Classification of Post-Soviet Countries by
The Level of Socio-Economic Development

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Abstract

The process of transition of 15 post-Soviet republics from the centrally-controlled economy to a market economy was accompanied by fundamental changes in their political, economic and social life. As a result of cluster analysis of 15 post-Soviet countries, 3 groups were defined, and during the last three periods the proportion and filling of groups is the same, which indicates stabilization of the cluster. Those post-Soviet countries that had strong natural and human capital in the beginning of the transition, have achieved significant success and integrated into the global economy. The Baltics also stand out: these countries have joined the European Union and significantly improved their macroeconomic indicators.

Keywords: Post-Soviet Countries, Classification, Cluster Analysis.

Introduction

It has been almost 29 years since the dissolution of the Soviet Union. Fifteen republics of the ex-USSR have initiated their own development. According to Firsova et al (2014), this led to emergence of a new transition process that has never existed before in the world practice - the transition from the centrally-controlled economy to the market economy. Moreover, with the dissolution of the USSR new states have undergone three stages of transformation from regional economy to the national economy of their own state. Akayev (2016) revealed that the first stage is the ideological transformation, the second - economic transformation, and the third stage is institutional.

At that, all post-Soviet countries had history of a unified Soviet approach to the economic management, such as centrally planned organization and financing, subordination to several sector ministries, etc. Despite these common features, differences in socio-economic development between ex-USSR republics were quite significant.

Difficulties that accompanied the transition from the centrally-controlled system of economic management to the market system, were approached differently by the governments of post-Soviet countries. Some stayed the course of the shocking therapy, while others implemented the gradualist policy. In their researches, Sunday, Babatunde (2018), Sawhney and Kiran (2019) mention that transition to the market has significantly affected the relationship between ex-republics of the USSR, which resulted in formation of communities and commonwealths (CIS, EEU, SCO, BRICS). A number of countries have changed their preferences from Russia to the EU countries and USA. Therefore, classification of the group of post-Soviet countries during dissolution of the Soviet Union (1991), post-crisis years (1999 and 2009), and the reporting period (2015, 2017) is considered relevant. This approach allows to assess changes in differentiation of post-Soviet countries under the influence of transformational shifts.

In this research, post-Soviet countries should be understood as a group of 15 countries, that were a part of the USSR.

On the one hand, the considered group of countries is characterized by common roots (ties of history, language, ethnic culture, confession, etc.), and on the other hand - by inconsistency in development after dissolution of the Soviet Union in 1991. This is the reason for increased interest on the part of Russian scientists pursuing this issue, such as Avdeeva (2014), Vardomskiy (2012), Petrov (2012), Tekueva et al (2016).

Considering the submitted materials from a perspective of the group of post-Soviet countries, the following papers, containing the authorial vision for the amount and members of the group of post-Soviet countries, should be mentioned.

In her research, Avdeeva (2014) studies the state of economies of post-Soviet countries as of 2013, groups the CIS countries 'in accordance with the state and budget revenue sources'. In this, three groups are identified:

The first group includes countries exporting energy carriers: Russia, Kazakhstan, Azerbaijan, the budget of these countries is filling through the hydrocarbon export;

The second group consists of countries exporting labor: Armenia, Moldova, Kirgizstan, Tajikistan, budgets are mostly funded through flow of funds from migrant workers;

The third group includes countries with export diversification, such as: Belarus, Uzbekistan, Ukraine, where along with commodities export there is a large proportion of highly processed products.

The multi-author monograph 'Social and economic development of the Post-Soviet countries: twentieth anniversary results' guided by L. Vardomskyi is the most detailed scientific work dedicated to post-Soviet countries. In particular, a socio-economic survey of each of 15 USSR republics is conducted, heritage of the Soviet Union and its impact on trajectories of counties during the transformation period are analyzed. Development of the classification of member countries of the Soviet Union during its dissolution is to the credit of the teams of authors. The authors specify three groups of countries: 1 - the Baltics (Latvia, Lithuania, Estonia); 2 - Neighbors of EU and Russia (Moldova, Belarus, Ukraine); 3 - Caucasus (Azerbaijan, Georgia, Armenia); 4 - Central Asian 'mosaics' (Kazakhstan, Kirgizstan, Tajikistan, Turkmenistan, Uzbekistan).

Considering socio-economic development of post-Soviet countries, Petrov (2012) specifies four groups of countries and one 'overshoot'. According to the territorial belonging, the countries are grouped as follows:

The first group is represented by Eastern European countries (Ukraine, Belarus and Moldova). Their location between Europe and Russia imposes certain limitations to their economic and social sovereignty.

The second group includes Central Asian countries (Kazakhstan, Kirgizia, Tajikistan, Uzbekistan, Turkmenistan). The political elite of these countries faces certain problems, each of which can threaten the existence of any of them. The region is influenced by Islamic culture and economic pressure from China.

The third group consists of Transcaucasian countries (Armenia, Azerbaijan and Georgia). Area of political instability. USA and Russia have maximum impact on these countries' policies.

The fourth group includes the Baltics (Latvia, Lithuania and Estonia). The economy of these countries is greatly influenced by their integration into the European Union.

Russia is an 'overshoot' - this country is seen as a separate group due to its leading role in the region.

The shortcoming of selected groups lies in the approach to categorization and grouping of post-Soviet countries, because scientists do not use any formalized methods, which does not devoid the results of subjectivism. It seems necessary to implement statistical tools such as table and graphic methods, grouping method, cluster analysis, and general scientific methods (analysis, synthesis).

Methods of Research

Objects grouping is one of the ways of studying the structure of cluster at a single point in time. It should be noted that post-Soviet countries are in a turbulent state and their positions always change with respect to each other. The possible solution to this situation is grouping in reference periods, such as 1991 (dissolution of the Soviet Union), 1999 (impact of the 1998 crisis), 2009 (impact of the 2008 crisis), 2015 (impact of the 2014 crisis), and 2017 (relevant data is currently available), which would help to establish the amount of change in the relationship between countries.

In most of researches groups of post-Soviet countries are specified In accordance with one of the indicators, and it is usually a qualitative one. However, their socio-economic development can be characterized by not only one indicator, but a set of them.

Therefore, to construct a classification it is more appropriate to use statistical methods of polythetic classification, which main feature is that all available attributes are used when forming a group.

The set of subjects of post-Soviet countries forms an attribute space. If the federal subject is characterized by m attributes, then it is considered as a point in the m-dimensional attribute space. The solution is to identify the points close to each other in this attribute space. This multidimensional grouping is solved by means of cluster analysis, when the entire set of objects is divided into homogeneous groups (clusters). Those post-Soviet countries that belong to the same cluster should be similar to each other, and the degree of similarity between them within each cluster should be higher than between the subjects of the Russian Federation included in other clusters.

At present, statistics has a significant range of clustering algorithms. Most often, researchers use hierarchical algorithms, among which the Ward method is the most common. According to Mooi and Sarstedt (2001), this method involves using dispersion analysis procedures to estimate distances between clusters. With this, as noted in the research by Nosov, Tcypin, Abdulragimov, Mahanova and Zhenzhebir (2019), at each step of clustering, elements leading to the smallest increase in intracluster dispersion, will be combined into one cluster. Therefore, the smallest clusters are gradually merging into larger ones.

Research Results and Discussion

The easiest way of grouping post-Soviet countries in accordance with their economy development levels, is the GDP grouping, as this indicator is calculated on the common methodological basis, which means that it is comparable in space. Figure 1 and figure 2 present positions of post-Soviet

countries in two-dimensional space in accordance with data obtained from the UN Statistics Division and the World Bank.

According to information presented in the figure 1, transformation processes have negatively affected the economic efficiency of the country: none of 15 ex-republics of the Soviet Union were able to keep the economy from sinking, therefore, the whole cluster has a rate of decline.

Looking at the GDP per capita value, it can be seen that Russia, the Baltics and three large republics (Kazakhstan, Ukraine and Belarus) had high figures. The value for other countries was varying around 750 USD.
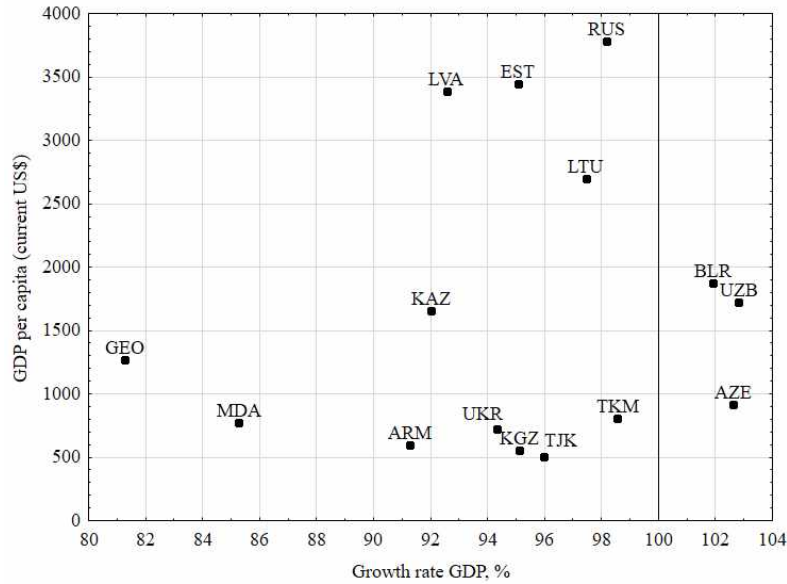

**Fig. 1: Distribution of post-Soviet countries by GDP per capita and GDP growth rate in 1991.
Drafted by authors using the service 'A world of information un data'**

To assess the impact of transformation processes on the economies of considered countries, it is proposed to look at the figure 2, that contains data for 2017.
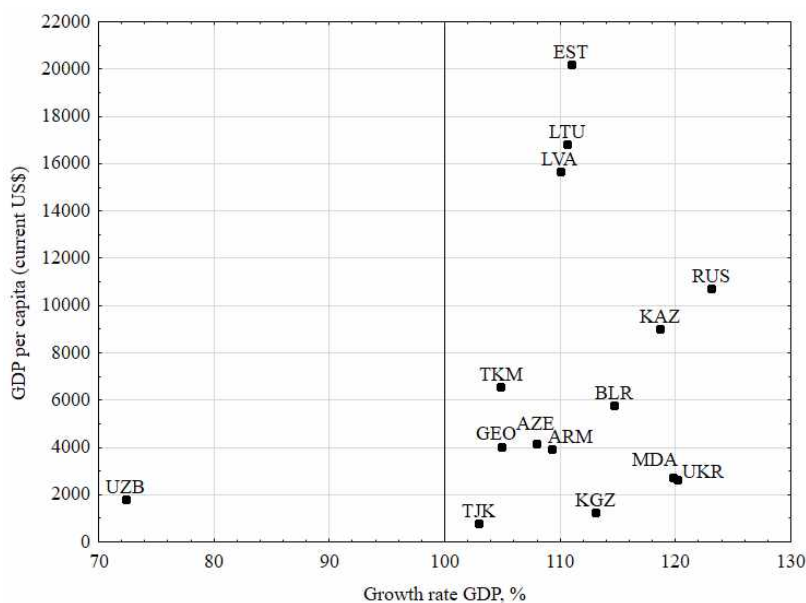
**Fig. 2: Distribution of post-Soviet countries by GDP per capita and GDP growth rate in 2017.
Drafted by authors based on the research by Benešová, Smutka and Laputková (2019).**

According to information presented in figure 2, high GDP per capita values in the Baltics (EST, LTU, LVA) are worth pointing out. In regard to such success, it should be noted that outcomes of the 25-year development of independent Latvia, Lithuania and Estonia are mixed. Technically, they carried out successful political and socio-economic transformations, which have made it possible to achieve the needed macroeconomic indicators and join the EU and NATO in a short time. On the other hand, by joining these unions, they themselves have transferred a significant part of sovereignty they have been working so actively towards, to the supranational level. Being subsidized Soviet Union republics, they are now subsidized by Brussels.

However, it is not entirely correct to judge positions of post-Soviet countries based on only two indicators, which means that there is a need to use a set of characteristics of objects. For these purposes, a multidimensional pooling is most suited, and cluster analysis appears to be one of its forms.

It is proposed to use socio-economic indicators provided by the World Bank and the UN Statistical Division as indicators in the cluster analysis: X1 - GDP per capita, USD per person; X2 - share of industry (sections C-E) in GDP, %; X3 - share of agriculture (sections A-B) in GDP, %; X4 - labor coefficient, %; X5 - the unemployment rate, %; X6 - share of export in GDP, %; X7 - gross fixed capital formation, USD per worker.

Information processing in the STATISTICA package results in the dendrogram presented in the figure 3.
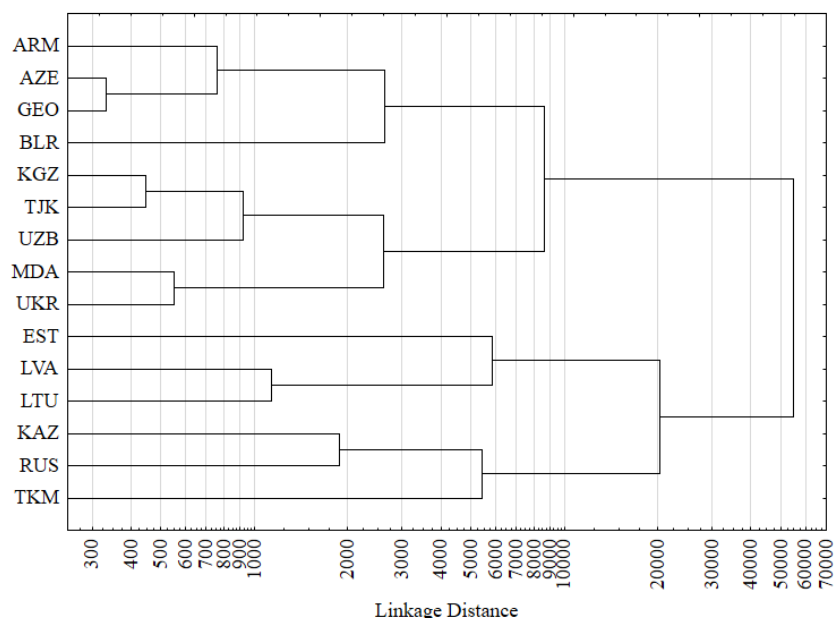
Fig. 3: Tree diagram of groups of post-Soviet countries in 2017

In their research, Benešová, I., Smutka, L. and Laputková, A. (2019) highlight that there are three groups in 2017. The first one includes Russia, Kazakhstan and Turkmenistan, which were characterized by average GDP per capita values, high share of industry and low share of agriculture. The second group has low values of the X1 indicator and average shares of industry and agriculture. The third group only consists of Estonia, Latvia and Lithuania, these countries have the highest GDP per capita values, low share of agriculture and the highest share of export in GDP.

Similar calculation conducted for the rest of reference points have provided the following results presented in the table 1.

Table 1: content of groups of post-Soviet countries in accordance with the results of the cluster analysis

Group	1991	1999	2009	2015	2017
1	RUS, LTU, LVA, EST	RUS, BLR, KAZ, TKM	RUS, BLR, KAZ, TKM	RUS, BLR, KAZ, AZE, TKM	RUS, TKM, KAZ
2	UKR, BLR, KAZ, GEO	UKR, UZB, GEO, AZE, MDA, KGZ, TJK, ARM	UKR, UZB, GEO, AZE, MDA, KGZ, TJK, ARM	UKR, UZB, GEO, MDA, KGZ, TJK, ARM	UKR, UZB, GEO, MDA, KGZ, TJK, ARM, AZE, BLR
3	UZB, AZE, MDA, KGZ, TJK, ARM, TKM	LTU, LVA, EST	LTU, LVA, EST	LTU, LVA, EST	LTU, LVA, EST

Drafted by authors in the STATISTICA package

It can be seen that the content of 1991 groups is completely different from the groups in subsequent periods. In all times Russia is included in the first group, but the content is different: whereas in the first year of transition to the market economy this group included the Baltics, further these countries were in a separate group. In the late 1990-s large countries which are now among the EEU members,

started to consolidate around Russia. It can be concluded that integration of the Baltics into the European Union had a great impact on them, which resulted in them moving apart from Russia.

Comparative characteristics of existing groups and the one obtained as a result of research, is presented in the table 2.

Table 2: comparison of the results with other studies

Group	Results of 2017 grouping	Avdeeva, Varapaeva (2014)	Vardomskyi et al (2012)	Petrov (2012)
1	RUS, TKM, KAZ	RUS, KAZ, AZE	LTU, LVA, EST	UKR, BLR, MDA
2	UKR, UZB, GEO, MDA, KGZ, TJK, ARM, AZE, BLR	ARM, MDA, KGZ, TJK	RUS, MDA, BLR, UKR	KAZ, KGZ, TJK, UZB, TKM
3	LTU, LVA, EST	BLR, UKR, UZB	AZE, GEO, ARM	ARM, AZE, GEO
4	-	-	KAZ, KGZ, TJK, TKM, UZB	LTU, LVA, EST
5	-	-	-	RUS

Drafted by authors using data regarding the CIS countries.

According to the data presented in the table 2, different grouping characteristics (and approaches), lying in the foundation of the grouping result in different contents of these groups. The only group that is similar in 3 out of 4 variants, is the one that includes the Baltics. Evidently, these republics differ so much from the rest 11 post-Soviet countries that they identify uniquely.

Conclusions

Obtained results show stabilization of the structure of post-Soviet countries. The conducted cluster procedure has resulted in three groups selected from the analyzed pooling of post-Soviet countries. The first cluster includes large post-Soviet countries led by Russia. All these countries have a common denominator such as natural capital and labor force.

The second group consists of countries that have changed their polarity, which means that they share political views with western countries and keep 'moving apart' from Russia in their development process (Ukraine, Armenia, Georgia).

The third group includes the Baltics, which are characterized by the most rapid pace of movement towards the market system, which can be due to a number of factors: the existence of fundamentals of market economy before the establishment of the centrally-controlled system, close economics and historical ties with the Western Europe, relatively balanced structure if the national economy or small disparities, consensus of all social groups on the necessity of transition to the market system.

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