Using Russian Federation taxes information and analytical system to monitor economic condition of the manufacturing industry

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Abstract. This paper describes a study of the financial and economic state and functioning of economic sectors of the constituent subjects of the Russian Federation based on the application of advanced information technologies. This study aims to analyse the performance of the Russian Federation national economy and the economy of 85 Russian Federation constituent subjects with a breakdown by different economic activities based on the Russian Federation Taxes information & analytical system of regional tax revenues designed. Basic calculations were made using the index method of economic activity evaluation developed by the authors. The index construction technique makes it possible to analyse dynamic trends in general and individual index development. Based on the method proposed, the constituent subjects of the Russian Federation have been ranked in accordance with their tax revenue indices for all kinds of economic activities in 2016. The efficiency of tax revenues by individual indicators included in the index has been reviewed. The constituent subjects of the Russian Federation have been ranked by the “Manufacturing Activity” indicator. Index distribution indicators have been calculated for each constituent subject of the Russian Federation.

1. Introduction

For the time being, the situation in the Russian Federation national economy is rather difficult. The economic development of the country is affected by both external and internal factors. External factors hampering the economic development include geopolitical situation aggravation, continuous expansion of sanction lists aimed to impede business activities of Russian companies, world market fluctuations, energy price fall, etc. The list of internal factors slowing the pace of economic development of the country is even broader. It includes prolonged financial and economic crisis, technological backwardness of domestic companies and industries, inefficient use of human and natural resources, unfavorable conditions for granting loan facilities to companies in the domestic market, aging and low commission rates of fixed assets.

One of the ways out of this situation is a detailed financial and economic analysis of the Russian national economy and economy of the 85 Russian Federation constituent subjects. This kind of study will assist in searching for those constituent entities, which require development support, and will
provide the keys to identifying the industries requiring improvements. The proposed methodology was implemented in the analytical module of intellectual studies of the Russian Federation Taxes information & analytical system.

2. Methodological foundations of the study

The subject of this study is the economy of the Russian Federation constituent subjects and the industries running in their territory. For the study, 85 Russian Federation constituent subjects and 13 types of economic activity were selected. The purpose of the study is the financial and economic analysis of 85 constituent subjects of the Russian Federation and the types of economic activities operating on their territory. The task of the study is to develop and apply methods for evaluating the performance of economic activities in the administrative entities under study.

These studies were realized using economic & statistical methods, system analysis and general scientific comparison and correlation methods. The main calculations were made using the index method of evaluation types of economic activity, developed by the authors. The index method refers to the statistical analysis methods and is applied in many science and technology sectors. This method was specifically applied in economic studies.

To date, this approach is the most popular in macroeconomic studies. For example, at the World Economic Forum in Davos in 2018, it was suggested to use the country’s Inclusive Development Index (IDI). The application of the index method in the economic studies is described in several papers issued by domestic [1] and foreign [2] authors. Particular attention is paid to the development of methods for calculating the stable economic well-being index known as Genuine Progress Indicator (GPI). GPI was developed by Herman Daly and John Cobb in 1989. The scientists suggested this index as the “economy assessment method that gives the best benchmarks for those who are interested in the economic well-being improvement” [3]. Establishing the GPI was one of the successful attempts to synthesize an aggregated monetary index. At present, the following papers [4], [5], [6] are known in the field of GPI research.

The environmental economy often uses the Environmental Sustainability Index (ISE), developed by the Columbia and Yale universities for the World Economic Forum in Davos. At present, the applied aspect of using the ISE is described in the papers [7] and [8]. The index method may also be used, for example, in logistics [9], in analyzing the green production development [10] or in analyzing the efficiency of production activities in various sectors of the economy [11], [12], etc. The index method can also be used to assess the development of the Russian Federation territories.

3. Results of the study

To ensure an objective assessment of the economic activity of the Russian Federation constituent entities, the authors suggest the method that is based on the integral indicator of tax revenues from all kinds of economic activity types (tax revenue efficiency index). To evaluate the effectiveness of tax revenues in the constituent entities of the Russian Federation using the index method is suggested. Statistical data for 2015–2016, presented by the Federal Tax Service of the Russian Federation, and statistical data on the main socio-economic indicators, provided by the Federal State Statistics Service of the Russian Federation, were used to compute the index values. To simplify subsequent analysis, the acquired data was consolidated in the database of the Russian Federation Taxes information & analytical system of regional tax receipts.

Let’s introduce the relative performance indicator that is the ratio of tax income value to the average annual number of employed populations of a constituent entity for a certain type of economic activity. The Ministry of Economic Development of the Russian Federation and the Federal Agency for Technical Regulation and Metrology developed the “All-Russian Classifier of Types of Economic Activity - OK 029-2014”. This document provides in-depth details of all the economic sectors of the Russian Federation, which are enlarged into 13 groups:

- Agriculture, hunting and forestry; fishing, fish farming;
- Mining of mineral resource;
• Manufacturing activity;
• Production and distribution of electricity, gas and water
• Construction
• Wholesale and retail trade; repair of motor vehicles, motorcycles, household goods and personal items
• Hotels and restaurants
• Transport and communication
• Real estate transactions, lease and provision of services
• Education
• Health and social services
• Providing other public, social and personal services
• Other activities.

Let’s call the suggested indicator as called the relative tax revenue efficiency index (RTREI) by the type of economic activity. Then, for each constituent entity, thirteen such indicators $RTREI_{ij}$ can be defined according to the number of economic activity types, where the index $i$ takes values from 1 to 85 (according to the number of the Russian Federation constituent entities, $n = 85$), and the index $j$ corresponds to the economic activity type ($m = 13$) and varies from 1 to 13. This average figure for an entity characterizes the tax income, brought to the country’s budget by one employee engaged in the concerned type of economic activity. In the future, let’s denote this indicator for simplicity of designation and use as $X_{ij}$.

Then, let’s calculate for each type of economic activity the average value of the relative tax revenue efficiency index for all constituent entities. As a result, we will obtain thirteen average values, which were determined by the simple average determination formula \( \bar{X}_j = \frac{\sum_{i=1}^{n} X_{ij}}{n} \).

Then, for each tax, let’s determine the variance $D_j$ and root-mean-square deviation $\sigma_j$ of the relative tax revenue efficiency index for all constituent entities. These variation indicators were calculated using the following formulas $D_j = \frac{\sum_{i=1}^{n}(X_{ij} - \bar{X}_j)^2}{n-1}$ and $\sigma_j = \sqrt{D_j}$. By using calculated average values, let’s center all relative indicators $X_{ij}$ according to the formula $\tilde{X}_{ij} = X_{ij} - \bar{X}_j$. Now, if for all computed centered relative indicators $\tilde{X}_{ij}$ we use a normalization operation with the help of the root-mean-square deviations $\sigma_j$, we will receive standardized relative tax revenue efficiency indices (indicators) for each type of economic activity for all constituent entities $U_{ij} = \frac{\tilde{X}_{ij}}{\sigma_j}$. Note that the values $U_{ij}$ are normalized and are dimensionless. In addition, all average values of standardized relative tax revenue efficiency indices for each type of economic activity are equal to zero, i.e. $\bar{U}_{ij} = 0$ for all $j$, whereas the all the variances of these indicators $D_j = \frac{\sum_{i=1}^{n}(U_{ij} - \bar{U}_j)^2}{n-1}$ are equal to one.

Since tax revenues from different economic activities are affected by many factors of a different nature, it can be assumed that standardized values $U_{ij}$ are subject to different laws of distribution, but with the same averages and variances. Thus, each constituent entity of the Russian Federation may be characterized by a system of dimensionless indicators with the same average, values equal to zero, and variances, equal to one.

If we summarize the indicators obtained by all types of economic activity for each constituent entity, then we will receive a certain aggregate indicator that reflects the efficiency of tax revenues in the constituent entity for all types of economic activity: $I_i = \sum_{j=1}^{m} U_{ij}$. The resultant tax revenue efficiency index is based on 13 indicators, and each indicator corresponds to the specific economic activity type and evaluates the level of economic development of the constituent entity (index value in the $i$-th constituent entity is $I_i$).
The suggested tax revenue efficiency index is an integral indicator that can be used to measure economic development level of regions, their comparison and assess tax revenue efficiency in various economic activities. The index constructing method makes it possible to analyze its dynamics and variations of its individual indicators, which allows evaluating changes in the economic activities of constituent entities dependent on the redistribution of the role of economic activities in terms of tax revenue efficiency. The calculation method suggested allows the use of a variety of different measurements in any socio-economic system (evaluating the resource, economic, social and other system potentials). This makes it possible to obtain a comprehensive indicator of the economic status and development prospects of the system as well as to assess its potential, define goals, identify infrastructural problems and economy diversification shortcomings, and assess investment risks and threats.

Below are some examples, which demonstrate possible use of the tax revenue efficiency index while analyzing the economic activities of constituent entities of the Russian Federation. Fig. 1 shows the ranking of the Russian Federation constituent entities in accordance with the tax revenue efficiency index values I. The constituent entities are fairly strong stratified by this indicator. 28 constituent entities have a positive value of this index (above the average level), and 57 constituent entities have a below-zero value of this index. From this picture it can be concluded that the economic development of the Russian Federation constituent entities is very uneven.

![Figure 1. Distribution of the Russian Federation subjects in accordance with the index of tax revenues for all types of economic activity in 2016](image)

Further, tax revenue efficiencies for specific types of economic activity, i.e. for individual indicators included in the index, may be analyzed. Fig. 2 is a graph, visually showing the distribution of the Russian Federation constituent entities by the Manufacturing Activity indicator. In total, 25 constituent entities are above the average level (zero mark), and 60 constituent entities are below this
mark. Yamal-Nenets Autonomous District, Leningrad Region, St. Petersburg, Kaliningrad Region, Komi Republic, Omsk Region, Ryazan Region, Yaroslavl Region, Khanty-Mansi Autonomous Area, Khabarovsk Region and Saratov Region are considered the most developed constituent entities by this indicator. Chechen Republic, Republic of Ingushetia, Republic of Kalmykia, Republic of Tyva, Astrakhan Region, Jewish Autonomous Region, Republic of Buryatia, Amur Region, Ivanovo Region and Republic of Sakha (Yakutia) are the weakest ones.

Figure 2. Distribution of the Russian Federation subjects in accordance with the index of tax revenues by type of economic activity "Production and distribution of electricity, gas and water" in 2016

4. Conclusions
To conclude, we note that this article provides a review of scientific papers of domestic and foreign authors describing the application of the index method and its indicators. It has been revealed that this method is widely used in various fields of economics and management. The tax revenue efficiency index, which is based on 13 indicators, each of which corresponds to the specific type of economic activity and evaluates the economic development level of the concerned constituent entity of the Russian Federation, has been suggested. The method developed has been embedded in the analytical module of the Russian Federation Taxes information & analytical system. Based on the method suggested, the constituent entities of the Russian Federation have been ranked in accordance with the value of the tax revenue efficiency index for all foreign economic activities in 2016. The efficiency of tax revenues has been reviewed by individual indicators included in the index. Using this approach, the constituent entities of the Russian Federation have been ranked by the Manufacturing Activity indicator.

It should be noted that the index method presented in this paper makes it possible to evaluate the efficiency (productivity) of tax revenues in the constituent entities of the Russian Federation
simultaneously for all types of economic activity, compare constituent entities with each other according to the value and structure of this indicator, classify the constituent entities of the Russian Federation in terms of the efficiency of tax revenues, analyze dynamic index changes and predict its values in the future. The suggested method of computing the index allows the use of a variety of factors of different nature, which affect the socio-economic system (economic, socio-demographic, technological, etc.). As result, a comprehensive indicator of the activities and development of the system may be obtained, system potential can be assessed, goals can be defined, infrastructure problems can be identified, shortcomings in the economy diversification can be revealed, and investment risks and threats can be assessed.

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