

Assessing The Level Of Macroeconomic Stability Of EU Countries

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Abstract

This article is devoted to the development of methods for assessing the integrated level of macroeconomic stability of the country. Systematization of literature sources and approaches to determining the factors influencing macroeconomic stability and methods of its assessment showed that this problem is still unresolved and needs attention, given the epidemiological threats as additional factors destabilizing the world economy. The urgency of solving this scientific problem lies in need of an adequate and timely response to changes in the development of the national economy to prevent them from escalating into crisis phenomena. The study of assessing the integrated level of macroeconomic stability in the country was carried out in the article in the following logical sequence: 1) the formation of the statistical base of the study in terms of three groups of indicators: stimulants, disincentives and nominators; 2) bringing the indicators of the statistical input base of the study to a comparable form; 3) determining the priority of the impact of the components of the indicator in the integrated indicator; 4) assessment of the integrated level of macroeconomic stability, considering both the ranking of input indicators and the strength of their impact on the formation of the desired integrated indicator; 5) conducting a qualitative interpretation of the integrated level of macroeconomic stability. The methodological tools of the study were the following methods: minimax approach to the normalization of the statistical base of the study; sigma-limited parameterization method and Pareto method for determining the priority of the impact of the components of the indicators of the integrated level of macroeconomic stability; Erlang's formula for estimating the integrated level of macroeconomic stability. The study period was 2006-2019. The countries selected for the study were the following: Poland, the Czech Republic, Lithuania, Latvia, Hungary and Slovakia. The article presents the results of the assessment of the integrated indicator, which showed that Lithuania, Latvia, the Czech Republic and Poland achieved macroeconomic stability on average from 2014 at 84%, Slovakia - 65%, while Hungary had relative stability from 2010 to 2016, at the level of 76-82%, but in 2017-2018 there is a destabilization of economic development to 45%. The results of the study can be useful for public authorities in determining macroeconomic stability as an element of national economic management, the use of which will protect against financial and economic crises by taking a set of preventive measures.

Keywords: Pareto diagram, macroeconomic stability, minimax approach, ranking, sigma-limited parameterization, Erlang's formula.

JEL Classification: E63.



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Introduction

The rapid development of globalization and convergence processes in the financial sphere, the strengthening of cooperation between countries in foreign economic activity and the free movement of labour inevitably affect the

state of macroeconomic stability in the country. Macroeconomic stability is the basis for sustainable economic growth, so its support is one of the most critical tasks not only of the central bank but also of other government regulators and supervisors. The concept of macroeconomic stability very often means constant economic growth without sharp recessions and ups and downs, accompanied by low inflation, employment, the strength of the national exchange rate. But in practice, this is not enough, especially in a pandemic and the transformation of socio-economic, behavioural patterns that accompany the world economy. For example, the official exchange rate increased from UAH 23.7 (07.01.2020) to UAH 28.5 (01.12.2020) per 1 US dollar, which is an increase of 20%. In 2020, there was a decrease in the welfare of the population in Ukraine; namely, real wages decreased, and revenues from abroad decreased. However, according to the National Bank of Ukraine in 2020, there is relative financial stability. Thus, to monitor the current state of economic development of the country and identify structural imbalances in the real and financial sectors of the economy, the result of a summary indicator becomes objectively necessary.

Literature review

The analysis of research in terms of finding factors influencing the macroeconomic stability of the country is quite relevant among scientists around the world. For example, the paper (Bilan et al., 2019) proved that the macroeconomic stability of a country largely depends on the strategic decisions of the government and the transition to long-term goals can significantly increase the level of stability in the country. The study (Brunilda, Duraj et al., 2015) is based on the definition of macroeconomic determinants for stable economic growth in terms of commercial banks. Also, the policy of the country's central bank plays an essential role in ensuring the development of the national economy (Dudchenko, 2020). The paper (OSEI, 2018) on the example of Ghana contains proof of the fact that the accumulation of foreign exchange reserves is the key to increasing investment attractiveness and economic growth. Scholars examine the dynamic relationship between foreign investment inflows and a country's overall economic development (Toyin, & Oludayol, 2020). Noteworthy is the work that examines in detail the relationship between macroeconomic stability and fiscal policy, which can be both cyclical and discretionary (Munir, K., & Riaz, N., 2019). Also, scientists (Stanciu, 2019) have built a causal chain based on financial stability as a result of macroeconomic stability and economic security of the country. The authors (Nela et al., 2019) analyze labour market flexibility as a mandatory determinant of a country's stability. A study by Jayawickrema, 2019 proved that the tools of state regulation of inflation are an effective way to achieve stability in the country. Researchers (Palienko & Lyulyov, 2018) have developed an indicator that prioritizes the social determinants of the development of potential human capital given the impact on the macroeconomic stability of the state.

The scientific community also pays close attention to building relationships between individual industries and overall macroeconomic stability. Accordingly, Eddassi, 2020 examines the experience of resource-rich countries in using fiscal policy instruments to minimize the negative impact of the global crisis on the development of the national economy. This issue was analyzed in more detail by Awujola et al., 2020, examining the economic situation of Nigeria, a country that is very sensitive to fluctuations in oil prices. The paper (Zolkover, & Terziev, 2020) conducted a fundamental analysis of current research in the field of the shadow economy and emphasized that this concept in most scholars is associated with the informal economy, macroeconomic stability and unemployment. Also, the impact of the tax burden on the development of the mining industry and its consequences on the macroeconomic stability of the whole state is considered (Miller, 2019). The article examines the relationship between decentralization processes and investment attractiveness on the example of 12 European countries (Molotok, 2020). According to Reshetnikova et al. (2020) and the basis of state stability is the effective functioning of the real sector of the economy. The authors consider social entrepreneurship as a driving force for innovation, which is the key to achieving macroeconomic stability (Zainea et al., 2020). Other researchers (Jafarzadeh, & Shuquan 2019) point out that poverty has been declining in the world in recent years, but that this shift has not occurred in developing countries, indicating an increase in income inequality in the world as a whole. The article (Bhowmik, 2020) provides practical recommendations for the formation of innovative fiscal policy to increase the share of agriculture and related industries during the economic downturn, which will stabilize in a recession. Scientists (Shymon, S. et al., 2020) have empirically proven the absence of a significant difference

between the concepts of macroeconomic stability and economic security of the country, which are assessed by different sets of factors. Scientists such as Rahmanov et al., 2020, suggest ways to overcome the adverse epidemiological effects on some areas of society. Thus, the question of finding factors and tools for assessing the level of macroeconomic stability of the country is still unresolved, because there are many prisms through which to look at this problem.

Research methodology

Determining the general characteristics of the country's macroeconomic stability involves the gradual implementation of the following steps.

1 stage. The choice of indicators for assessing the macroeconomic stability of the country in the dynamics of t years. Within the framework of this study, it is proposed to analyze the presence of imbalances in the development of the national economy based on 14 indicators (according to the methodology for determining macroeconomic imbalances in the EU), which are further grouped into a single comprehensive indicator – the level of macroeconomic stability.

To ensure the information unidirectionality of the selected indicators at the initial stage, it is advisable to divide them into three groups:

- stimulants: (net international investment position to GDP (NIIP), – export market shares (EMS), activity rate – % of total population aged 15-64 (AR));
- disincentives (nominal unit labour cost (NULC), house price index - deflated price index – deflated (HPI), private sector credit flow – consolidated (PSCF), private sector debt – consolidated (PSD), general government sector debt (GGSD), unemployment rate (UR), total financial sector liabilities (TFSL), long-term unemployment rate - % of active population aged 15-74 (LTUR), youth unemployment rate - % of active population aged 15-24 (YUR));
- nominators (current account balance to GDP (CAB), real effective exchange rate (REER)).

Indicators stimulators increase the level of the desired integrated indicator, disincentives – on the contrary, with a decrease will contribute to the growth of an integrated indicator of macroeconomic stability. At the same time, the nominators have normatively defined as the minimum and maximum possible levels.

Stage 2. Bringing the indicators of the statistical input base of the study to a comparable form based on the use of a minimax approach to their normalization. Thus, in particular, for indicators of stimulants that have a maximum allowable maximum normative value, the normalization formula takes the form:

$$\tilde{s}_{it} = \begin{cases} \frac{s_{it} - \min_t s_{it}}{\max_t s_{it} - \min_t s_{it}} \\ 1, \begin{cases} s_{it} \geq s_{inormmax} \\ s_{it} \leq s_{inormmin} \end{cases} \end{cases} \quad (1)$$

where \tilde{s}_{it} is the normalized value of the i -th indicator of macroeconomic stability assessment for the t -th year;

s_{it} is the actual value of the i -th indicator of macroeconomic stability assessment for the t -th year;

$s_{inormmax}$ is the maximum possible normative value of the i -th indicator of macroeconomic stability assessment;

$s_{inormmin}$ is the minimum possible normative value of the i -th indicator of macroeconomic stability assessment;

$\min_t s_{it}$ is the minimum possible value of the i -th indicator of macroeconomic stability assessment for the studied time range;

$\max_t s_{it}$ is the maximum possible value of the i -th indicator of macroeconomic stability assessment for the studied time range;

In turn, for indicators of disincentives, which have the maximum allowable minimum normative value, the normalization formula takes the form:

$$\tilde{s}_{it} = \begin{cases} \frac{\max_t s_{it} - s_{it}}{\max_t s_{it} - \min_t s_{it}} \\ 1, \begin{cases} s_{it} \geq s_{inormmax} \\ s_{it} \leq s_{inormmin} \end{cases} \end{cases} \quad (2)$$

where $\max_t s_{it}$ is the the maximum possible value of the i-th indicator of macroeconomic stability assessment for the studied time range.

For indicators-nominators the mathematical relation which allows to bring them in a comparable kind is presented by the following formula:

$$\tilde{s}_{it} = \begin{cases} \frac{\max_t s_{it} - s_{it}}{\max_t s_{it} - \min_t s_{it}} \\ 1, \begin{cases} s_{it} \leq s_{inormmax} \\ s_{it} \leq s_{inormmin} \end{cases} \end{cases} \quad (3)$$

where $\min (s_{inorm})$ is the minimum normative value of the i-th indicator for assessing macroeconomic stability; $|\dots|$ - number module.

In turn, for the classic indicator-stimulator (index of real wages,% to the previous year) for normalization used the formula:

$$\tilde{s}_{it} = \frac{s_{it} - \min_t s_{it}}{\max_t s_{it} - \min_t s_{it}} \quad (4)$$

where $\min_t s_{it}$ is the minimum possible value of the i-th indicator of macroeconomic stability assessment for the studied time range.

Stage 3. Ranking of input indicators, estimating the strength of the impact on the formation of the desired integrated indicator, as well as determining the priority of the effects of component indicators by constructing a Pareto diagram by the method of sigma-limited parameterization. To build a Pareto chart by the method of sigma-limited parameterization, there is a need to additionally involve another indicator as a performance indicator, where the indicator GDP per capita (current US \$) is selected. The Pareto diagram allows obtaining a visualization using the values of the Student's t-test of the priority of indicators. This approach refers to one of the one-dimensional significance tests.

Stage 4. Determining the weights of the priority of the impact of indicators on the formation of an integrated indicator of macroeconomic stability using a combination of ranks, distinguished based on the Pareto approach and variability (standard deviation) of each of the input indicators:

$$w_i = \frac{(1 - r_i) \cdot \sigma_i}{\sum_i (1 - r_i) \cdot \sigma_{i,t}} \quad (5)$$

where w_i is the weighting factor of the i-th indicator of macroeconomic stability assessment;

r_i is the rank of the i-th indicator of macroeconomic stability assessment, determined on the basis of the Pareto diagram by the method of sigma-limited parameterization;

σ_i is the the standard deviation of the i-th indicator of macroeconomic stability.

Stage 5. Estimation of the integrated level of macroeconomic stability based on Erlang’s formula, which takes into account both the ranking of input indicators and the strength of influence on the formation of the desired integrated indicator based on the appropriate degree of its normalized value and weighting of the relevant rank:

$$IEI_t = \left(1 + \frac{\tilde{m}_{1t}}{1!} + \frac{(\tilde{m}_{2t})^2}{2!} + \frac{(\tilde{m}_{3t})^3}{3!} + \dots + \frac{(\tilde{m}_{11t})^{11}}{11!} \right)^{-1} \quad (6)$$

where IEI_t is the integrated indicator of macroeconomic stability by the Erlang’s method for the t-th year;

\tilde{m}_{1t} is the normalized value of the first in rank (based on the Pareto diagram by the method of sigma-limited parameterization) indicator of macroeconomic stability for the t-th year;

1! is one factorial;

\tilde{m}_{2t} is the normalized value of the second-ranked (based on the Pareto diagram by the method of sigma-limited parameterization) indicator for assessing macroeconomic stability for the t-th year;

2! is two factorial.

Stage 6. Qualitative interpretation of the integrated level of macroeconomic stability in terms of four possible interval limits: high, above average, medium and low:

$$\begin{cases} \text{high, if } IEI_t \geq 0,75 \\ \text{above average, if } 0,50 \leq IEI_t < 0,75 \\ \text{average, if } 0,25 \leq IEI_t < 0,50 \\ \text{low, if } IEI_t < 0,25 \end{cases} \quad (7)$$

Results

The methodology for assessing the integrated level of macroeconomic stability has been tested based on data indicators of socio-economic development of such countries as Poland, the Czech Republic, Lithuania, Latvia, Hungary and Slovakia. The study period is 2006-2019. The source of statistical information on macroeconomic imbalances in the context of the European Union is Eurostat data.

Based on the use of the minimax approach, the input data array was normalized, which allowed reducing the indicators to a single comparable form, ranging from 0 to 1. (4), are presented in Table 1.

Table 1. Normalized values of indicators for assessing the macroeconomic stability of Poland (study fragment)

Year	CAB	NIIP	REER	EMS	NULC	HPI	PSCF	PSD	GGSD	UR	TFSL	AR	LTUR	YUR
2006	0.30	0.80	0.17	1.00	1.00	0.21	1.00	1.00	1.00	0.00	0.00	0.10	1.00	1.00
2007	0.25	0.83	0.00	1.00	1.00	0.00	1.00	1.00	1.00	0.24	0.28	0.00	1.00	1.00
2008	0.00	0.57	0.09	1.00	0.12	1.00	0.00	1.00	1.00	0.52	1.00	0.07	1.00	1.00
2009	0.02	0.50	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2010	0.09	0.18	1.00	1.00	0.08	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.23
2011	0.18	0.28	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.04	0.00
2012	0.18	0.16	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.09
2013	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.53	1.00	1.00	0.02	0.17
2014	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2015	1.00	0.30	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2016	1.00	0.32	0.77	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2017	1.00	0.34	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2018	1.00	0.55	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2019	1.00	0.82	1.00	1.00	0.22	0.74	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Source: compiled by author.

After normalization of the statistical input base of the study, there is a need for further ranking, assessing the strength of the impact on the formation of the desired integrated indicator, as well as determining the priority of

the effect of composite indicators by constructing a Pareto diagram by sigma-limited parameterization. Systematization of the results of Pareto charts in terms of Poland, the Czech Republic, Latvia, Lithuania, Hungary and Slovakia is presented in Table 2.

Table 2. Systematization of the results of significance/insignificance of indicators for assessing macroeconomic stability and their ranking

Indicator	Poland	The Czech Republic	Lithuania	Latvia	Hungary	Slovakia
CAB	Significant, 1 rank	Significant, 4 rank	Significant, 6 rank	Significant, 4 rank	Significant, 8 rank	Significant, 11 rank
NIIP	Significant, 5 rank	Significant, 11 rank	Significant, 9 rank	Significant, 6 rank	Significant, 11 rank	Significant, 2 rank
REER	Significant, 7 rank	Significant, 8 rank	Significant, 5 rank	Significant, 1 rank	Significant, 12 rank	Significant, 4 rank
EMS	Significant, 11 rank	Significant, 3 rank	Significant, 7 rank	Significant, 10 rank	Significant, 4 rank	Significant, 13 rank
NULC	Significant, 13 rank	Significant, 6 rank	Significant, 8 rank	Significant, 11 rank	Significant, 1 rank	Significant, 9 rank
HPI	Significant, 6 rank	Significant, 9 rank	Significant, 3 rank	Significant, 5 rank	Significant, 5 rank	Significant, 5 rank
PSCF	Significant, 3 rank	Significant, 13 rank	Significant, 4 rank	Insignificant	Significant, 7 rank	Significant, 3 rank
PSD	Significant, 8 rank	Significant, 1 rank	Significant, 11 rank	Significant, 3 rank	Significant, 10 rank	Significant, 10 rank
GGSD	Significant, 4 rank	Significant, 10 rank	Significant, 10 rank	Significant, 7 rank	Significant, 6 rank	Significant, 8 rank
UR	Significant, 10 rank	Significant, 5 rank	Significant, 13 rank	Significant, 9 rank	Significant, 3 rank	Significant, 7 rank
TFSL	Significant, 2 rank	Significant, 12 rank	Significant, 12 rank	Significant, 2 rank	Significant, 12 rank	Significant, 6 rank
AR	Significant, 9 rank	Significant, 7 rank	Significant, 1 rank	Significant, 8 rank	Significant, 2 rank	Insignificant
LTUR	Significant, 12 rank	Significant, 2 rank	Significant, 2 rank	Significant, 12 rank	Significant, 9 rank	Significant, 1 rank
YUR	Insignificant	Insignificant	Insignificant	Significant, 13 rank	Insignificant	Significant, 12 rank

Source: compiled by author.

At the last stage, we will assess the integrated level of macroeconomic stability based on Erlang's formula, which takes into account the ranking of input indicators, as well as a qualitative interpretation of the integrated level of macroeconomic stability in terms of four possible intervals: high, above average, medium and low. The results of the calculation of the integrated indicator of macroeconomic stability of Erlang are presented in Figure 1.

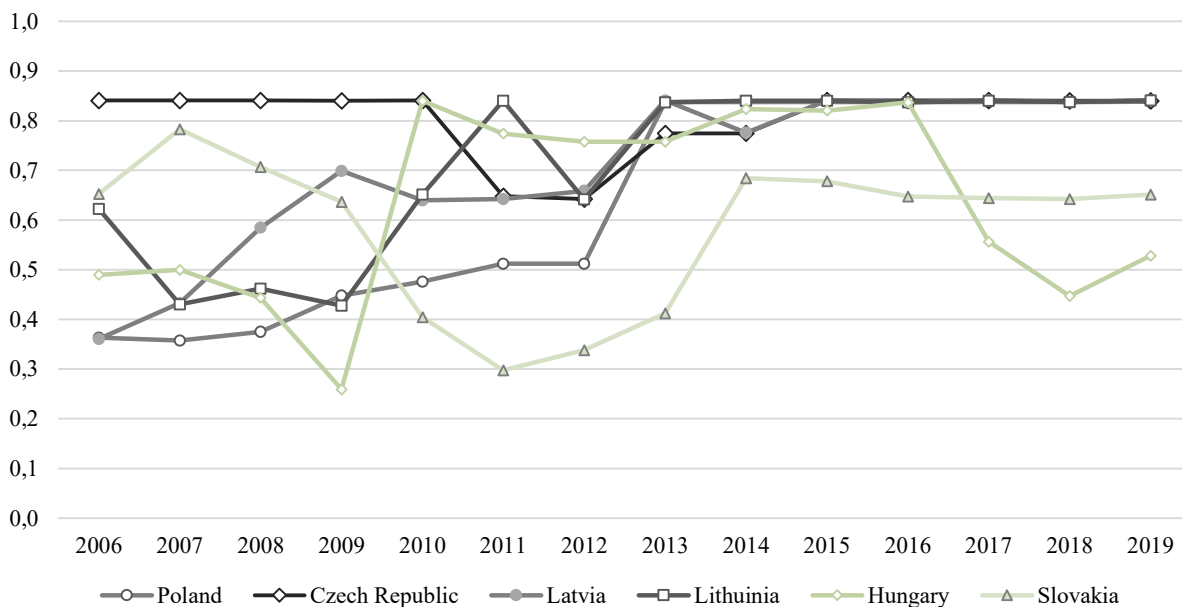


Figure 1. The dynamics of the level of macroeconomic stability of the EU countries during 2006-2019

Source: compiled by author.

The data in Figure 1 show that as of 2019, four countries (Poland, the Czech Republic, Latvia, Lithuania) have a high level of macroeconomic stability, while Hungary and Slovakia are above average. Most of the analyzed countries are characterized by a decrease in macroeconomic stability in the period from 2011 to 2013. It is worth noting that during 2006-2019 the level of macroeconomic stability in the Czech Republic was always above average, which indicates an effective state economic policy and balanced development of the economic and social sphere.

Conclusions

The proposed methodology for building a general indicator of macroeconomic stability can serve as a tool for monitoring current and future changes in the national economy to take a set of preventive measures to minimize risks and prevent crises in the development of real and financial sectors of the economy. As a result of this study, a comparative analysis of 14 determinants was conducted, which allow to identify the manifestations of macroeconomic imbalances in the development of the national economy of the country. The constructed Pareto charts made it possible to rank the factors influencing macroeconomic stability according to the level of their significance for each state, and then to generalize them to determine the integrated indicator by the Erlang method. The result of the analysis of the obtained indicators is that Lithuania, Latvia, the Czech Republic and Poland have achieved some stability since 2014 at an average of 84%, Slovakia has also achieved stability, but at 65%. As for Hungary, it had relative stability from 2010 to 2016 at 76-82%, but in 2017-2018 there was a destabilization of economic development to 45%. The priority areas of further research are to assess the impact of economic shadowing on the level of macroeconomic stability of the country.

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