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Effectiveness of Macroprudential Policy: Problems of Measurement and Evaluation

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ABSTRACT

The macroprudential policy of central banks plays a key role in ensuring financial stability not only at the level of individual states but also on the scale of the entire global economy. In this regard, adequate measurement of its effectiveness is an **urgent** task for national and supranational financial regulatory authorities. The present study is focused on solving this problem. **The purpose** of the study is to develop indicators and criteria for a comprehensive assessment of the effectiveness of countries' macroprudential policies, allowing for a cross-country analysis of this effectiveness and identifying the best global practices in macroprudential regulation. The study is based on the consolidation of the market and institutional approaches to measuring financial stability, as well as on the use of normative **methods** and methods of comparative economic analysis. **As a result** of the study, new indicators for diagnosing the effectiveness of macroprudential policy have been developed. Criteria are proposed to determine the international positions of countries in terms of the level of general, market, and institutional effectiveness of the macroprudential policy. Testing of the developed indicators and criteria was carried out for 180 countries for the period 1998–2019. The developed indicators and criteria for the effectiveness of macroprudential policy differ from the existing ones in a comprehensive manner, since they take into account the stability of financial markets and financial systems at the same time. They are also more representative as they include a wider range of parameters taken into account in financial stability calculations.

Keywords: financial market; financial institutions; financial stability; comparative analysis; macroprudential policy; policy effectiveness; central bank

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INTRODUCTION

Based on a knowledge-intensive review of the literature [1], in recent years there has been an increase in scientific interest in the problems of the effectiveness of macroprudential policies of central banks. This is due to the fact that a high-quality macroprudential policy can ensure financial stability and thus create conditions for economic growth [2]. However, as noted in some publications [3–4], public understanding of the essence and effectiveness of the macroprudential policy is still limited. In particular, scientific studies of macroprudential policy and practice of regulating financial stability do not provide exhaustive answers regarding its goals, regimes, transmission mechanism, and rules for making decisions by state authorities, and evaluating the effectiveness of these decisions. The unresolved problems are largely due to the versatility of the macroprudential policy and the duality of its goal: ensuring the stability of financial markets and financial systems [4].

In scientific research, a fragmented approach to assessing the effectiveness of macroprudential policies prevails. The fragmentation of ongoing research hinders the development of a methodology for effective state regulation of financial stability. International standards for the formation and application of financial regulation instruments are advisory in nature and allow for their adjustment at the level of national jurisdictions. The desire to eliminate the problem of fragmentation in assessing the effectiveness of macroprudential policies encouraged this study.

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This study consists of several sections. The first section includes an overview of current research related to measuring and evaluating the effectiveness of central bank macroprudential policies. The second section is a presentation of a new concept for measuring this effectiveness, an algorithm for calculating the integral indicator and criteria that allow building ratings and determining the international positions of countries in terms of the level of effectiveness of the macroprudential policy. The third section contains testing of the developed system of indicators and criteria using a database of 180 countries for the period 1998–2019. The next section is devoted to a discussion of the research results. The last section presents the main conclusions.

LITERATURE REVIEW

An analysis of the scientific and specialized literature on the topic of the study shows that at present there are *three main approaches* to the analysis and evaluation of the effectiveness of the macroprudential policy.

In the *first approach*, the effectiveness of macroprudential policies is assessed by the achieved level of financial stability. At the same time, the issue of measuring financial stability at the macroeconomic level continues to be the subject of heated scientific discussions. This is evidenced by the presence of many different concepts for determining financial stability, used in scientific research and in the practice of regulating financial stability [5]. This complicates the cross-country analysis of the effectiveness of macroprudential policies and does not allow for identifying the best world practices and extending them to countries that generate threats to financial stability.

The *second approach* examines the effectiveness of individual macroprudential policy instruments. The essence of these studies is to analyze the impact of regulatory instruments on the stability of the economy, financial markets, and financial systems. At the same time, as a rule, the requirements for bank capital and the debt burden of financial corporations are considered regulatory instruments.

Studies of the effectiveness of bank capital requirements are mainly focused on the analysis of the impact of these requirements on the cyclical nature of the economy and the stability of the banking sector.

The results of studies of the procyclical nature of the capital requirements of banks have formed two points of view regarding the effectiveness of this regulatory tool. According to the first point of view, the capital adequacy requirements of banks are an effective regulatory tool, as they have a positive effect on financial stability. This point of view is shared by Hodbod A. et al. [6]. According to the second point of view, banks' capital adequacy ratios are of limited effectiveness, and therefore there is no reason to increase these requirements. This point of view is shared by J. Mankart et al. [7].

The research results of the impact of bank capital requirements on the stability of the banking sector also show two points of view. According to the first point of view [8, 9], an increase in requirements for bank capital increases the stability of banks. According to the second point of view [10, 11], the effectiveness of regulatory capital as a tool to ensure the stability of the banking system is called into question.

Studies of the effectiveness of financial corporations' debt burden ratios are based mainly on the analysis of the impact of financial corporations' debt burden on financial stability.

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According to the results of a number of studies [12–15], financial leverage is the main indicator of banking crises and the cyclical nature of the economy. In particular, M. Gross et al. [15] found that leverage is procyclical. Leverage procyclicality can trigger financial and credit cycles during periods of growth in bank assets. And during the economic downturn, the most significant risk is the rate of decrease in the share of borrowed funds [12]. As a result of studying the impact of the debt of financial corporations on financial stability, A. Haldane and V. Madouros [13] came to the conclusion that it is necessary to limit this debt. In the development of this topic, a number of scientists and experts conducted a comparative analysis of the effectiveness of regulatory instruments and found that debt regulation has a stronger impact on risk than capital regulation [14].

The advantage of this approach is that it makes it possible to identify the advantages and disadvantages of the regulatory instruments used and, on this basis, to develop recommendations for improving macroprudential policies. At the same time, the ongoing studies are fragmentary, as they focus on the analysis of the relationship between regulatory instruments and the stability of credit markets and banking systems. In addition, the research results sometimes contain conflicting conclusions, which requires further research in this direction.

The *third approach* examines the effectiveness of macroprudential policy transmission channels and provides recommendations for optimizing the portfolio of regulatory instruments and the conditions for their application.

In particular, W. Wang and S. Huang [16] studied the effectiveness of the transmission mechanism of interest rates and came to the conclusion that interest rates can act as an economic stabilizer. As noted by X. Freixas and D. Perez-Reyna [17], a sharp drop in real interest rates can provoke a systemic crisis. At the same time, A. Mehrotra and R. Moessner [18] found that the tightening of macroprudential policy instruments in the form of restrictions on foreign currency positions helps to temporarily protect countries from the side effects of interest rates.

Analyzing the effectiveness of the portfolio of macroprudential instruments, R. Herring [19] came to the conclusion that it is expedient to exclude from it a part of the mandatory capital adequacy ratios of banks without compromising the effectiveness of the entire portfolio. L. Pfeifer et al. [20], on the contrary, proposed to increase the portfolio of regulatory instruments by introducing leverage ratios.

Analyzing the effectiveness of the macroprudential policy, A. Admati [21] drew attention to the low quality of financial stability management and therefore proposed to evaluate its effectiveness based on the ratings of responsibility and transparency of government bodies. Continuing this topic, S. Juhro et al. [22] noted the importance of combining macroprudential and monetary policies.

Developing recommendations to improve the effectiveness of the macroprudential policy, L. Donath et al. [23] emphasized the need for comprehensive monitoring of financial stability risks, covering all elements of financial systems and financial markets. According to these authors, such supervision allows for a comprehensive diagnosis and elimination of systemic vulnerabilities in the financial sector. M. Chen et al. [24] suggested taking into account the competing effects of macroprudential policies on financial markets and financial systems.

The advantage of this approach is that it allows us to evaluate the effectiveness of the transmission mechanism of the macroprudential policy and, on this basis, develop proposals for its improvement. At the same time, ongoing studies are focused on the analysis of the effectiveness of individual channels of the transmission mechanism without considering their relationship. At the same time, the need to take into account such a relationship is recognized and justified.

Summing up the analysis of publications, it should be noted that studies of the effectiveness of the macroprudential policy

are carried out in three relatively independent areas; are mostly fragmented and do not allow for a comprehensive assessment of the effectiveness of the policy. Meanwhile, as follows from scientific publications, the need for such a comprehensive assessment is long overdue. There is an obvious need to search for new, more informative indicators and criteria for measuring and evaluating the effectiveness of macroprudential policies of central banks.

RESEARCH METHODOLOGY

The hypothesis of this study is that the comprehensive nature of assessing the effectiveness of macroprudential policies is ensured by consolidating the results of achieving its two goals (ensuring the stability of financial markets and the stability of financial systems).

The following assumptions were made during the study:

1. The effectiveness of the macroprudential policy (GS) is understood as the degree to which financial stability is achieved simultaneously in the financial markets and in the financial systems of countries, which corresponds to its two goals.

2. Consolidation of the goals of the macroprudential policy is carried out on the basis of the principle of their equality. In this regard, the indicator of the general effectiveness of the macroprudential policy (GS) is calculated as the average of two indicators: market efficiency (MS) and institutional efficiency (IS).

3. A modified indicator of real interest rates is used as an indicator of market efficiency. The essence of the modification is that when calculating nominal interest rates in the financial market, in addition to the rates in the credit market, the rates in the bond market are additionally used. And when determining the level of inflation, along with the consumer price index, it is proposed to take into account the price index in the real estate market and the share price index. This modification allows us to get a more accurate description of the state of financial markets.

4. The ratio of total income (profit) to the total risk of the financial system is used as an indicator of the financial stability of the institution. This indicator shows how many unaccounted risks the financial system can cover if necessary.

The study is based on a combination of two methodological approaches to assessing financial stability: market (market stability) and institutional (sustainability of institutional units). The market approach will be applied to the valuation of MS, and the institutional approach to the valuation of IS.

The study uses the normative method of qualitative performance assessment, as well as comparative analysis methods to determine the international position of countries in terms of the effectiveness of macroprudential policies.

Approbation of the developed indicators and criteria is carried out on a sample of 180 countries for the period 1998–2019. For testing, statistical data posted on the website of the World Bank[1] and the European Central Bank are used.[2]

Indicators for Quantifying the Effectiveness of Macroprudential Policy

Taking into account the assumptions made, the index of the general macroprudential policy effectiveness (GS) is proposed to be calculated using the formulas (1)–(3):

$$GS = (MS + IS) / 2, \quad (1)$$

$$MS = (NC * C + NB * B) / (C + B) - \\ - (Ip * Q + In * N + Ia * A) / (Q + N + A), \quad (2)$$

$$IS = (ISb * Ab + ISk * Ak + ISf * Af) / (Ab + Ak + Af), \quad (3)$$

where MS — market stability index (real weighted average of the cost of debt instruments); IS — index of institutional stability (stability of the financial system);

[1] World Bank Open Data. The World Bank. URL: https://data.worldbank.org/ (accessed on 12.12.2022).

[2] Statistical Data Warehous. European Central Bank. URL: https://sdw.ecb.europa.eu/ (accessed on 12.12.2022).

NC — the nominal weighted average rate on the credit market; *C* — the volume of outstanding loans; *NB* — the nominal weighted average rate on the bond market; *B* — the capitalization of the bond market; *Ip* — consumer price index; *Q* — the volume of real GDP; *In* — price index in the real estate market; *N* — the volume of the real estate market; *Ia* — stock price index; *A* — capitalization of the stock market, US dollars; *ISb* — the ratio of the bank's profit to risk-weighted assets; *Ab* — banking assets; *ISk* — the ratio of profit of non-banking credit institutions to risk-weighted assets; *Ak* — assets of non-bank credit institutions; *ISf* — the ratio of profits of non-banking financial institutions (funds, brokers, dealers) to risk-weighted assets; *Af* — assets of non-banking financial institutions.

Indicators for Qualitative Evaluation of the Effectiveness of Macroprudential Policy

To qualitatively characterize the effectiveness of the macroprudential policies of central banks, it is proposed to use an evaluation scale (*Table 1*). The rating scale includes five levels of international position: high, above average, average, below average, and low.

Table 1 shows that the international positions of countries in terms of the effectiveness of macroprudential policies depend on the criteria corresponding to the values $n1–n3$, $m1–m3$, $k1–k3$. These criteria mean the following:

1. The criterion of low market effectiveness of macroprudential policy ($MS < 0$) means that real interest rates should be positive. Negative interest rates encourage speculation in a wide range of leveraged goods and can lead to high inflation and pyramid schemes. The value of one step of the scale is $n1$ and corresponds to the minimum margin required to prevent such speculation.

2. When assessing the institutional effectiveness of macroprudential policy (*IS*) the $m1$ criterion corresponds to a situation where financial institutions are not able to fully cover the expected risks. The $m3$ criterion characterizes the maximum level of unforeseen risks that may arise in the global financial system during a crisis. Based on this, the step size should be equal to one-third of $m3$.

3. When assessing the general effectiveness of macroprudential policy (*GS*), the values of criteria $k1–k3$ are calculated as the average value of criteria $n1–n3$, $m1–m3$.

RESULTS

To determine the numerical values of the criteria for the effectiveness of macroprudential policies of central banks, the statistical data of the World Bank[3] and the European Central Bank[4] for 180 countries for the period 1998–2019 were used. Due to the lack of open access to some aggregated statistical data (*NB, B, N, Ia, A, ISk, ISf*), used in formulas (1)–(3), a simplified version was used:

$$GS = (MS + IS) / 2 = ((NC - Ip) + ISb) / 2. \quad (4)$$

When forming the levels of market effectiveness of macroprudential policy (*MS*), a step equal to 2% was used. The value of 2% was chosen based on the results of studies that determine the range of the real neutral rate of central banks. These studies have shown that, in general, this interval tends to 2%. For example, D. Kreptsev et al. [25] allocate an interval from 1 to 3.2%, and the International Monetary Fund[5] — from 1% to 3%.

When forming the levels of institutional effectiveness of macroprudential policy (*IS*), the $m3$ criterion was set at 4.5%, which corresponds to the minimum capital requirements for banks under Basel. This value (4.5%) indicates that, if necessary, banking systems will be able to cover unforeseen losses in the same volume as the risks they take into account. This is a

[3] World Bank Open Data. The World Bank. URL: https://data.worldbank.org/ (accessed on 12.12.2022).

[4] Statistical Data Warehous. European Central Bank. URL: https://sdw.ecb.europa.eu/ (accessed on 12.12.2022).

[5] International Monetary Fund. 2019. Article IV consultation press release for Russian Federation. Country Report. URL: https://www.imf.org/en/Publications/CR/Issues/2019/08/01/Russian-Federation-2019-Article-IV–Consultation-Press-Release-Staff-Report-48549 (accessed on 12.12.2022).

Table 1

Criteria for Assessing the International Position of Countries on the Effectiveness of Macroprudential Policy, %

International positions	Market efficiency (*MS*)	Institutional efficiency (*IS*)	General efficiency (*GS*)
High	$MS \geq n3$	$IS \geq m3$	$GS \geq k3$
Above average	$n2 \leq MS < n3$	$m2 \leq IS < m3$	$k2 \leq GS < k3$
Average	$2n1 \leq MS < n2$	$m1 \leq IS < m2$	$k1 \leq GS < k2$
Below average	$0 \leq MS < n1$	$0 \leq IS < m1$	$0 \leq GS < k1$
Low	$MS < 0$	$IS < 0$	$GS < 0$

Source: Compiled by the authors.

Table 2

Values of Criteria for Assessing the International Position of Countries on the Effectiveness of Macroprudential Policy, %

International positions	Market efficiency (*MS*)	Institutional efficiency (*IS*)	General efficiency (*GS*)
High	$MS \geq 6{,}0$	$IS \geq 4{,}5$	$GS \geq 5{,}25$
Above average	$4{,}0 \leq MS < 6{,}0$	$3{,}0 \leq IS < 4{,}5$	$3{,}5 \leq GS < 5{,}25$
Average	$2{,}0 \leq MS < 4{,}0$	$1{,}5 \leq IS < 3{,}0$	$1{,}75 \leq GS < 3{,}5$
Below average	$0 \leq MS < 2{,}0$	$0 \leq IS < 1{,}5$	$0 \leq GS < 1{,}75$
Low	$MS < 0$	$IS < 0$	$GS < 0$

Source: Compiled by the authors.

fairly high value. Nevertheless, analysis of data on the stability of banking systems shows that this criterion is achievable. Thus, in 2017, the international position "high" in terms of (*IS*) was occupied by Swaziland (6.4), Estonia (5.9), Argentina (5.6), Uganda (5.6), and Sweden (4.5); in 2018 — Seychelles (7.51), Ghana (5.57), Lesotho (5.06), Norway (5.06); in 2019 — Seychelles (6.15), Lesotho (6.11), Ghana (5.78), Rwanda (5.65), Uganda (5.61), Zambia (5.10), Norway (4 .74).

Taking into account the established values of the criteria, a full rating scale was formed in terms of indicators of the general, market and institutional efficiency of the macroprudential policy (*Table 2*).

To check the calculated criteria for adequacy, a graphical analysis of the average values of indicators reflecting the effectiveness of macroprudential policies of central banks (*MS, IS, GS*) or the period 1998–2019 was carried out (*Fig. 1*). The results of this analysis confirmed the adequacy of the quantitative values of the criteria presented in *Table 2*.

Using the developed indicators and criteria, the general (*GS*), market (*MS*), and institutional (*IS*) effectiveness of macroprudential policies of the central banks of the EU countries for the period 2017–2019 was calculated, and the analyzed countries were determined by international positions (*Table 3*).

An analysis of the effectiveness of macroprudential policies of the EU countries allows us to come to the following main conclusions.

First, the average values of indicators of the general, market and institutional effectiveness of the macroprudential policies of the EU countries were lower than the average values of similar indicators in the countries worldwide.

Second, during the analyzed period, Romania (2017) and Greece (2018–2019); achieved the best performance in terms of the general efficiency of macroprudential policies; in terms of market efficiency — Greece (2017–2019); for institutional efficiency — Estonia (2017–2018) and Denmark (2019).

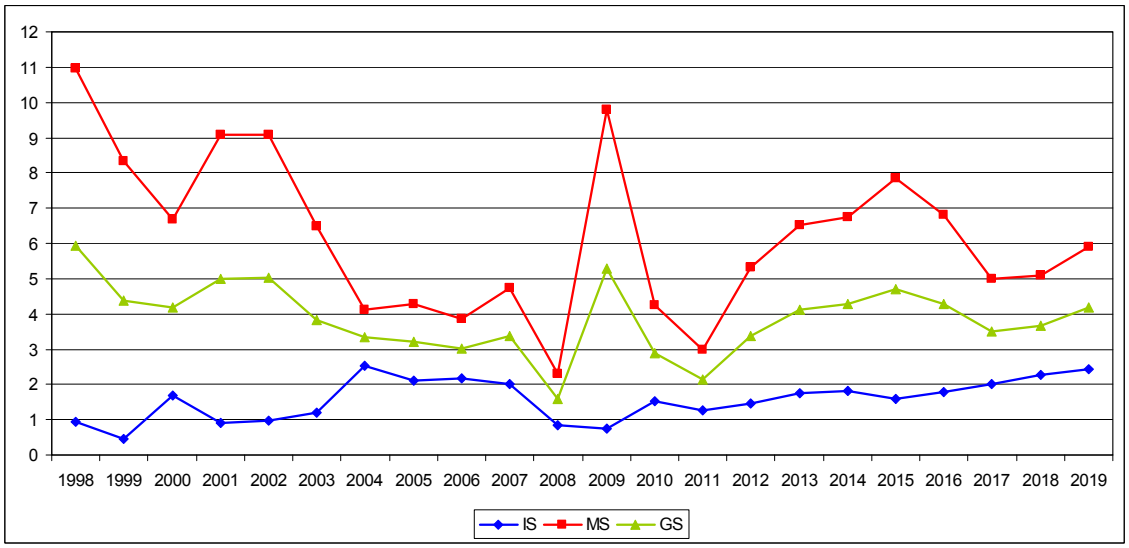

Fig. **Average Values of Indicators of Effectiveness of Macroprudential Policy of Central Banks for the Period 1998–2019, %**

Source: Authors' calculations based on the official statistics. URL: https://data.worldbank.org/; https://sdw.ecb.europa.eu/ (accessed on 12.12.2022).

Table 3

International Positions of EU Countries in 2019

International positions	Market efficiency (*MS*)	Institutional efficiency (*IS*)	General efficiency (*GS*)
High			
Above average		Cyprus, Denmark	
Average	Cyprus, Greece, Croatia, Ireland, Malta, Romania	Austria, Czech Republic, France, Croatia, Hungary, Ireland, Italy, Malta, Portugal, Sweden, Slovenia	Cyprus, Czech Republic, Denmark, Greece, Croatia, Ireland, Malta, Portugal
Below average	Austria, Bulgaria, Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, Ireland, Lithuania, Latvia, Poland, Portugal, Slovenia	Belgium, Germany, Estonia, Spain, Finland, Luxembourg, Netherlands, Poland, Slovakia	Austria, Belgium, Bulgaria, Germany, Estonia, Spain, Finland, France, Hungary, Italy, Lithuania, Luxembourg, Latvia, Poland, Romania, Sweden, Slovenia, Slovakia
Low	Belgium, UK, Hungary, Luxembourg, Netherlands, Sweden, Slovakia	Romania	UK, Netherlands

Source: Authors' calculations based on the official statistics. URL: https://data.worldbank.org/; URL: https://sdw.ecb.europa.eu/ (accessed on 12.12.2022).

Third, the UK (2017–2019), Lithuania (2017–2018), Luxembourg (2018), and the Netherlands (2019) were the source of general systemic risks).

Fourth, the source of systemic risks in financial markets was Austria (2017–2018), Belgium (2017–2019), Estonia (2017–2018), Spain (2017–2018), UK (2017–2019), Lithuania (2017–2018), Luxembourg (2017–2019), Sweden (2017–2019), Germany (2018), France (2018), Hungary (2018–2019), Netherlands (2019) Slovakia (2019).

Fifth, Greece (2017) and Romania (2019) acted as a source of systemic risks in the banking sector.

Sixth, the dynamics of the effectiveness of the macroprudential policy of the EU countries is multidirectional, which indicates a lack of coordination of this policy between countries.

Summing up the results of the analysis of the effectiveness of the macroprudential policy of the EU countries, it should be noted that, in general, this effectiveness is at an insufficiently high level, since most countries occupy the positions of "average" and "below average". The effectiveness of the macroprudential policy is characterized by multidirectional trends and contains threats to financial stability, mainly in relation to financial markets. This situation is explained by the policy of quantitative easing in order to stimulate economic growth; insufficient attention of central banks to the issues of regulating the stability of financial markets in comparison with the regulation of banking systems; lack of a methodology for developing, implementing and coordinating macroprudential policies that would allow effective government decisions in the area of financial regulation.

DISCUSSIONS

As a result of the study, new indicators and criteria for a comprehensive assessment of the effectiveness of the macroprudential policy were proposed. The value of the developed indicators and criteria lies in the fact that they can be used to conduct a comparative analysis of countries in terms of the general, market, and institutional efficiency of macroprudential policies and, on this basis, to identify the best world practices and sources of global risks in the form of countries with a low level of effectiveness.

These new indicators and benchmarks were developed on the assumption that the two macroprudential policy objectives are equal. In practice, the ratio of goals may be different depending on the chosen macroprudential policy regime. Since the development of macroprudential policy regimes and the assessment of the advantages and disadvantages of each of them were not included in the list of objectives of this study, we believe that research in this area is very relevant from the point of view of improving the effectiveness of state and international regulation of financial stability.

The study proposes to calculate the stability of financial systems for all participants in the sector of financial institutions and not just credit institutions. This increases the representativeness of the results of assessing the institutional effectiveness of the macroprudential policy. At the same time, financial activity is inherent in other sectors of the economy. Therefore, expanding the range of sectors of the economy to assess the effectiveness of macroprudential policies is a promising area for further research.

Another important point of the study is that the empirical analysis of the effectiveness of the countries' macroprudential policies was carried out using a simplified calculation formula (4). This is due to the fact that the publicly available official data of central banks, international financial organizations, and statistical agencies do not contain information about all the data used in formulas (1)–(3). In this regard, there is a need to improve the statistical base used in monitoring financial stability at the national and global levels of the world economy. In addition, this database must be updated regularly. Solving these problems will increase the level of scientific research in this area, as well as make practical conclusions more accurate.

CONCLUSIONS

As a result of the study, an integral indicator of a comprehensive assessment of the effectiveness of the macroprudential policy was developed, including private indicators in the form of market and institutional efficiency. Such an indicator of a comprehensive assessment of the effectiveness of the macroprudential policy has been developed for the first time. Its application makes it possible to form ratings of countries according to the general, market, and institutional efficiency of macroprudential policies, and to identify leading countries and countries that pose a threat to financial stability at the global level.

Criteria for a qualitative assessment of the general, market, and institutional efficiency of macroprudential policies have been formed, which makes it possible to determine the international positions of countries in terms

of these indicators. This is the first time such criteria have been proposed.

In general, the study is the first step in a comprehensive assessment of the effectiveness of macroprudential policies of central banks. This assessment is based on a number of assumptions that have arisen due to the lack of an evidence-based methodology and international standards for the formation and implementation of macroprudential policy. Therefore, there is a need for further research in this area. Their results will clarify and supplement the results of this study, as well as create a platform for making effective state and interstate decisions in the field of strategic management of financial stability.

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