

3.2. The impact of economic security on economic growth in European Union countries

Pavlo BURAK

*SHEI Pryazovskyi State Technical University
Universytetska st. 7, Mariupol 87555, Ukraine*

*Mykolas Romeris University
Ateities g. 20, Vilnius, 08303, Lithuania*

Email: burak_p_v@pstu.edu

ORCID: 0000-0001-5689-4355

Saulius KROMALCAS

*SMK College of Applied Sciences
Nemuno st. 2, Klaipeda 91199, Lithuania*

*Mykolas Romeris University
Ateities g. 20, Vilnius, 08303, Lithuania*

Email: saulius.kromalcas@smk.lt

ORCID ID: 0000-0001-9389-2623

Inga BILINSKIENĖ

*SMK College of Applied Sciences
Nemuno st. 2, Klaipeda 91199, Lithuania*

*Mykolas Romeris University
Ateities g. 20, Vilnius, 08303, Lithuania*

Email: inga.bilinskiene@smk.lt

ORCID ID: 0009-0004-1180-8141

Abstract. *Economic security is a relatively young discipline within the field of economic science, yet it plays a critical role in national security. Despite its importance,*

it has historically received insufficient attention from researchers. Economic security is essential for achieving economic sovereignty, fostering sustainable development, implementing effective social policies, protecting society from environmental risks, and enhancing national competitiveness in an increasingly interconnected global economy. An effective economic security system enables a country to identify threats to its national economic interests proactively, thereby preventing potential damage to the socio-economic structure. Unfortunately, in most cases a comprehensive understanding of economic security often emerges only after economic threats have materialized.

In today's rapidly evolving world, ensuring economic security has become one of the primary priorities for nations, serving as the cornerstone of national security and development. The dynamic nature of global development continuously alters the risks associated with economic security, making it imperative for countries to identify and mitigate these risks promptly. The issue of economic security has gained increased attention, particularly as economies have become more open and integrated into global economic processes. Although economic security is often conceptualized as a social phenomenon that safeguards the vital interests of individuals, society, and the state from potential dangers and threats, there remains no universally accepted definition within the broader context of national security.

The main objective of this article is to analyze how economic security impacts economic growth in EU countries.

The study shows that for weak economies, a high level of GDPpC growth can be provided even with relatively low development indicator values. At the same time, for advanced economies, high values in these indicators are a prerequisite for continued growth. Based on the model created in the study, it is possible to distribute countries by clusters. Such an interpretation is necessary in order to understand in which direction a country's economy should develop to ensure sustainable development. Thus, the proposed method makes it possible to objectively assess the potential

of the country's economic development.

Keywords: *economic security, economic growth, composite indicators, international indices, economic development, statistical analysis.*

Introduction

Economic security has emerged as a critical factor influencing economic growth, especially in the context of the European Union (EU) – a region characterized by the complex interplay of economic policies, integration processes, and diverse Member State economies. In the increasingly interconnected global economy, the concept of economic security transcends traditional notions of national security and encompasses a broader spectrum of issues including financial stability, energy supply security, labor market resilience, and the integrity of critical infrastructure. These components collectively shape the economic environment, affecting both individual Member States and the EU as a whole.

The EU, as a unique political and economic union, faces distinct challenges in maintaining economic security. The diversity of its Member States, in terms of economic development, resource endowments, and policy approaches, creates a multifaceted landscape where economic security can significantly impact growth trajectories. For instance, the 2008 financial crisis exposed vulnerabilities within the EU, leading to a prolonged period of economic stagnation in several Member States. Similarly, ongoing geopolitical tensions, energy dependency issues, and the COVID-19 pandemic have underscored the importance of robust economic security mechanisms to safeguard against external shocks.

Economic security in the EU context involves ensuring stable and sustainable growth through effective economic governance, crisis management frameworks, and policies that promote innovation, competitiveness, and social cohesion. These elements are crucial not only for preventing economic disruptions,

but also for fostering an environment conducive to long-term growth. The interdependence of EU economies means that economic security in one state can have profound implications for the entire union, highlighting the need for coordinated policies and collective action.

This article explores the impact of economic security on economic growth within the EU, examining how various dimensions of economic security – such as the financial system, innovation capability, environmental performance, etc. – affect growth outcomes. By analyzing these relationships, the study aims to provide insights into the ways in which the EU can strengthen its economic security to support sustained economic growth across its Member States.

Research results

Economic growth is a complex and multifaceted phenomenon, and its analysis is based on identifying content, qualitative and quantitative indicators, models, and types of growth. Of great importance is the definition of the principles of the growth of economic indicators and the economy as a whole. Economic growth reflects the process of improvement over certain periods, and its basic definition entails a long-term increase in productive capacity. This concept is associated with all sectors of life and elements of social development, including its economic component. Economic growth is a category that reflects general trends of positive or negative changes in a country's economic development, and is an important component and criterion of economic development. It is expressed directly in the quantitative increase in GDP and its components.

Economic growth is one of the key problems of the modern world, while economic development provides new opportunities for the implementation of projects to improve the living standards of the population. For enterprises, such growth is a necessary feature of existence. Transformative processes taking place in the national economy and changes in the development of a country

significantly affect

economic growth, which largely affects the life of the state and its future. Economic growth and economic development are not the same concept: the former is considered to be an increase in the volume of production of the gross national product; while the latter is the improvement of production and an increase in the socio-economic indicators of the country. All of this creates new questions and problems, contributing to an increase in interest in discussions related to the search for new factors and the formation of additional conditions for economic growth. For a long period, global economic growth has remained largely stable, despite difficulties that countries have encountered over the past twenty years. Economic growth is possible thanks to human potential, which, acting as a productive resource within enterprises, is embodied in employees' ability to solve professional problems. This sets the impetus for the development of production, because it is the person who is the engine and inspirer of progress. As economic growth represents a constant increase in the volume of the growth of goods and services over a certain period of time, it mirrors the evolution of the economy. Although the term evolution is not found in the works of the first economists, this definition is indirectly present in their socio-philosophical argumentation. Currently, this concept has become one of the most commonly used in economic theory.

There are two types of economic growth: extensive and intensive. It should be noted that in life, these two types of economic growth do not exist in their pure form, but act in concert, where one type dominates. The condition required for economic growth is a stable macroeconomic environment that promotes the attraction of new resources into economic circulation and their efficient use. The main conditions for economic growth are: effective economic state institutions; competitive business; high aggregate demand; the development of the service sector and information technology; and structural shifts in the economic system.

Entrepreneurs have a growing interest in increasing production capacity and improving the efficiency of their own production due to high aggregate demand. It is important to develop science-intensive industries such as the chemical industry, the production of electrical equipment, the microbiological industry, instrument making, and the computer science industry.

Economic growth has the following goals: improving the living conditions of the population; implementing the achievements of scientific and technological progress in practice; increasing the productive capacity of the economy; and stabilizing of the economic system. The drivers of economic growth are the circumstances that govern the rate and extent of long-term increases in a country's real output. The factors of economic growth are often grouped by type – extensive factors are considered to be the growth of capital and labor costs, while intensive factors are technological progress, the growth of the educational and professional skills of workers, increases in the mobility of resources, improvements in the production management of enterprises, and changes in legislation in the field of the economy. In short, intensive factors are everything that can significantly improve the quality of production factors and the process of using them.

The main factor of sustainable economic growth today is the ability to compete, which is based on innovation. Thus, to ensure a balance between economic policy and competition, it is necessary to apply a more flexible approach to the subjects of economic relations in antimonopoly regulation and develop regulatory documents with the participation of competition policy authorities. Additional factors of economic growth include: the natural resources of the national economy, the labor (human) potential of the society, capital (fixed and circulating), the entrepreneurial ability of businesspeople, scientific and technological progress, and aggregate demand. With economic growth, a country's potential also increases, as there is an increase in both fixed and circulating capital and in the labor force. Optimal economic growth ensures that the incomes of all social

groups in the country increase over a long period of time, while economic growth without the development of new, high-quality production is seen in underdeveloped countries. In order to increase economic growth, it is necessary to: use natural resources efficiently, because they are the basis for further development; use the opportunities of international economic integration by expanding positions in global sales markets, taking into account thorough market analysis; strengthen the innovative component in the socio-economic development of the country, having studied the demand for science-intensive products; and use the state, as a market entity, to maximize the national security of the country and provide a decent working atmosphere for the development of science, production, and business. To date, one of the key factors ensuring the achievement of stable economic growth has been the creation of conditions for innovative development. This will: reduce, but not eliminate, the dependence of a country's economy on raw materials and open up new opportunities for modernizing the structure of the national economy; improve the quality of life of the population and reduce income differentiation in society; and result in the creation of a large middle class.

Economic security and economic growth are fundamental objectives for countries worldwide, representing key drivers of long-term prosperity, societal well-being, and global competitiveness. Achieving and maintaining economic security is essential for withstanding shocks and uncertainties, ensuring stability, and fostering sustainable development. Economic growth, on the other hand, is the cornerstone of progress, signifying the ability of a country to increase its production, generate wealth, and improve living standards over time. Based on empirical data, theoretical foundations and international comparisons, the author aims to provide a comprehensive analysis of indicators that underlie economic security and economic growth. By understanding these indicators and their interaction, it will be possible to formulate an effective model for assessing the impact of economic security on economic growth. As was mentioned before, there is no single

definition of the economic security and economic growth of a country which scientists use. The essence of these two concepts is complicated and multifaceted.

According to Makštutis (2006), economic security refers to a state in which economic and governmental institutions are structured in a way that safeguards the nation's key interests. This state ensures that the country's development is balanced and socially oriented while maintaining robust economic and defense capabilities, regardless of whether domestic or international events are favorable or unfavorable.

Markevicius (2011) asserts that economic security and national welfare should always be top priorities for governments, as well as for political and national leaders. He identifies three distinct contexts for national security: philosophically, security should be regarded as a universal value; politically, it involves creating policies and tools to protect and uphold this value; economically, it focuses on the well-being of the population and the development of strategies to enhance this well-being.

Cernius (2019) describes investment security as a condition in which both private and public enterprises play a regulatory role in investment activities and actively participate in the investment process. Daujotas (2015) highlights that foreign direct investment is a crucial source of capital for developing nations, supplying essential resources for infrastructure, technological advancement, and the enhancement of economic capacity.

Quinn and Cahill (2016) suggest that scientific and technological security is vital for ensuring adequate social, economic, and political stability within a society. Carter (2011) notes that the security is one of the main objectives of economic policy. Access to safe, nutritious and affordable food is strongly related to socioeconomic factors. According to Malnar and Malnar (2015), demographic development is a decisive factor in modern security studies, and demographic factors can be signs of a security situation and possible change.

Choosing the right sub-indicator system is key to obtaining an objective assessment of it. This scorecard should consider all threats to economic security, and all indicators used must be independent, comparable, and representative. The author proposes to base the assessment of the level of the economic security of a country on a hierarchically constructed system of indicators, which includes the compiled indicator formed on the basis of sub-indicators grouped by components. As described earlier, the formation of a system of subindicators for assessing the economic security of a country should be carried out in accordance with the principles of representativeness, reliability, and availability of information.

While determining the indicators of economic security, the subjective position of the researcher, the priority of identified interests, threats, indicators, and their threshold levels should be taken into account. To assess economic security, a number of groups of indicators are proposed (Figure 1).

In order to form a system of indicators for assessing the level of economic security of a country, the author analyzed the composition of the subindicators used by well-known international indices and ratings. Based on the analysis of literary sources (Gryshova et. al., 2020), it was established that the most well-known and widely accepted indicators in this context are: the Global Competitiveness Index; the Index of Economic Freedom; the Fragile states index; the KOF Globalization Index; the Human Development Index; Worldwide Happiness; Doing Business; the Democracy Index; the Corruption Perceptions Index; Prosperity Index Legatum; and the Environmental Performance Index.

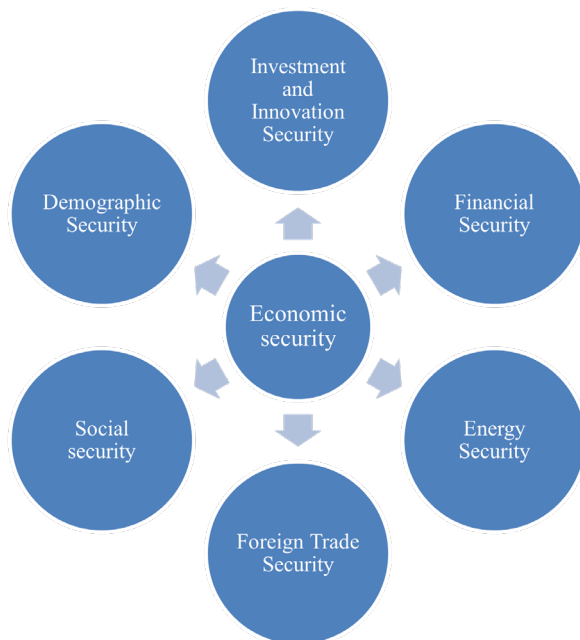


Figure 1. Main indicators of economic security

Source: created by the authors based on previous research

The authors examined the compliance of the aforementioned indicators with the above principles and the main threats to economic security, at the same time as eliminating duplicated indicators. As a result, sub-indicators were selected that clearly characterize individual components of a country's economic security. The selected indicators were checked for the absence of multicollinearity. To avoid an increased effect in calculating the compiled indicator of a country's economic security, correlation analysis was used to assess the density of statistical relationships between numerical series for the selected indicators, which could be used to assess the country's economic security. According to Denysov (2016), the criteria of economic security determine a qualitative position, which, in turn, forms a strategy of deterrence and counteraction to danger. The use of an objective system of criteria, parameters, indicators, and thresholds makes it possible to properly identify the magnitude of real and potential threats. The threshold level is a certain numerical expression of the quantitative and qualitative characteristics of

the state of economic security of the subject, which characterizes their maximum allowable values. In turn, non-compliance with these values harms the process of the normal development of various elements of reproduction and, as a consequence, leads to the consolidation of destructive trends in the economy. The composition of the selected sub-indicators makes it possible to distribute them by components: economic, political, social, and environmental.

To ascertain how economic security impacts the economic growth of a country, the main indicator of economic growth should be found. According to Kiseřáková et al. (2018), the World Economic Forum (WEF) defines economic growth as “the set of institutions, policies and factors that determine the level of productivity of the country.” The productivity of a country means a country’s ability to maintain a high level of income, but it is also one of the main factors influencing the return on investment that reflects the growth potential of the economy. In summary, economic growth is understood as the ability of a country to achieve sustained high growth rates of GDP per capita.

In the authors’ opinion, the economic growth of a country is the ability of its economy to compete with the economies of other countries in terms of the effective use of national resources, increasing the productivity of the national economy, and ensuring, on this basis, a high and constantly growing standard of living for the citizens of the state. When choosing dependent variables, the authors proceeded from the fact that the main economic indicators of a country’s development are in one way or another related to the volume of gross domestic product (GDP). Usually, indicators such as total GDP and GDP per capita are distinguished. At the same time, the use of absolute indicators in a generalizing study is inappropriate, since they can differ significantly in different countries.

As the main dependent variables, the authors chose the indicators of relative GDP growth and relative growth of GDP per capita. In addition, as studies show (Ludvigson et al, 2020), macroeconomic processes are rather slow and inertial.

Therefore, results in the form of changes in GDP growth rates may appear with some delay, so it is necessary to include output variables taken with a lag in relation to input values in the dataset.

It is obvious that the countries analyzed in this work differ significantly from one another. Even a cursory analysis of the array of input data shows significant differences both in indicators of economic development (including specific ones) and in the factors analyzed. At the same time, as a rule, in the behavior of individual objects of research, regularities can be identified that make it possible to combine groups for joint study and build generalizing conclusions.

Therefore, in addition to the obvious use of the constructed models for predicting economic development indicators (changes in the value of GDP and its share per capita), it is also advisable to consider the possibility of clustering individual countries into groups that unite countries that are closest in terms of their development characteristics.

To solve the clustering problem, a fairly large number of methods have been developed, including both statistical ones, which differ favorably in operating speed, and intelligent ones, built on the basis of neural networks and characterized by the ability to find nonlinear relationships in data.

When solving applied problems of analysis, the formation of feature descriptions of objects is a more complex operation than determining their similarity. As an example, we can compare several photographs, where it is easier to conclude that they depict the same object than to determine the array of features on the basis of which such a decision was made. Thus, the task of classifying objects based on their similarity to each other, when the belonging of training objects to any classes is not specified, is called the clustering problem. In other words, clustering is the task of dividing a set of objects into groups according to the criterion of their similarity. Within each of the obtained groups there are similar objects, and the objects of different groups are most different from each other. The effectiveness

of solving the formulated clustering problem is difficult to assess due to the lack of an objective criterion for assessing the quality of the results obtained. In addition, the specifics of the work of one or another clustering algorithm involve entering a certain set of input parameters before starting the analysis. One of the most common parameters is the number of clusters into which the initial array of objects being analyzed should be divided. The goals of applying clustering algorithms to data can be divided into two large groups:

1. Using clustering as an intermediate step in data processing. Clustering, due to its relative ease of use, is often used in exploratory analysis to initially determine the structure of the analyzed array and apply more complex algorithms to the resulting groups. It is also used to form a secondary array of objects that have average characteristics for each cluster to reduce the amount of stored data.
2. Using clustering to solve the problems of detecting anomalous objects. In this case, it is assumed that the anomalous object will not belong to any of the clusters; however, such output marking options are possible for a limited number of clustering algorithms. It should be noted that for this case, it is possible to evaluate the effectiveness of the algorithms used.

The classification of clustering algorithms can be carried out according to different criteria that characterize both the nature of the partition (hierarchical or flat) and the belonging of objects (clear or fuzzy) to clusters. The evaluation of the efficiency of clustering algorithms is subjective, and may vary for different data sets; however, the quality of their work in solving applied problems determines their popularity and the need to include software implementation in open libraries of data mining algorithms.

After researching methods of clustering, the authors propose the use of manual clustering when it is necessary to build a visual display of data using a scatter plot. Since the diagram is plotted using one parameter, only the vertical position of the points matters, and the horizontal difference serves only to separate

countries closely located on the diagram. Next, the authors constructed a similar diagram for two parameters – avg and avg_ – allowing the clarification of the picture of the distribution of countries into clusters.

Thus, the proposed method makes it possible to objectively assess the potential of a country's economic development. It is also pertinent to consider the results of applying the formal method of data clustering using k-means and g-means algorithms. This algorithm will be running on input data with various settings that govern the clustering process.

After the above actions, the relationships between clusters can be graphically displayed. This illustrates the location of links between clusters – that is, the degree of their similarity to each other. These data can be used to analyze the possible directions of development of countries in the transition from cluster to cluster.

The authors are interested in constructing an economic interpretation of the adjustment factors for dummy variables. Such an interpretation is necessary in order to understand in which direction the country's economy should develop to ensure sustainable development. Based on the principle of operation of the panel regression model with fixed effects, the coefficients for dummy variables show how much it is necessary to correct (increase or decrease) the result of model calculations for each object under study. Thus, it can be hypothesized that the adjustment coefficient shows the effectiveness of the country's economic development. The larger this coefficient, the less effort the country needs to input in order to achieve high growth rates of per capita income. The average GDPpC and cluster number were then plotted for each country. A similar result is also obtained if the average values of the correction factors are plotted instead of the cluster numbers.

It was noted above that the panel regression model with fixed effects showed the best result among statistical models. In this model, for each object, the value of unobservable individual effects is calculated, for which the method for

determining the regression coefficients is corrected. Thus, for each country, the model forms its own adjustment coefficient, which serves to compensate for its individual characteristics.

This adjustment factor can be viewed as a generalized indicator of the individual characteristics of a country, and can be used as the main indicator for grouping countries. According to this methodology, the construction of a diagram for two parameters – avg , for models describing relationships in the current period, and $avg_{_}$, for models describing relationships in the future – allows the picture of the distribution of countries into clusters to be clarified (Figure 2).

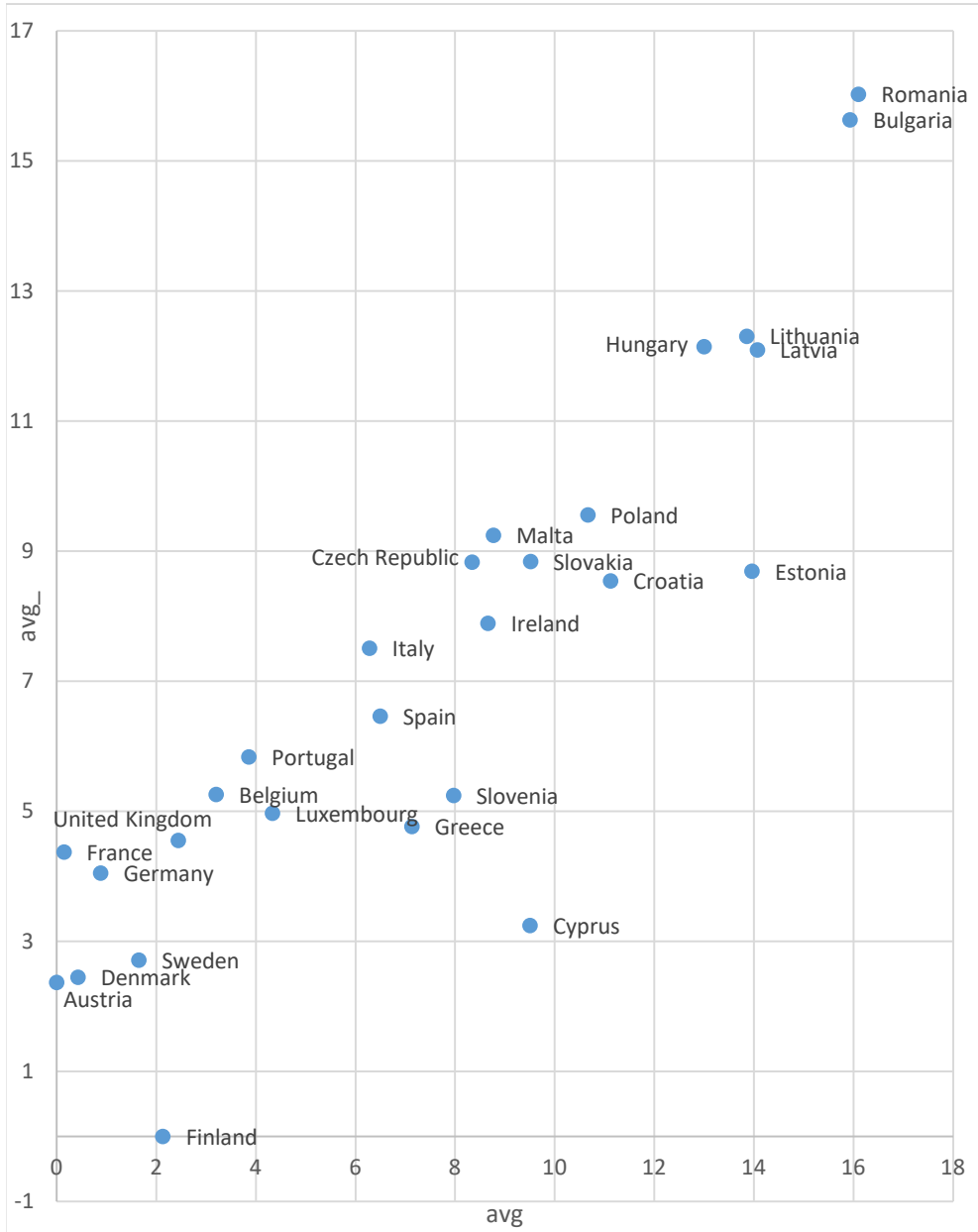


Figure 2. Distribution diagram of countries based on avg and avg_

Source: authors' calculations

Obviously, this distribution is not random. The analysis shows that countries that are close economically, and often also geographically, fall into one group. At

the same time, there is a tendency that the countries with the most developed economies are closer to the base of the coordinate plane, and the countries with a weakened or developing economy are the most distant from it. According to this methodology, the algorithm was run on input data with various settings that govern the clustering process (Table 1).

Table 1. Results of clustering data by country

COL1	Cluster number	Distance to cluster center	Average cluster distance
Finland	6	0	0
Sweden	5	0.07374	0.0672
Netherlands	5	0.087706	
Germany	5	0.073136	
France	5	0.090842	
Denmark	5	0.031469	
Austria	5	0.046426	
Portugal	4	0.049002	0.0482
Luxembourg	4	0.054576	
Belgium	4	0.01689	
Spain	3	0.123557	0.084
Slovenia	3	0.023043	
Greece	3	0.040557	
Cyprus	3	0.149035	
Slovakia	2	0.077127	0.0671
Malta	2	0.056134	
Italy	2	0.137686	
Ireland	2	0.041509	
Czech Republic	2	0.023099	
Poland	1	0.093547	0.1192
Hungary	1	0.158377	
Estonia	1	0.126342	
Croatia	1	0.098706	
Romania	0	0.1426	0.1295
Lithuania	0	0.127084	
Latvia	0	0.132298	
Bulgaria	0	0.116193	

Source: authors' calculations

It can also be noted that the algorithm placed Romania, Bulgaria, Lithuania, and Latvia in one cluster (№ 0), although they are visually fairly far apart. It can be concluded that in this case the limitations of the algorithm appear. Note that this cluster is characterized by the largest average distance from the elements to the center – that is, it is the first candidate for additional division.

The relationships between clusters can also be displayed graphically.

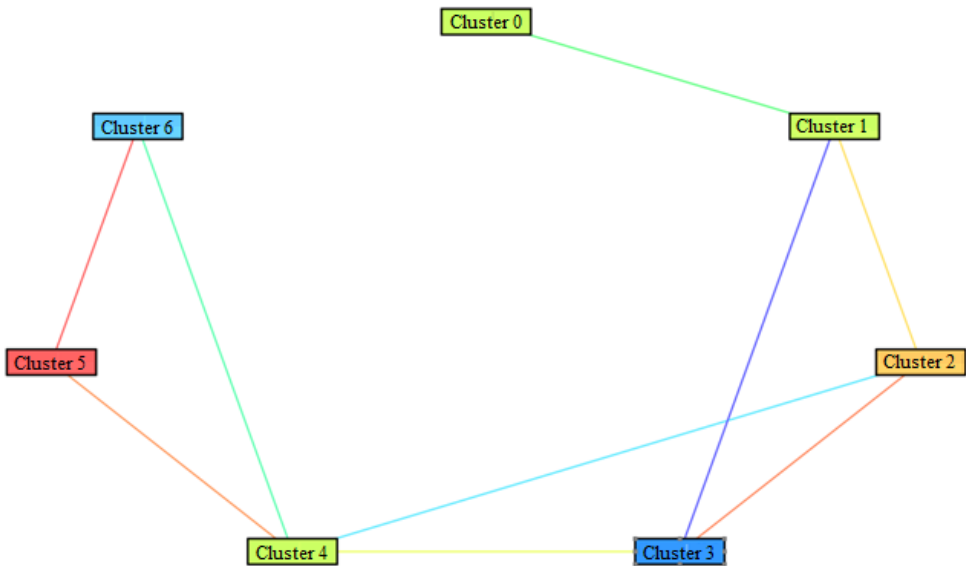


Figure 3. Cluster connections

Source: authors' calculations

Figure 3 illustrates the location of links between clusters – that is, the degree of their similarity to each other. These data can be used to analyze the possible directions of development of countries in the transition from cluster to cluster.

Conclusions

During this research, the theoretical bases of economic security and economic growth were analyzed. The main concepts of the economic security and economic growth of countries were determined. The study statistically proved the existence of a relationship between a country's economic growth, expressed through

indicators of the dynamics of GDP per capita, and the factors of economic security, which are represented by a system of indicators of economic, political, social, and environmental development. The analysis showed the correspondence between the calculated and empirical values of economic growth.

Based on the model obtained in the study, it is possible to distribute countries by clusters. Such an interpretation is necessary in order to understand in which direction a country's economy should develop to ensure sustainable development. Thus, the proposed method makes it possible to objectively assess the potential of a country's economic development.

Further research will be aimed at identifying closer relationships between economic and non-economic indicators and their impact on the economic growth and security of the EU countries. Due to the lack of research in this field, the authors believe that such studies and modeling may provide unexpected results.

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