MEDZINÁRODNÉ VZŤAHY
SLOVAK JOURNAL OF INTERNATIONAL RELATIONS
Faculty of International Relations, University of Economics in Bratislava
2025, Volume XXIII., Issue 1, Pages 5 – 23
DOI: https://doi.org/10.53465/SJIR.1339-2751.2025.1.5-23
ISSN 1336-1562 (print), ISSN 1339-2751 (online)
Submitted: 30. 1. 2025 | Accepted: 2. 6. 2025 | Published 15. 6. 2025

EXTERNAL MACROECONOMIC IMBALANCES IN SLOVAKIA: ITS DEVELOPMENT AND SYNCHRONIZATION

Pavla Bednářová,[1] *Vladimíra Hovorková Valentová*[2]

The main and original aim of the paper is to identify the spatial synchronization of external macroeconomic imbalances in Slovakia with EU countries from 2013 to 2022. The required results are obtained using the five Scoreboard indicators of Macroeconomic Imbalance Procedure and furthest neighbour agglomerative method of cluster analysis, with the resulting dendrogram. External Macroeconomic Imbalances in Slovakia were significantly synchronized with Baltic States and Central European countries in 2014 and 2022. In 2017 and 2020, macroeconomic imbalances exhibited similarities with the southern EU countries. At the same time, Slovakia faced a loss of external competitiveness.[3]
Key words: macroeconomic imbalance procedure, external macroeconomic indicators, Slovakia, cluster analysis, dendrogram
JEL: F15, O52, O57

1 INTRODUCTION

In 2023, Slovakia was assessed in the In-Depth Review for Slovakia. The European Commission approaches the elaboration of a deeper analysis within the Macroeconomic Imbalances Procedure (MIP) for countries with potential macroeconomic imbalances. As part of this procedure, indicators characterizing the macroeconomic situation, nominal and real convergence, including other aspects of trade performance, and data on foreign liabilities, including foreign direct investment and net

[1] Doc. PhDr. Ing. Pavla Bednářová, Ph.D., Department of Economics, Faculty of Economics, Technical University of Liberec, Studentská 1402/2, 461 17 Liberec 1, e-mail: pavla.bednarova@tul.cz. https://orcid.org/0000-0002-5397-4488
[2] Ing. Vladimíra Hovorková Valentová, Ph.D., Department of Economic Stastistics, Faculty of Economics, Technical University of Liberec, Studentská 1402/2, 461 17 Liberec 1, e-mail: vladimira.valentova@tul.cz. https://orcid.org/0000-0001-5718-315X
[3] This article was prepared within the internal grant competition (Project No. 65_PB entitled Macroecomic imbalances in EU countries, their evolution, synchronisation and correlation with the economic cycle) and supported by the financial resources of the Faculty of Economics of the Technical University of Liberec.

foreign debt, are analysed. The main reasons for this review for Slovakia are persistent concerns related to cost competitiveness, external accounts, government finances, house prices and household debt. This in-depth review on the prevention and correction of macroeconomic imbalances presents the main findings on the gravity and evolution of the challenges identified, as well as policy responses and potential policy needs (EC 2023a).

The main and original aim of the article is to identification the spatial synchronization of external macroeconomic imbalances in Slovakia with EU countries using cluster analysis statistical method from 2013 to 2022. The partial aim is to evaluate the development of external macroeconomic imbalances in Slovakia. This information can be an important indicator for early warning of adverse economic developments, as the high degree of interconnectedness of EU countries allows and encourages spillover effects between countries. By effectively monitoring and timely addressing macroeconomic imbalances, policymakers can mitigate risks, increase economic resilience, and promote sustainable growth.

Macroeconomic imbalance is defined in Regulation (EU) No. 1176/2011 on prevention and correction of macroeconomic imbalances as: "*any trend giving rise to macroeconomic developments which are adversely affecting, or have the potential to adversely affect, the proper functioning of the economy of a Member State or of the Economic and Monetary Union, or of the Union as a whole"* (EUR-LEX 2011, p. 4). The magnitude of the imbalance refers to the size of the obstacles to the proper functioning of economic activity, and to the risk of sudden correction, i.e. the probability of its correction occurring in a given period. In general, it is possible to consider any economic variable and evaluate, using these variables, the probability of a large change (or change in their combination) in the next period. However, not all cases of imbalances are a cause for concern or require policy intervention, as they may be part of a dynamic adjustment of the economy. The EU has implemented the MIP to address and rectify destabilising economic imbalances within its member states. The MIP commences annually with the Alert Mechanism Report (EC 2024), in which macroeconomic imbalances are monitored through five indicators of external position and competitiveness (current account balance, net international investment position, real effective exchange rate, export market share and nominal unit labour cost index), six indicators of internal macroeconomic imbalances (house price index, private sector credit flow, unemployment rate, private sector debt, general government gross debt and total financial sector liabilities), and three indicators of unemployment (activity rate, long-term unemployment rate and youth unemployment rate). The results of the study by Frankel and Saravelos (2012) were used as a theoretical basis for the selection of appropriate indicators of macroeconomic imbalances in the Scoreboard. In designing the Scoreboard, the European Commission worked with the Council, the European Parliament and the European Systemic Risk Board (ESRB). These fourteen main indicators are complemented by twenty-eight MIP auxiliary indicators,

which provide additional information related to macroeconomic situations, nominal and real convergence within and outside the European Union and the eurozone. The auxiliary indicators broaden the information base for understanding potential imbalances as well as the adjustment capacity of the economy. Details on the definitions of the MIP indicators can be found in the Scoreboard (EC 2012), Eurostat (2024) or Alert Mechanism Report (EC 2024).

2 LITERATURE REVIEW

The Macroeconomic Imbalances Procedure aims to prevent and correct such imbalances to maintain the overall economic health of the EU (Hodson 2018). Gros (2012), Sella, Vivaldo, Groth and Ghil (2016), Bandrés, Gadea-Rivas and Gómez-Loscos (2017) identified links and synchronization between economic growth, economic cycle and macroeconomic imbalances. They also examined correlations for Europe at both national and regional levels and showed that the degree of homogeneity of regional economic cycles within countries is quite different and that spatial correlation has increased during the convergence process towards the introduction of the euro. Bednářová and Hovorková Valentová (2016, 2017) examined the process of imbalance accumulation in the euro area. They found that, over the period under review, non-euro area countries responded to economic shocks with a higher degree of similarity and lower volatility than euro area countries, while the post-crisis recovery was faster and more intense in these countries and recommend that countries joining a currency union should focus more on meeting the criteria ex ante rather than ex post. The deterioration of economic, social and political stability and cohesion in the EU since 2007 has also been confirmed by Casagrande and Dallago (2021).

Other studies focus on the possibility of predicting economic crises depending on the development of macroeconomic imbalances. The ECB Occasional Paper (ECB 2018) reviewed the process of accumulating imbalances in the euro area and their unwinding over the past 20 years, concluding that if these indicators had been properly monitored in the first decade of EMU, they would have predicted the crisis well in advance. Frieden and Walter (2017) highlighted that the Eurozone crisis shares many characteristics with previous debt and balance of payments crises. Identifying crises and even classifying their severity has been achieved by Biegun and Karwowski (2020), who also defined the concept of so-called multidimensional crises based on several economic indicators such as GDP decline, inflation or depreciation of the national currency. In the following study, Biegun, Dahl, and Karwowski (2024) tested the ability of MIP to predict changes in GDP that can be considered as proxies for economic deterioration or improvement by using MIP auxiliary indicators. The results showed that only four main indicators and four auxiliary indicators were able to predict the upcoming crisis.

According to Bricongne, Mata Garcia and Turrini (2019) or Schuller and Sondernann (2019), credible and decisive structural reforms are key to resolving

macroeconomic imbalances. They have shown that the structural reforms implemented in euro area countries have increased resilience, reduced structural unemployment and increased productivity and growth potential in the euro area. Institutional integration as a solution to the euro area crisis detected by Mongelli, Dorrucci, Ioannou and Terzi (2015) or Koll and Watt (2022). On the other hand, Bénassy-Quéré and Wolff (2020) looked at how the macroeconomic imbalances worked in practice and recommended streamlining the Scoreboard, involving national macroprudential councils, better linking the different recommendations and further involving the Commission in the national policy debate. Koll and Watt (2022) even point to the need for an overall more radical reform of the MIP because of the demonstrated close link between macroeconomic imbalances and fiscal results, as Heinemann et al. (2018) and Coelho (2019). A reformed MIP could serve as a useful complement to the Stability and Growth Pact.

Slovakia is among the countries with the highest share of exporting companies. The manufacturing sector is the main engine of growth in Slovakia, which is why the country is sensitive to external shocks due to the high level of integration in global value chains. To analyse the development of external macroeconomic imbalances in Slovakia, it is important to consider the various factors that affect the country's economic stability, as detected Harkman and Staehr (2018) or Domonkos et al. (2017). They identified the factors that drove the current account dynamics of the eleven Central and Eastern European EU members. The current account showed considerable persistence in both cases. For floaters, the current account was driven by domestic factors, while for fixers the current account was driven mainly by external factors. The analysis demonstrated the importance of the exchange rate regime for the drivers of the current account balance in the CEE countries. Nguyen and Rondeau (2019) analyzed the transmission and synchronization of economic cycles, especially in the context of EU enlargement and the adoption of the euro, and provided insight into how the Slovak economy interacts with its European partners.

Możdzierz (2015) analysed the development and determinants of macroeconomic imbalances in the surveyed countries, including Slovakia, in 2004-2013. He identified common characteristics of the economies under study that are typical of countries in economic transition, catching up with the advanced EU countries. The implementation of this conclusion can be seen in the fact that some indicative thresholds are different for euro area countries. Čajka (2010) was primarily focused on the comparison of real and nominal convergence in two EU economies, namely Slovenia and Slovakia, which adopted the single European currency at the beginning of 2007 and 2009, respectively. He proved that if country “naturally” (in economic terms) comes to the fulfillment of nominal convergence criteria, then it doesn’t have to worry much about possibly negative impact of joining of the euro area (especially loss of autonomous monetary policy). The negative impact of the economic and financial crisis on the external balance in Slovakia was examined by Čajka, Gajdůšková and Bolotov (2011). Knapková,

Kiaba and Hudec (2019) identified the impacts of macroeconomic indicators on public debt of the Slovak Republic, just like Gomez-Puig nad Sosvilla-Rivero (2018). Macroeconomic indicators, which authors proved to be statistically significant, were GDP growth rate, openness of economy, size of public sector, government bond yields, and unemployment rate.

3 DATA AND METHODOLOGY

The procedure for macroeconomic imbalances is a mechanism of supervision and enforcement of rules, which is aimed at preventing and correcting macroeconomic imbalances within the European Union. The MIP procedure is defined in two regulations, in Regulation of the European Parliament and the Council (EU) no. 1176/2011 of November 16, 2011 on the prevention and correction of macroeconomic imbalances and in Regulation of the European Parliament and the Council (EU) no. 1174/2011 of 16 November 2011 on enforcement measures to correct excessive macroeconomic imbalances in the euro area (EUR-Lex 2011). Both parts of supervision (preventive and corrective) are clearly timed and fit into the course of the European Semester (EC 2016). External macroeconomic imbalances are monitored through five indicators: current account balance (% of GDP, 3 year average), net international investment position (% of GDP), real effective exchange rate (42 trading partners, HICP deflator, 3 year % change), export market share (% of world exports, 5 year % change), nominal unit labour cost index (2015=100, 3 year % change) – see Table 1. The definition of individual indicators on the Scoreboard includes their calculation and thresholds (EUROSTAT 2024). The existence of macroeconomic imbalances in the individual countries is detected in the case when the indicator threshold values are exceeded and these thresholds can differ for countries which are part of the eurozone and for the European countries which have not been participating in the project of the single currency yet.

Cluster analysis aims to group objects, such as EU countries, based on their similarity in the examined indicators. Countries within the same cluster are very similar, while those in different clusters show significant differences. The standardized squared Euclidean distance, as mentioned in Everitt et al. (2011), is used as the basic metric:

$$D_N(i,i') = \sqrt{\sum_{j=1}^{p} d_j^2\,(i;\ i')/s^2(x_j)} \qquad (1)$$

$$\text{where } d_j(i;\ i') = x_{ij} - x_{i'j}\ , j = 1, 2, \dots, p$$

The reason why this metric was chosen was the need of expressing the observed indicators in different units of measurement. However, it requires the observed indicators to be uncorrelated. To ensure this, a Pearson's correlation coefficient is calculated for each pair of observed indicators, and a t-test is performed at the 5% significance level (test for zero population correlation). This test can demonstrate the correlation between variables,

as stated in the alternative hypothesis. The procedure for calculating the Pearson's correlation coefficient is described by Black (2010):

$$r = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sqrt{\sum(x-\bar{x})^2 \sum(y-\bar{y})^2}} \quad (2)$$

The t-test criterion from the test for zero population correlation was published e.g. by Newbold, Carlson and Thorne (2013):

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} \quad (3)$$

Table 1: Indicators of External Macroeconomic Imbalances

Indicator	***Definition***	***Threshold***
Current account balance (**CA**)	$\frac{\left(\frac{CA}{GDP}\right)_t + \left(\frac{CA}{GDP}\right)_{t-1} + \left(\frac{CA}{GDP}\right)_{t-2}}{3}.100$	< -4 % >6 %
Net international investment position (**NIIP**)	$\frac{NIIP_t}{GDP_t}.100$	< -35 %
Real effective exchange rate (**REER**)	$\frac{(REER\_HISC\_42)_t - (REER\_HISC\_42)_{t-3}}{(REER\_HISC\_42)_{t-3}}.100$	± 5 % (EA) ± 11 % (non EA)
Export market share (**EXP**)	$\frac{\left(\frac{EXP_c}{EXP_{world}}\right)_t - \left(\frac{EXP_c}{EXP_{world}}\right)_{t-5}}{\left(\frac{EXP_c}{EXP_{world}}\right)_{t-5}}.100$	< -6 %
Nominal unit labour cost index (**ULC**)	$\frac{(ULC)_t - (ULC)_{t-3}}{(ULC)_{t-3}}.100$	+ 9 % (EA) + 12 % (non EA)

Source: own processing based on data from EC (2017) and EC (2024).

To maintain objectivity, it is necessary to exclude indicators that are highly correlated with other indicators from the analysis, preventing potential bias in the results. The furthest neighbor method, one of the hierarchical agglomerative methods, is used to cluster the objects. This method clusters variables on the basis of the minimum distance between the outermost elements of the cluster. The clusters are graphically portrayed by a dendrogram, and the final number of clusters is determined heuristically. The presence of outlying objects may cause the results of the analysis to be biased.. An EU country may have observed indicator values so far removed from the others that they form a separate cluster. However, a separate cluster may also be formed by a country that is not an outlier. An appropriate test must be used to determine whether a country is an outlier or not. The testing and identification of outliers is addressed by Davies and Gather (1993). Cluster analysis is a state-based method that only captures where countries stand

in the year for which we have the selected indicators. In order to capture the evolution of the positions of the EU countries in relation to the evolution of the external imbalance indicators, a cluster analysis is carried out in four selected years, 2014, 2017, 2020 and 2022, using data from the Alert Mechanism Report (EC 2024) and Eurostat (2024). Instead of static cluster analysis, it would be possible to use its dynamic version, which would allow tracking changes over time. However, we did not choose this option, as the development of economic imbalances is not so dynamic, and it would not be possible to illustrate clusters in individual periods using a dendrogram. The static form of cluster analysis makes it possible to observe which countries formed clusters in the monitored periods, analyze the reasons for some countries moving into a different cluster, work with the number of clusters in the monitored periods, etc. A significant additional advantage of the static model is its easier interpretation.

4 Development of external macroeconomic imbalances for Slovakia

Macroeconomic development in Slovakia is closely connected with the overall economic development of the EU, when in 2014, EU countries experienced a moderate economic recovery with low inflation and growing current account surpluses, due to low oil prices and very accommodative monetary policies. More than half of the Member States reported significantly negative values for the indicator of the net investment position. Trends in cost competitiveness were in line with external adjustment needs. However, 18 EU countries still recorded a cumulative loss in their share of world exports. In 2017, EU countries experienced nominal GDP growth, which had a positive impact on correcting external macroeconomic imbalances. The majority of EU countries experienced an improvement in their net investment position with regards to the external environment, although some still maintained a highly negative position. This was supported by a recovery in export demand within the EU and increased competitiveness, resulting in an increase in their share of world exports. Although unit labour costs began to rise with the economic recovery, growth remained relatively subdued. The COVID-19 pandemic has resulted in a severe economic crisis across all EU countries, temporarily impacting their external positions and competitiveness. This has had a significant effect on countries with a significant cross-border tourism sector. In 2020, economic activity was disrupted, output declined sharply, and government initiatives to maintain jobs led to an increase in unit labour costs and a reduction in overall labour productivity. The positive economic development in EU countries in 2022 was stopped by the price shock after the Russian invasion of Ukraine, which unleashed unprecedented inflation, which, together with a reduction in purchasing power and a significant tightening of monetary policy, led to a noticeable slowdown during the year. Export performance weakened against the background of subdued world trade and current account balances of almost all member states declined significantly. Economic development and specific values of Slovakian

external macroeconomic imbalances indicators in the period under review are presented in the Table 2.

Table 2: External macroeconomic imbalance indicators

	Threshold	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***	***2020***	***2021***	***2022***
Current account balance (**CA**)	-4%/+6%	-0.7	1.3	0.3	-1.2	-2.2	-2.3	-2.5	-1.7	-2.2	-3.6
Net international investment position (**NIIP**)	-35%	-62.0	-63.4	-63.6	-66.6	-68.2	-69.4	-65.6	-64.7	-60.5	-61.0
Real effective exchange rate (**REER**)	±5% (EA) ±11% (non-EA)	2.1	1.2	-1.2	-1.6	-1.9	2.5	2.5	5.2	3.1	3.8
Export market share (**EXP**)	-6%	-4.3	1.7	3.9	7.1	4.8	1.9	1.1	7.2	-1.9	-6.6
Nominal unit labour cost index (**ULC**)	9% (EA) 12% (non-EA)	3.4	3.0	2.5	4.0	7.8	11.3	14.2	15.4	12.6	13.3
Real **GDP** (1 year % change)		0.6	2.7	5.2	1.9	2.9	4.0	2.5	-3.3	4.8	1.8
EU Real GDP (1 year % change)		-0.1	1.6	2.3	2.0	2.8	2.1	1.8	-5.6	6.0	3.4
EA Real GDP (1 year % change)		-0.2	1.4	2.0	1.9	2.6	1.8	1.6	-6.1	5.9	3.4
Inflation (1 year % change)		1.5	-0.1	-0.3	-0.5	1.4	2.5	2.8	2.0	2.8	12.1

Note: Figures highlighted are the ones at or beyond the threshold.
Source: own processing using Eurostat (2023) and EC (2024).

External macroeconomic imbalances are linked to the economic performance and interdependence of the EU countries. Slovakia showed higher real GDP growth rates compared to the EU and EA average in 2013-2019. Despite the fact that the economic downturn in 2020 was lower than in the EU and EA, the post-crisis recovery is slower and in 2022 the GDP growth rate was half that. This was subsequently reflected in the deterioration of the external position and competitiveness, which significantly worsened in 2022, three indicators were beyond the indicative threshold values, namely the net international investment position, export market share and nominal unit labour cost index. The value of net investment position indicator exceeded the indicative threshold value throughout the monitored period and was significantly negative. The net foreign investment position provides an aggregated view of the net financial position (claims minus liabilities) of a country vis-à-vis non-residents, which enables an analysis of the dynamics of the country's foreign position vis-à-vis the rest of the world. For a deeper

understanding of the degree of vulnerability of a country, in addition to the size of the NIIP, its composition is also important, namely the separation of liabilities that require the payment of principal or interest separately from liabilities that do not generate debt. For these reasons, the risks to the Slovak economy were limited, since a significant part of foreign liabilities is related to direct foreign investments, mainly in the automotive industry and the financial sector. These are therefore primarily liabilities without risk of default.

A more pronounced negative impact on external competitiveness was the development of nominal unit labour costs, which have been steadily increasing since 2017, exceeded the threshold for EA countries in 2018, and even exceeded the threshold for non-EA countries from 2019. Nominal unit labour costs rose due to high wage growth in the context of a tight labour market situation and a more dynamic convergence towards the EU average already before the pandemic. In 2020, their growth accelerated further in connection with the COVID-19 pandemic and the effect of labour accumulation on labour productivity. In the last decade, Slovakia saw a drop in productivity from 82% per person in PPS to 73% of the EU average in 2022 (EC 2023). The subsequent growth in nominal unit labor costs was primarily a consequence of the high rate of core inflation, which was overall well above the level of the Eurozone and the EU. This development has had a negative impact on current account deficits, which are gradually worsening, also in connection with the high concentration of exports in several sectors and integration into global value chains.

The largest share of exports of goods from Slovakia is occupied by the traded category Machinery and transport equipment, which also includes cars. Although anti-pandemic measures in the country limited vehicle production in 2020 and 2021, and in 2022 the Slovak automotive industry had to cope with problems in supply chains, the value of exported machinery and transport equipment increased by almost 11% year-on-year. Although this was the highest growth in the last ten years, the share of this class in total exports decreased slightly. While it accounted for approximately 61% in 2021, in 2022 machinery and transport equipment accounted for less than 58% of total exports. The absolute majority, 80% of exported goods, went to EU member states and the volume of these exports increased by almost 17% year-on-year, exports to countries outside the EU increased by more than 14%. Even so, Slovakia struggled with a decreasing share of export markets. According to Eurostat's definition (EUROSTAT 2024), the Export market share indicator measures the degree of importance of a country within the total exports of the world. Therefore, a loss of export market share can occur not only due to a decline in exports but also due to a deterioration in the relative position on the world market. This happens when a country's exports grow at a slower rate than world exports. The indicator calculates a five-year percentage change, reflecting the values of structural loss of competitiveness.

5 CLUSTER ANALYSIS OF EXTERNAL MACROECONOMIC IMBALANCE INDICATORS

Cluster analysis is used to demonstrate the similarity or dissimilarity of external macroeconomic imbalance indicators of Slovakia with other EU countries. Table 3 shows the uncorrelated external macroeconomic indicators used for the analysis and the identification of outliers.

Table 3: Cluster analysis of external macroeconomic imbalance indicators

Year	*Uncorrelated indicators*	*Identification of outliers*
2014	NIIP, REER, EXP	UK (F = 2.958, P-Value = 0.052 Czech Republic (F = 2.235, P-Value = 0.109) All EU countries were analyzed
2017	NIIP, REER, EXP, ULC	Greece (F = 1.857, P-value = 0.1509) Romania (F = 1.726, P-value = 0.1772) All EU countries were analyzed
2020	NIIP, EXP, ULC	Ireland (F = 4.592, P-Value = 0.0112) Ireland was excluded from the analysis
2022	CA, REER, EXP	All EU countries were analyzed

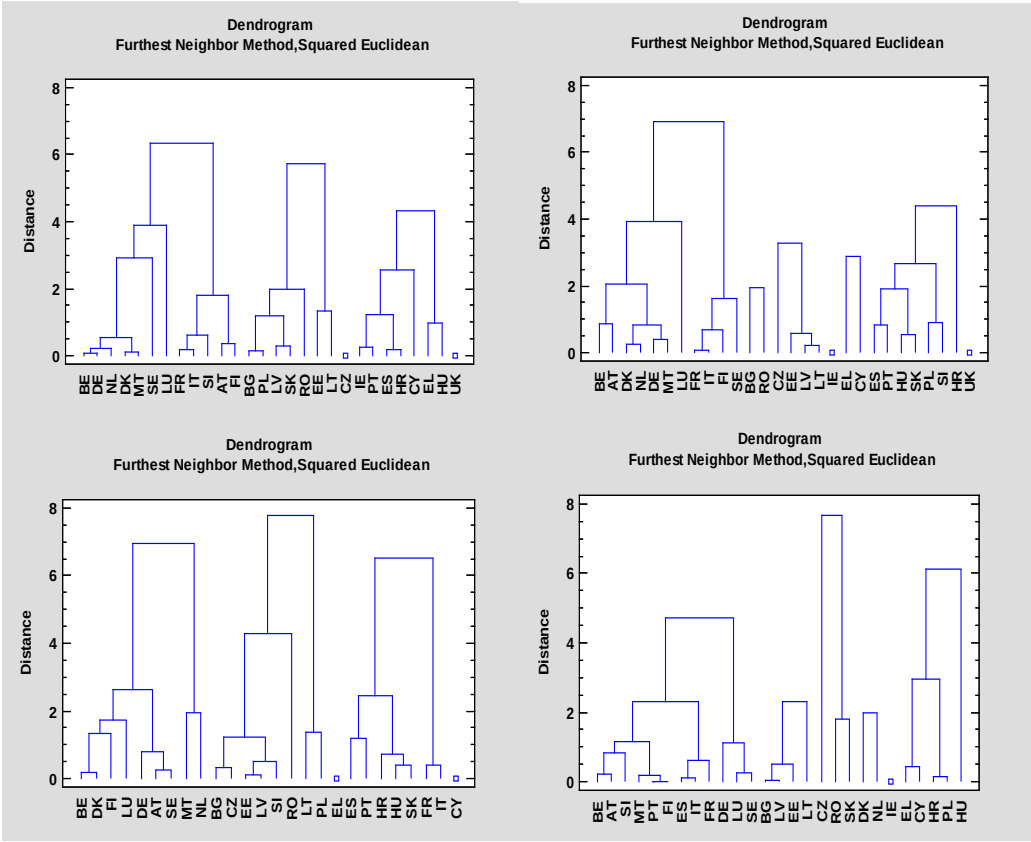
Source: Authors' own data obtained using STATGRAPHICS Centurion XVIII

The results of the cluster analysis are shown in the dendrograms in Figure 1. The number of clusters makes it possible to obtain clear and easily interpretable results, since the small distance of the links (distance up to 8 on the y-axis) explains a high degree of mutual similarityin the occurrence of macroeconomic imbalances between countries within each cluster.

The cluster analysis revealed in 2014 three country clusters and identified the Czech Republic and United Kingdom as separate countries whose three-year real effective exchange rate changes differed significantly from those of other European economies. Slovakia, Bulgaria, Poland, Latvia, Romania, Estonia, and Lithuania were comprised in the second cluster. These economies improved their net international investment position and increased their share of export markets by 15.1%. However, their net international investment position was significantly negative (-59.9%). The cost competitiveness of these countries was reduced due to an increase in nominal unit labour costs. This increase reflects a limited labour supply, economic growth driven by domestic demand, and the catching-up effect of other economies. The twelve European countries (cluster 1) had a significant synchronization and collectively had a high net international investment position (15.2%). The indicator for the loss of export market shares gradually approached the threshold, and the countries demonstrated stable development of the change in nominal unit labour costs. The indicators of external macroeconomic imbalances and their development confirm a relatively stable external position and competitiveness. The seven EU countries in a fourth cluster experienced economic

growth, which was reflected in a small current account surplus and improved export performance. In 2014, all countries had a significantly negative net international investment position and experienced a cumulative loss in world export shares (-14.2%). The recovery in cost competitiveness was due to declining nominal unit labour costs and weakening real effective exchange rates.

Fig. 1: Resulting dendrogram 2014, 2017, 2020, 2022



Source: Authors' own data obtained using STATGRAPHICS Centurion XVIII.

In 2017, a dendrogram showed that seven clusters, or rather five clusters and two separate countries, were defined at a comparable level of mutual similarity of external macroeconomic indicators (distance to value 7). Slovakia, Spain, Portugal, Hungary, Poland, Slovenia, and Croatia were grouped together in the sixth cluster. These countries exhibited a negative net international investment position (-66.2%), but conversely, increased their share of export markets (14.2%). The cluster analysis was conducted to evaluate the persistent synchronization of external indicators for eleven EU countries (the first cluster) due to their high positive NIIP values of 28.6%. The other cost competitiveness indicators remained stable. The countries' excellent external position and

growing competitiveness are reflected in a 4.2% increase in export market shares. The second cluster comprised Bulgaria and Romania. They exceeded the threshold of the net international investment position indicator (-45.3%), had an increased export share (28.2%), and experienced a high increase in nominal unit labour costs (12.8%), which poses a threat to cost competitiveness. In third cluster, Baltic States are closely linked to the Czech Republic. These countries have a highly negative net international investment position and have experienced a relatively rapid increase in nominal unit labour costs. Although rising labour costs have had an impact on external price competitiveness, this has been substantially offset by GDP growth. One separate cluster is Ireland, which has a highly negative net international investment position (-149.3%), primarily due to the activities of multinationals. Ireland has long faced significant external volatility. In contrast, the country's share of export markets has significantly increased (64.4%). In another cluster, Greece and Cyprus had a highly negative net international investment position (-132%). The values of the other indicators only marginally declined. The United Kingdom was identified as a separate cluster once again. Bednářová and Hovorková Valentová (2021) also examined the UK's specific position in terms of external macroeconomic imbalances and identified that the UK showed a relatively high degree of synchronization with EU countries only in 2007, but not in the following years.

The dendrogram shows five clusters in 2020, consisting of three clusters and two separate countries. The clustering distance is up to 8. In 2020, Slovakia, Hungary, Croatia, Portugal, Spain, and Italy and were grouped together in the fourth cluster. These countries experienced a significant loss in their net international investment position (-54.5%), a minor decrease in export markets (-0.1%), and only marginal growth in unit labour costs (11.5%). As a result, their overall external position deteriorated. This fourth group only joined the 'core' EU countries at considerably higher clustering distances (26). The first cluster comprised nine core EU countries. This cluster exhibits very good average values for the external investment position (45.5%) and export market share (9.7%) indicators. However, there is a risk associated with the evolution of unit labour costs, which already exceed the threshold with an average value of 10.8%. The second cluster comprises Bulgaria, Czech Republic, Estonia, Latvia, and Slovenia, followed by Romania, Lithuania, and Poland at greater distances. These countries experienced above-average growth in unit labour costs (18.3%), a deterioration in their net international investment position (-27.4%), but an increase in their share of export markets (22.4%). The separate clusters were identified Greece and Cyprus. In the case of Greece, the external position has deteriorated, with a significant overshooting of the thresholds for the export market share (-10.1%) and the net international investment position (-175%). This is due to prolonged public borrowing on concessional terms. In 2020, Cyprus experienced excessive macroeconomic imbalances due to the current account indicator exceeding the indicative threshold, resulting in a large deficit of 10.1% of GDP. The reduction in international tourism and the widening of the deficit in the primary income balance were

the primary causes. Additionally, the net international investment position remained significantly negative.

In 2022, in the third cluster, Slovakia showed a significant similarity only with the Czech Republic and Romania, for the first time in the observed period. This means that in the case of Slovakia, there was a different development of macroeconomic imbalances, as these countries faced a decline in external competitiveness, with the negative development of current account balance (-4.3%), the loss of export markets share (-2.5%) and the appreciation of real effective exchange rate real exchange rate by an average of 6.7%. Subsequently, these countries were connected to the Baltic countries Lithuania, Latvia, Estonia and Bulgaria at higher distances, similar to 2014. Slovakia was connected to core and southern EU countries (cluster 1) only at distances of more than 20, indicating a high degree of dissimilarity. The twelve EU countries in the first cluster also showed a loss on export markets share (-4%), but a positive value of current account balance indicator (2.1%) and a very slight depreciation of the real effective exchange rate, i.e. overall, the countries' external competitiveness improved.

6 DISCUSSION

The results of the cluster analysis show that the main causes of Slovakia's deteriorating external competitiveness are insufficient productivity growth (especially in tradable goods), overdependence on wage-driven growth and a concentrated export structure. Economic policy and action strategies in Slovakia should pay particular attention to strengthening external competitiveness by implementing policies aimed at moderating wage growth, diversifying exports and increasing productivity in order to ensure long-term external sustainability. Given that the increase in nominal unit labour costs is a key driver of imbalances, policies to enhance labour mobility, retraining and automation should be a priority. Targeted reforms could include incentives for productivity-enhancing investment and training in high-tech manufacturing and services. Given the loss of market share in export markets and the high dependence on car exports, policy makers should encourage diversification into high value-added sectors (e.g. electronics, pharmaceuticals, digital services). In addition, there is scope to focus on using EU Recovery and Resilience Facility (RRF) funds for long-term competitiveness reforms that address identified imbalances - in particular innovation and energy transition.

These recommendations are closely aligned with existing Slovak national strategies, namely the National Reform Programme of the Slovak Republic 2024 (MFSR 2025), which emphasises structural reforms, export diversification and labour market flexibility – objectives directly linked to addressing macroeconomic imbalances. Similarly, the Economic Policy Strategy of the Slovak Republic until 2030 (MHSR 2025) prioritises increasing competitiveness through innovation and productivity, which corresponds to the need to contain rising unit labour costs and strengthen the external balance. Integrating lessons from cluster-based surveillance into these strategic

frameworks can further improve policy responsiveness and resilience. Spatial clustering can also serve as an early warning system. If growing imbalances emerge in comparable countries, Slovakia should anticipate similar risks.

The previous case study of the Slovak economy is a contribution to the scientific and professional discussion on the synchronization of European economies in the process of their integration in the EU or the euro area. The unique method is the use of cluster analysis for obtaining a spatial view of the synchronization of macroeconomic imbalances across EU countries compared to the commonly used time series and comparative analyses. This approach can be used for long time periods and for the specific situation and development of each individual European economy. Cluster analysis also allows for the assessment of similarities in the development of macroeconomic imbalances in European countries by determining the so-called final distance in the cluster analysis. The final distance in the cluster analysis thus determines the value common to all countries that entered the analysis and were thus similar to each other in terms of external macroeconomic imbalances. Thus, based on the change in the value of the final distance, it is possible to determine the evolution of homogeneity (lower final distance) or heterogeneity (higher final distance) of the cluster of countries in the European Union, in euro area countries and in non-euro area countries depending on, for example, economic crises or other institutional or political changes, as discussed by Bednářová and Hovorková Valentová (2017). On the other hand, the static nature of cluster analysis, which does not allow capturing the continuous development of macroeconomic imbalance indicators, represents a limitation for research. The potential for further research therefore lies in the use of dynamic cluster analysis (DCA).

7 CONCLUSION

In 2023, Slovakia was assessed in the In-Depth Review. The European Commission approaches the elaboration of a deeper analysis within the Macroeconomic Imbalances Procedure (MIP) for countries with potential macroeconomic imbalances. The main and original aim of the article was to identification the spatial synchronization of external macroeconomic imbalances in Slovakia with EU countries from 2013 to 2022. The statistical method of cluster analysis, the standardized Euclidean squared distance and the nearest neighbor method, was used to determine the position of Slovakia among other EU countries in terms of similarity or dissimilarity in external macroeconomic imbalances. The cluster analysis is represented graphically by a dendrogram and it was performed in four years of the period under review in order to capture development trends – specifically, in the years 2014, 2017, 2020 and 2022. The evaluation was performed with the use of five indicators of external macroeconomic imbalances, which are defined in the Scoreboard.

In 2022, three external macroeconomic imbalances indicators were beyond the indicative threshold values, namely the net international investment position, export

market share and nominal unit labour cost index. The value of net investment position indicator exceeded the indicative threshold value throughout the monitored period and was significantly negative. A pronounced negative impact on external competitiveness was the development of nominal unit labour costs, which have been steadily increasing since 2017. Nominal unit labour costs rose due to high wage growth in the context of a tight labour market situation, a more dynamic convergence towards the EU average, in connection with the COVID-19 pandemic and in a consequence of the high rate inflation. This development had a negative impact on current account deficits and on a loss of export markets, also in connection with the high concentration of exports in several sectors and integration into global value chains.

In 2014, cluster analysis connected Slovakia with the Baltic and Central European countries. These economies improved their net international investment position and increased their share of export markets. The cost competitiveness of these countries decreased due to increases in nominal unit labor costs. This increase reflected limited labor supply, economic growth driven by domestic demand, and a catch-up effect with other economies. In 2017, Slovakia showed similarities with Central and Southern European countries. These countries reported a negative net international investment position but increased their export markets share. In 2020, Slovakia was grouped in a cluster with practically the same countries. In these countries, the loss of the net international investment position again increased significantly, there were a slight decrease in the shares of export markets, and unit labor costs increased marginally. As a result, their overall external position deteriorated. In 2022, for the first time in the monitored period, Slovakia showed significant similarity only with the Czech Republic and Romania. These countries faced a decline in external competitiveness, with a negative development of the current account balance, a loss of share in export markets and an appreciation of the real effective real exchange rate. This information can be an important indicator for early warning of adverse economic developments, as the high degree of interconnectedness of EU countries allows and encourages spillover effects between countries. Economic policy makers can also reduce risks, increase economic resilience and promote sustainable growth by monitoring and timely addressing macroeconomic imbalances.

REFERENCES:

1. BANDRÉS, E. – GADEA-RIVAS, M. D. – GÓMEZ-LOSCOS, A. (2017): Regional Business Cycles across Europe. [Online.] In: *Banco de Espana occasional Paper No. 1702*, 2017. [Cited 2.11.2024.] Available online: <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2900138>.
2. BEDNÁŘOVÁ, P. – HOVORKOVÁ VALENTOVÁ, V. (2016): The development of macroeconomic imbalances in European countries in the process of integration. In: *Proceedings of 14th International Conference Economic Policy*

in the European Union Member Countries. Karviná: Silesian University, pp. 44-53.
3. BEDNÁŘOVÁ, P. – HOVORKOVÁ VALENTOVÁ, V. (2017): The Development of External Macroeconomic Imbalances in the EU Countries. In: *Proceedings of the International Scientific Conference Economic and Social Policy: Economic Policy in Global Environment*. Havířov: University of Social Administration, pp. 25-34.
4. BEDNÁŘOVÁ, P. – HOVORKOVÁ VALENTOVÁ, V. (2021): Brexit in Terms of External Macroeconomic Imbalances. In: *Proceedings from the 22nd International Scientific Conference International Relations 2021*. Bratislava: University of Economics in Bratislava, Faculty of International Relations, pp. 67-78.
5. BÉNASSY-QUÉRÉ, A. – WOLFF, G. (2020): *How has the macro-economic imbalances procedure worked in practice to improve the resilience of theeuro area*? Study for the European Parliament. EU: European Union, 2020. 56 p. ISBN 978-92-846-6463-4. https://doi.org/10.2861/063774
6. BIEGUN, K. – KARWOWSKI, J. (2020): Macroeconomic imbalance procedure (MIP) scoreboard indicators and their predictive strength of "multidimensional crises". In: *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 2020, Vol. 15, No. 1, pp. 11-28. https://doi.org/10.24136/EQ.2020.001
7. BIEGUN, K. – DAHL, M. – KARWOWSKI, J. (2024): Predictive strength of Macroeconomic Imbalance Procedure indicators. In: *Economics and Law*, 2024, Vol. 23, No. 1, pp. 23-45. https://doi.org/10.12775/EiP.2024.002
8. BLACK, K. (2010): *Business Statistics for Contemporary Decision Making*. Hoboken, New Jersey: Wiley & sons, 2010. 832 p. ISBN 978-0470-40901-5.
9. BRICONGNE, J. C. – MATA GARCIA, N. – A. TURRINI (2019): Macroeconomic Imbalance Procedure, Economic Reform and Policy Progress in the European Union. [Online.] In: *Working Papers*, 2019. [Cited 20.11.2024.] Available online: <https://sciencespo.hal.science/hal-03475400v1>.
10. CASAGRANDE, S. – DALLAGO, B. (2021): Socio-economic and political challenges of EU member countries: grasping the policy direction of the European semester. In: *Comparative Economic Studies*, 2021, Vol. 64, pp. 487-519. https://doi.org/10.1057/s41294-021-00171-2
11. ČAJKA, R. (2010): Single European Currency Experience of New Member States of the European Union – Problem of Nominal and Real Convergence. In: 20th *International Trade and Finance Association Conference Papers*. No. 3.
12. ČAJKA, R. – GAJDŮŠKOVA, K. – BOLOTOV, I. (2011): Comparison of Impact of the Economic Crisis and Anti-Crisis Measures on the Czech Republic and Slovakia. In: *Management & Gouvernance*, 2011, Vol. 4, pp. 79-92.

13. COELHO, M. (2019): Fiscal Stimulus in a Monetary Union: Evidence from Eurozone Regions. In: *IMF Economic Review*, 2019, Vol. 67, pp. 573-617. https://doi.org/10.1057/s41308-019-00084-2
14. DAVIES L. – GATHER, U. (1993): The identification of multiple outliers. In: *Journal of the American Statistical Association*, 1993, Vol. 88, No. 423, pp. 782-792. https://doi.org/10.2307/2290763
15. DOMONKOS, T, – OSTRIHOŇ, F. – ŠIKULOVÁ, I. – ŠIRAŇOVÁ. M. (2017): Analysing the Relevance of the MIP Scoreboard's Indicators. In: *National Institute Economic Review*, 2017, Vol. 239, No. 1, pp. 32-52. https://doi.org/10.1177/002795011723900112
16. EC (2012): Scoreboard for the surveillance of macroeconomic imbalances: technical explanations on the scoreboard. [Online.] In: *Occasional Paper 92/2012*, 2012. [Cited 23.11.2024.] Available online: <https://ec.europa.eu/economy_finance/publications/occasional_paper/2012/op92_en.htm>.
17. EC (2016): The Macroeconomic Imbalance Procedure. Rationale, Process, Application: A Compendium. [Online.] In: *Institutional Papers 39*, 2016. [Cited 24.3.2024.] Available online: <file:///C:/aaa/the%20macroeconomic%20imbalance%20procedure-KCBC16039ENN.pdf>.
18. EC (2017): *Social scoreboard 2017 – Headline indicators – Descriptions and highlights*. [Online.] In: *European Commission*, 2017. [Cited 12.9.2024.] https://doi.org/10.2767/02949
19. EC (2023): Country Report – Slovakia. [Online.] In: *European Commission*, 2023. [Cited 12.9.2024.] Available online: <https://economy-finance.ec.europa.eu/document/download/58422f15-5311-486d-9956-2a0be07df8e7_en?filename=SK_SWD_2023_625_en.pdf>.
20. EC (2023a): In-Depth Review for Slovakia. [Online]. In: *Institutional Paper 223*, 2023. [Cited 2.11.2024.] Available online: <https://economy-finance.ec.europa.eu/system/files/2023-05/ip223_en.pdf>.
21. EC (2024): Alert Mechanism Report. [Online]. In: *Institutional Paper 261*, 2024 [Cited 26.8.2024] Available online: <https://economy-finance.ec.europa.eu/economic-and-fiscal-governance/macroeconomic-imbalance-procedure/alert-mechanism-report_en>.
22. ECB (2018): Macroeconomic imbalances in the euro area: where do we stand? [Online.] In: *Occasional Paper Series*, 2018. [Cited 26.8.2024.] Available online: <https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op211.en.pdf>.
23. EUR-LEX (2011): *Regulation (EU) No 1176/2011 of the European Parliament and of the Council*. [Online]. In: *Official Journal of European Union*, 2011. [Cited 26.8.2024.] Available online: <https://eur-

lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:306:0025:0032:en:PDF>.
24. EUROSTAT (2024): *Data Browser*. [Online.] In: *Eurostat*, 2024. [Cited 30.10.2024.] Available online: <https://ec.europa.eu/eurostat/databrowser/explore/all/all_themes>.
25. EVERITT, S. B. – LANDAU, S. – MORVEN, L. – STAHL, D. (2011): *Cluster Analysis*. Hoboken, New Jersey: Wiley & sons, 2011, 330 p. ISBN 978-0-470-74991-3.
26. FRANKEL, J. – SARAVELOS, G. (2012): Can Leading Indicators Assess Country Vulnerability? Evidence from the 2008-09 Global Financial Crisis. *HKS Faculty Research Working Paper Series RWP11-024*. Harvard University. [Online]. In: *Harvard university*, 2024. [Cited 30.10.2024.] Available online: <http://nrs.harvard.edu/urn-3:HUL.InstRepos:5027952>.
27. FRIEDEN J. – WALTER, S. (2017): Understanding the Political Economy of the Eurozone Crisis. In: *Annual Review of Political Science*, 2017, Vol. 20, pp. 371-390. https://doi.org/10.1146/annurev-polisci-051215-023101
28. GOMEZ-PUIG, M. – SOSVILLA-RIVERO, S. (2018): Public debt and economic growth: further evidence for the euro area. In: *Acta Oeconomica*, 2018, Vol. 68, No. 2, pp. 209-229. https://doi.org/10.1556/032.2018.68.2.2
29. GROS, D. (2012): Macroeconomic imbalances in the euro area: symptom or cause of the crisis? [Online.] In: *CEPS Policy*, 2012. [Cited 24.10.2024.] Available online: <https://www.ceps.eu/ceps-publications/macroeconomic-imbalances-euro-area-symptom-or-cause-crisis/>.
30. HANSEN, R. M. – LOVERING I. A. (2022). Balancing EU social and economic governance through performance management. *Contemporary Politics*, 2022, Vol. 19, No. 1, pp. 22-42. https://doi.org/10.1080/13569775.2022.2044604.
31. HARKMANN, K. – STAEHR, K. (2018): Current Account Dynamics and Exchange Rate Regimes in Central and Eastern Europe. In: *Eesti Pank Working Paper Series 8/2018*. Eesti Pank, 2018. https://doi.org/10.23656/25045520/082018/0160
32. HEINEMANN, F. – MOESSINGER, M.D. – YETER, M. (2018): Do fiscal rules constrain fiscal policy? A meta-regression-analysis. In: *European Journal of Political Economy*, 2018, Vol. 51, pp. 69-92. https://doi.org/10.1016/j.ejpoleco.2017.03.008
33. HODSON, D. (2018): The macroeconomic imbalance procedure as European integration: a legalisation perspective. In: *Journal of European Public Policy*, 2018, Vol. 25, No. 11, pp. 1610-1628. http://dx.doi.org/10.1080/13501763.2017.1340326
34. KNAPKOVÁ, M. – KIABA, M. – HUDEC, S. (2019): Impact of macroeconomic indicators on public debt of Slovak Republic. In: *Journal of Business Economics*

and Management, 2019, Vol. 20, No. 4, pp. 734-753. https://doi.org/10.3846/jbem.2019.10184
35. KOLL, W. – WATT, A. (2022): The macroeconomic imbalance procedure at the heart of EU economic governance reform. *Intereconomics: Review of European Economic Policy*. 2022, Vol. 57, No. 1, pp. 56-62. https://doi.org/10.1007/s10272-022-1028-7
36. MHSR (2025): *Economic Policy Strategy of the Slovak Republic until 2030*. [Online.] In: *MHSR*, 2025. [Cited 21.4.2025.] Available online: <https://www.mhsr.sk/uploads/files/T3H3k8da.pdf?csrt=206256746814787643 6>.
37. MFSR (2025): *National Reform Programme of the Slovak Republic 2024*. [Online.] In: *MFSR*, 2025. [Cited 21.4.2025.] Available online: <https://www.mfsr.sk/en/finance/institute-financial-policy/strategic-documents/national-reform-program/>.
38. MONGELLI, F. P. – DORRUCCI, E. – IOANNOU, D. – TERZI, A. (2015): Responses to the Euro Area Crisis: Measuring the Path of European Institutional Integration. In: *Journal of European Integration*, 2015, Vol. 37, No. 7, pp. 769-786. https://doi.org/10.1080/07036337.2015.1079373
39. MOŹDZIERZ, A. (2015): Macroeconomic Imbalances in the Economies of Former Communist Countries During the European Integration. In: *Journal of US-China Public Administration*, 2015, Vol. 12, No. 12, pp. 936-956. https://doi.org/10.17265/1548-6591/2015.12.004.
40. NEWBOLD, P. – CARLSON, W. L. – THORNE, B. M. (2013): *Statistics for Business and Economics*. Harlow: Pearson Education, 2013. 800 pp. ISBN 978-0-273-76706-0.
41. NGUYEN, H. S. – RONDEAU, F. (2019): The transmission of business cycles: Lessons from the 2004 enlargement of the EU and the adoption of the euro. *Economics of Transition and Institutional Change*. 2019, Vol. 27, No. 3, pp. 729-743. DOI: 10.1111/ecot.12212
42. SELLA, L. – VIVALDO, G. – GROTH, A. – GHIL, M. (2016): Economic Cycles and Their Synchronization: A Comparison of Cyclic Modes in Three European Countries. In: *Journal of Business Cycle Research*, 2016, Vol. 12, No. 1, pp. 25-48. https://doi.org/10.1007/s41549-016-0003-4
43. SCHULER, T. – SONDERMANN, D. (2019): *Macroeconomic imbalances and structural reforms*. [Online]. In: *ECB Central Banking Seminar*, 2019. [Cited 26.8.2024.] Available online: <https://www.ecb.europa.eu/pub/conferences/shared/pdf/20190701_CBS2019/ecb>.