

Sigma Convergent Analysis of The Production Structure of the Bulgarian Economy¹

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Abstract

The article examines the structural convergence of production in the Bulgarian economy to the Eurozone using the σ analysis methodology. It first shows the dynamics of the aggregated divergence index and then of the dissimilarity and distance index. These three indices were calculated for each year of the analyzed period, and when interpreting their results, emphasis is placed on the direction and speed of their change over time.

Keywords: economic structure, structural convergence, sigma convergence, divergence index

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Introduction

A defining indicator of the state and development of national economies is GDP. It is also extremely important for the implementation of European policy in EU member states. The EU has implemented a policy of convergence of production structure, which aims to achieve dynamic growth and high employment. But what are the differences in the socio-economic situation and development of the countries CEE and how much do they differ? How does the accession of new member states affect the gross domestic product of the EU and to what extent does the enlargement of the community increase or decrease disparities? The answer to all these questions is important in order to achieve greater effectiveness of the implemented policy.

The measurement of differences and the degree of convergence is necessary, with a view to taking concrete actions to overcome them. For this purpose, comparable statistical data and indicators are available that allow an analysis of convergence and divergence in the member states of the European Community. Key instruments for achieving structural convergence are the European funds and the economic policies of the member states. They serve to eliminate the main disparities in the Community through synchronous development and structural adjustment.

1. Thesis statement and literature review

One of the many possible aspects of the problem of the structural convergence of Bulgaria to the Eurozone is that of the convergence of their production structures. It can be traced back to other economists Chenery (1960) and Baumol (1967), but became more prominent in the period after 2000, especially after the creation of the single European currency. It has been proven that structural convergence contributes to accelerating real convergence, to synchronizing the economic cycles of countries (Angeloni et al., 2005), and it also increases the effectiveness of the common monetary policy implemented by the European Central Bank. This is also the reason for a large part of the scientific research on the problem, and also the reason that they are directed precisely to its production aspect.

The accession of Bulgaria and Romania in 2007 to the EU led to a doubling of socio-economic differences between the countries, including an increase in inequality in terms of gross domestic product, labor productivity, employment, educational level, innovation, new technologies, etc. In the past, other examples of similar development have been proven during the accession of other countries to the EU (Palan, 2013) already in the 1980s.

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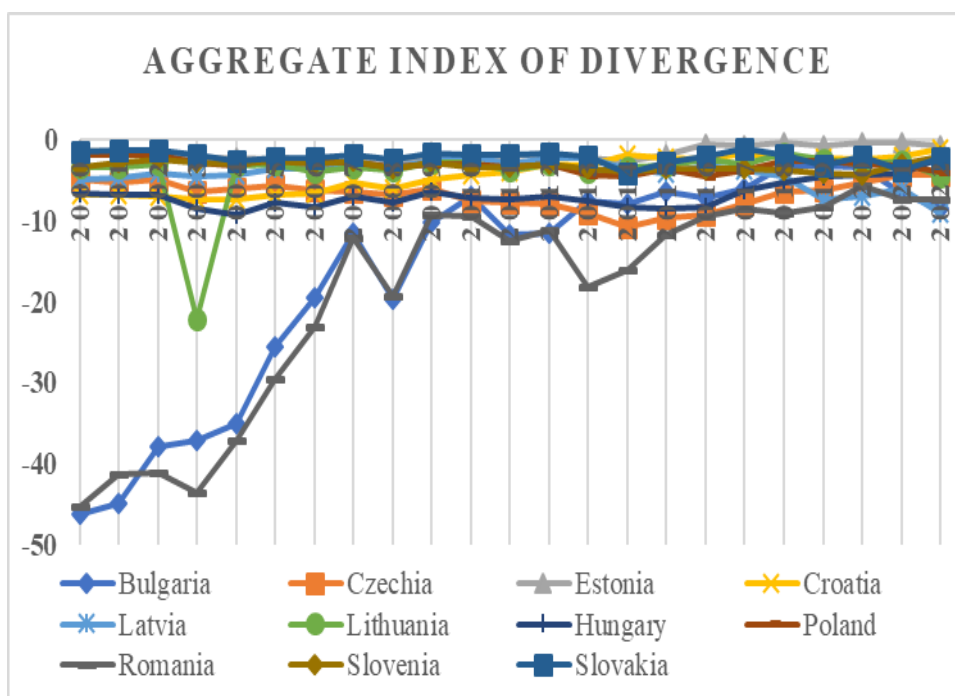
Structural convergence can be used to measure the level and dynamics of differences in the structure of various indicators in the economy, and if they decrease, this is a sign of structural convergence. In this sense, Palan (2013) argues that sigma convergence, like beta convergence, can also be absolute or conditional, and in both cases, it is measured according to the long-run pattern of specialization of economies proved by Baumol (1986) and Gallor (1996). Galor defines absolute and conditional convergence as convergence between economies, which is independent of the initial conditions in each of them, and for conditional convergence he also sets an additional condition for similarity of other main characteristics of economies according to the idea of growth models.

One of the most comprehensive studies of structural convergence at the sectoral level is that of Wacziarg (2004). He presents it by estimating bilateral correlations between pairs of countries using multi-country data for the period 1969-1997, using a simple time trend, and analyzing the time dynamics of bilateral correlations through regression analysis to infer trends in convergence.

Empirical studies conducted mainly in the period 1990-2007 regarding the EU member states on the real convergence, show that the countries are converging in several key aspects - productivity (Knill, 2007); indicators characterizing the labor market as well as per capita income (Marelli, E., Signorelli, M. & Tyrowicz, J. 2012). However, regarding the convergence of economic structures (Scharpf, 2016), things are not so clear and easy to follow.

2. Results and discussion

Through the divergence index, it is possible to determine the place of the individual economy according to the degree of convergence and to follow its change over the years in a comparative aspect compared to the rest of the EU countries. The values of the aggregate divergence index for the production structure vary through the analyzed period. After Bulgaria's accession to the EU, the lowest value of the index was observed in 2008 and the highest in 2019. Divergence index equal to zero means that the country's economic structure is fully aligned with the euro area, while a deviation away from zero implies a greater degree of divergence.



Source: author's own calculations based on Eurostat data.

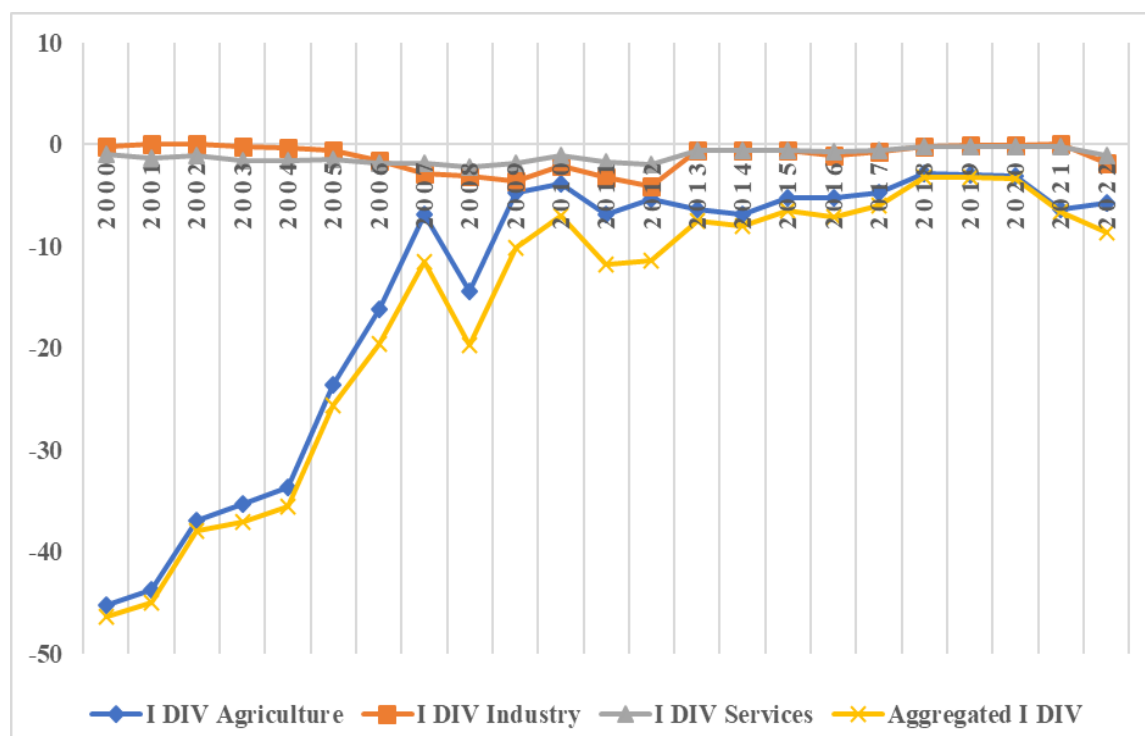
Figure 1. Aggregated index of divergence for Bulgaria and CEE countries at the sectoral level in the period 2000-2022

In the first half of the considered period, the divergence index is characterized by rapid growth, i.e. with greater convergence with the Eurozone. As a result, in 2000, Bulgaria, from being the most distant country according to this indicator, gradually became fully comparable to the other countries, both as a group and individually. In the second half of the period, however, this trend slowed down and even partially reversed. For Romania, the indicator shows an almost similar movement, although its fluctuations at the beginning and end of the period are much larger than in Bulgaria. This also affects the difference between the two countries, which until the middle of the period is significant considering their almost identical starting positions. In the following years, Romania continues to approach the Eurozone in terms of structure and at the end of the period it is already in a slightly better position than that of Bulgaria.

Thus, small factors of some magnitudes, such as the relative share of agriculture in the production structure of economy, may have a significant impact on the value and change of this indicator. When assessing the degree of convergence between economies this should be taken into account. The same applies when the reference values of the index are set or when it is used as a starting point for policy development.

In order to establish the reasons for the respective values of the aggregate index of divergence and the trends that can be deduced on its basis, it was calculated separately for the three main economic sectors.

In agriculture, the average value for the considered period of the index of divergence regarding the share of GDP produced is the largest -14.2, and the differences for the other two sectors are smaller. For the period from 2000 to 2022, the average value of the indicator for the services sector is -1.1, for industry - 1.18, and the aggregate index for the economy as a whole is -16.5 on average. The data show that, on average, over 86% of the aggregate divergence index is determined by the divergence index for the agriculture sector, and the other two sectors have a smaller contribution of 7.2% for the industry sector and 6.6% for the services.

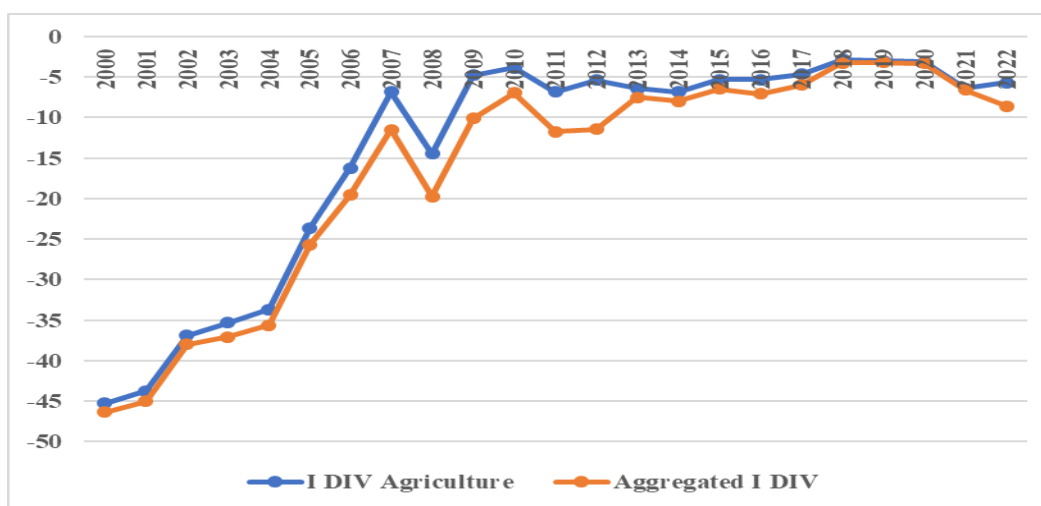


Source: author's own calculations based on Eurostat data.

Figure 2. Structural convergence of production in the three main sectors in Bulgaria compared to the Eurozone according to the divergence index

It should be noted that the dynamics of the divergence index is very similar to the dynamics of the relative share of agriculture in the gross added value. This is expected given the specifics of the methodology used to calculate this index. According to her, the value of the index mostly depends on the share of agriculture in the reference economy (the Eurozone). When the share is very low, as is the case with agriculture in the Eurozone, the value of the divergence index increases significantly, even if the absolute difference in shares is very small. At the same time, an analogous absolute difference in any other sector would have less impact on the aggregated index.

Hence, the direction of change of the two indices - aggregated and for the agrarian sector in individual years is very identical. In industry and services, during most of the period, changes in the divergence index were reported to be the same in direction, but in more than half of the period, they were different in direction compared to the aggregated divergence index.



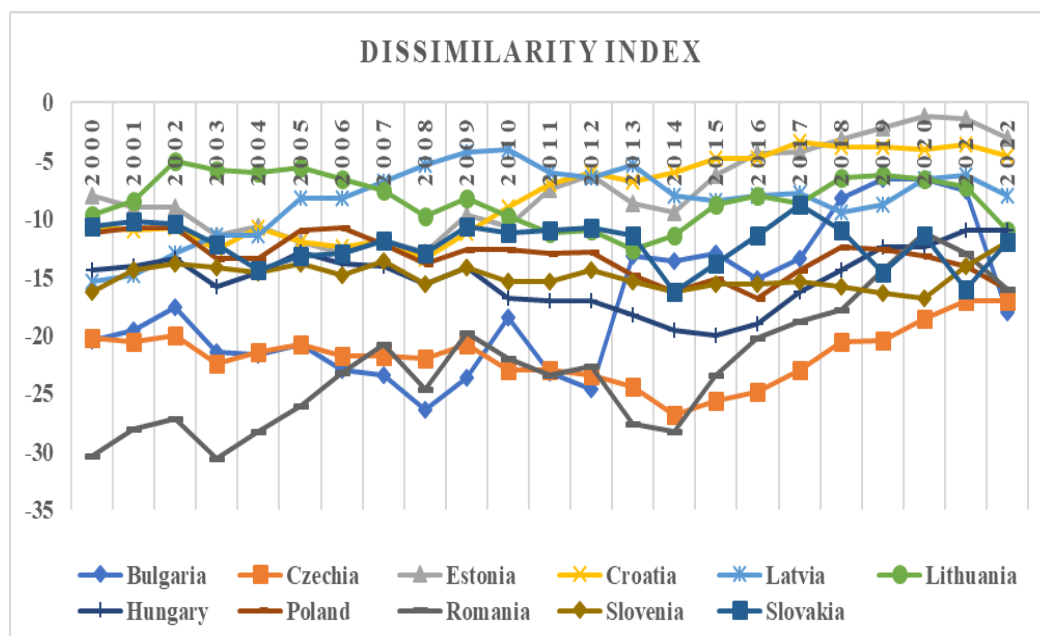
Source: author's calculations based on Eurostat data.

Figure 3. Dynamics of the aggregate divergence index and the divergence index in agriculture for the Bulgarian economy in the period 2000-2022

The trend of convergence of the Bulgarian economy with the Eurozone is also reflected in the increase at the sectoral level of the value of the aggregated index of divergence, which continues even after Bulgaria's accession to the EU, but at a slower pace. At first, fluctuations were observed around the previously reached values, and the index began to grow more noticeably in 2014. At this level of aggregation, the Bulgarian economy does not differ significantly from the other considered countries in terms of the degree of structural similarity with the Eurozone. In 2020, it even stands out as the second closest economy to the reference, compared to the other countries that have not yet adopted the single European currency. In the last year 2022, however, the situation changed and Bulgaria, compared to the other countries, ranked last in this indicator. During most of the studied period, Bulgaria was significantly ahead of its neighbor Romania, and only in the last year the Romanian economy overtook the Bulgarian one.

In general, the divergence index at the sectoral level for Bulgaria is increasing significantly, which indicates an increasing structural convergence with the countries of the Eurozone. The main reason for this is the decrease in the relative share of agriculture, while the changes in the other two sectors are not so great. By 2022, the value of the indicator begins to move away from zero, which means that for the country, the convergence in its production structure is decreasing compared to that in the Eurozone. Significant differences with the rest of the countries under consideration are also beginning to be observed, especially with those already in the Eurozone. In general, at the end of the period, a trend of increasing structural differences towards the Eurozone slightly dominates for the countries of the group, with Estonia and Croatia showing the strongest trend towards convergence, and divergence is present for Latvia, Bulgaria and Romania.

Analogous information is provided by the difference index, which also takes only negative values like the divergence index, and again, if its value is closer to zero, this indicates a greater degree of structural similarity with the Eurozone. The two indicators are used simultaneously to confirm each other's results, but taking into account some peculiarities of the dissimilarity index, when the results of the two differ, preference is given to the divergence index, which more accurately captures the convergence/divergence processes.

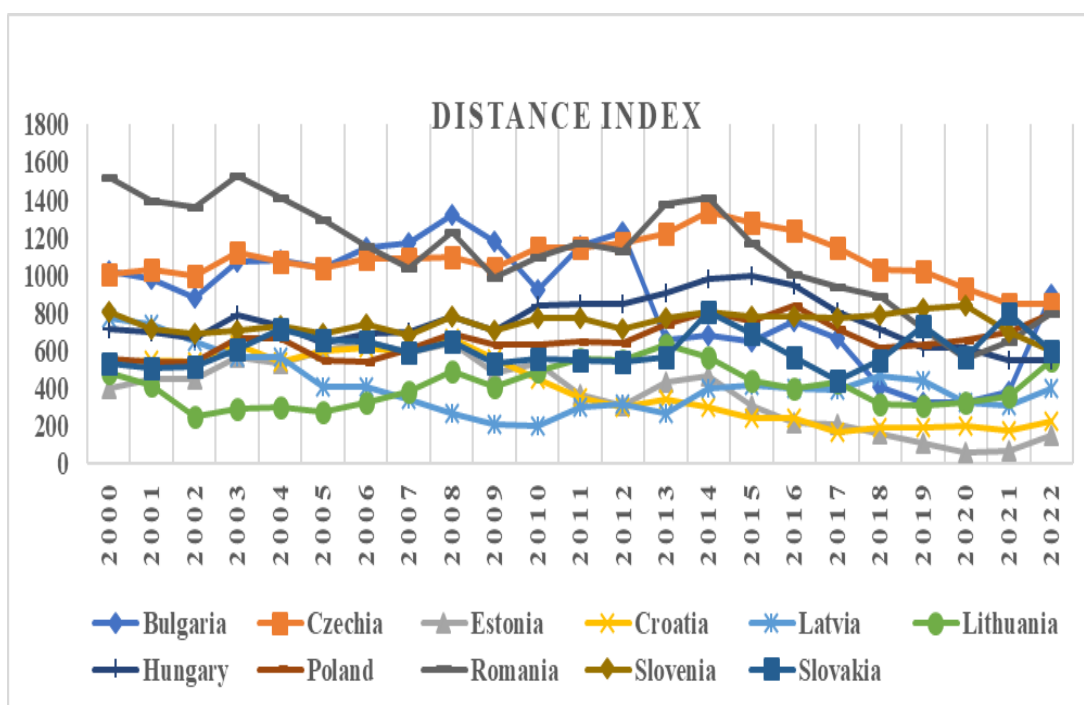


Source: author's own calculations based on Eurostat data.

Figure 4. Aggregated disparity index for Bulgaria and the rest of the CEE countries at the sectoral level in the period 2000-2022

The values of the aggregate index of difference obtained at the sectoral level for Bulgaria show a process of convergence of the production structure towards the Eurozone in a way different from the index of divergence. First of all, Bulgaria's initial position is very similar to the rest of the analyzed countries, and especially to Romania, and according to him, it can even be argued that they belong to the same group as them. The general trend observed is that the index is increasing, i.e. structural similarity with the Eurozone is increasing, which essentially also confirms the observations from the divergence index.

The third index whose value is positive is calculated in percentages. If its value is equal to zero, this indicates that the compared economies have the same structure, and if its value increases, this indicates structural divergence, and conversely, if it decreases, it indicates structural convergence.



Source: author's own calculations based on Eurostat data.

Figure 5. Aggregated distance index for Bulgaria and the rest of the CEE countries at the sectoral level in the period 2000-2022.

According to the distance index, there is convergence in all of the observed countries, except for Lithuania, Poland and Slovakia. The process of convergence until 2021 is particularly significant, but for the last 2022 in a number of countries such as Bulgaria, Estonia, Lithuania and Latvia, this process is weakening, and this is especially true for Bulgaria, whose distance index has increased by nearly three times compared to 2021.

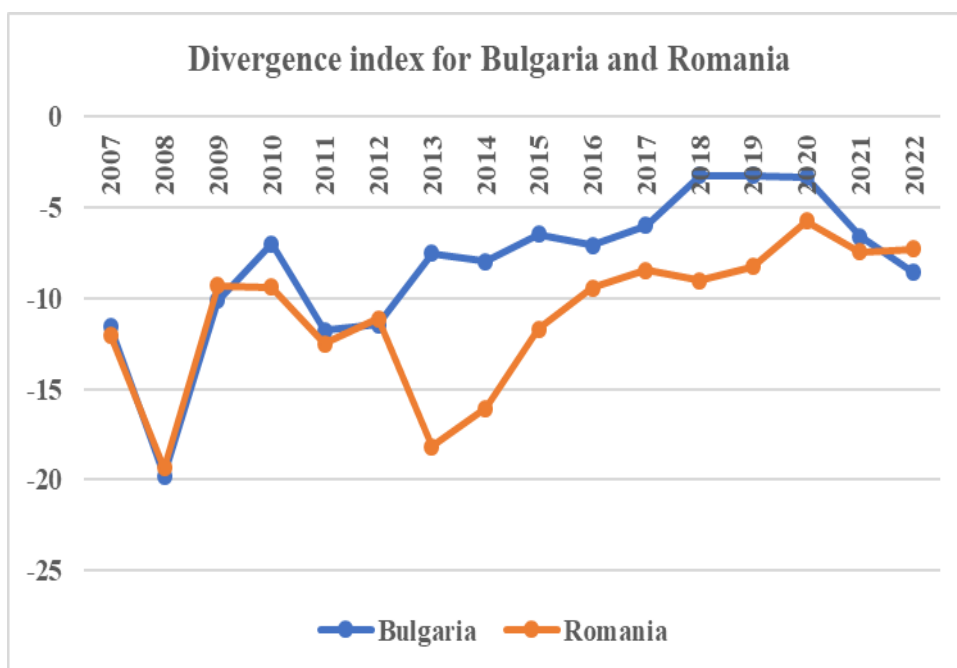
Within the period considered, the changes in the index of difference are significantly smaller than in the index of divergence, and again indicate the presence of a process of convergence towards the Eurozone. At the beginning of the studied period, the value of the index increases, which indicates that structural convergence is increasing. In the following years until 2009, the index fluctuated around the reached value, but without a clear direction. This is the main difference compared to the observed dynamics of the divergence index, where the period up to 2009 was almost without exception characterized by a sharp increase in values, while during the rest of the period until its end the dynamics of both indicators were approximately the same.

The dynamics of the index for other countries is also interesting. In more detail, if we make a comparison with them, we will see that Bulgaria is in a relatively favorable situation regarding the structural convergence of production with the Eurozone. In addition to the stated starting positions, the initial increase of the index places our country in the upper half of the ranking in terms of similarity to the Eurozone among the countries studied, and from 2009 to 2021 it is almost always the second most similar country to the Eurozone. The values of the disparity index also show that in the last few years the closest country to the Eurozone, which is not yet a member of it, is Bulgaria, and countries such as Slovenia and Slovakia, which are already part of the currency zone, remain much further away. The divergence index, in turn, shows that Romania is more distant from the rest of the economies. This is because until 201 relative share of the services sector was the lowest among the countries observed, about 20% below the Eurozone and hardly capture by the divergence index. After 2020, the differences between the countries measured by the difference index tend to increase, which is an indication of the impact of the Covid pandemic and of the remaining structural differences between them.

However, when comparing the values of these three indices, the differences in the way they are calculated must be taken into account. The disparity index is obtained by summing the absolute differences in the shares of individual economic sectors, and is therefore less sensitive to the size of each share. However, both indices grew within the period, which showed a reduction in the differences in the structure of production between Bulgaria and the Eurozone.

The presented analysis of the sectoral structure of production for Bulgaria and the CEE countries helps to bring out the main trends in their development and make comparisons between them and the Eurozone. Certain positive trends can be identified in certain sectors, as well as negative processes in others. The indices of divergence and dissimilarity allow for a more generalized comparison at the sectoral level and more solid conclusions about the extent of ongoing convergence processes.

More specifically, according to the values of the divergence index for the Bulgarian economy, convergent processes were recorded during most of the considered period, but in the last two years the value of the index was lower, i.e. the differences are greater than in 2020. Compared to the beginning of the period, however, the difference is impressive, i.e. convergent processes are present. If we compare only the results of Romania and for the period after the accession of both countries to the EU, it turns out that Bulgaria has a much more similar structure to the Eurozone than Romania. In recent years, the index of divergence in absolute value has also been growing. The two countries show a relatively similar and high degree of structural convergence compared to the other observed CEE countries.



Source: author's own calculations based on Eurostat data.

Figure 6. Aggregated index of divergence for Bulgaria and Romania for the period 2007-2022.

The dissimilarity index and the distance index generally confirm the conclusions drawn. For Bulgaria throughout the period, they are characterized by similar changes as the divergence index. According to them, at the end of the period, the countries that have the most similar structure to that of the Eurozone are Estonia and Croatia, and for the rest there are signs of increasing differences, i.e. for incipient divergence. The process is developing unevenly and is at its very beginning, so that certain trends can be outlined as to how its development will continue in the future.

Conclusion

As can be seen, the structural convergence between the economies of CEE and the Eurozone is a long-term process, in which it should not be expected that all countries will be able to reach complete similarity in their production structures. The large differences in the production structures of CEE countries that are not yet members of the Eurozone may lead, in the event of subsequent crises, to divergence of their economic cycles with those of the Eurozone, but on the other hand, the presence of structural convergence may contribute to accelerate real convergence.

The convergence of the production structure in different countries is influenced by a number of factors. Some of them, such as the free movement of factors of production, the unification of demand conditions with ever closer integration between countries, and the reduction of transport costs lead to the acceleration of the process, and others, such as economies of scale, the size of the local market, the connections with other industries etc. lead to its delay and even divergence. All this requires that in the coming years, additional and permanent studies of the convergence in the production structures, as well as the determining factors, continue to be done.

Structural convergence between EU countries requires time and effort, and it cannot be expected that they will all achieve exactly the same production structure. A good example of this is Bulgaria and Romania, which before joining the EU had a production structure that was significantly different from that of the Eurozone. Over time, despite their gradual integration into the EU and over 15 years of membership, some significant differences with the Eurozone remain. These differences will ultimately lead to a different impact of the monetary policy of the European Central Bank in Bulgaria and will contribute to the divergence of the economic cycles of Bulgaria and the Eurozone in the event of its eventual accession to it. In light of the above contradictions, we believe that the current economic policy challenges are significant.

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