

Cluster Analysis as a Tool for the Distribution of the Constituent Entities of the Russian Federation According to the Level of Economic Security

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Abstract. In recent years, the cluster approach has become one of the main methods used in public administration both in Russia and abroad. Economic security is the basis of strategic planning designed to implement the strategic national priorities of the Russian Federation, and plays a dominant role in the economic stability of the country. Therefore, it is important to evaluate the economic security of the constituent entities of the Russian Federation. The article identifies indicators that affect the economic security of the constituent entities of the Russian Federation. Based on the indicators listed in the economic security strategy of the Russian Federation for the period until 2030, the distribution of regions by cluster is presented. The study period is 8 years from 2010 to 2017. The analysis is carried out on the subjects of the Russian Federation based on 24 indicators.

1. Introduction

The interpretation of the term “cluster”, its description and classification, as well as its application in the economy, have become widespread both in the works of domestic and foreign researchers. At the federal and regional levels, work is underway to identify promising clusters of the economy. Among the normative legal acts regulating state support of clusters at the level of the Russian Federation can be identified:

- The order of the Government of the Russian Federation of November 17, 2008 N 1662-r (as amended on September 28, 2018) “On the Concept of long-term socio-economic development of the Russian Federation for the period until 2020” [1];
- Decree of the Government of the Russian Federation of 08.12.2011 N 2227-r (as amended on 10/18/2018) “On approval of the Strategy of innovative development of the Russian Federation for the period until 2020” [2];
- Order of the Ministry of Industry and Trade of Russia dated 01.26.2016 N 130 (as amended on 06/30/2017) "On the organization of work in the Ministry of Industry and Trade of the Russian Federation to confirm the conformity of the industrial cluster and the specialized organization of the industrial cluster with the requirements for industrial clusters and specialized industrial organizations clusters in order to apply measures of stimulation of activity in the industry to them "[3] and others.

Taking into account the Presidential Decree No. 208 “On the Strategy for the Economic Security of the Russian Federation for the Period until 2030” [4] signed in May 2017, it should be noted that assessing the economic security of the regions on the basis of the indicators presented in it will determine the regions that are leaders in the field of economic security, as well as those requiring state support.

2. Materials and methods

Consideration of the market as an economic category, the study of basic market laws, the study of supply and demand are devoted to the works of foreign scientists: S.Brew, T.Veblena, J.Keyns, F.Kotler, H.Leibenstein, K.Makkonella, A.Marshall, U. Petty, A great contribution to the development of the general theory of cluster analysis was made by Moore A.W., Gray A.G., Pelleg D., Tryon R.C., Bailey D.E., Jain A.K., Dubes R.C. (algorithms and clustering techniques); Ball G.H., Hall D.J., MacQueen J., Lloyd Stuart R. (k-means methods); Jordan M.I. ; Moore A.W., Trevor H., Tibshirani R., Friedman J. (hierarchical methods); Hardin R.H., Sloane N.J.A., Smith W. D., Sokal R.R., Sneath, P.H. (centroid method) and others [5].

A significant contribution to the development of cluster analysis methods was also made by domestic scientists - I.I. Eliseeva, E.M. Braverman, A.A. Dorofeyuk, L.A. Rastrigin, I.B. Muchnik, Yu.I. Zhuravlev, etc.

The methodological basis of statistical market research is laid in the works of domestic scientists: S. Ayvazyan, I.V. Antonova, M.Yu. Arkhipova V.I. Kuznetsov, V.G. Minashkin, N.A. Sadovnikova, A.A. Frankel and others [6,7,8,9,10].

The research information base was the official data of the Federal State Statistics Service [11] and its territorial bodies, statistical collections, yearbooks, monographic research materials of domestic and foreign scientists, as well as Internet resources and studies conducted by the author. A representative set of data used, their accumulation, systematization, analysis and economic interpretation guaranteed the reliability of the research results.

To assess the economic security of the regions, a cluster approach was used. The assessment was carried out using the k-medoids algorithm (Fast K-Medoids, FKM) - a modification of PAM. The k-medoids algorithm is a modification of the classical k-means clustering algorithm and is intended to solve the problems of distinguishing groups of objects (clusters) in cases when objects are clustered without using the properties of linear space. In this case, unlike k-means, the center of the cluster may not be any point in the feature space (centroid), but only the point corresponding to the clustered sample - the medoid [12].

3. Results and discussion

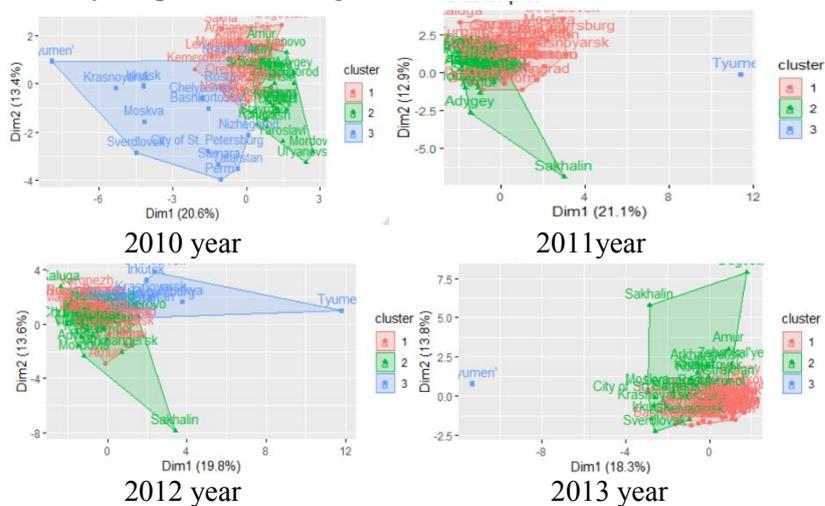
To assess the regional economic security using the cluster approach, it is necessary to determine which of the 40 indicators listed in the economic security strategy of the Russian Federation for the period up to 2030 have a direct impact on the regional economic security. Taking into account the regional specifics, those indicators were excluded from the list for which statistics are not kept in the subjects.

In the course of the analysis of the normative legal act, the indicators for assessing the state of economic security of the regions, presented in table 1, were selected:

Table 1. Indicators for assessing the state of economic security of regions.

Number	Name of indicator
1	index of physical volume of gross regional product;
2	level of crime in the field of economics.
3	the proportion of workers with wages below the subsistence minimum of the able-bodied population;
4	decile coefficient (income ratio of 10 percent of the most affluent population and 10 percent of the least affluent population);
5	retail turnover;
6	share of innovative goods, works, services in the total export of goods, works, services of industrial enterprises;
7	deficit of the consolidated budget of the constituent entities of the Russian Federation;
8	balance of production and consumption of energy resources (per capita);
9	the proportion of citizens with cash incomes below the cost of living minimum;
10	production index by type of economic activity "Extraction of minerals";
11	the proportion of the working age population in the total population;
12	share of organizations implementing technological innovations;
13	share of innovative goods, works, services in the total volume of goods, works, services shipped;
14	the share of high-tech and high-tech products in the gross regional product;
15	coefficient of tension in the labor market;
16	energy intensity of gross regional product;
17	labor productivity index;
18	the volume of state debt of the constituent entities of the Russian Federation and the debt of municipalities
19	the share of investments in machinery, equipment and vehicles in the total investment in fixed assets;
20	level of inflation;
21	share of investments in fixed assets in gross regional product;
22	degree of depreciation of fixed assets;
23	industrial production index;
24	gross domestic product per capita (at purchasing power parity)

The study was carried out on the basis of official statistics posted on the website <http://gks.ru> [17]. The results of the study are presented in Figure 1:



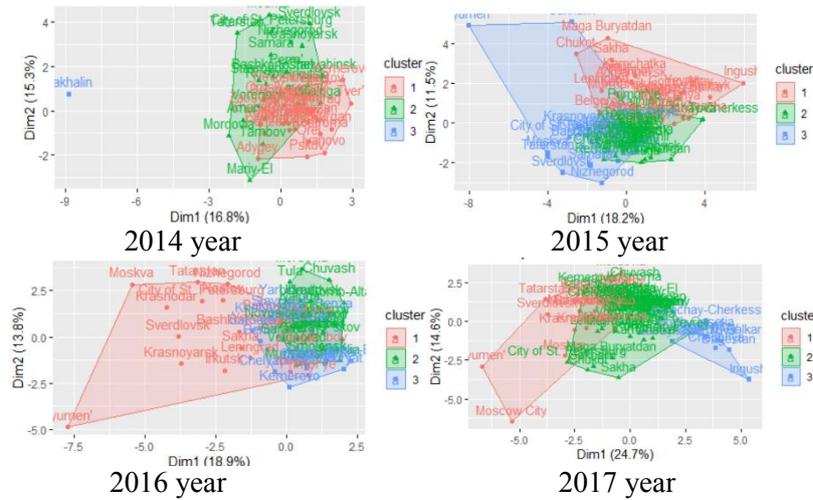


Figure 1. The distribution of constituent entities of the Russian Federation by cluster.

Cluster designation:

- 1 cluster - average values for the sample;
- 2 cluster indicators are below the average values in the sample;
- 3 cluster - indicators are higher than the average values in the sample.

As can be seen from the presented figure, two clusters of the Tyumen region and the Sakhalin region are especially distinguished during the study period. Sakhalin received significant development due to the implementation of the Sakhalin-1 and Sakhalin- oil and gas projects. 2 ”(1999-2013), however, so far it has not been able to overcome the barrier of transition to another cluster. The Tyumen region occupies a leading position in many respects. In 2018, this subject of the Russian Federation headed the National Investment Climate Rating.

From the foregoing, we can conclude that the analytical conclusions obtained by this model will be qualitative and adequate.

4. Conclusions

Based on the indicators presented in the Presidential Decree of May 17, 2017. No. 208 “On the Economic Security Strategy of the Russian Federation for the period until 2030”, a cluster analysis was carried out using the k-medoids algorithm (Fast K-Medoids, FKM) - a modification of PAM. Cluster analysis allowed us to distribute the subjects into clusters and showed the further need to study the research topic, which involves identifying factors that directly affect the economic security of regions and developing methods for assessing it.

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