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STRESS TESTING OF THE BANKING SYSTEM OF UKRAINE: TOOLS, SCENARIOS AND RESULTS IN WARTIME CONDITIONS

This article explores the evolution of stress-testing practices within the Ukrainian banking system during wartime, particularly in the period from 2022 to 2024. The full-scale military invasion of Ukraine by Russia has introduced unprecedented risks that necessitate a reassessment of traditional methods for financial risk analysis and stress testing. The study highlights how the National Bank of Ukraine (NBU) has adjusted its approach to scenario modeling in response to infrastructure damage, forced migration, increased credit risk, and a greater reliance on state and international financial support.

Two primary stress-testing scenarios implemented by the NBU in 2023 are examined: the baseline scenario, which assumes partial economic recovery under stable security conditions, and the adverse scenario, which models economic deterioration under worsening wartime conditions. The impact of these scenarios on liquidity, capital adequacy, and non-performing loans (NPLs) is analyzed based on official NBU data. The paper also considers the integration of external macro-financial factors, such as international reserves and foreign aid flows, into stress-testing frameworks. A comparative mention is made of U.S. stress-testing regulation under the Dodd–Frank Act, serving as an international benchmark.

The results indicate that the Ukrainian banking sector has demonstrated a relatively high level of resilience despite extreme shocks. However, the article argues that further improvements are needed in the collection of regional risk data, the modeling of war-related systemic risks, and the development of long-term, multi-scenario planning frameworks.

The paper concludes by recommending enhanced cooperation with international organizations, the incorporation of behavioral and geopolitical risks, and the adaptation of Western practices to Ukraine's specific wartime context. These measures are presented as essential for strengthening the financial stability of Ukraine's banking system in the face of ongoing conflict and subsequent recovery challenges.

Keywords: stress testing, banking system, financial stability, war risks, scenario analysis, bank capital, NBU.

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СТРЕС-ТЕСТУВАННЯ БАНКІВСЬКОЇ СИСТЕМИ УКРАЇНИ: ІНСТРУМЕНТИ, СЦЕНАРІЇ ТА РЕЗУЛЬТАТИ В УМОВАХ ВІЙНИ

У статті досліджено підходи до стрес-тестування банківської системи України в умовах війни. Проаналізовано ризики, сценарії та результати тестів 2022–2024 рр. Проаналізовано еволюцію підходів Національного банку України до проведення тестів. Виокремлено зміни у політиці НБУ, обґрунтовано та запропоновано напрями вдосконалення методології з урахуванням поточних викликів, досвіду міжнародних організацій та геополітичних викликів.

Ключові слова: стрес-тестування, банківська система, фінансова стійкість, ризики війни, сценарний аналіз, капітал банків, НБУ.

Problem Statement. The financial stability of the banking system is a critical component of a country's economic security, particularly under the conditions of full-scale war. In Ukraine, stress testing of banking institutions has become a vital tool not only for identifying vulnerabilities within the financial sector but also for developing effective regulatory intervention mechanisms. In this context, there arises a need to reconsider traditional approaches to risk assessment and to expand scenario analysis to account for the specific conditions of wartime. Unlike conventional macroeconomic shocks, wartime risks are often nonlinear, asymmetric, and involve prolonged uncertainty across financial markets, public finance, and institutional stability. Furthermore, the

geographic fragmentation of economic activity, the destruction of infrastructure, and the migration of population complicate the modelling of credit and liquidity risks. Standard regulatory tools must now be supplemented with real-time stress-testing mechanisms that integrate geopolitical and behavioral risk factors. These unique conditions necessitate a more flexible, forward-looking stress-testing framework that can support the resilience and strategic adaptability of the banking system under crisis scenarios.

Analysis of Recent Research and Publications. The issue of assessing the financial resilience of banks under crisis conditions, particularly in the context of war, has been the focus of research by both Ukrainian and international scholars. Notably, the works of Mishchenko and Bondar [8], Shulha and Tarasiuk [9], as well as Anderson [11] and Jarvis [12], examine the current challenges faced by the banking sector in connection with wartime risks, the identification of new instability factors, and the methodologies for conducting stress testing under conditions of high uncertainty.

Prior to 2022, stress testing in Ukraine was conducted based on methodologies adapted to peacetime conditions, with a primary focus on classical macroeconomic risks. However, the full-scale Russian aggression against Ukraine has drastically transformed the financial risk landscape and necessitated the development of new approaches to assessing banks' resilience. The new reality encompasses infrastructure destruction, the loss of assets in temporarily occupied territories, large-scale migration processes, rising credit risks, and increased reliance of the banking system on state support.

Given these emerging challenges, analyzing the practice of stress testing in Ukraine during the 2022–2024 period is particularly relevant for formulating effective measures to stabilize the financial system.

Purpose and Objectives of the Study. The purpose of this article is to conduct a comprehensive analysis of the current practice of stress testing in Ukraine's banking system under wartime conditions, assess the results of such tests, and develop recommendations for improving future approaches. To achieve this goal, the study explores the theoretical foundations and modern methodologies of stress testing, analyzes the evolution of the National Bank of Ukraine's approaches to testing in both pre-war and wartime periods, and characterizes the new risks and specific features of the stress testing scenarios applied between 2022 and 2024. Furthermore, the article evaluates the results of stress testing in the banking system, identifying key challenges and proposing ways to enhance stress testing models, taking into account international experience and the specific features of martial law in Ukraine.

Presentation of the Main Material. Beginning with the theoretical foundations, it is important to note that stress testing is a process of modeling the impact of various shocks on the financial condition of a bank or the banking system in order to assess their resilience. According to the recommendations of the Basel Committee [1], effective stress testing should account for both traditional risks—such as credit, market, and operational risks—and more specific risks, including concentration, systemic, and behavioral risks.

During peacetime, stress testing in Ukraine was primarily focused on macroeconomic shocks such as exchange rate fluctuations, GDP decline, and rising inflation. However, after 2022, the National Bank of Ukraine (NBU) was compelled to radically revise its methodology to reflect the new wartime realities. Key features of this updated approach included accounting for asset destruction in combat zones, mass population displacement, sovereign debt risks, and the banking sector's reliance on international financial assistance.

To better understand the changes in stress testing approaches, it is useful to present Table 1, which summarizes the key characteristics of the scenarios applied in different periods:

Table 1

Comparison of Key Approaches to Stress Testing Parameters Before and After 2022

Indicator	Pre-war Period	Post-2022 Period
Main focus	Economic risks	Geopolitical and institutional risks
Asset data	By borrower type	Considering territorial location
Liquidity models	Standard ratios	Scenarios with restricted access to resources
Involvement of international partners	Minimal	Active cooperation with the IMF and World Bank

Source: compiled by the author based on [2; 5].

Such a development of approaches indicates the adaptation of the Ukrainian financial regulator to extraordinary challenges. At the same time, it is important to highlight the specific features of the scenario analysis used during the 2022–2024 period.

In 2023, the National Bank of Ukraine implemented two main scenarios in its stress-testing practice: the baseline and the adverse. The baseline scenario assumed partial economic recovery under conditions of stable security, while the adverse scenario projected a deepening economic crisis in the event of escalating hostilities, a widening budget deficit, and currency instability.

To illustrate, Figure 1 presents the expected changes in key macroeconomic indicators under the baseline and adverse scenarios.

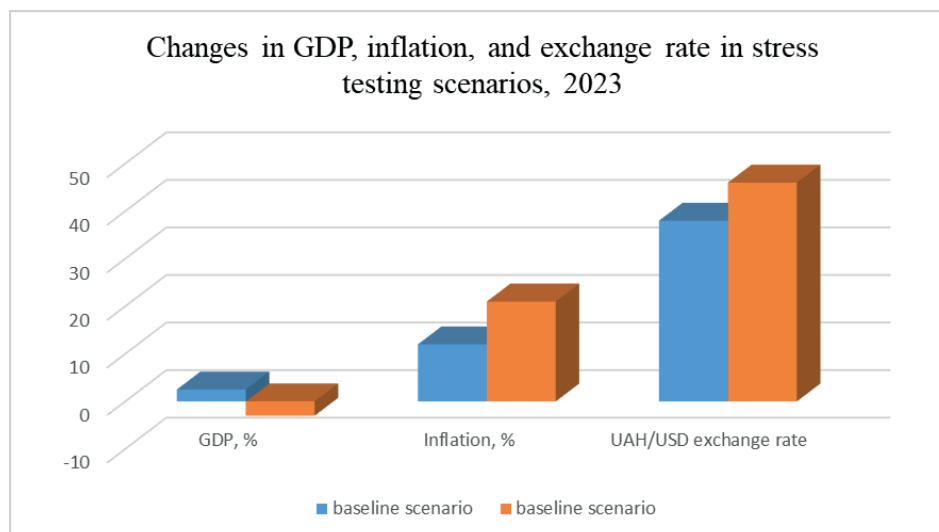


Fig. 1. Changes in GDP, inflation, and exchange rate in stress testing scenarios, 2023
(compiled by the author based on [2])

It can be observed that under the baseline scenario, GDP growth of 2.5% was expected alongside controlled inflation at around 12%, whereas the adverse scenario projected an economic contraction of 3% with inflation exceeding 20%. These indicators significantly impacted the resilience of banking portfolios.

A detailed risk structure analysis revealed that the key threats to Ukraine's banking system included the geographical concentration of assets in conflict-affected regions, liquidity risks arising from branch operation restrictions and loss of communication channels, as well as dependence on state support through refinancing and government bonds.

In this context, liquidity management in banks was of particular importance. According to data from the National Bank of Ukraine [2], the average liquidity coverage ratio (LCR) in 2023 remained above 190%, enabling banks to withstand short-term stress shocks.

This dynamic is illustrated in Figure 2, which shows changes in liquidity indicators of the banking system over the period 2022–2024:

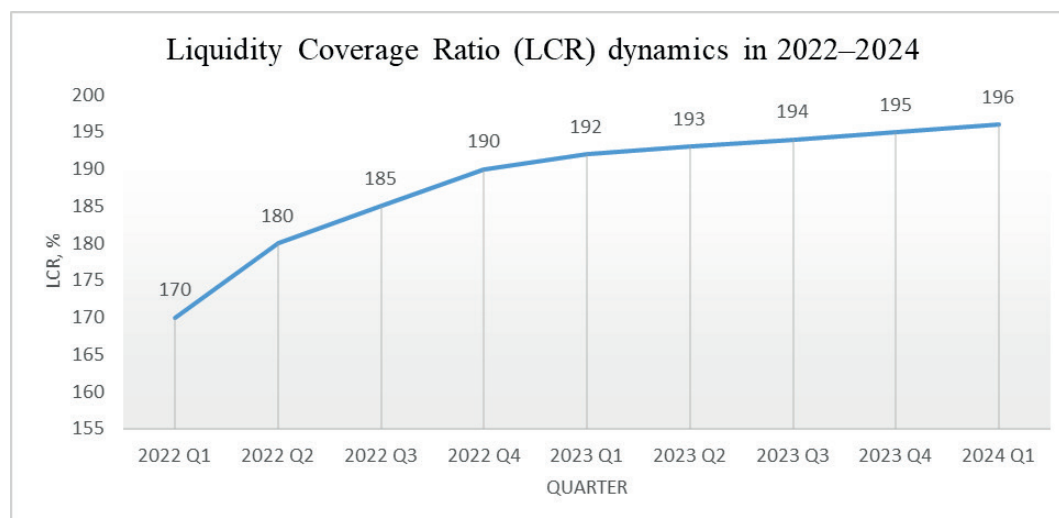


Fig. 2. Dynamics of the Liquidity Coverage Ratio (LCR) in 2022–2024, %
(compiled by the author based on [2])

Liquidity indicators demonstrated gradual stabilization, which was the result of both government support measures and the banks' own adaptability to the new operating conditions amid the war.

Alongside liquidity risks, special attention was given to asset quality risks. Amid the deteriorating financial condition of borrowers, the level of non-performing loans (NPLs) in the banking system remained high but controlled due to restructuring programs and state support for businesses.

To illustrate this dynamic, it is appropriate to present Table 2, which reflects changes in the NPL ratio for the period 2021–2024:

Table 2

Dynamics of the Non-Performing Loans (NPL) Ratio in Ukraine, %

Year	NPL ratio, %
2021	27%
2022	29%
2023	30%
2024 (оцінка)	28%

Source: compiled by the author based on [2].

Despite difficult conditions, the banking system was able to limit the growth of the share of problem loans through flexible portfolio management and active interaction with borrowers.

Equally significant factors affecting banks' resilience remain external risks, primarily related to fluctuations in the volume of international financial assistance and the country's foreign currency reserves. High volatility of external financing, delays in international tranche disbursements, and instability in global financial markets pose additional challenges to maintaining the stability of the banking system.

To visualize the situation, Figure 3 is presented, illustrating the dynamics of Ukraine's international reserves for the period 2021–2024:

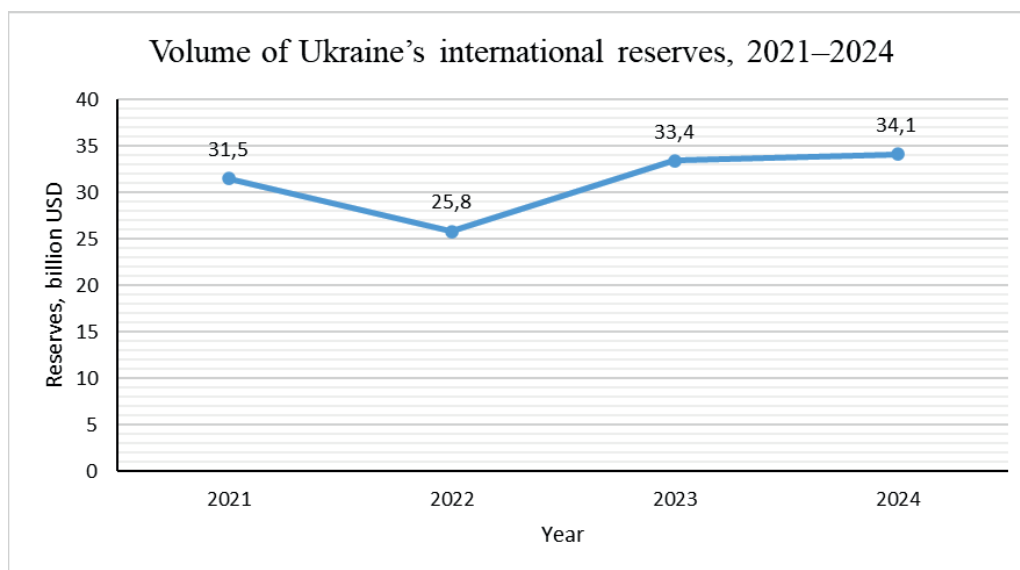


Fig. 3. Volume of Ukraine's international reserves in 2021–2024, billion USD
(compiled by the author based on [2])

After the sharp decline in reserves at the onset of the war, their volume was restored due to international financial support, which enabled the stabilization of the exchange rate and helped avoid a severe currency crisis. The presented data confirm the importance of integrating external factors into stress testing scenarios, as macrofinancial stability directly influences the banks' ability to withstand shocks.

A valuable reference for improving stress testing approaches in Ukraine is the experience of the United States, where, following the 2008 financial crisis, a rigorous supervisory framework for assessing banking stability was introduced. In 2009, the Federal Reserve System first implemented the Supervisory Capital Assessment Program (SCAP), and since 2010, a permanent system of annual stress testing has been operating in accordance with the requirements of the Dodd–Frank Act. Its main goal is to assess whether systemically important banks can withstand severe macroeconomic shocks over a three-year planning horizon.

The American approach is characterized by a high level of scenario detail, covering changes in GDP, unemployment, inflation, interest rates, asset price dynamics, and corporate default rates. Each year, baseline, adverse, and severely adverse scenarios are published, and banks with assets exceeding USD 100 billion are required to conduct stress testing under the supervision of the Federal Reserve, FDIC, and OCC.

A notable feature of this system is the mandatory disclosure of results. If capital shortfalls are identified, banks may face restrictions on dividend payments, share repurchases, or executive compensation. This creates a transparent system of discipline and accountability.

Moreover, behavioral models are employed in the U.S., including the probability of mass deposit withdrawals in cases of declining public trust, market panic effects, and psychological factors influencing borrower behavior. These approaches are not yet typical in Ukrainian stress testing practice.

When comparing these practices to the realities of Ukraine, several potential areas for improvement can be identified. These include: formalizing automatic regulatory intervention triggers based on test results; extending the scenario horizon to 3–5 years; implementing behavioral stress analysis models for depositors and borrowers; enhancing the transparency and public accessibility of the testing process; and establishing a unified information infrastructure for interagency cooperation.

Thus, the U.S. experience demonstrates how stress testing can serve not only as a technical risk assessment tool but also as a vital component of the banking supervision system. Integrating such practices in Ukraine would make the process more adaptable to the complex challenges of wartime and postwar recovery and enhance public trust in the financial system as a whole.

Summarizing the results of the conducted analysis, it can be concluded that Ukraine's banking system has demonstrated significant adaptability under wartime conditions. However, the effectiveness of stress testing as a tool for risk control and management requires further development.

Conclusions. The conducted analysis of stress testing in Ukraine's banking system during 2022–2024 has shown that adapting methodologies to wartime conditions significantly improved the effectiveness of risk assessment and allowed for the development of more realistic and relevant scenarios. A positive outcome is that most banking institutions were able to maintain adequate levels of capitalization and liquidity even under adverse scenarios.

However, the process revealed a number of challenges, including the limited ability of existing models to account for territorial and regional risks, lack of comprehensive data from temporarily occupied territories, and insufficient attention to cyber and behavioral threats. These shortcomings highlight the need for continuous refinement of Ukraine's stress testing framework.

To further improve stress testing practices, several directions should be considered. Among the most important are the development of a multi-scenario approach that includes geopolitical, behavioral, and sector-specific risks; integration of variables such as infrastructure damage, migration dynamics, and energy insecurity; enhanced data collection and monitoring of asset quality in high-risk areas; and increased collaboration with international institutions to develop harmonized stress testing standards. Additionally, extending the planning horizon to 3–5 years would enable a more robust long-term assessment of banking resilience.

The experience of the United States offers valuable lessons in this regard. Since the 2008 financial crisis, U.S. regulators have developed a highly structured and transparent system of supervisory stress testing, including the Supervisory Capital Assessment Program (SCAP) and the Dodd–Frank Act Stress Tests (DFAST). These programs feature detailed macroeconomic scenarios, mandatory public disclosure of results, and enforceable supervisory actions in cases of capital shortfall. Moreover, U.S. stress testing integrates behavioral models, accounting for market panic and depositor behavior—an approach that remains largely absent in Ukraine.

Adopting similar elements in the Ukrainian context could help institutionalize more consistent and proactive regulatory oversight. It would also improve public and investor confidence in the banking sector by making risk assessment more comprehensive, data-driven, and forward-looking.

Thus, stress testing should evolve into a core component of strategic management for Ukraine's financial system. Its role must extend beyond diagnostics to support policy decisions, guide resource allocation, and ensure the long-term sustainability of banking institutions amid continuing military challenges and in the post-war recovery period. In this regard, aligning with best international practices—particularly the U.S. model—can significantly enhance the resilience and credibility of Ukraine's financial architecture.

References:

1. Basel Committee on Banking Supervision. (2018). *Stress testing principles*. Bank for International Settlements <<https://www.bis.org/bcbss/publ/d450.pdf>> (2025, May, 14). [in English].
2. National Bank of Ukraine. (2024). *Financial stability report* <https://bank.gov.ua/admin_uploads/article/FSR_2024-H1_eng.pdf?v=13> (2025, May, 4). [in English].

3. International Monetary Fund. (2024). *Ukraine: Financial Sector Assessment Program. Technical Note: Stress testing (Country Report No. 24/127)* <<https://www.imf.org/en/Publications/CR/Issues/2024/03/27/Ukraine-Financial-Sector-Assessment-Program-Technical-Note-Stress-Testing-531197>> (2025, May, 17). [in English].
4. World Bank. (2024). *Ukraine economic update – Spring 2024* <<https://openknowledge.worldbank.org/entities/publication/59eef1d-3f8b-4eb8-b065-dc4acc624dd2>> (2025, May, 8). [in English].
5. European Banking Authority. (2023). *EU-wide stress test methodology 2023* <<https://www.eba.europa.eu/risk-analysis-and-data/eu-wide-stress-testing>> (2025, May, 14). [in English].
6. Organisation for Economic Co-operation and Development. (2023). *Financial resilience of emerging economies under crisis conditions* <[https://one.oecd.org/document/C\(2023\)16/REV6/en/pdf](https://one.oecd.org/document/C(2023)16/REV6/en/pdf)> (2025, May, 15). [in English].
7. Стрес-тестування банків як інструмент банківського регулювання. Національний банк України <https://bank.gov.ua/admin_uploads/article/Stres-testuvannya_bankiv_19-05-2023.pdf?v=4> (2025, травень, 20).
Stres-testuvannya bankiv yak instrument bankivs'koho rehulyuvannya [Stress testing of banks as a tool of banking regulation]. Natsional'nyy bank Ukrayiny [National Bank of Ukraine] <https://bank.gov.ua/admin_uploads/article/Stres-testuvannya_bankiv_19-05-2023.pdf?v=4> (2025, May, 20). [in Ukrainian].
8. Погореленко, Н.П. (2018). Роль Національного банку України у забезпеченні стабільного розвитку банківської системи. *Вісник Харківського національного університету імені В. Н. Каразіна*, 93, 57-76. DOI: <https://doi.org/10.26565/2311-2379-2017-93-07>.
- Pohorelenko, N. P. (2018). Rol' Natsional'noho banku Ukrayiny u zabezpechenni stabil'noho rozvytku bankivs'koyi systemy. [The role of the National Bank of Ukraine in ensuring the stable development of the banking system]. *Visnyk Kharkivs'koho natsional'noho universytetu imeni V. N. Karazina*. [Bulletin of the V. N. Karazin Kharkiv National University], 93, 57–76. DOI: <https://doi.org/10.26565/2311-2379-2017-93-07> [in Ukrainian].
9. Краснова, І.В., Журавльов, О.С., Шевалдіна, В.Г. (2023). Вплив воєнного стану на банківський сектор України. *Збірник наукових праць “Вчені записки”*, 31(2), 322-338. DOI: 10.33111/vz_kneu.31.22.02.29.201.207.
Krasnova, I.V., Zhuravl'ov, O.S., Shevaldina, V.H. (2023). Vplyv voyennoho stanu na bankivs'kyi sektor Ukrayiny. [Impact of martial law on the banking sector of Ukraine]. *Zbirnyk naukovykh prats' “Vcheni zapysky”* [Collection of Scientific Papers “Scientific Notes”], 31 (2), 322–338. DOI: https://doi.org/10.33111/vz_kneu.31.22.02.29.201.207 [in Ukrainian].
10. United States Congress. (2020). *Dodd–Frank Wall Street Reform and Consumer Protection Act: Stress testing requirements*. Board of Governors of the Federal Reserve System <<https://www.federalreserve.gov/supervisionreg/dfa-stress-tests-2025.htm>> (2025, May, 19). [in English].
11. Anderson, R. (2022). *Stress testing and bank resilience: Lessons from conflict-affected economies*. Routledge. [in English].
12. Jarvis, M. (2023). *Financial systems under pressure: War, crisis, and risk management*. Springer. [in English].
13. Аванесова, Н., Бакало, І. (2025). Фінансова стабільність банківської системи України в умовах воєнного стану: виклики та шляхи зміцнення. *Економіка та суспільство*, 73. DOI: <https://doi.org/10.32782/2524-0072/2025-73-78>.
- Avanesova, N., Bakalo, I. (2025). Finansova stabil'nist' bankivs'koyi systemy Ukrayiny v umovakh voyennoho stanu: vyklyky ta shlyakhy zmitsnennya. [Financial stability of the banking system of Ukraine under martial law: Challenges and ways to strengthen it]. *Ekonomika ta suspil'stvo* [Economy and Society], 73. DOI: <https://doi.org/10.32782/2524-0072/2025-73-78> [in Ukrainian].