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CHAPTER 5

THEORETICAL AND PRAXEOLOGICAL APPROACHES TO MONITORING THE STATE OF FINANCIAL SECURITY OF UKRAINE

ABSTRACT

In today's conditions of globalization and constant changes in the financial market, the issue of preserving financial security is becoming extremely important for every country. Financial security not only determines the stability of the national economy, but is also the basis of the well-being of citizens and the ability of the state to perform its social and economic functions. The purpose of this study is a comprehensive substantiation of the theoretical and methodological foundations and practical methods of monitoring the state of financial security of Ukraine in conditions of economic turbulence as a factor ensuring the preservation of the state's financial system.

Taking into account the fact that the methodical approach to calculating the level of economic security of Ukraine does not involve a regional assessment, a methodical approach to monitoring the security state of the financial stability of the regions has been developed. The given methodological approach includes the following sequence of actions: division of the component "financial security of the region" into subcomponents; creation of a list of indicators for each financial security subsystem of the region; normalization of these indicators within the subsystem, determination of their importance for each separate subsystem of financial security of the region; generalization of indicators into complex indicators for assessing the state of financial security of the region in the context of various subsystems; ranking of regions according to the obtained values; calculation of the integral indicator of the state of financial security for individual regions and research periods, as well as grouping of regions based on the obtained results; comparing the state of financial security of regions based on the calculated values of the integral indicator of the state of financial security and highlighting specific aspects that are specific to each region.

A list of 22 indicators of the state of financial security of regions has been created, which meets the following criteria: it is scientifically based, characterized by the availability of statistical data and suitability for mathematical and other types of analysis, highlighting the change of a phenomenon or process over time, unambiguous interpretation. It is proved that the selected indicators of the state of financial security of the regions are not in a strong relationship, and are also interconnected with the state of financial security of the state, which generally confirms the proposed hypothesis that the formed matrix of data of the identified indicators can characterize the state of financial security of the

region, testify to specific problems and special opportunities in the region, and, accordingly, to be used as input information in the process of calculating the integral indicator of the financial security of the region.

On the basis of the proposed methodology for assessing the state of financial security of regions, integral indicators of the state of financial security of regions of Ukraine were calculated, which are actually the result of collapsing indicators by subsystems into a system index for a certain region, high values of which characterize a relatively stable value of financial security of a certain region, and low values signal its dangerous or critical condition. The regions of Ukraine were clustered according to the ranges of the financial security of the regions, according to the results of which the regions were divided into 4 groups: with a critical state of financial security of the region (0.000–0.381) (Luhansk, Donetsk regions), a dangerous state (0.382–0.499), a satisfactory state (0.500–0.618) and conditionally high (0.619–1.000) (Dnipro, Kyiv, Poltava regions).

KEYWORDS

Economic security, financial security, management of the financial security system, monitoring of financial security, national security.

In today's conditions of globalization and constant changes in the financial market, the issue of preserving financial security is becoming extremely important for every country. Financial security not only determines the stability of the national economy, but is also the basis of the well-being of citizens and the ability of the state to perform its social and economic functions. Since the beginning of the Russian military invasion on February 24, 2022, the National Bank of Ukraine fixed the official exchange rate, and in the summer of 2022 increased it by 25 %, introducing additional restrictions on the foreign exchange market to ensure the macro-financial stability of the state. At the beginning of 2023, the difference between the official and cash exchange rates in Ukraine did not exceed 10–11 %, and market fluctuations were minimal even during massive shelling. Thanks to administrative measures and the support of the international community, it was possible to preserve Ukraine's international reserves. According to data at the end of January 2023, their level (29.9 billion USD) exceeded the volume of reserves before the military invasion by 9 %. So, the financial security of Ukraine is preserved now in extremely difficult conditions. Artificial restrictions that have been introduced in the field of currency security, which is an important component of financial security, work temporarily and may generate new risks over time. To avoid this, the National Bank of Ukraine constantly monitors the situation, analyzes possible scenarios and prepares appropriate solutions.

The purpose of this study is a comprehensive substantiation of the theoretical and methodological foundations and practical methods of monitoring the state of financial security of Ukraine in conditions of economic turbulence as a factor ensuring the preservation of the state's financial system. In accordance with the purpose of the study, the following theoretical, methodological and practical tasks were set: to reveal the conceptual basis for assessing the state of financial security

of the state; to investigate the security condition of the financial system of Ukraine as a basis for ensuring the economic security of the state; to develop a methodological concept for the transformation of approaches to monitoring the financial security of Ukraine.

Scientists, including: S. Akinleye, R. Dauda, O. Iwegbu, O. Popogbe [1], G. Datsenko et al., made a significant contribution to the development of the scientific paradigm of monitoring the security state of the financial system of states [2], N. Davydenko, Yu. Bilyak, Yu. Nehoda, N. Shevchenko [3], K. Garškaitė-Milvydienė, N. Maknickienė, M. Tvaronavičienė [4], Md. Hossain, U. Jahan, R. Rifat, A. Rasel, M. Rahman [5], V. Kovalenko at al. [6], M. Kryshtanovych, R. Shulyar, M. Svitlyk, O. Zorya, N. Fatiukha [7], M. Kunytska-Iliash [8], S. Onyshchenko, I. Shchurov, A. Cherviak, O. Kivshyk [9], P. Panda [10], A. Poltorak, O. Khrystenko, A. Sukhorukova, T. Moroz, O. Sharin [11], N. Reshetnikova, Zh. Gornostaeva, Yu. Chernysheva, I. Kushnareva, E. Alekhina [12], H. Salkić, A. Omerović, A. Salkić, M. Kvasina [13], N. Sirenko et al. [14], N. Vyhovska, I. Voronenko, A. Konovalenko, V. Dovgaliuk, I. Lytvynchuk [15], X. Xie, M. Osińska, M. Szczepaniak [16], S. Yekimov, O. Prodius, T. Chelombitko, A. Dudnyk, V. Chernyak [17], S. Yekimov, V. Purtov, I. Buriak, D. Kabachenko [18], S. Yekimov, V. Sarychev, N. Malyuga, L. Shkulipa [19] and others, the scientific results of which highlight the current conclusions of security theory, the classification of factors and conditions that are a prerequisite for the creation of threats financial security, the role and place of financial security in general theories of international relations.

5.1 CONCEPTUAL BASES FOR ASSESSING THE STATE OF FINANCIAL SECURITY OF THE STATE

The financial security of the country means the state in which the operations of the internal and external financial system do not disrupt the normal functionality of this complex system and do not cause obstacles to the formation of favorable financial conditions for its balanced development. This state can be measured using the aggregation of indicators reflecting the state of monetary, currency, banking, budgetary, tax, debt security, as well as the security of the non-banking financial sector.

Having analyzed the genesis of regulatory and legal provision of financial security, it was found that for the further development of the scientific approach, it is necessary to apply a systematic approach for a deep understanding of the nature of such a complex phenomenon as security, and consider it in various aspects, such as financial, economic, national. This approach will contribute to the creation of a complex systemic regulatory framework that will help implement an effective mechanism for ensuring the country's financial security.

It should be noted that imperative globalization processes are characterized by both unifying and polarizing consequences. Proponents of globalization focus attention on its positive results, noting that globalization is a source of additional freedom and progress, the formation of an impetus for economic development, a global network of information, logistical and transport advantages, the development of the investment mechanism and the acceleration of the introduction of innovations, while opponents of globalization argue that it can cause TNCs to absorb established markets, economic inequality, social tensions, and loss of cultural identity.

The division of the concept of "financial security" was carried out according to the object of protection, and this analysis made it possible to identify the following structural components: financial security of households, business entities, territorial communities, economic sectors, regions, the state and the global financial space. This distribution confirms that financial security actually determines the conditions for the functioning and development of industries and regions, as well as for society as a whole and each of its individuals in particular. At the same time, the financial security of the state combines all accumulated risks, confirming the existence of interdependence between all objects of protection and the general financial security of the country.

The author's view on the systematic taxonomy of the state's financial security and its place in the national security system is presented, in which the state's financial security is conventionally divided into three subsystems: the security of state finances; security of the financial market; cyber security of the financial sector (**Fig. 5.1**).

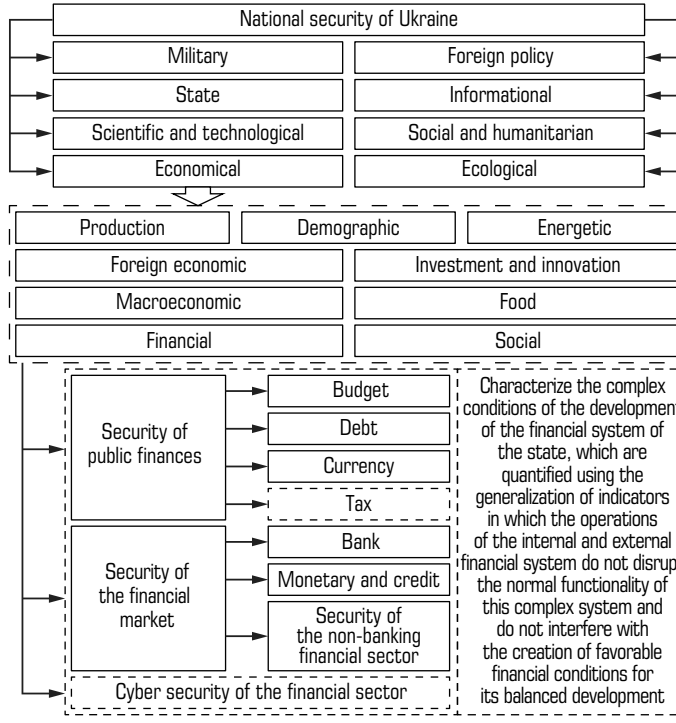

Fig. 5.1 Classification of financial security and its role in the overall structure of the country's national security
Note: systematized and expanded by the authors

In our opinion, the financial sector is the most vulnerable to cyber attacks. It is financial institutions, given their key role as intermediaries in monetary transactions, that become the main targets for cyber attacks, among which: illegal actions on ATMs, financial transactions, destruction of files, introduction of malicious programs into banking systems, incidents affecting internal processes and extortion. Such attacks can cause significant material losses and harm the reputation of financial institutions. That is why a separate subsystem – "cybernetic security of the financial sector" has been singled out in the structure of financial security.

Let's summarize the indicators of the state of financial security of the state, which are proposed for use by domestic legislation [20], in the **Table 5.1**.

Table 5.1 Complex of indicators of the state of financial security of Ukraine

Indicator	Calculation method	Notes
1	**2**	**3**
Bank security		
Share of overdue credit debt to the total volume of loans granted by banks to residents of Ukraine, %	$\frac{LA_o}{LA} \times 100\ \%$	LA_o – overdue loan debt, million UAH; LA – loans granted to residents of Ukraine, million UAH
Ratio of loans and deposits of banks issued in foreign currency, %	$\frac{LAC}{RDC} \times 100\ \%$	LAC – loans granted to residents of Ukraine in foreign currency, million UAH; RDC – deposits raised from residents in foreign currency, million UAH
The specific weight of foreign capital in the total structure of the authorized capital of banking institutions, %	$\frac{FC}{BC} \times 100\ \%$	FC – foreign capital in the authorized capital of banks, million UAH; BC – authorized capital of banking institutions, million UAH
Ratio of loans and deposits (long-term), times	$\frac{LA_{1-5} + LA_{>5}}{RD_{1-5} + RD_{>5}}$	LA_{1-5} – loans granted to residents for a term of 1 to 5 years, million UAH; $LA_{>5}$ – loans granted to residents for a term of more than 5 years, million UAH; RD_{1-5} – deposits attracted for a period of 1 to 5 years from residents, million UAH; $RD_{>5}$ – deposits attracted for a period of more than 5 years from residents, million UAH
Return on assets, %	$\frac{BP}{AV_a} \times 100\ \%$	BP – bank profit after tax, million UAH; AV_a – value of assets of banking institutions, million UAH
Ratio of liquid assets and liabilities (short-term), %	$\frac{AL}{L_{st}} \times 100\ \%$	AL – liquid assets, million UAH; L_{st} – liabilities (short-term), million UAH
The specific weight of the assets of the 5 largest banking institutions in the total assets of the banking system, %	$\frac{BA_5}{BA} \times 100\ \%$	BA_5 – volume of assets of the 5 largest banking institutions, million UAH; BA – assets of banks, million UAH

Continuation of Table 5.1

1	2	3
Security of the financial market (non-banking)		
Insurance penetration level, %	$\frac{GIP}{GDP} \times 100\ \%$	*GIP* – gross insurance premiums, million UAH; *GDP* – gross domestic product, million UAH
Capitalization level of listed companies, % of GDP	$\frac{CSE}{GDP} \times 100\ \%$	*CSE* – assessment of the market value of capital that is traded on stock exchanges in the form of shares, million UAH
Volatility level of the indicator of the First Stock Trading System (hereinafter - FSTS), the number of critical deviations (–10 %)	$\sum_{t=1}^{T} K_i; K_i = \begin{cases} 0, & T_p FSTS \geq 90\ \%; \\ 1, & T_p FSTS < 90\ \%; \end{cases}$ $T_p FSTS = \frac{FSTS_t}{FSTS_{t-1}} \times 100\ \%$	*T* – every Friday of the period
The specific weight of insurance premium income of the 3 largest insurance companies in the structure of insurance premium income, %	$\frac{IP_3}{IP} \times 100\ \%$	IP_3 – insurance premiums of the 3 largest insurance companies (excluding life insurance), million UAH; *IP* – insurance premiums, million UAH
Debt security		
Ratio of public debt (state and state-guaranteed) to GDP, %	$\frac{SD}{GDP} \times 100\ \%$	*SD* – amount of public debt, million UAH
Ratio of gross external debt to GDP, %	$\frac{GED \times AR_{UAN}}{GDP} \times 100\ \%$	*GED* – gross external debt, million USD; AR_{UAN} – average exchange rate of the UAH
Weighted average yield of domestic state loan bonds, %	$\frac{\sum_{n=1}^{N} IB}{n}$	*IB* – yield on domestic state loan bonds; *n* – the number of periods
EMBI+Ukraine index (Emerging Markets Bond Index)	weighted average spread of Eurobonds of Ukraine to the yield level of US bonds	
Ratio of international reserves to gross external debt, %	$\frac{RA}{GED} \times 100\ \%$	*RA* – volume of reserve assets, million USD
Budget security		
Ratio of the state budget deficit to GDP, %	$\frac{SB_d}{GDP} \times 100\ \%$	SB_d – state budget deficit, million UAH
Deficit of budgetary and extra-budgetary funds of the general government sector, % of GDP	$\frac{SA_d - CB_d}{GDP} \times 100\ \%$	SA_d – deficit of the general government sector, million UAH; CB_D – deficit of the consolidated budget, million UAH
GDP redistribution through the combined budget, %	$\frac{CB_r}{GDP} \times 100\ \%$	*CBr* – revenues of the consolidated budget, million UAH

Continuation of Table 5.1

1	2	3
Ratio of debt repayment and service payments to state revenues, %	$\frac{SB_s + SB_r}{SBR} \times 100\ \%$	SB_s – public debt service, million UAH; SBr – repayment of public debt, million UAH; SBR – state budget revenues, million UAH
Currency security		
The average change in the exchange rate of the UAH to the USD for the period	$\frac{AR_{UAN\ n}}{AR_{UAN\ n-1}}$	$AR_{UAN\ n}$ – average UAH to USD exchange rate (current year); $AR_{UAN\ n-1}$ – average UAH to USD exchange rate (previous year)
Gross international reserves of Ukraine, months of imports	$\frac{IR}{AIL}$	IR – international reserves of Ukraine, million USD; AIL – average monthly level of imports, million USD
Share of loans formed in foreign currency in the total amount of loans, %	$\frac{LA_{fc}}{LA} \times 100\ \%$	LAf_c – loans granted in foreign currency to residents, million UAH
Balance of purchase and sale of foreign currency (by population), billion USD	$C_{sp} - C_{bp}$	C_{sp} – volume of sold currency, billion USD; C_{bp} – volume of purchased currency, billion USD
Dollarization of the money supply, %	$D_{ms} = \frac{TD_{fc} + OD_{fc} + SE_{fc}}{M_3} \cdot 100$	D_{mc} – dollarization of the money supply, %; TD_{fc} – transferable deposits (foreign currency); OD_{fc} – other deposits (foreign currency); SE_{fc} – securities (foreign currency); M_3 – money supply [14]
Monetary and credit security		
The specific weight of cash in the structure of the money supply, %	$\frac{M_0}{M_3}$	M_0 – cash in circulation, million UAH; M_3 – money supply, million UAH
The difference between loan and deposit rates, % of points	$LA_{\%} - RD_{\%}$	$LA_{\%}$ – loan rates, %; $RD_{\%}$ – deposit rates, %
Weighted average interest rate on loans in UAH relative to the consumer price index, % points	$LA_{\%aver} - CPI$	$LA_{\%aver}$ – weighted average interest rate on loans in UAH, %; CPI – consumer price index
Share of consumer loans in their overall structure, %	$\frac{LA_{hh}}{LA} \times 100\ \%$	LA_{hh} – consumer loans granted to households
Share of loans (long-term) in their total amount, %	$\frac{\frac{LA_{>5fc}}{AR_{UAN\ n} / AR_{UAN\ n-1}} + LA_{UAH}}{LA} \times 100\ \%$	$LA_{>5fc}$ – loans for a term of more than 5 years (foreign currency); LA_{UAN} – loans in national currency for a term of more than 5 years

Note: summarized by the authors

The main methodology, which in the legislative and regulatory space illuminates the mechanisms for assessing the financial security of Ukraine, is presented in the Methodological recommendations [20], approved on October 29, 2013, which have "informational, advisory, explanatory nature and are not mandatory" [20].

The above recommendations summarize the approaches that allow to quantitatively assess the state of economic stability of Ukraine and the level of financial security as its key component. This methodology contains a list of indicators, their recommended values, as well as procedures for calculating the overall indicator of economic security and its components. These methodological recommendations are based on a complex analysis of indicators of economic stability in order to identify possible threats and are used by the Ministry of Economic Development, Trade and Agriculture of Ukraine for a comprehensive assessment of the level of economic security [20]. Accordingly, this technique should be used to monitor the components of financial security in order to make management decisions regarding the analysis, prevention and elimination of real and potential threats in the field of finance.

To assess the level of financial security, it is necessary to assess the state of its components (their integral indices) using the analysis of the values of a set of indicators selected according to the principles of reliability, representativeness and information availability. So, for example, Ukraine's debt security is characterized by a set of numerical indicators that can be highlighted in the form of a vector. The set of indicators (components of the vector) is partly based on statistical data, and partly on data obtained by the method of expert evaluation.

Indicators of the level of financial security of the state are interconnected indicators of the state of the financial system, which quantitatively reflect the level of risk and have a high sensitivity and signaling ability to warn scientists, the state and market participants about probable threats that arise as a result of changes in macroeconomic conditions, and adoption management decisions in the field of finance.

Let's note that for each of the indicators of the state of financial security, the set of which is divided into three types depending on their economic content (stimulators, destimulators, mixed), ranges of characteristic values are defined.

5.2 ANALYSIS OF THE STATE OF FINANCIAL SECURITY OF UKRAINE AS A BASIS FOR ENSURING THE ECONOMIC SECURITY OF THE STATE

The security of state finances is classified into budgetary, debt, currency and tax security of the state, which we have singled out. Taking the above as a basis, let's analyze the state of these subsystems during 2009–2022, using the Methodology [20].

It is advisable to consider the state's debt security as the optimal ratio between borrowing (internal and external) taking into account certain indicators, such as the cost of servicing and the total amount of public debt [21, 22].

Let's analyze the value of the above-mentioned indicators in 2009–2022 and summarize the normalized indicators in the integrated index of the state of debt security for their further forecasting in the medium term. The input data for determining the set of debt security indicators proposed by the Ministry of Economic Development and Trade of Ukraine are presented in the **Table 5.2**.

Table 5.2 Input information for calculating indicators of Ukraine's debt security

Years						
GDP of Ukraine, billion UAH						
2009	2010	2011	2012	2013	2014	2015
913.3	1082.6	1316.6	1408.9	1454.9	1566.7	1979.5
2016	2017	2018	2019	2020	2021	2022
2383.2	2982.9	3558.7	3974.6	4194.1	5459.6	5191.0
GDP of Ukraine, billion USD						
2009	2010	2011	2012	2013	2014	2015
117.2	136.4	163.2	175.8	183.3	131.8	90.6
2016	2017	2018	2019	2020	2021	2022
93.3	112.2	130.8	153.8	155.6	199.8	160.5
State debt of Ukraine (state and state-guaranteed), billion UAH						
2009	2010	2011	2012	2013	2014	2015
316.9	432.2	473.1	515.5	584.1	1100.6	1572.2
2016	2017	2018	2019	2020	2021	2022
1929.8	2141.7	2168.6	1998.3	2551.9	2671.8	4071.7
Public debt of Ukraine (state and state-guaranteed), billion USD						
2009	2010	2011	2012	2013	2014	2015
39.69	54.29	59.22	64.50	73.08	69.79	65.51
2016	2017	2018	2019	2020	2021	2022
70.97	76.31	78.32	84.36	90.26	97.95	111.34
Gross foreign debt of Ukraine, billion USD						
2009	2010	2011	2012	2013	2014	2015
103.4	117.3	126.2	135.1	142.1	126.3	118.7
2016	2017	2018	2019	2020	2021	2022
113.5	116.6	114.7	121.7	125.7	129.7	132.0
Official international reserves, billion USD						
2009	2010	2011	2012	2013	2014	2015
26.5	34.6	31.8	24.5	20.4	7.5	13.3
2016	2017	2018	2019	2020	2021	2022
15.5	18.8	20.8	25.3	29.1	30.9	28.5

Note: summarized by the authors based on data [23–25]

Let's present the data on the aggregate state debt of Ukraine in **Fig. 5.2**.

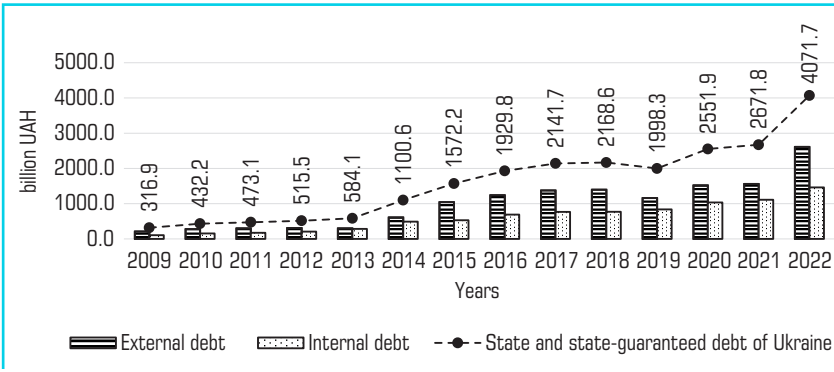

Fig. 5.2 Dynamics of the volumes of the state debt of Ukraine
Note: calculated by the authors based on [25]

In our opinion, it is appropriate to analyze the dynamics of the gross domestic product of Ukraine simultaneously in the national monetary unit and in USD. Let's highlight the graphically obtained indicators of Ukraine's GDP for 2009–2022 in **Fig. 5.3**.

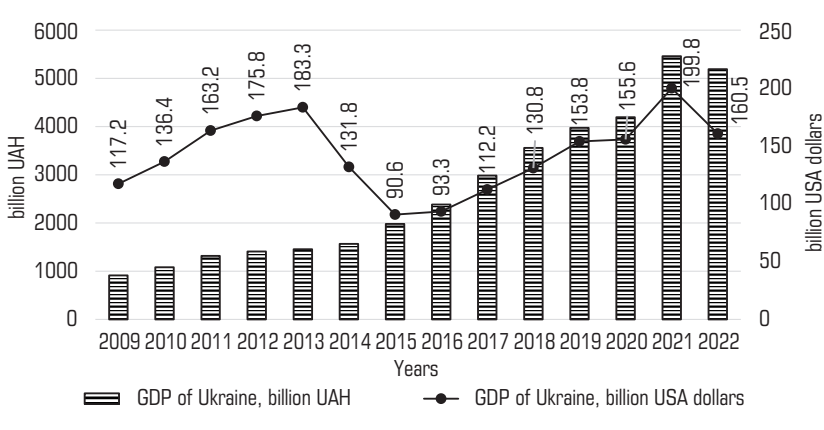

Fig. 5.3 Dynamics of Ukraine's GDP for 2009–2022
Note: summarized by the authors based on [25]

Analyzing the data of **Fig. 5.3**, it is appropriate to pay attention to the fact that the GDP of the state, calculated in the national monetary unit, has a steady upward trend (from 913.3 billion UAH according to the results of 2009 to 5191.0 billion UAH in 2022). The GDP of Ukraine, defined

in USD, steadily increased during 2009–2013 (from 117.2 billion USD in 2009 to 183.3 billion USD in 2013), in 2014 the indicator decreased to 131, 8 billion USD or by 28 % compared to 2013. During 2015–2017, the studied indicator did not exceed the value of the crisis year of 2009 at all, being in the range of 90.6–106.3 billion USD. As of the end of 2022, the GDP of Ukraine, defined in USD, amounted to 165.5 billion USD. Using the statistical data highlighted in the **Table 5.3**, let's calculate the absolute values of indicators of the state of debt security of Ukraine and present them in the **Table 5.3**.

Table 5.3 Dynamics of Ukraine's debt security

Years						
Ratio of public debt (state and state-guaranteed) to GDP, % (x_1)						
2009	2010	2011	2012	2013	2014	2015
34.7	39.9	35.9	36.6	40.1	70.2	79.4
2016	2017	2018	2019	2020	2021	2022
81.0	71.8	60.9	50.3	60.9	48.9	78.4
Ratio of gross external debt to GDP, % (x_2)						
2009	2010	2011	2012	2013	2014	2015
88.2	86.0	77.4	76.8	77.5	95.8	131.0
2016	2017	2018	2019	2020	2021	2022
121.7	103.9	87.7	79.2	80.8	64.8	82.2
Weighted average yield of domestic loan bonds, % (x_3)						
2009	2010	2011	2012	2013	2014	2015
12.2	10.4	9.2	12.9	13.1	13.4	13.1
2016	2017	2018	2019	2020	2021	2022
9.2	10.5	17.8	16.9	10.2	11.3	18.3
EMBI+Ukraine index, % (x_4)						
2009	2010	2011	2012	2013	2014	2015
1606.2	556.0	549.4	765.2	680.9	2226.0	2374.6
2016	2017	2018	2019	2020	2021	2022
590.9	691.4	825.5	770.3	1011.9	1082.0	1093.0
The ratio of international reserves to gross external debt, % (x_5)						
2009	2010	2011	2012	2013	2014	2015
25.63	29.47	25.19	18.17	14.37	5.96	11.20
2016	2017	2018	2019	2020	2021	2022
13.69	16.12	18.15	20.78	23.18	23.85	21.59

*Note: calculated by the authors according to the data in the **Table 5.2** based on the methodology [20]*

Analytical data of **Table 5.3** show that the ratio of public debt to GDP increased from 34.7 % in 2009 to 78.4 % as of 2022, which exceeds the legally established threshold (critical) level. Let's draw attention to the fact that the value of this indicator has been in a permanently critical state since 2014 (**Fig. 5.4**).

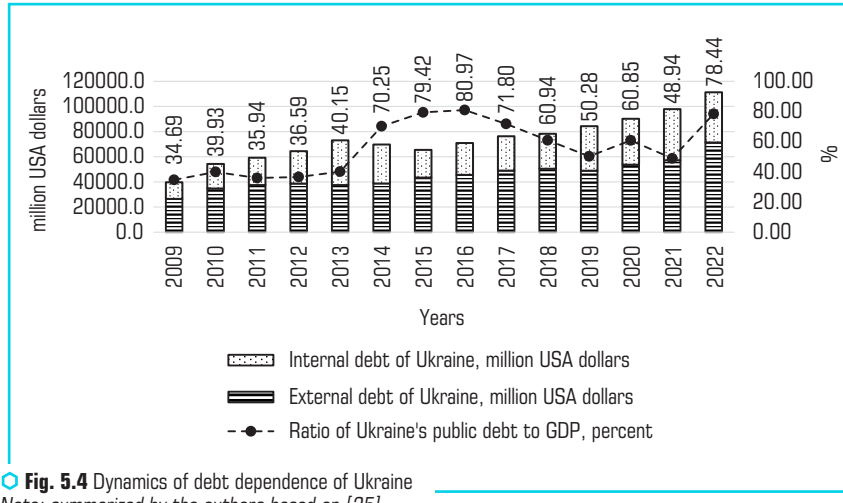

Fig. 5.4 Dynamics of debt dependence of Ukraine
Note: summarized by the authors based on [25]

During the period of sovereign development, in our opinion, there was an atmosphere of too rapid increase in the state's debt obligations, which caused a weakening of the activity of the inflow of foreign investments due to an objective increase in the level of risk for foreign investors. Let's agree with the opinion about the emergence of a debt spiral, i.e. a situation where the budget deficit requires additional government borrowing, accordingly, the public debt and the costs of its maintenance increase, which again cause the budget deficit [26].

Having analyzed the comparative data on the size of the public debt of different countries of the world and their credit ratings, as well as the data of the medium-term Strategy for the management of the public debt of Ukraine for 2021–2024 [21], 15 peer countries (**Table 5.4**) were selected for the analysis of the level of debt dependence (**Fig. 5.5**).

Comparing the structure of the total debt of Ukraine and the average similar indicators for the formed groups of countries (**Fig. 5.5**), there are indisputable statements that the indicator of the specific weight of external public debt in Ukraine (78.4 %) is significantly higher than the average indicators in the three analysis groups (38–56 %), in addition, the structure of public debt by instruments also has its own characteristics: the specific weight of marketable securities is lower than the average indicators of analytical groups, and the non-marketable public debt, on the contrary, is higher.

Table 5.4 The set of countries selected for comparison of levels of debt dependence of Ukraine, 2023

Developing countries that significantly influence the economic development of their region ("Development" group)			**Countries selected by the criterion of geographical proximity to Ukraine ("Region" group)**			**Countries with similar credit ratings of international rating agencies ("Rating" group)**		
S&P	Moody's	Fitch	S&P	Moody's	Fitch	S&P	Moody's	Fitch
Turkey			Poland			Pakistan		
BB–	Ba2	BB+	BBB+	A2	A–	B	B3	B
Nigeria			Bulgaria			Macedonia		
B	B2	B+	BBB–	Baa2	BBB	BB–	NR	BB+
Thailand			Croatia			Iraq		
BBB+	Baa1	BBB+	BB+	Ba2	BB+	B–	Caa1	B–
Uruguay			Czech Republic			Lebanon		
BBB	Baa2	BBB–	AA–	A1	A+	B–	B3	B–
			Serbia			Ghana		
			BB	Ba3	BB	B–	B3	B
			Hungary			**Ukraine**		
			BBB–	Baa3	BBB–	B–	**Caa2**	**B**–

Note: created by the author using data [21] and rating agencies S&P, Moody's, Fitch

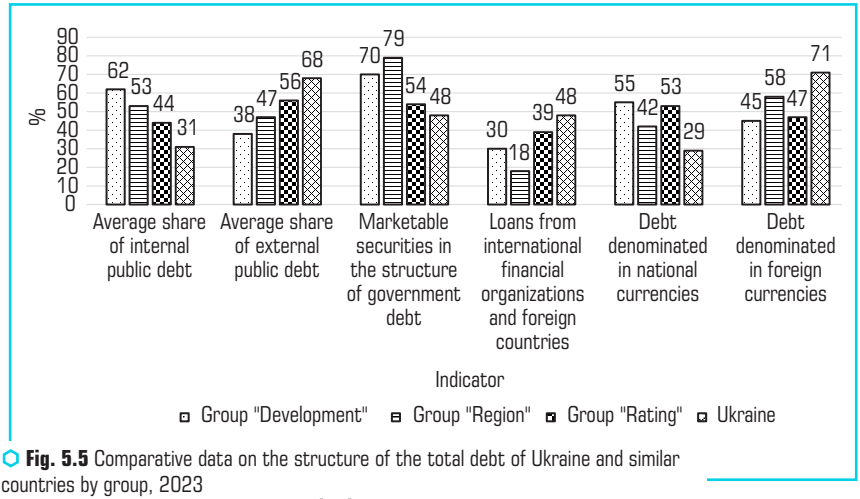

Fig. 5.5 Comparative data on the structure of the total debt of Ukraine and similar countries by group, 2023
Note: created by the author using data [21] and rating agencies S&P, Moody's, Fitch

Loans from international financial organizations and governments of foreign countries in the structure of the total public debt of Ukraine make up 48 %, which is significantly more compared to the average indicators of all comparison groups. The structure of state debt in relation to currency

is also highlighted. Thus, Ukraine recorded the lowest rate of public debt denominated in the national currency (29 %), compared to the average rates for all analytical groups (42–55 %), which definitely increases currency risks. In international practice, the analysis of the level of foreign debt per person is also used. Note that Ukraine's gross external debt per person increased from 2,245.3 USD in 2009 to 3207.8 USD in 2023. Let's present the dynamics of normalized values of indicators of Ukraine's debt security for 2009–2023 in the **Table 5.5**.

Table 5.5 Dynamics of normalized values of indicators of Ukraine's debt security

Years						
Ratio of public debt (state and state-guaranteed) to GDP, % (x_1)						
2009	2010	2011	2012	2013	2014	2015
0.71	0.60	0.68	0.67	0.60	0.17	0.15
2016	2017	2018	2019	2020	2021	2022
0.15	0.17	0.20	0.39	0.20	0.42	0.15
Ratio of gross external debt to GDP, % (x_2)						
2009	2010	2011	2012	2013	2014	2015
0.16	0.16	0.18	0.18	0.18	0.15	0.11
2016	2017	2018	2019	2020	2021	2022
0.12	0.13	0.16	0.18	0.17	0.30	0.17
Weighted average yield of domestic loan bonds, % (x_3)						
2009	2010	2011	2012	2013	2014	2015
0.18	0.26	0.38	0.17	0.16	0.16	0.17
2016	2017	2018	2019	2020	2021	2022
0.16	0.25	0.12	0.13	0.28	0.19	0.12
EMBI+Ukraine index, % (x_4)						
2009	2010	2011	2012	2013	2014	2015
0.12	0.54	0.55	0.36	0.42	0.09	0.08
2016	2017	2018	2019	2020	2021	2022
0.51	0.46	0.32	0.35	0.20	0.18	0.18
Ratio of international reserves to gross external debt, % (x_5)						
2009	2010	2011	2012	2013	2014	2015
0.27	0.32	0.27	0.18	0.14	0.06	0.11
2016	2017	2018	2019	2020	2021	2022
0.14	0.16	0.18	0.21	0.24	0.25	0.22
Integrated index of debt security, % (x_6)						
2009	2010	2011	2012	2013	2014	2015
0.30	0.38	0.41	0.32	0.30	0.13	0.12
2016	2017	2018	2019	2020	2021	2022
0.21	0.23	0.19	0.25	0.22	0.28	0.17

Note: calculated by the authors taking into account the methodology [20]

Therefore, having studied the state and trends of debt security of Ukraine, let's come to the conclusion that the vast majority of indicators of the state of debt security during the last period are in the zone of critical values, which confirms the negative influence of the state of debt security of the state on the level of its financial security [27, 28].

Let's analyze the state of budget security of Ukraine for 2009–2022 and summarize the results of the analysis in **Table 5.6**.

The intense hostilities in Ukraine, which began on February 24, 2022, led to the fact that the Government immediately introduced a number of measures in connection with martial law. Among these measures was the reorientation of the country's budget to military needs and spending on the most necessary social and humanitarian goals, which are aimed at supporting the population and internally displaced persons, as well as ensuring the operation of critical infrastructure. Due to a shortage of domestic resources in a war-torn economy, significant amounts of foreign aid from international partners have helped to finance priority expenditures on time and in full, including pensions, social benefits, salaries of medical and educational personnel, as well as spending on security, defense, health care. self and education [29].

Table 5.6 Dynamics of the state of budgetary security of Ukraine

Years						
Ratio of deficit/surplus of the state budget to GDP, % (x_1)						
2009	2010	2011	2012	2013	2014	2015
–3.89	–5.94	–1.79	–3.79	–4.45	–4.98	–2.28
2016	2017	2018	2019	2020	2021	2022
–2.94	–1.60	–1.66	–1.96	–5.18	–3.63	–17.62
Deficit of budgetary and extra-budgetary funds of the general government sector, % of GDP (x_2)						
2009	2010	2011	2012	2013	2014	2015
–2.02	–0.71	–0.86	–0.53	0.05	–0.23	–0.11
2016	2017	2018	2019	2020	2021	2022
0.13	0.03	–0.21	–0.01	–0.31	1.06	9.25
GDP redistribution through the combined budget, % (x_3)						
2009	2010	2011	2012	2013	2014	2015
29.89	29.05	30.27	31.62	30.43	29.11	32.94
2016	2017	2018	2019	2020	2021	2022
32.84	34.09	33.28	32.45	32.82	30.45	42.31
The ratio of service payments and repayment of the state debt to budget revenues, % (x_4)						
2009	2010	2011	2012	2013	2014	2015
18.54	17.02	26.86	26.76	33.58	47.42	59.22
2016	2017	2018	2019	2020	2021	2022
37.48	59.80	37.80	46.67	47.21	46.61	34.43

Note: calculated and systematized by the authors based on the methodology [20]

Let's present the normalized indicators of budget security of Ukraine for 2009–2022 and summarize the results of the analysis in **Table 5.7**.

Table 5.7 State dynamics of normalized indicators of budget security of Ukraine

Years						
Ratio of the state budget deficit to GDP, % (x_1)						
2009	2010	2011	2012	2013	2014	2015
0.62	0.21	1.00	0.64	0.51	0.40	0.94
2016	2017	2018	2019	2020	2021	2022
0.81	1.00	1.00	1.00	0.36	0.70	0.05
Deficit of budgetary and extra-budgetary funds of the general government sector, % of GDP (x_2)						
2009	2010	2011	2012	2013	2014	2015
1.00	0.86	0.83	0.89	1.00	0.95	0.98
2016	2017	2018	2019	2020	2021	2022
0.96	0.99	0.96	1.00	0.94	0.82	0.11
GDP redistribution through the combined budget, % (x_3)						
2009	2010	2011	2012	2013	2014	2015
0.81	0.90	0.78	0.69	0.77	0.89	0.60
2016	2017	2018	2019	2020	2021	2022
0.61	0.49	0.57	0.64	0.61	0.77	0.17
The ratio of payments for repayment and maintenance of the state debt to budget revenues, % (x_4)						
2009	2010	2011	2012	2013	2014	2015
0.17	0.19	0.12	0.12	0.10	0.07	0.05
2016	2017	2018	2019	2020	2021	2022
0.09	0.05	0.08	0.07	0.07	0.07	0.09
Integral indicator of budget security of Ukraine, % (x_5)						
2009	2010	2011	2012	2013	2014	2015
0.64	0.52	0.68	0.58	0.58	0.56	0.64
2016	2017	2018	2019	2020	2021	2022
0.61	0.64	0.65	0.67	0.48	0.58	0.10

Note: calculated and systematized by the authors based on the methodology [20]

During 2022, the arrival of international financial aid and the recovery of export earnings contributed to the maintenance of relative macro-financial stability and the gradual stabilization of inflationary and devaluation expectations due to the reduction of volatility in the foreign exchange market.

As of January 1, 2023, international reserves of Ukraine amounted to 28.5 billion USD. During 2022, international reserves decreased by 7.9 %, but foreign currency receipts from international partners made it possible to form the volume of international reserves, which corresponded

to 3.6 months of future imports. According to the results of 2022, the surplus of the current account of the balance of payments amounted to 8.6 billion USD. This was largely the result of receiving grants from international partners and the reduction of payments for investment income. The negative balance of trade in goods and services increased due to a sharp decrease in exports of goods and services by 29.9 %, while imports decreased by only 3.9 %.

Therefore, the security level of the budgetary sphere of Ukraine during the analysis period ranged from 64 % in 2009 to 10 % according to the results of 2022, which is characterized as a critical value of the security state of the budgetary sphere of Ukraine.

The next subsystem of the security of state finances and, accordingly, the financial security of Ukraine, the state of which must be analyzed, is currency security, which in the official methodology of the Ministry of Economic Development and Trade is considered as the state of exchange rate formation, which is characterized by the stability of the national currency and the trust of the population in it, and in in which the conditions for attracting foreign investments, progressive development of the economy, and integration aspects are being formed in the state [20].

The first indicator of assessing the state of currency security is the average indicator of changes in the official exchange rate of the UAH to the USD, which is determined by dividing the average official exchange rate in the current period by a similar indicator in the previous period (**Fig. 5.6**).

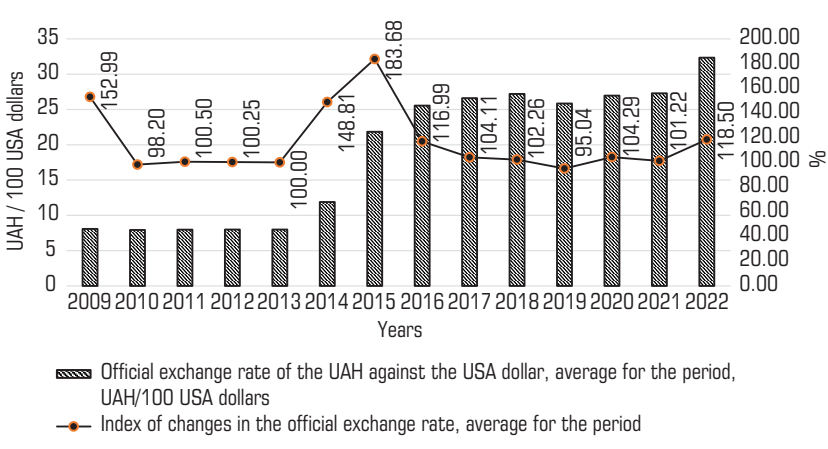

Fig. 5.6 Dynamics of changes in the official exchange rate of Ukraine
Note: summarized by the authors based on data [24]

It should be noted that during the war, the fixed exchange rate made it possible to preserve the stability of the financial system, and for the population and business to partially adapt to life in extremely difficult crises. Over time, these restrictions have caused more problems than good. In 2023, the exchange rate of the national currency is already determined according to general

practice based on the exchange rate for currency transactions on the interbank market. The main prerequisite for such changes was a slowdown in inflation. The second prerequisite was significant foreign exchange reserves of more than 40 billion USD. The third prerequisite was the yield level of UAH deposits (about 15 %), which covers both inflation and exchange rate fluctuations. Let's note that the National Bank cites the accumulation of imbalances in the national economy among the reasons for the above-mentioned changes. An artificially strong national currency significantly reduces the income of exporters and the income of the state budget. In addition, in the conditions of martial law, the vast majority of budget expenditures, which are not directly related to the defense of the state, are financed with the help of international partners, which comes in foreign currency. Accordingly, a weaker UAH makes aid from international partners larger in UAH equivalent, and the government gains room for maneuvers with the financing of social expenditures due to the exchange rate difference.

The next indicator of Ukraine's foreign exchange security status highlights information on Ukraine's gross international reserves, expressed in months of imports (**Fig. 5.7**).

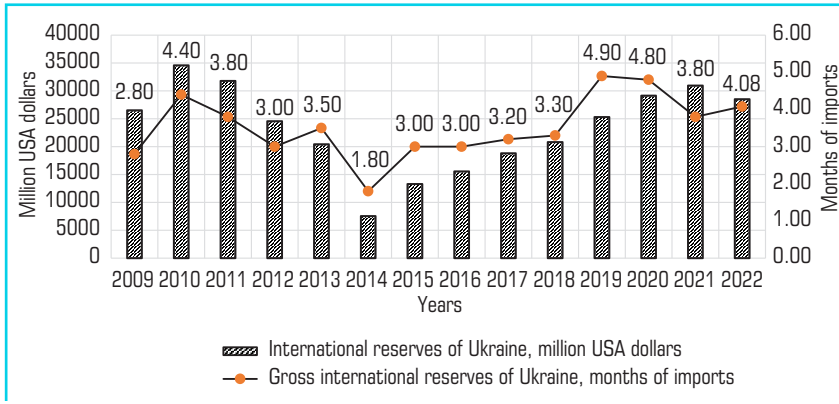

Fig. 5.7 Dynamics of Ukraine's international reserves
Note: summarized by the authors based on data [24]

According to the Methodology [20], the optimal value of this indicator is 5 months, and the range of values [3; 5] is considered satisfactory. Therefore, even during the war period, as of the end of 2022, international reserves amount to 28.5 billion USD, which corresponds to 4.08 months of imports. The next disincentive indicator of the currency security of Ukraine is the share of foreign currency loans in the total volume of loans. According to the results of expert assessment, it is considered that the optimal value of this indicator should not exceed 20 % [20], while a value of 50 % indicates a critical state of this indicator. For the period 2016–2018, the value of the indicator exceeds 40 %, which signals a dangerous or even critical state of the indicator (**Fig. 5.8**).

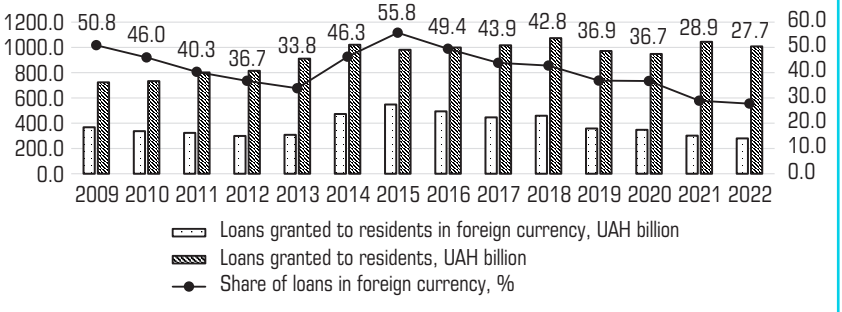

Fig. 5.8 Loans in foreign currency in Ukraine
Note: calculated by the authors based on data [24]

The next indicator of the mixed type of state of currency security of the state in the system of its financial security is the balance of purchase and sale of foreign currency by the population, the optimal value of which is a value close to zero. This indicator is calculated in billion USD by subtracting the amount of currency bought by the population from the amount of currency sold. The peculiarity of the dynamics of the values of this indicator is that during 2009–2013 the volume of sold currency exceeded the volume of purchased currency in the population and the balance of this value was in the range [2.9; 13.4], and since 2014 the situation has changed, and exceeded the amount of currency purchased from the population. Despite this feature, the normalized values of the indicator during the entire period under study are in the zone of dangerous and critical values, which indicates the presence of certain problems in the process of ensuring the currency security of the state.

The indicator-disincentive of the security state of the currency sphere is the dollarization of the money supply (5.1), the optimal value of which should not exceed 15 %, while a value of 30 % is already considered critical in the process of analyzing the state of financial security of Ukraine:

$$D_{ms} = \frac{TD_{fc} + OD_{fc} + SE_{fc}}{M_3} \cdot 100, \qquad (5.1)$$

where D_{mc} – dollarization of the money supply, %; TD_{fc} – transferable deposits (foreign currency); OD_{fc} – other deposits (foreign currency); SE_{fc} – securities (foreign currency); M_3 – money supply [20].

Let's summarize the obtained values of indicators of the state of currency security of Ukraine for 2009–2022 in the **Table 5.8**.

It is impossible to ignore the systematization of the received normalized values of indicators of the state of currency security of Ukraine for 2009–2022 (**Table 5.9**), which will be summarized in the integral index of currency security of the corresponding period.

Therefore, there is an indisputable statement that during the studied period, the state of currency security cannot be assessed as satisfactory. A positive trend, in our opinion, was the upward dynamics of the integral indicator of the state of currency security during 2014–2021, accordingly, it is possible to speak with caution about positive trends and strengthening of the state of currency security, however, military actions on the territory of Ukraine have catastrophically worsened and the state of currency security of Ukraine.

Table 5.8 Dynamics of the state of currency security of Ukraine

Years						
Change in the official exchange rate of the UAH to the USD, average for the period (x_1)						
2009	2010	2011	2012	2013	2014	2015
152.99	98.20	100.50	100.25	100.00	148.81	183.68
2016	2017	2018	2019	2020	2021	2022
116.99	104.11	102.26	95.04	104.29	101.22	118.50
Gross international reserves of Ukraine, months of imports (x_2)						
2009	2010	2011	2012	2013	2014	2015
2.80	4.40	3.80	3.00	3.50	1.80	3.00
2016	2017	2018	2019	2020	2021	2022
3.00	3.20	3.30	4.90	4.80	3.80	4.08
Share of foreign currency loans in the total volume of loans, % (x_3)						
2009	2010	2011	2012	2013	2014	2015
50.85	46.03	40.31	36.75	33.82	46.31	55.81
2016	2017	2018	2019	2020	2021	2022
49.43	43.87	42.78	36.85	36.68	28.90	27.73
Balance of purchase and sale of foreign currency (by population), billion USD (x_4)						
2009	2010	2011	2012	2013	2014	2015
0.57	–9.70	–13.40	–10.20	–1.20	2.40	1.50
2016	2017	2018	2019	2020	2021	2022
2.50	2.10	1.50	0.20	1.10	1.20	23.10
Dollarization of the money supply, % (x_5)						
2009	2010	2011	2012	2013	2014	2015
29.1	29.1	30.4	32.1	27.2	32.6	32.2
2016	2017	2018	2019	2020	2021	2022
32.9	31.9	29.2	28.7	26.9	23	32

Note: calculated by the authors based on the methodology [20]

Table 5.9 Dynamics of normalized values of indicators of the state of currency security of Ukraine

Years						
The average change in the exchange rate of the UAH to the USD for the period (x_1)						
2009	2010	2011	2012	2013	2014	2015
0.17	1.00	1.00	1.00	1.00	0.17	0.14
2016	2017	2018	2019	2020	2021	2022
0.35	0.99	1.00	0.98	0.97	1.00	0.33
Gross international reserves of Ukraine, months of imports (x_2)						
2009	2010	2011	2012	2013	2014	2015
0.72	0.94	0.88	0.80	0.85	0.32	0.80
2016	2017	2018	2019	2020	2021	2022
0.80	0.82	0.83	0.99	0.98	0.88	0.91
The share of foreign currency loans in the total volume of loans, % (x_3)						
2009	2010	2011	2012	2013	2014	2015
0.20	0.36	0.52	0.61	0.69	0.36	0.18
2016	2017	2018	2019	2020	2021	2022
0.22	0.43	0.46	0.60	0.61	0.82	0.85
Balance of purchase and sale of foreign currency (by population), billion USD (x_4)						
2009	2010	2011	2012	2013	2014	2015
0.98	0.05	0.03	0.04	0.95	0.90	0.94
2016	2017	2018	2019	2020	2021	2022
0.90	0.92	0.94	0.99	0.96	0.95	0.05
Dollarization of the money supply, % (x_5)						
2009	2010	2011	2012	2013	2014	2015
0.26	0.26	0.20	0.19	0.39	0.18	0.19
2016	2017	2018	2019	2020	2021	2022
0.18	0.19	0.25	0.29	0.41	0.65	0.19
Integral index of currency security, % (x_6)						
2009	2010	2011	2012	2013	2014	2015
0.41	0.47	0.47	0.47	0.67	0.34	0.40
2016	2017	2018	2019	2020	2021	2022
0.43	0.59	0.61	0.67	0.68	0.75	0.40

*Note: calculated by the authors according to the information in the **Table 5.8** based on the methodology [20]*

The main idea of the structure of the financial security of Ukraine proposed by us is that the security of the financial market, as an important component of the financial security of the state, consists of the security of the banking sphere, the monetary sphere and the sphere of the non-banking financial sector. Accordingly, it is time to review the state of these components, the results of which will be the basis for developing strategic vectors for improving the state of security of the financial market of Ukraine and, accordingly, its financial security. Developed and efficient insurance companies, banking institutions and other elements of the financial market are a guarantee of the development of the state's financial system.

The first component of the security of the financial market is banking security of Ukraine, which in the methodology of the Ministry of Economic Development and Trade is considered as the level of financial stability of banking institutions, which, regardless of the conditions of the functioning of the banking system, forms the possibility of its protection from destabilizing factors [20].

One of the priority indicators of the state of banking security, which characterizes certain trends regarding changes in its level, is the specific weight of overdue debt on loans (x_1), the optimal value of which is set at the level of 2 %, and the critical value at the level of 7 %.

The military aggression against Ukraine caused, among other things, the cessation of the long-term trend of a gradual decrease in the share of non-performing loans (NPL), which was observed since 2018. During this period, the volume of NPLs decreased by almost 300 billion UAH, and their share in the loan portfolio decreased from 55 % to 27 % as of March 1, 2022. From March to May 2022, the share of non-performing loans remained almost stable, taking into account the change in regulatory requirements for credit risk assessment. From June 2022, banking institutions began to recognize NPLs. As of January 1, 2023, the share of non-performing loans increased to 38 %, and the total amount of non-performing loans from March to December 2022 increased by 127 billion UAH and amounted to 432 billion UAH.

One of the indicators of the state of banking security of the state according to the Methodology [20] is the ratio of loans and deposits issued by banking institutions in foreign currency. It is quite logical that the optimal range for this indicator is a value close to 100 %, and more precisely the range from 90 % to 110 %. Note that absolutely dangerous values for this mixed type indicator are values lower than 50 % and higher than 180 %. Let's note that according to the results of 2022, this indicator was only 40.86 %, which corresponds to a critical level.

The ratio of foreign capital in the authorized capital of banking institutions is also determined as an indicator, the analysis of which makes it possible to assess the state of banking security of the state. So, the optimal range for this mixed-type indicator is considered to be from 20 % to 25 %. The results of monitoring the state and development of trends in the increase of foreign capital in the total authorized capital of banking institutions prove that in 2015–2017, about half of the available authorized capital of banks was formed at the expense of foreign capital, which was a dangerous signal for forecasting and assessing the state of banking security in Ukraine. During 2018–2021, it was at the level of 28 %, which corresponded to a satisfactory level of

banking security. According to the results of 2022, the share of foreign capital in the authorized capital of banking institutions was 14.3 %.

In order to carry out a comprehensive assessment of the state of banking security in Ukraine, the ratio of long-term loans and deposits is also calculated. The optimal value of the indicator should not exceed one, and a value close to 3 is considered critical. Thus, the normalized values of the indicator provide grounds for concluding that since 2015 the values have been in the range of critical indicators that ensure the level of banking security in this area at a level no higher 20 %. Thus, according to the results of 2022, long-term loans exceeded long-term deposits by 3.6 times, which signals the distrust of the stakeholders of the banking system in keeping funds in it.

A mixed-type indicator in the process of analyzing the state of banking security in Ukraine is the profitability of the assets of banking institutions for the corresponding period, the optimal values of which should be in the range [1; 1.5]. The analysis revealed that the actual values of the indicator approached the optimal range only in 2018, in which the return on assets was 1.7 %, which corresponds to 92 % of the safety level of this indicator. The minimum value of the analyzed indicator was recorded in 2016 and was –12.6 %.

The ratio of liquid assets of banking institutions to their short-term liabilities of the corresponding period is considered in the process of assessing the state of banking security as the sixth indicator of a mixed type, the optimal values of which should be close to unity. This indicator is one of the economic norms established by the NBU for the purpose of control. It defines the minimum actual volume of assets to effectively ensure the fulfillment of obligations. The NBU regulations stipulate that the value of this indicator should not be less than 60 %. It should be noted that in the Methodology of the Ministry of Economic Development and Trade [20] 60 % is a value that is actually in the range of critical values.

One of the indicators for assessing the state of banking security is the specific weight of the assets of the 5 largest banking institutions in the total assets of the state's banking system. As of January 1, 2023, the largest banking institutions were four banks with a state share: JSC KB "PrivatBank" (total assets – 734.413 billion UAH), JSC "Oschadbank" (total assets – 298.158 billion UAH), JSC "Ukreximbank" (total assets assets – 256.500 billion UAH), JSC "Ukrgasbank" (total assets – 146.351 billion UAH), as well as one bank of foreign banking groups JSC "Raiffeisen Bank Aval" (total assets – 187.290 billion UAH). Accordingly, according to the results of 2022, the total assets of these 5 largest banking institutions amounted to 1,622.712 billion UAH, or 68.94 % of all bank assets.

System data on the state and certain trends of changes in the level of banking security indicators are presented in the **Table 5.10**.

Values of indicators of banking security in accordance with the approved methodology [20] should be translated into normalized values, which are calculated and systematized in the **Table 5.11**.

Fig. 5.9 presents the dynamics of the values of the integral index of banking security of Ukraine for 2009–2022 and the forecast made using the polynomial trend line of the 6th degree (R^2=0.68).

Table 5.10 Dynamics of the absolute values of indicators of the banking security of Ukraine

Years						
Share of overdue credit debt to the total volume of loans granted by banks to residents of Ukraine, % (x_1)						
2009	2010	2011	2012	2013	2014	2015
5.64	11.20	9.60	8.90	10.90	16.30	24.80
2016	2017	2018	2019	2020	2021	2022
28.20	54.50	52.80	48.40	41.00	30.00	38.00
Ratio of loans and deposits of banks issued in foreign currency, % (x_2)						
2009	2010	2011	2012	2013	2014	2015
215.94	190.20	153.00	118.80	124.10	152.70	168.60
2016	2017	2018	2019	2020	2021	2022
134.50	109.40	117.00	83.50	68.50	62.00	40.86
The specific weight of foreign capital in the general structure of the authorized capital of banking institutions, % (x_3)						
2009	2010	2011	2012	2013	2014	2015
36.70	40.60	41.90	39.50	34.00	32.50	44.00
2016	2017	2018	2019	2020	2021	2022
48.80	48.80	28.00	28.70	28.10	28.00	14.30
Ratio of loans and deposits (long-term), times (x_4)						
2009	2010	2011	2012	2013	2014	2015
6.17	3.75	3.10	2.37	1.76	2.83	3.89
2016	2017	2018	2019	2020	2021	2022
4.13	3.28	3.80	3.80	3.30	3.50	3.60
Return on assets, % (x_5)						
2009	2010	2011	2012	2013	2014	2015
–4.38	–1.50	–0.80	0.50	0.10	–4.07	–5.50
2016	2017	2018	2019	2020	2021	2022
–12.60	–1.90	1.70	4.30	2.40	4.10	–0.50
Ratio of liquid assets and liabilities (short-term), % (x_6)						
2009	2010	2011	2012	2013	2014	2015
35.88	91.19	94.73	90.28	89.11	86.14	92.87
2016	2017	2018	2019	2020	2021	2022
92.09	98.37	93.50	91.00	86.80	89.10	85.90
The specific weight of the assets of the 5 largest banking institutions in the total assets of the banking system, % (x_7)						
2009	2010	2011	2012	2013	2014	2015
32.54	37.00	36.60	38.60	40.00	43.40	53.6
2016	2017	2018	2019	2020	2021	2022
55.6	59.7	60.2	61.4	58.7	55.4	68.94

Note: calculated by the authors

Table 5.11 Dynamics of normalized values of indicators of the state of banking security of Ukraine

Years						
1	**2**	**3**	**4**	**5**	**6**	**7**
Share of overdue credit debt to the total volume of loans granted by banks to residents of Ukraine, % (x_1)						
2009	2010	2011	2012	2013	2014	2015
0.34	0.13	0.15	0.16	0.13	0.09	0.06
2016	2017	2018	2019	2020	2021	2022
0.05	0.03	0.03	0.03	0.03	0.05	0.04
Ratio of loans and deposits of banks issued in foreign currency, % (x_2)						
2009	2010	2011	2012	2013	2014	2015
0.17	0.19	0.47	0.91	0.86	0.47	0.31
2016	2017	2018	2019	2020	2021	2022
0.71	1.00	0.93	0.46	0.22	0.28	0.16
The specific weight of foreign capital in the total structure of the authorized capital of banking institutions, % (x_3)						
2009	2010	2011	2012	2013	2014	2015
0.53	0.39	0.39	0.42	0.64	0.70	0.36
2016	2017	2018	2019	2020	2021	2022
0.31	0.31	0.88	0.85	0.88	0.88	0.54
Ratio of loans and deposits (long-term), times (x_4)						
2009	2010	2011	2012	2013	2014	2015
0.10	0.16	0.19	0.36	0.61	0.24	0.15
2016	2017	2018	2019	2020	2021	2022
0.15	0.18	0.16	0.16	0.18	0.17	0.17
Return on assets, % (x_5)						
2009	2010	2011	2012	2013	2014	2015
0.05	0.13	0.24	0.80	0.64	0.05	0.04
2016	2017	2018	2019	2020	2021	2022
0.02	0.11	0.92	0.16	0.64	0.17	0.30
Ratio of liquid assets and liabilities (short-term), % (x_6)						
2009	2010	2011	2012	2013	2014	2015
0.02	0.01	0.01	0.01	0.01	0.01	0.01
2016	2017	2018	2019	2020	2021	2022
0.01	0.01	0.01	0.01	0.01	0.01	0.01
The specific weight of the assets of the 5 largest banking institutions in the total assets of the banking system, % (x_7)						
2009	2010	2011	2012	2013	2014	2015
0.90	0.72	0.74	0.66	0.60	0.53	0.33
2016	2017	2018	2019	2020	2021	2022
0.29	0.21	0.20	0.20	0.23	0.29	0.02

Continuation of Table 5.11

1	2	3	4	5	6	7
Integrated index of banking security, % (x_8)						
2009	2010	2011	2012	2013	2014	2015
0.29	0.24	0.31	0.47	0.50	0.29	0.18
2016	2017	2018	2019	2020	2021	2022
0.22	0.26	0.45	0.26	0.31	0.26	0.18

*Note: calculated and systematized by the authors according to the data in the **Table 5.10** based on the methodology [20]*

So, having carried out a comprehensive assessment of the state of financial security of Ukraine for 2009–2022, let's summarize the normalized values of the integral index of the security state of the financial system of Ukraine in **Fig. 5.10**.

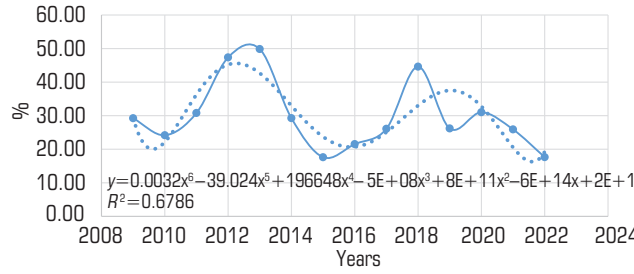

Fig. 5.9 Dynamics of values of the integral index of banking security of Ukraine
*Note: presented by the authors according to the data in the **Table 5.11** based on the methodology [20]*

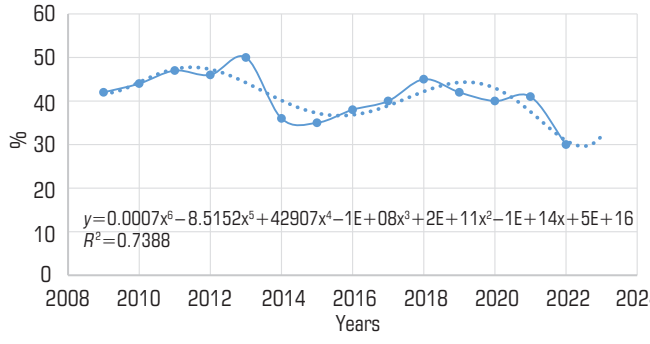

Fig. 5.10 Dynamics of the integral index of the security state of the financial system of Ukraine, %
Note: calculated by the authors

Therefore, the data obtained in the process of calculations testify to the dangerous state of financial security of Ukraine.

5.3 METHODOLOGICAL CONCEPT OF TRANSFORMATION OF APPROACHES TO MONITORING THE STATE OF FINANCIAL SECURITY OF UKRAINE

The methodology of the Ministry of Economic Development and Trade of Ukraine, which in the legislative and regulatory space of Ukraine is the main methodology that illuminates the mechanisms of assessing the economic security of Ukraine, the structural element of which is financial security, was studied. The shortcomings of this technique, which cause incorrect results of assessing the state of financial security, are outlined, and directions for its improvement are proposed, including:

1. Timely revision of weighting coefficients, which numerically characterize the importance of a certain indicator in comparison with other indicators of the state of financial security.

Among the available methods for calculating the weighting coefficients, the method of sensitivity theory is the most optimal. The use of this method is recommended when there is a macroeconomic model, the initial data of which are indicators of the level of financial security of the state and its subsystems. Thus, the weighting factors for individual indicators (a_i) are determined by assessing how much the integral indicator (D_j) reacts to changes in the normalized state indicators of financial security subsystems (y_i) (5.2):

$$a_i = \frac{\left|D_i \Delta y_i\right|}{\sum_{i=1}^{n} \left|D_j \Delta y_i\right|}. \tag{5.2}$$

Using the method of the sensitivity theory to determine the weighting coefficients provides an opportunity to specify these coefficients in different periods of the study, which can be an advantage of this method, in our opinion. However, it is worth considering that using this method can significantly complicate the process of assessing financial security, requiring additional effort and time.

In the case when there is no macroeconomic model that has indicators of financial security and its subsystems as input data, the method of principal components is used to calculate the weighting coefficients (5.3), the input data of which are the dynamic series of certain indicators:

$$a_i = \frac{c_i \left|d_i\right|}{\sum c_i \left|d_i\right|}, \tag{5.3}$$

where c_i – contribution of indicator I to the total variance of a set of indicators; d_i – factor loadings [30].

Using the method of principal components, it is possible to obtain weighting coefficients with fixed values that remain constant throughout the study period. This, in our opinion, can cause a distortion of the evaluation results. Correlation-regression analysis and statistical approaches, as a rule, reveal general patterns without paying attention to the peculiarities of specific periods, such as crisis moments.

Game methods can also be used in the calculations of weighting factors to assess the financial security of the state. Subsystems of financial security are presented in the form of matrices, where rows correspond to different time periods, and columns reflect normalized indicators for these subsystems. The resulting matrices for financial security subsystems are considered as matrices of a zero-sum game, where the gain of the first player is equal to the loss of the second. After determining the optimal mixed strategies for both players (F_1, F_2), the second mixed strategy can be considered as a certain set of weighting coefficients in the calculation of the general indicator of the state of financial security of the country (FS_j) in the additive form (5.4):

$$FS_j = \sum_{i=1}^{n} \left(F_2^* i\right) y_{ij}, \tag{5.4}$$

or in multiplicative form (5.5):

$$FS_j = \prod_{i=1}^{n} y_{ij}^{\left(F_2^* i\right)}. \tag{5.5}$$

Therefore, analyzing the existing methods for calculating the weighting coefficients of indicators of the country's financial stability, it is possible to conclude that depending on the specific stages of economic development, different approaches to determining these coefficients can be used. Possible methods include expert judgments, game approaches, principal component methods, and sensitivity theory methods, each with its own advantages and limitations.

2. The maximum replacement of the use of subjective expert evaluations in the process of calculating weighting coefficients of indicators in favor of methods with a higher level of objectivity (method of principal components; game methods; modeling methods).

3. Systematic updating of the list of indicators of the state of debt security, taking into account structural changes in the state's economy (including the replacement of the EMBI+Ukraine index indicator with the indicator of the sovereign credit rating of Ukraine, determined by the authoritative international rating agency Standard & Poor's).

4. Taking into account the non-linearity of economic processes, the application of the multiplicative form of the integral indicator of the state of financial security (5.6) instead of the additive form, among the shortcomings of which the significance of the integral indicator under the condition of zero data of individual indicators is highlighted, as well as the compensation of the value of the integral index for certain indicators at the expense of others:

$$FS_j = \prod_{i=1}^{n} y_{ij}^{a_i}, F, \text{ where } \sum_{i=1}^{n} a_i = 1 \text{ and } a_i \geq 1. \tag{5.6}$$

The region is one of the structural components, which is allocated according to the object of protection in the structure of financial security. The term "financial security of the region" is considered as the conditions for the financial development of a specific region within the state, under which internal and external threats do not lead to negative processes in a complex system

and do not prevent the creation of favorable financial conditions for the sustainable development of the region.

Therefore, in the process of monitoring the financial security of the region, it is necessary to calculate a certain complex indicator, the value of which will indicate the level of financial stability in the region, the investment climate, entrepreneurial activity and the standard of living of the population.

Ensuring the financial stability of Ukraine's regions is an important element of guaranteeing the overall financial stability of the state. This connection arises as a result of decentralization reforms aimed at creating effective local self-government to provide affordable and high-quality public services, establishing institutions of civic participation, creating a safe environment for residents, as well as coordinating the interests of local communities and the central government. Consequently, the quality of the performance of their functions by local government structures has a great impact on local tax policy, the formation of local budget revenues, the provision of insurance and banking services, the investment climate in the region and the standard of living of the population. These circumstances substantiate the need for a systematic and operational analysis of the financial stability of the regions of Ukraine in order to determine the strengths and weaknesses of the current state, diagnose opportunities and potential threats.

Methodological approaches [20] do not provide for a regional section of the assessment. It is possible to adapt the methodology for calculating the level of financial security of the state to the specifics of the regions, however, most indicators are based on statistical information at the state level and, accordingly, cannot highlight the specifics of regional development.

In order to assess the security level of the financial stability of the regions of Ukraine, their further analysis and comparison, as well as to identify the main problems, opportunities and possible threats, a methodical approach to monitoring the security level of the financial stability of the regions is proposed. This approach differs from those currently used, as it provides an opportunity to quickly assess the state of financial stability of individual regions of Ukraine and to identify specific threats and reserves specific to each region. This information can be used for further measures to increase the financial stability of specific regions.

At the first stage of the proposed methodical approach to the analysis of the financial security of the region, the category "financial security of the region" is decomposed into separate interconnected subsystems: financial security of the community of the region; economic entities of the region and their entrepreneurial activity; sectoral financial security of the region; security by the level of financial autonomy.

At the second stage, the list of quantitative indicators in the subsystems of the security level of financial stability of the region, which are interconnected with the state of financial security of the state, is formed. These indicators signal the degree of threats, are characterized by sensitivity to changes in the financial situation in the region, and can be used in the decision-making process in the field of financial policy.

The formed list of indicators must meet the following criteria: be scientifically based and be characterized by the availability of statistical data for the operational analysis of the financial

security of the region. Let's also note that the complex of selected quantitative indicators should be characterized by suitability for mathematical and other types of analysis, coverage of changes in a phenomenon or process over time, and unambiguous interpretation.

The selected indicators should be checked for multicollinearity, accordingly, indicators with a strong connection according to the Chaddock scale should be excluded from the system of indicators. In addition, we have to prove that the set of selected indicators are interconnected with the state of financial security of the state, which will confirm the hypothesis that the formed data matrix of the identified indicators can be used as input information in the process of calculating the integral indicator of the state of financial security of the region.

Formation of a set of indicators of the state of financial security of the region took place taking into account the principles of reliability, representativeness and information availability.

So, 22 financial indicators are selected, which are calculated by region and systematically published in the reports of the Ministry, which were previously checked for the presence of correlations. It has been verified that they are not in direct functional dependence. Each the selected indicators provides important information about the state of the financial security of the region, therefore, their comprehensive application is proposed for a comprehensive analysis.

A hypothesis is put forward, according to which the totality of these indicators objectively characterizes the state of financial security of the region, as well as specific problems and opportunities.

To prove or disprove this hypothesis, the basic ideas of the polynomial algorithm for the extrapolation of parameters of stochastic systems [31] were applied, on the basis of which a polynomial power correlation-regression model was developed for assessing the financial security of the region of Ukraine according to formula (5.7):

$$y_x^{(n,N)}(1,i) = M\left[X(i)\right] + \sum_{j=1}^{n}\sum_{w=1}^{N}\left(x^w(j) - M\left[X^w(j)\right]\right)S_{(j-1)N+w}^{(nN)}\left((i-1)N+1\right), \quad (5.7)$$

where $y_x^{(n,N)}(1,i)$ – state of the financial security of the region (realization at a point and a random sequence, provided that n elements are used with the highest order of stochastic connections N); $M\left[X(i)\right]$ – mathematical expectation of the state of financial security of the region; $x^w(j)$ – empirical values of indicators of the state of financial security of the region; $M\left[X^w(j)\right]$ – mathematical expectation of indicators of the state of financial security of the region; $S_{(j-1)N+w}^{(nN)}\left((i-1)N+1\right)$ – weighting factors [31].

Table 5.12 presents the calculated values of the state of financial security, calculated using the obtained polynomial correlation-regression model $\left(m_x^{(k,N)}(1,i)\right)$, as well as the amount of error.

The determined values of the safety level of financial stability based on the values of 22 indicators, which are determined by region, differ insignificantly from the empirical values (the average level of error is 0.18 %), which justifies the statement about the relative accuracy of the forecasts made using this model and proves the declared hypothesis , that the set of selected indicators can objectively characterize the security state of the financial stability of the region and sufficiently accurately signal the presence of specific problems and opportunities of a specific region of the state.

Table 5.12 Results of approbation of a methodical approach to monitoring the level of financial security using a polynomial correlation-regression model

Years	State of financial security (according to the classical method), %	State of financial security (calculated according to the obtained model), %	Absolute error	Relative error, %
	y	$y_x^{(n,N)}(1, i)$		
2014	36.536	36.584	0.048	0.13
2015	35.847	35.761	–0.086	–0.24
2016	38.745	38.666	–0.079	–0.20
2017	40.023	40.081	0.058	0.14
2018	45.746	45.675	–0.071	–0.16
2019	42.669	42.575	–0.094	–0.22
2020	40.179	40.211	0.032	0.08
2021	41.123	41.198	0.075	0.18
2022	30.007	30.567	0.560	1.87
Average value of error				0.18

Note: calculated by the authors

At the second stage of applying the methodical approach to monitoring the security state of the financial stability of the region, the absolute values of the indicators by region were calculated and the data matrix $X=\{x_{ij}\}$ was built, where x_{ij} – the value of the j-th indicators for the i-th region of the state; $i=\overline{1.22}$; $j=\overline{1.24}$.

At the third stage of the application of the methodical approach to monitoring the security state of the financial stability of the region, the indicators are standardized in the financial security subsystems of the region. Normalization of indicators is proposed to be carried out using the method – relative to the range of variation (5.8), because it is this method that allows taking into account the difference in indicators in a certain period of the study.

$$C: y_{ij}=\frac{x_{ij}-x_{\min}}{x_{\max}-x_{\min}};\ B: y_{ij}=\frac{x_{\max}-x_{ij}}{x_{\max}-x_{\min}}. \tag{5.8}$$

Matrix distribution $X=\{x_{ij}\}$, where x_{ij} – the value of j-th indicators for the i-th area; into groups is as follows: indicators characterizing the security level of financial stability of the population of the region have been added to the 1st group of indicators (matrix $X_{PR}=\{x_{ij}\}$). To the second – indicators that signal the level of financial security of economic entities and their entrepreneurial activity (matrix $X_{EE}=\{x_{ij}\}$). To the third – indicators characterizing the level of industry financial security of the region (matrix $X_{IFS}=\{x_{ij}\}$). To the fourth – indicators of regional financial security according to the level of financial autonomy (matrix $X_{RS}=\{x_{ij}\}$).

At the fourth stage of applying the methodical approach to monitoring the security state of the financial stability of the region, weighting indicators were determined for the indicators of specific financial security subsystems of the region.

At the fifth stage of applying the methodical approach to monitoring the security state of the financial stability of the region, indicators were summarized into integral indexes of the state of regional financial security in terms of its subsystems, and regions were ranked according to the obtained values. The complexity of this stage is explained by a significant number of options for calculating the integral indicator, as well as disparities in the development of the regions of Ukraine.

At the sixth stage of the methodical approach, the integral value of the state of financial security by region and research period was determined, the regions were clustered according to the calculated values (**Table 5.13**).

Table 5.13 Clustering of regions of Ukraine by ranges of values of financial security of regions of Ukraine

Range	**0.000–0.381**	**0.382–0.499**	**0.500–0.618**	**0.619–1.000**
Security situation of the region	Critical	Dangerous	Satisfactory	High
Regions	Donetsk, Luhansk	Volyn, Zaporizhzhia, Zhytomyr, Mykolaiv, Zakarpattia, Kirovohrad, Chernivtsi, Rivne, Khmelnytskyi, Sumy, Ternopil, Kherson, Chernihiv, Kharkiv	Vinnytsia, Ivano-Frankivsk, Lviv, Odesa, Cherkasy	Dnipro, Kyiv, Poltava

Note: presented by the authors

Cluster analysis is a key tool for the typology of objects, the purpose of which is to divide objects into relatively homogeneous groups, taking into account the analysis of indicators that objectively characterize these objects.

In the process of calculating the integral indicator, the application of the additive model leads to the fact that there is a possibility of compensation for the deterioration of the safety level of one subsystem due to the increase in the safety level of another partial assessment. In order to prevent such a situation, the integral indicator, in our opinion, should be determined by the formula of the geometric mean (5.9):

$$FS_{ri} = \sqrt[4]{E_{1i} \cdot E_{2i} \cdot E_{3i} \cdot E_{4i}} = \sqrt[4]{\prod E_{ij}}, \quad (5.9)$$

where FS_{ri} – an integral indicator of financial security of the i-th region of Ukraine; x_{1i}, x_{2i}, x_{3i}, x_{4i} – partial coefficients.

The analysis results obtained by formula (5.9) may turn out to be incorrect, taking into account the theoretical possibility of zero values of x_{1i}, x_{2i}, x_{3i}, x_{4i}. Accordingly, let's apply the modified formula (5.10):

$$FS_{ri} = \sqrt{\prod\left(1+E_{ij}\right)-1}. \quad (5.10)$$

As a result, a taxonomic integral value of the security state of the financial stability of the regions of Ukraine was obtained for periods in the interval from 0 to 1. Interpreting the value of this indicator, let's pay attention to the fact that high values of the indicator characterize a high level of security state of a certain region, and low values signal its critical state. The integral indicator of the security state of the financial stability of the regions of Ukraine is the result of collapsing the partial indicators into a complex index for a certain area.

The highest security level of financial stability of regions in 2022 was recorded in the following regions: Kyiv, Dnipro, Poltava, and the lowest – in Donetsk and Luhansk regions.

At the last stage of the proposed methodological approach, a comparison of the security state of the financial stability of the regions takes place, specific problematic aspects and opportunities of a certain region are highlighted.

The heterogeneity of the security level of financial stability of the regions of Ukraine is caused by the influence of economic, political, social and geographical factors.

CONCLUSIONS

Considering that the methodical approach to calculating the level of economic security of Ukraine, proposed for use in order No. 1277 dated October 29, 2013, does not provide for a regional assessment, a methodical approach to monitoring the security state of the financial stability of regions is proposed.

The given methodical approach includes the following sequence of actions: division of the component "financial security of the region" into subcomponents; creating a list of indicators for each financial security subsystem of the region; normalization of these indicators within the subsystem, determination of their importance for each separate subsystem of financial security of the region; generalization of indicators into complex indicators for assessing the state of financial security of the region in the context of various subsystems; ranking of regions according to the obtained values; calculation of the integral indicator of the state of financial security for individual regions and research periods, as well as grouping of regions based on the results obtained; comparing the state of financial security of regions based on the calculated values of the integral indicator of the state of financial security and highlighting specific aspects that are specific to each region.

A list of 22 indicators of the state of financial security of regions has been formed, which meets the following criteria: it is scientifically based, characterized by the availability of statistical data and suitability for mathematical and other types of analysis, highlighting the change of a phenomenon or process over time, unambiguous interpretation.

It is proved that the selected indicators of the state of financial security of the regions are not strongly related according to the Chaddock scale, and are also interconnected with the state of financial security of the state, which generally confirms the hypothesis that the formed matrix of data of the identified indicators can characterize the state of financial security of the region, testify

to specific problems and special opportunities in the region, and accordingly, be used as input information in the process of calculating the integral indicator of the financial security of the region.

On the basis of the proposed methodology for assessing the state of financial security of regions, integral indicators of the state of financial security of regions of Ukraine were calcula ted, which are actually the result of collapsing indicators by subsystems into a system index for a certain region, high values of which characterize a relatively stable value of financial security of a certain region, and low values signal its dangerous or critical condition. The regions of Ukraine were clustered according to the ranges of the financial security of the regions, according to the results of which the regions were divided into 4 groups: with a critical state of financial security of the region (0.000–0.381) (Luhansk, Donetsk), a dangerous state (0.382–0.499), a satisfactory state (0.500–0.618) and conditionally high (0.619–1.000) (Dnipro, Kyiv, Poltava).

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this paper.

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