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The Application of the Index Method in Evaluating the Efficiency of Regional Educational Systems across the Russian Federation

Andrei A. Ksenofontov [a], Yulia M. Gruzina [a], Marina A. Ponomareva [a , *], Anastasia A. Yussuf [a]

[a] Financial University under the Government of the Russian Federation, Moscow, Russian Federation

Abstract

The purpose of this study is to analyse the educational performance of 85 Russian regions in 2024 using the index method, in the context of the new economic reality. The object of the study comprises 85 regions of the country. The subject of the study is the economic activity type "Education". To conduct the research, data on the amount of tax revenues and the number of labor resources engaged in this sector were used. The scientific novelty of the study lies in applying the index method to address the comparative analysis of regions in the context of the new economic reality, where education acts as a crucial factor in ensuring the sovereign development of the Russian economy. A ranking of regional performance in the area of education has been compiled. An assessment of interregional imbalances in the education sector for 2024 has been carried out. The Lorenz coefficient has been calculated and the Lorenz curve has been plotted. It is concluded that the distribution of entities in the reviewed sector is uneven, but very close to a uniform distribution. This fact is also confirmed by the range of variation of the indicator calculated for the education sector, which is one of the lowest compared to other sectors considered. Moscow demonstrates the highest performance in the education sector, while the Republic of Dagestan shows the lowest. Regions where underdevelopment in the field of education is presumably acting as a constraining factor for economic growth have been identified. A strong correlation between the education and healthcare sectors has been revealed.

Keywords: economic activity type "Education", education sector, employed population, index method, tax revenue, regional development.

1. Introduction

In the current context of the Russian Federation's transition to a model of sovereign economic development, strengthening and diversifying the production potential in the regions is

* Corresponding author
E-mail addresses: AAKsenofontov@fa.ru (A.A. Ksenofontov), YMGruzina@fa.ru (Yu.M. Gruzina), AAYussuf@fa.ru (A.A. Yussuf), MAPonomareva@fa.ru (M.A. Ponomareva)

becoming increasingly important. Import substitution and the development of the manufacturing industry are emerging as strategic priorities of state policy at the level of the constituent entities of the Russian Federation. The success of these initiatives directly depends on the ability of regions to attract, train and retain qualified personnel.

In this context, human capital becomes a strategic asset for ensuring sustainable growth and competitiveness of the regions. Education is traditionally the foundational sphere for its development (Molchanov, 2023), and thus emerges as a key factor in the effectiveness of the transforming regional economy. However, there is a profound contradiction between the growing need of regions for qualified specialists and the actual processes of human capital reproduction. The higher vocational education system, which is meant to meet this demand (Gruzina et al., 2022), often serves as a channel for the outflow of the most talented and motivated young people to the largest agglomerations in Russia. Obtaining an education at the country's leading universities without subsequently returning to the region of origin leads to a persistent brain drain, depletion of the local workforce potential, and an increase in regional disparities. As noted in the Strategy for Spatial Development of the Russian Federation for the Period up to 2030, with a Forecast up to 2036, the country continues to see trends of "concentration of scientific-technological and educational potential in a limited number of constituent entities of the Russian Federation", as well as uneven spatial distribution of labour-force shortage risks.

These circumstances cast doubt not only on the implementation of industrial policy strategies in the constituent entities of the Russian Federation, but also on ensuring sovereign economic growth for the entire country. According to the calculations of the authors of this study (Fattahov et al., 2025), underfunding of the social sector in education and healthcare, as well as a "prolonged imbalance in the distribution of financial resources" between regions, has a negative impact on the sustainable long-term socioeconomic development of territories.

The issues of balanced development of the national education system are in the spotlight of attention both for the academic community and for state institutions. One of the main goals of the projects under the state university support program "PRIORITY–2030"[1] is to ensure balanced spatial development of the country and guarantee access to high-quality higher education across the constituent entities of the Russian Federation (Prioritet–2030..., 2026).

A review of scientific literature on the performance of Russian regions in various spheres – including education – and identifying territorial imbalances reveals the broad and multidimensional nature of these studies. Various authors have examined aspects such as the impact of digital transformation trends in the economy (Abramov, Andreev, 2023) and the level of regional innovation development (Shed'ko, Babayan, 2023; Kryzhko, Rudskaya, 2024; Golova, 2024; Abramov, Andreev, 2023), the effects of sanctions pressure (Fattahov et al., 2025; Plisetskij, 2023; Fedotova et al., 2025), and uncertainty (Klejner, 2025) on the formation of balanced socio-economic development strategies for the constituent entities of the Russian Federation. The importance of integrating sustainable development goals into regional strategies is highlighted in the study (Korshunov, 2023; Tkachenko, 2024) focuses on assessing the differentiation of Russian regions according to economic and demographic indicators. Meanwhile, the study (Molchanov, Molchanova, 2023) presents the theoretical aspects of strategic management and territorial development planning for updating the managerial approach and related instruments.

The uneven nature of scientific and technological development among the constituent entities of the Russian Federation is demonstrated in (Volkova, Romanyuk, 2023; Kuznetsova, 2023). Furthermore, researchers pay special attention to the influence of the education system's state on the level of territorial development (Belyakov, Krasnova, 2016), as well as to the interdependence between human capital and socio-economic growth in the regions (Eskindarov et al., 2022). This review of scientific publications underscores the relevance of the topic under consideration. The purpose of this study is to assess the performance of the constituent entities of the Russian Federation in education through interregional comparison.

The Russian Federation currently consists of eighty-nine constituent entities. Unfortunately, the authors lack statistical data for the new regions, so eighty-five constituent entities served as the subject of the study. According to the All-Russian Classifier of Economic Activities (OKVED),

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[1] The program was developed by the Ministry of Science and Higher Education of the Russian Federation as part of the federal project "Development of Integration Processes in the Sphere of Science, Higher Education and Industry" under the national project "Science and Universities", and the federal project "Personnel for the Digital Economy" within the national program "Digital Economy of the Russian Federation".

all economic sectors correspond to specific types of economic activity. Education falls under class R "Education" (Rosstandart..., 2026) (hereinafter OKVED "Education"). This study is focused on activities under OKVED "Education" in eighty-five regions of the country.

2. Materials and methods

The main thesis of the study is that tax revenues collected within a constituent entity of the Russian Federation to some extent reflect the effectiveness of its economic activity. A more accurate picture can be provided by the ratio of the volume of tax revenues (TR) to the number of people employed in generating them (EP) in the region. An equivalent of this indicator is the gross regional product (GRP) per capita. The research conducted by the authors has shown that the profile of the GRP-per-capita curve matches the profile of the TR-to-EP ratio curve.

The study is based on information from open sources, which was obtained and formed through observations, experiments, and accumulated experience. The analysis was conducted using statistical data from Rosstat, which reflects the number of people employed in various economic activities (Regiony Rossii..., 2026).

Data on the volume of tax revenues by type of economic activity, broken down by constituent entities of the Russian Federation, were obtained from statistical report No. 1-NOM "Report on the Accrual and Receipt of Taxes, Fees, and Insurance Contributions to the Budget System of the Russian Federation by Main Types of Economic Activity", published by the Federal Tax Service of the Russian Federation (Statistika i analitika..., 2026). Since Rosstat releases data on the number of employed persons with a two-year time lag, the study was conducted for 2024.

In the 1-NOM report, tax revenues are presented according to OKVED R 85. As mentioned above, class R refers to "Education". Based on the hierarchical structure of OKVED, class 85 R is subdivided into the following subclasses: 85.1 – "General Education", 85.2 – "Vocational Education", 85.3 – "Vocational Training", and 85.4 – "Additional Education" (Rosstandart..., 2026). Thus, the study attempts to account for tax revenues collected across all aspects of educational activity that are of interest to the authors.

The study is based on general scientific methods of cognition, such as a systematic approach, analysis, synthesis, methods of comparison and juxtaposition, and the method of classification. Special methods include data visualization techniques and economic and statistical procedures. The index approach made it possible to assess the dynamics of indicators characteristic of regional economic systems.

This method allows aggregating individual indicators into a composite score for comparative analysis. The specifics of applying the index-based approach to interregional comparison are described in detail by the authors in the publication "Index Method for Assessing the Efficiency of Economic Activity Types" (Kamaletdinov, Ksenofontov, 2019). A portion of the research was conducted using the Russian Taxes information and analytical system, developed with the participation of one of the article's authors (Ksenofontov et al., 2020).

A comparative analysis of countries, regions, and economic sectors based on their level of economic development was conducted using an index-based approach. In macroeconomics, an example of the use of indices is the Genuine Progress Indicator (GPI), which integrates a measure of the economic well-being of countries around the world (Berik, 2020; Cook, Davidsdottir, 2021). This allows for the evaluation of the performance and efficiency of different countries' economies.

For instance, C. Guan et al. and X. Long and X. Ji used the GPI to analyse the economic potential of the People's Republic of China (Guan et al., 2021; Long, Ji, 2019), while M.J.V. Fox and J.D. Erickson analyzed the performance of the fifty US states (Fox, Erickson, 2020). D.C. Andrade and J.R. Garcia published the results of a dynamic GPI assessment for Brazil covering the period from 1970 to 2010 (Andrade, Garcia, 2015). P. Ekins and S. Simon calculated this indicator for the United Kingdom and the Netherlands (Ekins, Simon, 2001), and N. Hanley et al. applied it to Scotland (Hanley et al., 1999). The index method is also extensively used – in particular – for analysing the socio-economic development of the Russian Federation (Mikheeva, 2020; Sharafutdinov et al., 2019; Urunov, Morozova, 2024; Fattahov et al., 2025), studying the efficiency of human resource use (Ilyasova et al., 2020; Stofarandova, Abdusalamova, 2022), assessing the impact of human capital on labour productivity (Avdeeva, 2024), and identifying ways to improve the spatial organisation of the national economy (Stroev, 2023).

This research is grounded in the fundamental principle of economic disparity, serving as its core theoretical framework. Over the past two centuries, scholars have maintained a persistent focus on the issue of income stratification within societies, with the phenomenon of income disparity consistently occupying a central position in analytical discourse. A pivotal milestone in the exploration of this topic was achieved by Max Otto Lorenz in the early 20th century. His groundbreaking contribution introduced a visual methodology for examining income distribution patterns, famously known as the Lorenz curve.

The present investigation adopts a distinct analytical perspective, shifting attention away from individual household earnings towards a broader examination of fiscal inflows across the 85 constituent regions of the Russian Federation. Particular emphasis is placed on the educational sector's financial dynamics. This innovative approach enables researchers to repurpose traditional analytical instruments, originally designed for income inequality studies, to evaluate regional disparities in educational resource allocation specifically for the year 2024. By doing so, it provides a unique lens through which to assess the distributional challenges faced by the education sector at the subnational level.

When calculating the value of the Lorenz coefficient, in accordance with the All-Russian Classifier of Types of Economic Activity (OKVED) for "Education $K_{L\_Education}$", we use the formula (1):

$$K_{L\_Education} = \frac{\sum_j |d_{Лj Education} - d_{EPj\_Education}|}{2} \qquad (1)$$

In this formula, summation is performed across the 85 constituent entities. The value of the Lorenz coefficient can range from 0 to 1. The closer this value is to 0, the more evenly distributed the revenues are.

3. Results

Based on the stated objective of the study, an assessment was conducted of the performance of the 85 constituent entities of the Russian Federation in the "Education" sector (according to OKVED) for 2024. It should be noted that during this period, a total of 43 375 195 866 thousand rubles in tax revenue was collected. At the same time, tax revenues in the OKVED R 85 "Education" sector amounted to 626 062 220 thousand rubles – 1.44 % of the country's total tax revenue. The chain growth rate of tax revenue (TR) in this sector exceeded 8 %. For the total tax revenue over the same period, this figure reached 14 %. In 2024, Moscow had the highest tax revenue collection in the education sector, with a value of 109 458 390 thousand rubles. Saint Petersburg follows this entity with almost a 2.5-fold gap (45 302 556 thousand rubles). The Jewish Autonomous Region had the lowest tax revenue in the education sector (528 836 thousand rubles).

In total, 73 267.3 thousand people were employed in the Russian economy in 2024. Of these, 5 359.2 thousand people worked in the education sector, accounting for 7.31 % of the total employed population. The highest number of people employed in OKVED R "Education" was recorded in Moscow (393.1 thousand people). Saint Petersburg holds the next position with 242.2 thousand people. The lowest number of employed people was observed in the Nenets and Chukotka Autonomous Regions, with 2.90 thousand people in each entity.

In order to quantify regional discrepancies in educational resource distribution for 2024, the Lorenz coefficient was derived through application of formula (1). The obtained results revealed that the coefficient amounted to 0.17 in 2024. Such a figure suggests that revenue allocation among regional educational authorities approaches equitability, albeit not perfectly so. For contextual reference, the concurrent Lorenz coefficient for consolidated tax revenues across all Russian Federation regions stood at 0.33 during the identical period, signaling considerably more pronounced regional disparities in overall tax revenue distribution.

To visualize the concentration of tax revenues and the employed population (EP) in the education sector, the Lorenz curve was plotted (see Figure 1). In this graph the x-axis represents the cumulative share of the employed population in the "Education" sector ($d_{TR\_Education}$); the y-axis shows the cumulative share of tax revenues in this sector ($d_{EP\_Education}$) across the 85 constituent entities of the Russian Federation.

The Lorenz curve for analyzing tax revenues in the education sector (OKVED R 85) was constructed by ranking the constituent entities of the Russian Federation according to the increasing share of each entity in the total volume of corresponding revenues.

In the graph (Figure 1), the line of absolute equality corresponds to a situation of uniform

distribution of tax revenues in the education sector across all regions. The actual distribution is displayed as the Lorenz curve. The degree of deviation of this curve from the line of uniform distribution serves as a measure of inequality: the greater the deviation, the stronger the unevenness of the indicator. In this case, there is a slight deviation of the curve from the equality line, indicating a low level of interregional differentiation and the proximity of the actual distribution of tax revenues in the education sector to a uniform one.
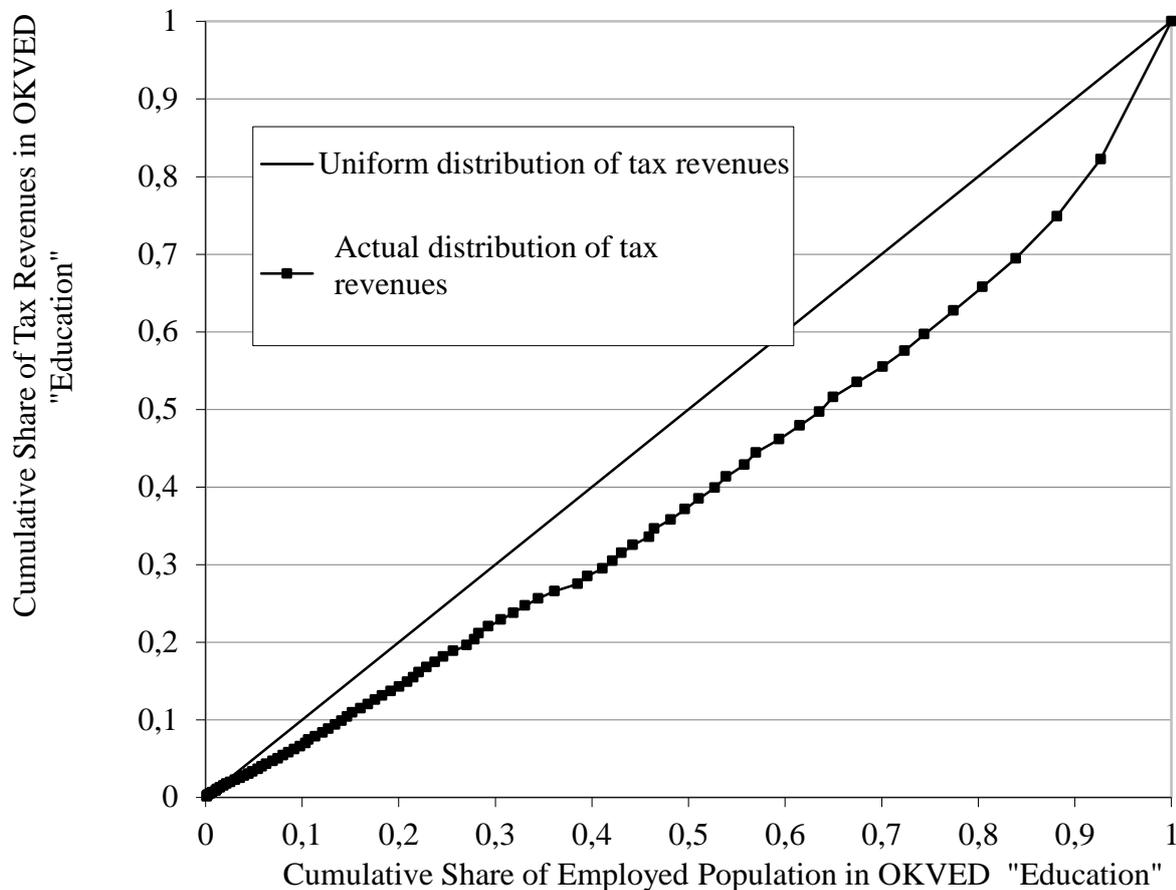

Fig. 1. Lorenz curve of tax revenues for the 85 constituent entities of the Russian Federation by OKVED "Education" in 2024

Next, an assessment of the performance efficiency of the constituent entities of the Russian Federation was conducted using the index-based method. As noted above, the index calculation methodology is presented in the article (Kamaletdinov, Ksenofontov, 2019).

The proposed tax revenue efficiency indicator – ETRE (Efficiency of Tax Revenue in Education) – is the ratio of TR to EP for any region of Russia. ETRE is calculated for each constituent entity of the Russian Federation across 14 OKVED categories. An overall ranking by total tax revenues is also calculated for the 85 constituent entities. Index i corresponds to the number of regions under consideration (i.e., 85), and index j – to the 14 types of economic activity according to OKVED. The focus of this study is the *ETRE-85_Education* indicator.

A visualization of the distribution of the constituent entities of the Russian Federation by the *ETRE-85_Education* indicator in 2024 is presented in Figure 2. The zero mark on the graph corresponds to the average level of economic development of the education sector in the country.

The graph presents the ranks of the 85 constituent entities of the Russian Federation. When conducting a comparative analysis, it is necessary to take into account the uneven population distribution caused by extreme climatic conditions. For this reason, some regions of the Far North were excluded from the overall sample. The low total population in the Chukotka and Nenets Autonomous Regions also determines the minimal number of employed persons (EP) in the education sector. This circumstance significantly distorts the results when these entities are

included in the general comparative analysis; their figures are statistical outliers.
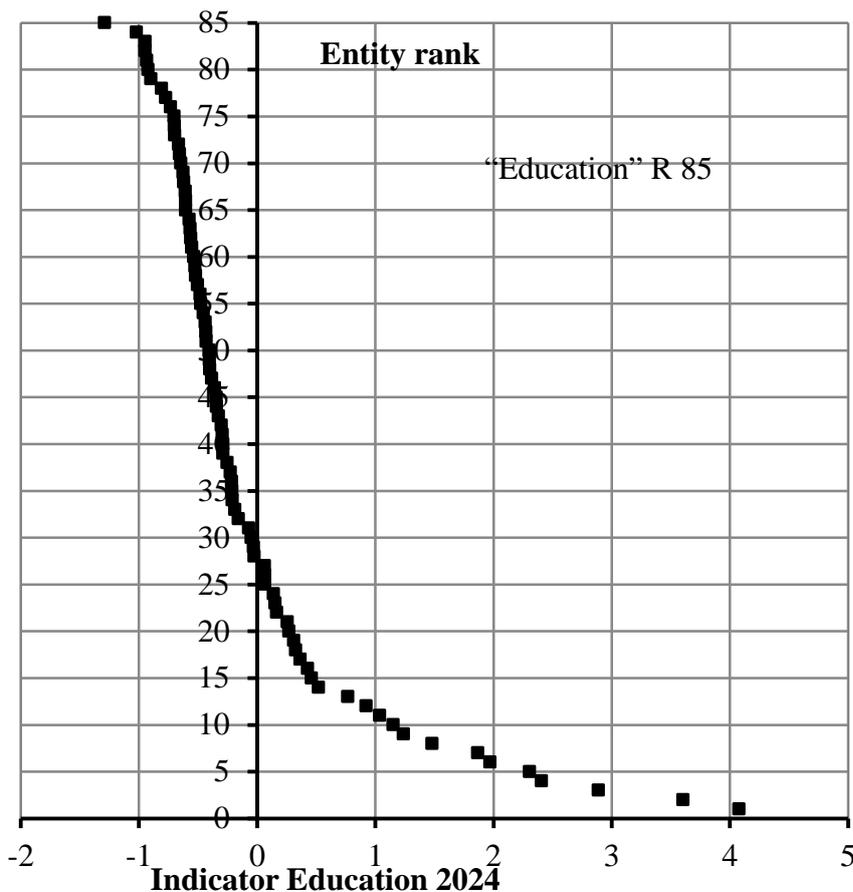

Fig. 2. Distribution of Russian regions by OKVED "Education" in 2024
Source: compiled by the authors based on calculations using data from
(Regiony Rossii..., 2026; Statistika i analitika..., 2026)

A total of 25 entities ranked above the average development level, while 58 ranked below it (two entities were excluded from consideration). The range of variation for the OKVED "Education" indicator amounted to 5,37. Using the index based method, rankings were calculated for other economic sectors. The highest range of variation is observed in OKVED "Wholesale and retail trade; repair of motor vehicles and motorcycles" (9,20), while the lowest is in OKVED "Transportation and storage" and "Health and social service activities", with variation ranges of 4,44 and 4,81, respectively. Thus, the analysis confirms that the education sector demonstrates more uniform spatial development compared to many other economic sectors.

It should be noted that the range of variation for the total tax revenue (TR) indicator across the Russian Federation in 2024 equals 51,57, indicating an extremely uneven distribution of tax revenues among the country's regions.

The maximum value of the "Education" indicator is observed in Moscow, with a score of 4,08. Saint Petersburg has a value of 1,97. Sevastopol, with a score of −0,29, ranks 41st nationwide. The growth of the research and education cluster in Krasnodar Region has yielded positive results: the indicator value reached 0,46, and the entity's rank is 15th. The least effective performance in the education sector is demonstrated by the Republic of Crimea (−0,92); Astrakhan region (−0,93); the Republic of North Ossetia–Alania (−0,95); the Republic of Mari El (−0,95); the Karachaey Cherkess Republic (−1,02); the Republic of Dagestan (−1,29).

4. Discussion
The study aimed to identify regions where insufficiently high efficiency of educational activities can act as a constraint on economic development.

To address this task, a comparison was conducted of the positions of the constituent entities of the Russian Federation in the efficiency rankings for the following OKVED categories: "Education" and "Manufacturing". In the manufacturing industry, the range of variation amounted to 6,61. The highest indicator value (3,12) belongs to Leningrad region, while the lowest belongs to Amur region (−1,84).

In fact, the lowest indicator value (−3,34) corresponds to Murmansk region. However, this entity is considered a statistical outlier because it has negative TR in the manufacturing sector amounting to −34 293 103 thousand rubles. Most likely, this reflects an export VAT refund. Therefore, this region was excluded from the main sample to ensure a correct interregional comparison.

Table 1 presents a ranked list of the 24 regions that perform most effectively according to OKVED "Manufacturing". It also includes the indicator values for OKVED "Education". It should be recalled that the zero mark in any of the 14 calculated rankings corresponds to the average development level across the country.

Table 1. Efficiency of performance of 24 constituent entities of the Russian Federation by OKVED "Manufacturing" and "Education"

No	Region	Manufacturing	Education
1	Leningrad Region	3,12	0,25
2	City of Saint Petersburg	2,92	1,97
3	Omsk Region	2,89	-0,52
4	Ryazan Region	1,97	-0,29
5	Yaroslavl Region	1,77	-0,23
6	Volgograd Region	1,72	-0,55
7	Republic of Komi	1,72	0,06
8	Yamalo-Nenets Autonomous region	1,61	2,89
9	Khabarovsk Krai	0,92	0,33
10	Nizhniy Novgorod Region	0,88	-0,16
11	Kaluga Region	0,84	-0,21
12	Perm Region	0,79	0,15
13	Republic of Adygea	0,74	-0,43
14	Moscow Region	0,70	1,04
15	Vologda Region	0,69	-0,30
16	Samara Region	0,65	-0,22
17	City of Moscow	0,61	4,08
18	Tula Region	0,57	-0,48
19	Krasnoyarsk Krai	0,51	0,06
20	Khanty-Mansi Autonomous Region – Yugra	0,48	1,24
21	Republic of Tatarstan	0,44	0,36
22	Republic of Mordovia	0,37	-0,44
23	Kaliningrad Region	0,30	0,17
24	Chelyabinsk Region	0,27	-0,29

Source: compiled by the authors

Analysis of the data in Table 1 reveals that a number of constituent entities of the Russian Federation perform effectively in the manufacturing sector but fall below the average development level in the education sector. These regions are Omsk, Ryazan, Yaroslavl, Volgograd, Nizhny Novgorod, Kaluga, Vologda, Samara, Tula, Kaliningrad and Chelyabinsk regions, and the Republic of Adygea and Mordovia.

Special attention should be given to Astrakhan region, which ranks 33rd in the efficiency rating for manufacturing industries (above the average development level) but holds only the 81st position in education. This entity also lags behind in healthcare, ranking 73rd nationwide.

It can be concluded that Astrakhan region significantly lags in social development, which constrains its economic growth.

A similar situation is observed in the Chuvash Republic. The entity ranks 30th in OKVED "Manufacturing" but only 69th in OKVED "Education". In the healthcare sector, the republic is in 60th place.

It should be noted that these entities occupy the 67th and 66th positions, respectively, in the overall efficiency ranking of the constituent entities of the Russian Federation based on total TR.

5. Conclusion

The results of the correlation analysis between tax revenues in the OKVED "Education" sector and other economic industries revealed a maximum correlation coefficient of 0,99 between the education and healthcare sectors. This suggests that regions with a higher level of education development typically also demonstrate a higher level of healthcare development.

This interdependence may indicate an improvement in the availability and quality of medical services in regions with a well-developed education sector in the field of medicine. Thus, for balanced regional development, it seems advisable to:

– Strengthen the development of medical education and human resources capacity in the regions;

– Stimulate public engagement in small and medium-sized entrepreneurship focused on medical services.

In current conditions, the sustainable economic development of Russia largely depends on the competitiveness of the industrial sector, especially in high-tech industries. A key factor for this is ensuring these enterprises have access to qualified personnel – which, in turn, requires the development of regional educational infrastructure. Establishing modern local educational centers could address two interconnected challenges: preventing the outflow of talented young people and attracting applicants (potential labor resources) from other regions. Among the regions for which the solution of this problem is of paramount importance, we should highlight a group of industrial regions that play a key role in Russia's economic development: Nizhny Novgorod, Omsk, Ryazan, Yaroslavl, Volgograd regions, and others.

A logical follow-up to this work would be a study aimed at developing recommendations for harmonizing the development of the constituent entities of the Russian Federation in the education sector, with the goal of reducing interregional socio-economic inequality.

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