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FORECASTING THE STABILITY OF THE BANKING SECTOR

A new methodological approach to forecasting stress periods in the banking sector based on the use of logistic regression is considered. The model takes into account the critical shortcomings of traditional banking stability indices, which are mainly descriptive tools and do not have the predictive potential necessary for proactive risk management. It is hypothesized that existing macroeconomic and bank performance indicators cannot adequately predict the stability of the banking sector, since they mostly reflect previous and current conditions, rather than future risks or stress periods.

Using annual changes in key bank balance sheet indicators, the proposed model provides an effective forecasting system with reliable performance indicators. A key feature of this research is its ability to identify the most significant indicators contributing to stress in the banking sector, especially under martial law. The model identified other critical factors of bank activity that significantly affect the level of stress, including capital adequacy, liquidity ratios, and the structure of assets and liabilities, which should be prioritized in the monitoring system. The forecasts of stress periods obtained using the model which demonstrates significant correlation with the indicators of the Financial Stress Index (FSI) of the National Bank of Ukraine, confirming its reliability. However, such a model goes further, offering practical conclusions that allow regulators to anticipate stress events, and not just analyze them retrospectively. In addition, the research offers a practical method for using open data provided by the NBU to conduct such forecasting researches, ensuring transparency and reproducibility.

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ПРОГНОЗУВАННЯ СТАБІЛЬНОСТІ БАНКІВСЬКОГО СЕКТОРУ

Розглянуто новий методологічний підхід до прогнозування стресових періодів у банківському секторі на основі застосування логістичної регресії. Модель враховує критичні недоліки традиційних індексів банківської стабільності, які є переважно описовими інструментами і не мають прогностичного потенціалу, необхідного для проактивного управління ризиками.

Висунуто гіпотезу, що наявні макроекономічні показники та показники діяльності банків не можуть адекватно прогнозувати стабільність банківського сектору, оскільки вони здебільшого відображають попередні та теперішні умови, а не майбутні ризики чи стресові періоди.

Використовуючи річні зміни ключових показників балансу банків, запропонована модель забезпечує ефективну систему прогнозування з надійними показниками ефективності. Ключовою особливістю цього дослідження є його здатність визначати найбільш значущі індикатори, що сприяють стресу в банківському секторі, особливо в умовах воєнного стану. Модель виявила інші критичні фактори діяльності банків, які суттєво впливають на рівень стресу, зокрема достатність капіталу, нормативи ліквідності та структура активів і пасивів, які мають бути пріоритетними в системі моніторингу. Прогнози стресових періодів, отримані за допомогою моделі, демонструють значну кореляцію з показниками Індексу фінансового стресу (ІФС) Національного банку України, що підтверджує її надійність. Однак така модель йде далі, пропонуючи практичні висновки, які дають змогу регуляторам передбачати стресові події, а не лише аналізувати їх ретроспективно. Крім того, дослідження пропонує практичний метод використання відкритих даних, наданих НБУ, для проведення подібних прогнозних досліджень,

By integrating publicly available datasets, the study demonstrates a scalable approach that can be adapted to other contexts. The research results contribute to the field of financial stability research by bridging the gap between descriptive analysis and predictive modeling, providing regulators with a powerful tool for timely interventions and mitigating systemic risks in the Ukrainian banking sector during periods of heightened uncertainty.

Keywords: banking sector stability, banking supervision, financial stress, integral stability index.

забезпечуючи прозорість та відтворюваність. Інтегруючи загальнодоступні набори даних, дослідження демонструє масштабований підхід, який може бути адаптований до інших контекстів. Результати дослідження роблять внесок у сферу досліджень фінансової стабільності, долаючи розрив між описовим аналізом та прогнозним моделюванням, надаючи регуляторам потужний інструмент для здійснення своєчасних інтервенцій та пом'якшення системних ризиків у банківському секторі України в періоди підвищеної невизначеності.

Ключові слова: стабільність банківського сектору, банківський нагляд, фінансовий стрес, інтегральний індекс стабільності.

JEL Classification: G21, G28.

Introduction

Banking sector stability is a cornerstone of economic resilience, especially in economies facing heightened uncertainty, such as in Ukraine during martial law. However, existing banking stability indices, in particular the Financial Stress Index (FSI) of the National Bank of Ukraine (NBU, n. d.), are largely descriptive in nature. While these indices effectively reflect the historical state of the banking sector, they lack the ability to predict future periods of stress. This limitation reduces their usefulness for proactive decision-making by regulators and stakeholders.

The research aims to address these gaps by developing a methodological approach to forecasting banking sector instability. Using annual changes in key balance sheet indicators and predictive analytics, a model is presented that aims to forecast periods of stress with high accuracy and practical implications. This approach is a significant step towards creating an index that will allow regulators to take preventive measures, ensuring the stability and resilience of the banking sector in volatile conditions.

In recent years, much research has been conducted on the development of indices to measure and predict the stability of the banking and financial systems. These indices often serve as an integral part of early warning systems (EWSs), which can prevent financial crises and support the resilience of financial institutions. The researches of scholars present different methodologies and ideas for constructing and implementing these indices in different regions, each of which considers unique economic conditions and specific data limitations.

Before proceeding to the analysis, it is important to understand what the modeling results will be aimed at. First of all, there are theoretical works by national scholars that provide a detailed explanation of the concept of "stability".

In their work, Yevtukh and Shved (2016) highlight important features of a stable banking system, emphasizing the absence of bank failures, profitability, compliance with national legislation, and resilience to external

shocks. There is also a discussion of the role of state regulators in identifying and improving the banking system. The emphasis on the historical and cultural evolution of banking systems in developed countries is particularly valuable, as it illustrates how legal norms, customs, and economic policies have shaped their resilience over the centuries. However, the text does not delve into quantitative methods or specific indicators that could be used to systematically assess and measure banking stability.

Chkheailo and Kukhar (2022) have made a significant contribution to this field by developing a model for assessing the health of individual banks. Although the calculations presented in their study cannot be directly applied to the assessment of the entire banking system, the indicators they propose are very valuable for analyzing financial stability. Their research, which focuses on bank stability under martial law, highlighted that the financial stability index of a bank is insufficient for stable functioning. The authors recommend prioritizing key factors affecting financial stability, such as equity, liquid and working assets, liabilities (both short-term and long-term), and authorized capital, in order to increase overall stability.

A more complete set of indicators related to the stability of the entire banking sector is presented by Pogorelenko and Sydorenko (2011). Their work deepens the concept of "financial stability", offers a detailed analysis of its content, and summarizes modern methods of risk analysis and assessment. The authors emphasize the importance of improving the system for monitoring the stability of the banking sector as a proactive measure to prevent financial crises. This aspect is especially relevant in the context of globalization of the world economy, when monitoring systemic risks in both the financial system and the banking sector is becoming paramount. The International Monetary Fund has also made a significant contribution to this area by developing a system of financial stability indicators. This system has 12 core indicators and 28 recommended indicators covering sectors such as deposit-taking corporations (banks), other financial corporations, non-financial corporations, households, the liquidity market, and the real estate market. Pogorelenko and Sydorenko's emphasis on a systemic approach to monitoring, combined with the IMF's indicator framework, provides a solid foundation for developing effective tools to assess and ensure financial stability at the macroeconomic scale.

Cheang and Choy's (2011) paper on the Aggregate Financial Stability Index (AFSI) for Macau highlights the importance of monitoring financial stability for early intervention in times of potential crisis. The authors emphasize that an index that reflects the system-wide financial condition over time can provide insights into the emergence of financial stress, which is of practical importance to regulators. While the Macau AFSI effectively captures stressful moments in the region's financial history, limitations in the interpretation of such indices are acknowledged, suggesting that the aggregate index should be used with caution and in conjunction with other indicators.

Similarly, the research by Albulescu and Goyeau (2010) on the Romanian financial system considers the construction of the AFSI to provide a transparent and practical method for assessing systemic financial stability. This work is particularly valuable for its structured approach, which details the methodological steps required to construct the index, such as the selection of indicators and the application of weighting methods. The results of the research suggest that the AFSI not only allows for tracking the dynamics of stability, but also helps to identify periods of stability, instability and crisis. This methodology offers repeatable findings that can be adapted to different financial systems, although it is also data-dependent and the choice of indicators requires customization based on system-specific factors.

Koop and Korobilis (2014), considering a dynamic index of financial conditions for the US financial system, suggest a more flexible approach to constructing the index. By using techniques such as dynamic model selection (DMS) and dynamic model averaging (DMA), the index adapts to changing conditions in the financial sector and the economy as a whole. This approach is particularly relevant in dynamic and complex financial environments such as the United States, where variable selection and weighting must reflect current economic realities. Their emphasis on flexible methodology is a valuable achievement, although it may be difficult to apply in environments with less complete data availability.

Meanwhile, Sere-Ejembi et al. (2014) study on the Banking System Stability Index (BSSI) in Nigeria shows how stability indices can reflect the resilience of the regional banking environment to shocks. The Nigerian BSSI has successfully captured crisis episodes, including the intervention of the Central Bank of Nigeria in 2009, and has served as a signal of potential instability. However, the authors identify limitations, particularly in retrospective indicators and sample size that may affect the index's predictive accuracy. The study's recommendation for using the BSSI as a regulatory tool highlights its potential as a precautionary tool, although it also stresses the need to improve the availability and quality of data to increase the reliability of the index.

Some issues of financial stability in the context of financial policy have also been considered by scholars Chugunov (2023), Gusarevych (2023), Pasichnyi et al. (2023).

In all these studies, the advantages of stability indices are clear; their authors offer a quantitative tool for assessing financial stability and identifying vulnerabilities. However, there are also shortcomings, including data limitations, methodological adaptation to different financial environments, and the need for continuous improvement. Taken together, these findings indicate that while financial stability indices play an important role in providing early warning and assessing the health of the financial sector, they need to be complemented by other regulatory measures and qualitative analytical data to ensure a comprehensive approach to financial stability.

Several models are usually used to assess the financial stability of the banking system. The following approaches are widely used in international practice (Dzyublyuk et al., 2014):

rating systems (e.g. CAMELSO, PATROL, ORAP) provide a comprehensive assessment of financial stability, but are limited by their subjective nature and applicability only for real-time assessment;

statistical models (e.g. FIMS, SAABA) include various data sets and influencing factors in the analysis, but are often expensive to implement;

ratio analysis systems (e.g. BAKIS) effectively identify general trends in the banking sector, but require large and detailed studies to obtain meaningful conclusions;

comprehensive banking risk assessment systems (e.g. RATE, RAST) take into account various influencing factors, but, as a rule, do not make their conclusions publicly available.

One of the most famous aggregated financial stability indices is the banking Z-Score. This indicator is calculated as the sum of the bank's capital-to-asset ratio and return on assets divided by the standard deviation of return on assets. The basic principle of the Bank Z-Score is that a banking system is considered stable when the probability of losses exceeding its capital is minimized. However, its application in the Ukrainian context poses certain difficulties, primarily due to the significant delay between the calculation of this indicator by World Bank experts and its final publication. In addition, since the indicator is usually calculated on an annual basis, obtaining quarterly or monthly values requires significant additional calculations.

One of the significant shortcomings is that many existing models are based on indicators of the current state of the banking system, rather than tools for predicting future stresses. These indices often lack the methodological basis necessary to predict potential crises, which limits their usefulness in proactive risk management of banks. In order to fill this gap, we have proposed a forecasting model that allows us to solve the classification problem, in which class 1 is predicted as a stressed period, 0 as a normal one, offering clear predictive value. Such an approach not only expands the possibilities of monitoring the stability of the banking system, but also provides a reliable basis for predicting stressed periods, thus contributing to more effective decision-making and risk mitigation.

The aim of the research is to develop a model for predicting the stability of the banking sector based on the corresponding aggregated index.

The research hypothesis is that it is impossible to predict the stability of the banking sector using existing macroeconomic and bank performance indicators, as these indicators mainly reflect previous and current conditions and do not provide sufficient prediction of future risks or stressful periods.

The methodology uses logistic regression to predict banking sector stability by modeling the relationship between selected indicators and the likelihood of financial stress. Logistic regression is a statistical method that estimates the probability of a binary outcome (e.g., stress or no stress) based on predictor variables, assigning regression coefficients to each indicator to

quantify their impact and significance. Indicators with higher absolute coefficients and low p-values (less than 0.05) are identified as the most significant for predicting stress. In the results of logistic regression, the z-score shows how many standard deviations the coefficient differs from zero, providing a measure of the significance of each predictor in explaining the binary outcome. Regression outputs a probability score for each observation, classifying it as 1 (stress) or 0 (no stress) based on a predefined threshold, thus providing a reliable basis for detecting periods of instability. The class 1 prediction probability is an index.

The main part of the research consists of three sections: a general description of the methodology for building a predictive model for the basis of linear regression, a description of the input indicators and the feasibility of their use, the forecasting result, and the interpretation of the calculation results.

1. Description of the proposed forecasting model

We propose the methodology for calculating the aggregated stability index of the banking sector of Ukraine, based on the use of financial aggregated data of the banking system of Ukraine, which includes balance sheet and other indicators of bank activity. This methodology is designed to forecast financial stress in the next month by analyzing changes in these indicators in the current month. Such a dynamic approach allows us to determine an index that reflects changes in the banking sector, which can potentially serve as an early warning of its financial stress.

The calculation of the index begins with the aggregation of monthly data on balance sheets, financial ratios and a report on balance sheet balances and key indicators of the activities of Ukrainian banks. This aggregated data set forms a cumulative monthly state of the overall financial activity of the sector. Taking into account monthly changes, the goal of the model is to identify early signs of potential stress in the banking system. Significant fluctuations in key indicators, such as liquidity ratios, capital adequacy or credit risk indicators, are indicated as signals of increased risk of instability.

To determine the specific impact of each variable on the likelihood of future financial stress, regression analysis uses weighting factors. Thus, key indicators, including liquidity, capital adequacy and credit risk ratios, are prioritized according to their significance in the forecast model.

To predict whether a sector will experience stress in the next month, we use a logistic regression model in which the outcome variable (Y) indicates whether the next month is classified as "stressed" (1) or "non-stressed" (0). The classification is based on predefined financial stress thresholds calibrated to detect variations in risk intensity, in particular:

- a month is classified as stressed (Y=1) if the financial stress index exceeds a threshold of 0.034 under normal conditions;
- during periods of increased risk, the threshold for classifying a month as stressed increases to 0.16.

Using logistic regression and dynamic indicator analysis, the methodology improves the accuracy of financial stress forecasting, offering

stakeholders a practical tool for early detection and mitigation of risks. This approach not only improves the monitoring of banking sector stability, but also highlights the importance of adaptive thresholds to account for the unique dynamics of the Ukrainian financial system, especially during periods of heightened uncertainty

2. Description of the indicators used

The independent variables (X) in the model cover a wide range of financial indicators aggregated from the banking sector. They are the loan-to-deposit ratio, the operating income-to-operating expenses ratio, the foreign currency assets-to-foreign currency liabilities ratio, the non-performing loans-to-equity ratio, the return on assets (ROA), the return on equity (ROE), funds with the National Bank of Ukraine, government bonds, funds of non-resident non-bank financial institutions, loans to non-residents, term deposits of other non-resident banks and loans received from other non-resident banks, total assets of non-residents (excluding reserves for active operations) and reserves for active operations of banks – selected for a comprehensive assessment of the financial soundness, credit risk, liquidity, operational efficiency and external risks of the Ukrainian banking sector.

Each of these ratios serves as a basis for assessing the financial strength, liquidity, efficiency and external risks of banks, which are crucial factors in predicting the likelihood of financial stress. For example, the loan-to-deposit ratio reflects liquidity and credit risk, with higher values indicating a potentially stressed state, while the operating income-to-operating expense ratio signals operational efficiency, with a higher figure indicating better financial health and ability to manage costs. The ratio of foreign currency assets to foreign currency liabilities provides an indication of currency risk; an unbalanced currency position can lead to significant vulnerability in unstable conditions. The ratio of non-performing loans to capital measures credit risk by comparing non-performing loans to capital, where a high ratio indicates solvency problems. Return on assets and return on equity measure the profitability and efficiency of asset use, indicating a bank's ability to generate profits and maintain sustainability. Funds at the National Bank are a critical liquidity buffer that can support banks in times of stress, enhancing their stability. A sharp change in them may mean that banks require liquid funds to cover current needs, which may be especially relevant in times of stress/crisis. Government bonds serve as a stabilizing asset, especially during martial law, as they offer banks the opportunity to receive stable income in conditions of uncertainty in the lending market. Risk to non-residents through indicators such as funds of non-resident non-bank financial institutions, loans granted to non-residents and total assets of non-residents indicate foreign dependence and vulnerability to changes in international financial markets. Such dynamics are especially relevant in times of martial law, when foreign capital is more likely to react quickly to risks, which enhances its role in identifying periods of financial stress. Ultimately, reserves for active operations indicate the availability of resources to cover expected losses due to the occurrence of risks.

Given the representativeness and significance of these indicators, the implementation of these indicators in a multifaceted model for assessing the monthly probability of financial stress allows for the early identification of vulnerabilities in the banking sector.

3. Results of modeling

The model for forecasting the stability of the banking sector is summarized in the following *Table* and *Figure 1*.

Table

Correlation calculation results of the influence of individual variables on the probability of financial stress in the banking sector of Ukraine

Indicator	Regression coefficient	Standard error	z-coefficient	p-Indicator	Confidence interval. Lower limit	Confidence interval. Upper limit
Constant	–8.3539	2.568	–3.253	0.001	–13.388	–3.32
Loan to deposit ratio	3.5496	7.82	0.454	0.65	–11.777	18.877
Operating income to operating expenses ratio	2.683	1.976	1.358	0.175	–1.19	6.556
Foreign currency assets to liabilities ratio	–50.9382	35.737	–1.425	0.154	–120.982	19.106
Non-performing loans to equity	–6.0106	5.092	–1.18	0.238	–15.99	3.969
ROA (return on assets)	–4.5957	1.525	–3.013	0.003	–7.585	–1.606
ROE (return on equity)	4.5623	1.514	3.014	0.003	1.595	7.529
Funds in the NBU	4.9227	1.632	3.017	0.003	1.725	8.121
Government bonds	10.076	5.184	1.944	0.052	–0.084	20.236
Funds of non-bank financial institutions-non-residents	0.0928	0.466	0.199	0.842	–0.821	1.007
Loans granted to non-residents	6.3848	3.731	1.711	0.087	–0.928	13.698
Term deposits of other non-resident banks and loans received from other non-resident banks	–10.0759	4.298	–2.344	0.019	–18.5	–1.652
Total assets of non-residents (not adjusted for reserves for active operations)	8.7488	3.671	2.383	0.017	1.554	15.943
Reserves for active operations of banks (including reserves for operations recorded in off-balance sheet accounts)	–24.8814	10.977	–2.267	0.023	–46.397	–3.366

Source: calculated by the author

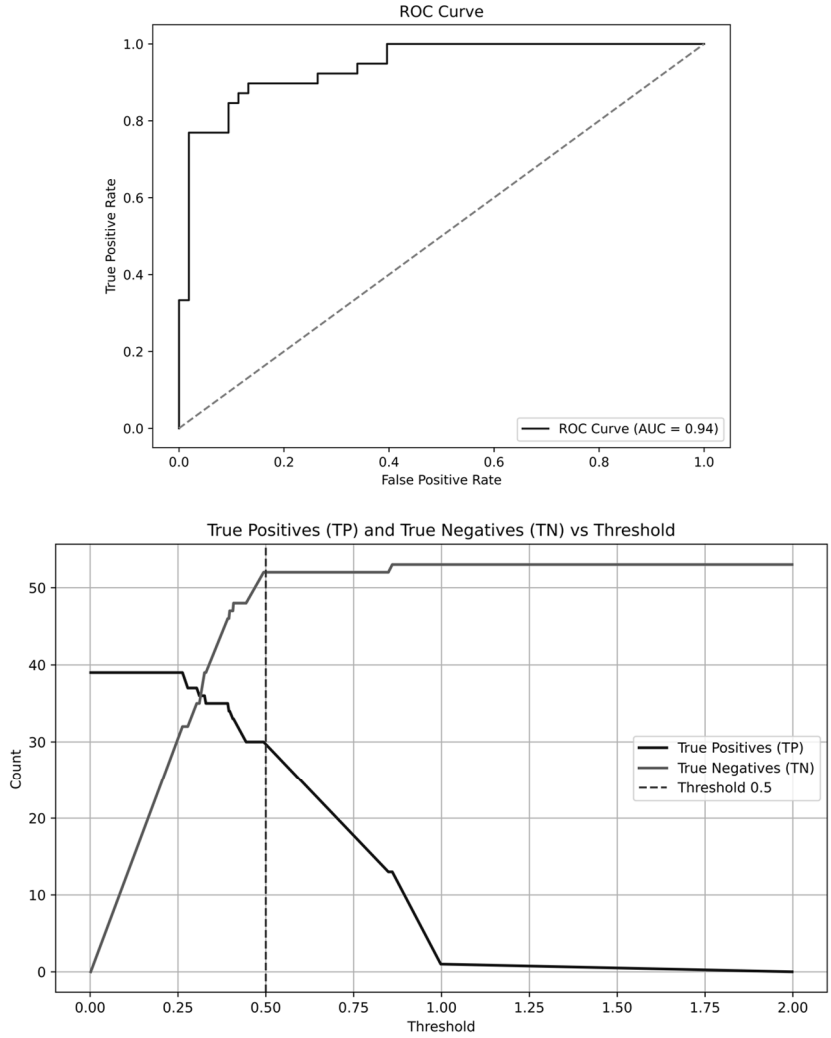

Figure 1. AUC-ROC curve and TPR,
TNR indicators for logistic regression results

Source: calculated by the author.

The logistic regression model demonstrated robust performance, achieving an overall accuracy of 88.04% and an AUC (area under the receiver operating characteristic curve) of 94%, indicating a high discriminative ability to distinguish between stressful and non-stressful periods. The model accuracy is 96%, confirming its high ability to correctly identify stressful periods among predicted positive cases. The recall coefficient of 74% reflects the model's effectiveness in detecting 74% of actual stressful periods. The F1 indicator, which balances accuracy and recall, was calculated at 84%, indicating a balanced performance in predicting both positive and negative classes.

The chosen threshold of 50% was found to be the most optimal for achieving a balanced and accurate forecast. These results highlight the robustness of the model and its practical suitability for forecasting purposes, especially in scenarios requiring early detection of potential stress in the

banking sector. The high AUC and accuracy rates indicate that the model is able to minimize false predictions, while the repeatability rate ensures that a significant proportion of true stress periods are detected. Overall, the model offers a powerful tool for forecasting and effectively responding to the occurrence of stress situations, which can be used by various stakeholders.

Based on the results of the logistic regression, the importance of each indicator in predicting a stress period for the banking sector can be assessed using regression coefficients and p-values. Indicators with a smaller p-value (usually <0.05) are considered statistically significant, indicating a stronger relationship with the probability of a stress period. Below is a breakdown of which indicators appear to be more influential and which are less so.

Significant indicators (p-value < 0.05).

The constant has a significant negative coefficient (–8.3539, p=0.001), indicating that without other factors there is a low baseline probability of a stress event.

Return on assets (ROA): The ROA coefficient (–4.5957, p=0.003) is negative and significant, which supports the thesis that lower return on assets is associated with an increased probability of stress. In the case when banks receive lower return on assets, this may be a precursor to stress.

Return on equity (ROE): The ROE coefficient (4.5623, p=0.003) is positive and significant. In this model, a higher ROE is associated with a higher probability of a stress event. After all, banks that strive primarily to achieve a higher return on equity quite often generate a high risk appetite, which makes them more vulnerable to stress.

The indicator of bank debt to the NBU: has a significant positive coefficient (4.9227, p=0.003). Higher values of this indicator occur when banks rely more on central bank support, which may signal their instability.

The significant negative value of term deposits from other non-resident banks and loans received from non-resident banks (–10.0759, p=0.019) suggests that higher liabilities from non-resident banks may correlate with stress, since a bank's dependence on foreign financing is usually associated with a higher level of risk.

The value of total non-resident assets is positive and significant (8.7488, p=0.017). This may mean that a bank's ownership of foreign assets indicates increased dependence on external financial conditions, which is a hypothetical risk factor in periods of financial instability.

To cover potential losses, banks form reserves, which act as a "financial buffer", which allows maintaining the stability of banks during economic downturns. According to the results of the calculations, it was found that the reserve ratio for active operations is significant and has a negative value (–24.8814, p=0.023). Limit indicators (p-value between 0.05 and 0.10). This provides grounds for the conclusion that the formation of a larger volume of reserves by banks to cover expected losses on active operations leads to a reduction in the risk of stress for the banking sector.

According to the results of the research, the group of limit indicators (p-value between 0.05 and 0.10) includes domestic government bonds and loans granted to non-residents.

The peculiarity of the current functioning of the banking sector of Ukraine is the excess of liquid resources, which are largely invested in domestic government bonds (domestic government bonds); Although not very significant (p=0.052), the positive correlation coefficient (10.076) allows us to make an assumption about a possible connection between risk and OVDP. The dependence of the Ukrainian banking sector on the yield of OVDP, especially in conditions of high risk and stress in the financial system, may indicate an insufficient development of the credit market, where banks avoid lending due to high risks of borrower default and operating costs, choosing bonds as a more reliable instrument with a predicted yield. The tendency to increase the yield on OVDP in such conditions indicates a weak diversification of bank assets and a strong dependence of the lending market on the state of the economy, while investments in bonds allow avoiding operating costs, maintaining the stability of banks' financial flows.

At the same time, as Pylypets (2023) notes, the increase in deposits in the lending sector and the decrease in demand for loans from the population and business, as well as the steady slowdown in loan growth, are explained by the high risks associated with lending to the real sector, since the banking system has high rates of non-returns and overdue loans. The seriousness of the problem of excessive liquidity due to the increase in the share of government bonds is also emphasized by Borodenko and Gorban (2024), emphasizing that banks' business models are undergoing transformational changes due to a change in the structure of profitability.

The coefficient of loans to non-residents is moderately significant (6.3848, p=0.087). After all, lending to non-residents may be associated with stress through the transmission of cross-border risks.

Insignificant indicators (p-value > 0.10).

Loan-to-deposit ratio: with a high p-value (0.650), this ratio (3.5496) is not statistically significant and therefore does not accurately predict stress. Although a higher ratio may indicate liquidity risk, in this case it does not demonstrate a strong relationship.

The value of *the ratio of operating income to operating expenses* (2.683) and p-value (0.175) indicate its limited predictive power, since in such a model this indicator does not allow to distinguish between stable and stressed banks.

The ratio of assets to liabilities in foreign currency with a large standard error and p-value of 0.154 (–50.9382) is also not statistically significant, despite the fact that currency mismatches on the active and passive parts of the balance sheet often generate risk. However, the proposed model does not identify it as a strong predictor.

The ratio of non-performing loans to capital is an important *indicator for ensuring the stability of the banking sector.* Although non-performing

loans are generally important for predicting stability, the p-value (0.238) indicates that they may not be as influential here, perhaps due to limited data variation or existing risk mitigation measures.

Funds of non-resident non-bank financial institutions: this coefficient (0.0928, p=0.842) shows little predictive power. Although dependence on foreign institutions may imply risk, it does not appear to be significant in this model.

The data in *Figure 2* largely demonstrate the correspondence between the predicted stresses based on the proposed aggregate index and the actual stress periods identified using the National Bank's Financial Stress Index. In particular, this is the beginning of 2019, marked by the armed aggression of the Russian Federation in the Kerch Strait; the first quarter of 2020, which coincided with the beginning of the COVID-19 pandemic and the associated economic shocks due to quarantine measures; as well as the entire period after February 2022, characterized by full-scale military aggression of the Russian Federation.

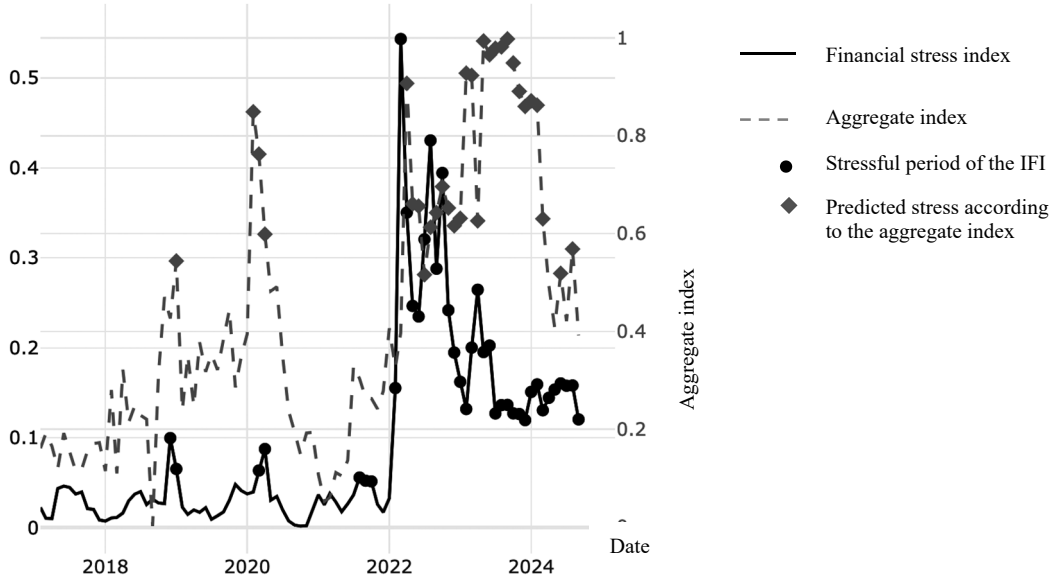

Figure 2. Dynamics of the Financial Stress Index and the forecasted aggregated banking sector stability index in Ukraine during 2018 – October 2024.

Source: calculated by the author.

Thus, the results obtained allow us to assert the high ability of the model to effectively capture significant geopolitical and economic shocks, confirming its usefulness in identifying periods of increased stress in the banking sector.

Conclusions

The initial hypothesis that it was impossible to predict the stability of the banking sector using available macroeconomic and operational data was rejected. By developing a logistic regression model, the research demonstrates that it is indeed possible to predict future stress periods in the

banking sector with sufficient forecasting accuracy. The model achieved an accuracy of 88.04%, an AUC of 94%, and an F1 score of 0.84, confirming its robustness and effectiveness. Using annual changes in key balance sheet indicators, the model provides a robust framework for proactive risk management, offering significant progress compared to traditional descriptive tools that only assess past and present conditions. These results confirm the potential of predictive methodologies in enhancing the early warning capabilities of financial regulators.

This means that the logistic function that predicts the probability of being classified as a stressed period (class 1) can serve as an aggregate index for identifying indicators that cause financial instability. Among the most important predictors are return on assets (negative relationship), which reflects a decrease in profitability during stress; return on equity (positive relationship), which captures increased volatility of profits; funds in the NBU (positive relationship), which indicates the dependence of banks on liquidity support from the central bank; total assets of non-residents (positive relationship), which illustrates the generation of risks associated with the funds of non-bank financial institutions-non-residents; reserves for active operations (negative relationship), which reflects an increase in the level of deductions to cover losses on loans during stress. These indicators are critically important for determining the financial vulnerability of Ukraine's banking sector, especially under martial law conditions, when profitability and risk reduction mechanisms are crucial to ensuring its sustainability.

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