the time period 2015-2018 (Fakhrutdinova et al., 2019). In this article, the time period has been extended to 2019 (Table 1).

Table 1. Descriptive statistics of the series of rating points of Russian regions on the quality of life in 2015-2019.

	2015	2016	2017	2018	2019
Standard deviation (σ)	11.5	11.21	11.42	10.92	11.21
Mimumum	12.63	12.53	13.96	16.2	17.53
Maximum	76.23	76.54	76.92	77.37	79.28
Coefficient of variation (coefficient of imbalance)	0.2636	0.2550	0.2531	0.2355	0.2417

Source: authors based on (RIA, 2020).

The list of regions forming the top ten of outsider regions of this rating remains almost unchanged. The observed stability of interregional differences and imbalances makes it possible to predict with high probability the persistence of existing differences in the development of the Russian Federation's subjects. It is necessary to note the growth of the composite index of quality of life in almost all regions. To identify and gradate gaps in the socio-economic, institutional and demographic state of Russian regions, we will analyze the spread of values of key indicators of the current state of the subjects of the Russian Federation selected from each of the 11 groups of factors in the quality of life rating (Table 2).

Table 2. A selection of key indicators for assessing the quality of life in the subjects of the Russian Federation, from among the groups of factors in the rating of Russian regions "Quality of Life" "RIA Novosti»

№	Groups of quality of life factors	Selected key indicator
1	Income level of the population	Per capita monetary income of the population
2	Population employment and labor market	Unemployment rate, as a percentage of the labor force
3	Housing conditions of the population	The total area of residential premises, falling on average per inhabitant
4	Security of residence	The crime rate
5	The demographic situation	The rate of natural increase / decrease of population per 1,000 people
6	Environmental and climatic conditions	Emissions of pollutants into the atmosphere from stationary sources, thousand tons
7	The health of the population and level of education	- Life expectancy at birth; - Infant mortality per 1,000 live births; - Percentage of the population aged 15 and over with a higher education
8	Provision of social infrastructure objects, including: Provision with educational facilities Provision with public health facilities	Provision of pre-school children with places in organizations that carry out educational activities under educational programs of pre-school education, supervision and care of children Number of hospital beds per 10,000 people; Number of dispensary and health organizations; The capacity of dispensary and health and polyclinic organisations, visits per shift
9	Level of economic development	- Gross regional product per capita - Absolute volume of investments in fixed assets, million rubles (in actual prices)
10	The level of development of small business	Number of small enterprises per 10,000 people
11	Development of the territory and development of transport infrastructure	- Share of paved roads in the total length of public roads, percent - Density of public railway tracks, km of tracks per 10,000 square km of territory - The density of public roads with hard surface (end of year; kilometres of ways per 1000 square km)

Source: authors based on (RIA, 2020).

Statistical tables of frequency distribution and descriptive statistics were constructed for all key indicators using the Gretl econometric package, and the hypothesis of the normal distribution of the sample

of key indicator values was tested. As an example, we will consider in detail the results of statistical analysis of the first three key indicators. Previously, we analyzed statistics on the average per capita monetary income of the population in 85 subjects (Fakhrudinova et al., 2019). From the data of statistical tables 03.04, we find that the average per capita monetary income of the population, in most domestic regions, is lower than the average value for the total combination formed from 85 subjects of the Russian Federation (Table 3, 4).

Table 3. Interval variation series

Interval	Middle	Frequency	rel.	int.
< 19,01	14.8	6	6,90%	6,90%
19.02 27.45	27.45	42	48,28%	55,17%
27.45 35.88	35.88	25	28,74%	83,91%
35.88 44.31	44.31	5	5,75%	89,66%
44.31 52.74	52.74	3	3,45%	93,10%
52.74 61.18	61.18	1	1,15%	94,25%
61.18 69.61	69.61	1	1,15%	95,40%
69.61 78.04	78.04	1	1,15%	96,55%
>= 78,04	82.26	3	3,45%	100,0%

Source: authors.

The frequency distribution for Y, the observations 1-85
 Number of columns = 9, average = 30, 3296, article dep. = 13,5253
 Chi-square (2) = 176.421 p-value 0.00000
 Critical value = 12.5916

Table 4. Descriptive statistics, observations 1-85 were used for the average per capita monetary income of the population (85 observations)

Average	Median	Mimumum	Maximum
30.3296	26.6457	14.8000	82.2553
Article dep.	Variation	Asymmetry	Excess
13.5253	0.445945	2.40706	5.87493
5% Percent	95% Percent	IQ range	Missed observations
18.1349	67.8035	8.26700	0

Source: authors.

Comparing the observed and critical Chi-square value ($176,421 > 12, 5916$) according to the per capita monetary income of the population and the Chi-square value ($128,532 > 12,5916$) according to the unemployment rate series, we conclude that the hypothesis of a normal distribution of these values is not accepted. Analysis of the frequency distribution for such an indicator as "The total area of residential premises accounted on average per inhabitant" revealed a higher value of the median (26.4000) compared to the average (25.9540), which implies that in most subjects of the Russian Federation, the total area of residential premises, which on average accounts for one inhabitant, is higher than the average value for the total combination formed from 85 subjects of the Russian Federation. Comparing the observed and critical

Chi-squared values ($7,965 < 12, 5916$), we conclude that the hypothesis of the normal distribution of the sample values of the indicator of the total area of residential premises, falling on average per inhabitant, is accepted. Let's analyze the overall results of statistical analysis of all key indicators. To do this, we will form two tables that differ in the opposite semantic meaning of key indicators in relation to the characteristic of the quality of life of the population of the Russian Federation subjects. Table 5 summarizes the key indicators, the growth of the value of which has a positive impact on the change in the quality of life of the population of a particular region. In Table 6, on the contrary, we have collected key indicators, the growth of the value of which has a negative impact on the quality of life of the population of a particular region.

Table 5. Key indicators that positively correlate with the integral rating score of the quality of life of the population

Key indicator	Mimimum		Maximum		Variation
	Subject of the Russian Federation	Meaning	Subject of the Russian Federation	Meaning	
Average per capita income of the population (thousand rubles)	Republic of Tyva	14.8	Yamalo-Nenets Autonomous district	82.26	0.446
Life expectancy at birth, years	Chukotka Autonomous District	63.58	Republic of Ingushetia	82.41	0.034
The total area of residential premises, on average per inhabitant, sq. m	Republic of Tyva	14.1	Moscow region	32.7	0.143
Percentage of the population aged 15 and over with a higher education, %	Jewish Autonomous region	23	Moscow	49.7	0.163
The rate of natural increase / decrease of population per 1,000 people	Tula region	-7.9	Chechen Republic	16.3	3.945
Provision of pre-school children with places in organizations that carry out educational activities under educational programs of pre-school education, supervision and care of children, there are places per 1000 children, people	Republic of Dagestan	253	Chukotka Autonomous District	1002	0.196
Number of hospital beds per 10,000 people	Republic of Ingushetia	44.4	Chukotka Autonomous District	131.3	0.163
Number of dispensary and health organizations	Nenets Autonomous District	6	Moscow region	1123	0.859
The capacity of dispensary and health and polyclinic organisations, visits per shift	Nenets Autonomous District	1206	Moscow	390332	1.096
Gross regional product per capita, rub	Republic of Ingushetia	114844	Nenets Autonomous District	6288468	1.159
Absolute volume of investments in fixed assets, million rubles (in actual prices)	Republic of Tyva	10485	Moscow	2429320	1.564

Number of small enterprises per 10,000 people	Chechen Republic	19	St. Petersburg	424	0.484
The share of paved roads in the total length of public roads, %	Chukotka Autonomous District	39.2	Belgorod region	91.2	0.196
The density of railway lines of general use	Republic of Sakha Yakutia	2	St. Petersburg	3082	1.840
The density of public roads with hard surface (end of year; kilometres of ways per 1000 square km)	Chukotka Autonomous District	1.2	Moscow	2524	1.377

Source: authors based on (EMISS Government Statistics, 2020; Rosstat, 2019 a,b,c).

Table 6. Key indicators that negatively correlate with the integral rating score of the quality of life of the population

Key indicator	Mimimum		Maximum		Variation
	Subject of the Russian Federation	Meaning	Subject of the Russian Federation	Meaning	
Unemployment rate, as a percentage of the labor force	St. Petersburg	1.5	Republic of Ingushetia	26.8	0.602
Crime rate (the number of registered crimes per 100 thousand people)	Chechen Republic	231.7358	Republic of Tyva	2876.396	0.319
Emissions of pollutants into the atmosphere from stationary sources, thousand tons	Republic of Ingushetia	1.5	Krasnoyarsk Krai	2319.3	1.7474
Infant mortality per 1,000 live births	Nenets Autonomous District	1.6	Chukotka Autonomous District	12.7	0.311

Source: authors based on (EMISS Government Statistics, 2020; Rosstat, 2019 a,b,c).

7. Conclusion

The statistical analysis revealed the most significant strategic gaps in the quality of life levels in the subjects of the Russian Federation and allows to determine the main activities of federal and regional authorities to reduce the identified gaps (Rochelle, Yeung, Bond, & Li, 2015). First of all, it is necessary to balance the level of economic development of the subjects of the Russian Federation, improve the quality of medical services to preserve the health of the population, increase the degree of provision of regions with health facilities, increase the degree of development of the territory and the development of transport infrastructure, which together will lead to an improvement in the demographic situation (Aganbegyan, 2015; Lyytikäinen & Kemppainen, 2016).

When improving the methodology for assessing the heterogeneity of the subjects of the Russian Federation in terms of quality of life, it is necessary to take into account the existing world experience. Existing similar national ratings of social well-being are formed from economic and social indicators. The leaders in such ratings are either countries that have high per capita GDP indicators, or those that are leading solely by subjective feelings. In such ratings, the countries with the most cheerful inhabitants (Paraguay, Costa Rica and Panama) are leading. Such a gap in the methods of measuring the quality of life and values

is due to the established cultural and historical traditions, national and confessional norms of behavior. It is currently not possible to create a single methodology for diagnosing the quality of life.

However, in one country, the problem of eliminating the gap between official statistics that characterize the nominal dynamics of socio-economic indicators and the actual perception of the population of the complexity of solving ordinary household tasks, such as making an appointment for a doctor of narrow specialization, entering an educational institution on a budget basis, placing children in kindergarten and school is quite solvable. In our opinion, for the Russian regions, the index of the qualitative environment for the life of Russians should, firstly, meet modern challenges on the most typical socio-economic problems of the population and, secondly, serve as an analytical basis for reducing the gap between the Russian regions. The basic methodological principle of improvement of the technique is the principle of identifying real rather than statistical satisfaction of man by territorial social sphere, including education, health, social support, personal safety, etc. Strategic priority in the development of methods for the assessment of quality of life is the formation of quality social infrastructure for the implementation of the human capital of compatriots. Such infrastructure implies the availability of high-quality medical care, high-quality education, life safety and a favorable ecological environment. At the same time, it seems reasonable to create a system of real-time monitoring of the dynamics of the subject of the Russian Federation in the system of regional economic management based on complex indicators of the quality of life of the population.

References

- Aganbegyan, A. (2015). Increasing the extremely low Russian population life time - The most important immediate task. *Economic Strategies*, 5-6, 60-79.
- EMISS Government Statistics (2020). The level of crime. <https://www.fedstat.ru/indicator/58923>
- Fakhrutdinova, E. V., Kamasheva, A. V., & Valeev, E. R. (2019). Statistical analysis of differentiation of subjects of the Russian Federation by the quality of life of the population. *Economic Sciences*, 181, 356-362.
- Lyytikäinen, L., & Kemppainen, T. (2016). Regional inequalities in self-rated health in Russia: What is the role of social and economic capital? *Social Science and Medicine*, 161, 92-99.
- RIA (2020). Rating of regions of the Russian Federation on quality of life - 2019. <https://ria.ru/20200217/1564483827.html>
- Rochelle, T. L., Yeung, D. K., Bond, M. H., & Li, L. M. W. (2015). Predictors of the gender gap in life expectancy across 54 nations. *Psychology, Health & Medicine*, 20(2), 129-138.
- Rosstat (2019a). Information for monitoring the socio-economic situation of the subjects of the Russian Federation. <https://rosstat.gov.ru/folder/11109/document/13259>
- Rosstat (2019b). Regions of Russia. Socio-economic indicators - 2019. https://rosstat.gov.ru/bgd/regl/b19_14p/Main.htm
- Rosstat (2019c). Russian statistical yearbook 2019. https://rosstat.gov.ru/bgd/regl/b19_13/Main.htm
- Studopedia (2014). Indicators of variation. https://studopedia.ru/3_91068_pokazateli-variatsii.html