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# ASSESSING THE IMPACT OF THE EXOGENOUS DRIVERS ON THE RESILIENCE OF THE MOLDOVAN BANKING SYSTEM

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**Abstract:** The resilience of banking systems in the face of imminent external vulnerabilities and shocks is becoming vital in the modern world. The instability of national economies and the uneven economic development of individual states, fuelled by banking speculation, cause national banking crises. The latter become part of the global financial turmoil. In this sense, forming a resilient banking system, an essential constituent of a general economic model determining the country's future, becomes relevant. For the Republic of Moldova, creating a resilient banking system becomes a priority in joining the EU. For this, at the initial stage, it is necessary to elucidate the exogenous drivers influencing the resilience of the Moldovan banking system. In order to structure the exogenous factors after the impact level, ANOVA is applied. ANOVA allows a more profound and more accurate examination of the relationships between variables, the identification of hidden factors, and the creation of more accurate models for predicting the future values of these variables. Through ANOVA, we identified the dependencies between exogenous factors and determined which are more significant and which do not affect the resilience of the Moldovan banking system. Applying ANOVA, we determined how each of the exogenous drivers affects the resilience of banking systems, and based on the results obtained, ways to strengthen the resilience of the banking system will be further developed. These findings have practical implications for the future of the Moldovan banking system, providing a roadmap for strengthening its resilience and stability.

**Keywords:** resilient banking system, exogenous drivers, exogenous drivers, NPL, ANOVA.

**JEL Classification:** E3, F3, G21

## 1 Introduction

In the context of the vulnerability of financial markets and the intensification of the cross-border process of forming the global financial system, the banking sector should be developed while considering the influence of external factors on the functioning of financial institutions. Ensuring financial stability is of decisive importance for commercial banks both in the stages of the crisis and

recovery from it, as well as in the stage of post-crisis economic recovery. After the global economic crisis and the pandemic crisis, which was a catalyst for the development of FinTech, the competition in the financial services market intensified. Under these conditions, the tasks of managing liquidity and financial stability were updated for the domestic banking system, the effectiveness of which was the well-being of the banks themselves, the formation of reserves and funds, and functionally oriented towards promoting their development. In the context of the current financial environment and national macroeconomic instability, solving the problems of ensuring the financial stability and reliability of commercial banks and other economic agents becomes more difficult. Risks arising in the financial system are not "automatically" eliminated by the market mechanism. Therefore, the modern financial sector needs new tools to ensure financial stability. Market instability has a negative impact not only on financial stability but also on the sustainable development of the national economy. In these, it is necessary to develop a strategy for developing the banking system from the perspective of resilience. The objectives of the financial stability management strategy, considering the global experience and the characteristics of the Moldovan financial system, update the importance of generalizing and understanding the progressive internal and external achievements in this direction. The evolution of the forms and methods of regulating financial stability in market conditions and economic uncertainty has many facets and contradictory elements. For the financial system's stability of the Republic of Moldova financial system to impact sustainable economic growth, it needs resilient development, especially of the banking system, which is its essential component.

**2 Literature review**

The Cambridge English dictionary defines resilience as "the quality of being able to return quickly to a previous good condition after problems: The resilience of the economy has come as a surprise to some" (Cambridge Dictionary).

The term "resilience" transcends disciplinary boundaries, finding application in numerical methods, mechanics, economics, sociology, and psychology. In all these sciences, resilience is understood as the ability of a dynamic system to return to its initial state (equilibrium position) after the stabilization of external factors. Some authors define resilience as the ability of a subject to fulfill, at a level established by society, its inherent functions and role in society, regardless of the influence of external and internal factors that prevent their implementation (Xiaoyu and Gang, 2024). In the same context, Fleming J and Ledogar RJ note that resilience is a process that expresses the strength of elements, despite external influences.

The notion of "resilience" was first adopted in systems ecology in the 1970s, when a new approach based on second-order cybernetic models that do not assume equilibrium was accepted (Walker & Cooper, 2011).

The concept of resilience in the context of systems was first used in ecology in the last century. The pioneer in this field was Holling, who, in his article Resilience and Stability of Ecological Systems, defined resilience as the ability of the system to master shocks in the state of variables and, therefore, to return to the initial state of equilibrium until the emergence of vulnerabilities (Holling, 1973). This historical context provides a rich foundation for our understanding of resilience.

In the meantime, this concept has been adopted by other fields of science. Resilience has been adopted in areas where crises persist and system management adapted to exogenous crises is needed (Ruza et al., 2019). These areas are the urban system, transport, and, finally, the financial system.

For the research of complex systems, it is necessary to emphasize the system's ability to respond to external vulnerabilities, overcome shocks, and evolve, which constitutes resilience. The banking system, which by all its characteristics is a complex adaptive system, must have its resilience placed at the center of financial stability (Cecchetti and Tucker, 2016).

In the context of economic globalization, when currency, banking, and financial crises periodically break out in one or another part of the world, the problem of ensuring stable economic development in each country becomes more acute, which largely depends on the resilience of the banking sector. The determining factors in the formation of trust from depositors, partners, and investors in banks are their financial stability and stable development (Ocampo et al., 2000). There is no doubt that both financial stability and stable development should not be short-term achievements of banks, but their strategic objectives, which in turn will determine the dynamism of market transformations and the improvement of social standards.

The resilience of the banking system does not imply a state of stagnation but a state of sustainable development, not only the effective overcoming of all external and internal influences but also a flexible response aimed not so much at prevention but at the use of new circumstances and properties and relationships for self -development. Even in countries with developed economies, in crisis conditions and the absence of internal compensators, the market system demonstrates a state of extreme instability. An unbalanced commodity system cannot stabilize independently and requires instruments of monetary leverage from the issuing center. J. Tobin (1965) and M. Sidrauski (1967) proposed such models of monetary policy at the macroeconomic level.

F. S. Mishkin, in his publication: "Global financial instability," offers the following definition of financial stability: This is the balance of financial flows, the availability of own funds that allow the organization to function for a certain period. Financial independence is highly dependent on financial stability (Mishkin, 1999).

Some authors distinguish between static and dynamic financial system resilience. By static financial resilience of the banking system, we mean compliance with the parameters of the banking system's activity (capital, liquidity, solvency, profitability, level of problematic assets, etc.) within acceptable limits. Dynamic financial resilience means a constant and balanced growth of positive factors, simultaneously with the reduction of the negative parameters of the banking system's activity within the limits of acceptable risk by a particular system of strategic objectives and current agreed for its operation in the process of progressive development (Ponomareva & Malakova, 2016).

In his work "Safeguarding Financial Stability: Theory and Practice," G. Schinasi formulated the following definition of financial resilience: "This is a state in which the financial system can withstand shocks and eliminate imbalances, thus reducing the likelihood of serious disruptions" (Schinasi, 2006).

Financial resilience is a dynamic integral characteristic of the ability of the banking system as a resource and risk transformation system to fully perform (with maximum efficiency and minimum losses) its functions, resisting the influence of external and internal environmental factors (BIS, 2018).

**3 The impact of exogenous factors on the resilience of the banking system**

Generalizing the offered resilience concepts gives reasons to state that the banking system's resilience has a complex characteristic. From a methodological point of view in specialized literature, resilience is based on five pillars (Constas et al., 2020). Critical outcomes are the first pillar of resilience and constitute the characteristic of the development of the banking system. The second pillar, disturbance

events, represents the vulnerabilities and shocks that could impact the integrity of the banking system. Threatening conditions are the conditions that could threaten the development of the banking system and jeopardize its operation. Disturbance modifiers are rendered through favorable arrangements and properties of the banking system, which provide support and guarantees to withstand external turbulences and maintain and/or improve them. Systemic contexts represent the properties of the banking system, which have the power to improve it or set limits to possible reactions in case of exogenous factors that could deregulate the banking system. As a complex concept, the banking system's resilience is complicated to assess. The study will present resilience through the NPL (Non-Performing Loans) indicator. In the banking sector, bad debts are understood as non-performing loans, which record the presence of obligations for which interest payments have stopped (non-accrual loans) and overdue loans. The standard period for recording violations of agreements according to international standards is a delay in paying debts and interest by 90 days or more. Outstanding loans also include restructured debt (lousy debt restructurings). Loans on which interest payments have ceased represent the most significant portion of outstanding loans and are considered indicators of the probability of default (Wahlen, 1994). Thus, we can consider the NPL indicator of the banking system a simplified representation of its resilience. Figure 1 shows Moldova's Non-Performing Loans Ratio for the last five years. We can see that during the last five years, the NPL ratio has continuously decreased, which indicates a positive evolution of the resilience of the Moldovan banking system.

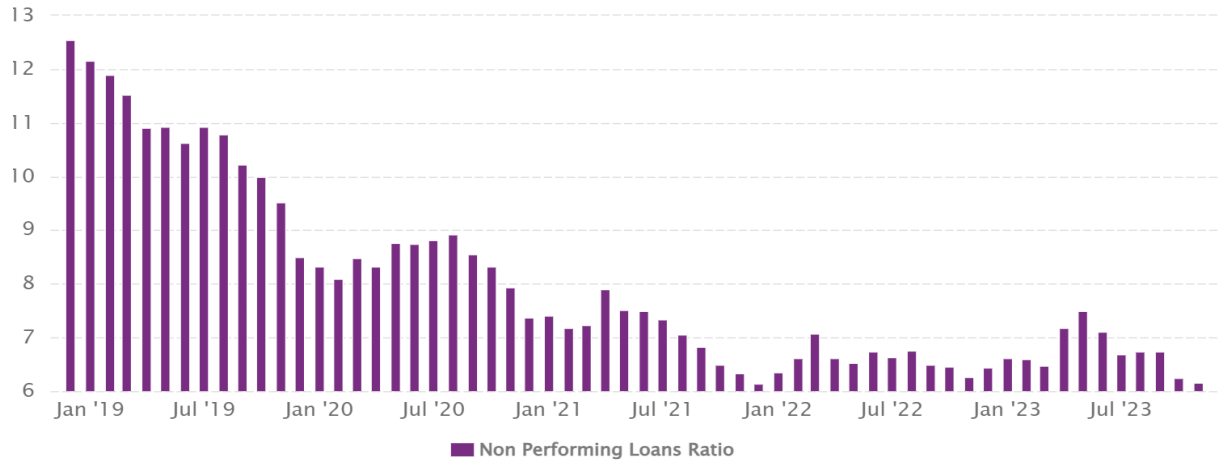


**Figure 1. Moldova's Non-Performing Loans Ratio, Jan 2019-Jul 2024**

**Source:** Ceicdata (2024).

Next, we will determine the exogenous factors that influence the banking system's resilience, in our case on NPL. In the specialized literature, the impact factors on NPLs are mostly grouped into two categories: internal factors (specific to the banking system/banks) and external (macroeconomic) factors (Mahyoub and Mohd Said, 2021). In the present study, we will analyze how exogenous factors influence NPL. In this regard, the following exogenous impact factors on non-performing loans were selected: real GDP growth, unemployment rate, public debt, and internal loans granted to the private sector by banks as a percentage of GDP. To determine the impact of exogenous factors on NPL, we will use the ANOVA method, a statistical method used to test for significant differences between the means of data groups (). The first results obtained are the goodness of fit coefficients, including $R^2$ (the coefficient of determination) and adjusted $R^2$.

**Table 1 Goodness of fit statistics (NPL)**

| | |
|---|---|
| Observations | 40 |
| Sum of weights | 40 |
| DF | 36 |
| $R^2$ | 0.873 |
| Adjusted $R^2$ | 0.863 |
| MSE | 24.501 |
| RMSE | 4.950 |
| MAPE | 82.501 |
| DW | 1.437 |
| Cp | 4.000 |
| AIC | 131.733 |
| SBC | 138.489 |
| PC | 0.155 |
| Press | 1088.916 |
| $Q^2$ | 0.844 |

From the tables, we can see that $R^2$ (the coefficient of determination) has a value of 0.873 and indicates how much of the variability of the modeled variable (NPL) is explained by the explanatory variables (exogenous factors); thus, 87% of the variability is explained. The remaining 13% is explained by other variables, which are not included in the model.

**Table 2 Analysis of variance (NPL)**

| Source | DF | Sum of squares | Mean squares | F | Pr > F | p-values significati on codes |
|---|---|---|---|---|---|---|
| Model | 3.000 | 6077.127 | 2025.709 | 82.680 | **<0.0001** | *** |
| Error | 36.000 | 882.022 | 24.501 | | | |
| Corrected Total | 39.000 | 6959.149 | | | | |

From the analysis of variance, we can determine whether the information provided by the exogenous factors has value or not. The test used here is Fisher's F test. Given that the probability corresponding to the F-value in this case is 0.001, this means that we would be taking a risk of 0.1%.
Therefore, we can find that exogenous factors affect NPL, considering that $R^2$ is very good (0.87).

**Table 3 Model parameters (NPL)**

| Source | Value | Standard error | t | Pr > \|t\| | Lower bound (95%) | Upper bound (95%) | p-values significati on codes |
|---|---|---|---|---|---|---|---|
| Intercept | 2.253 | 1.565 | 1.440 | 0.159 | -0.921 | 5.428 | ° |
| NPL-Domestic credit to private sector (% of GDP) | 20.546 | 2.214 | 9.281 | **<0.0001** | 16.056 | 25.035 | *** |
| NPL-GDP growth | 0.000 | 2.214 | 0.000 | 1.000 | -4.489 | 4.489 | ° |
| NPL-Public debt (% of GDP) | 27.707 | 2.214 | 12.516 | **<0.0001** | 23.217 | 32.196 | *** |
| NPL-Unemployment, total (% of total labor force) | 0.000 | 0.000 | | | | | |

Analyzing the table, where the parameter model is presented, and the figure below, we can see that the analyzed exogenous factors have significantly different effects on NPL. The public debt (% of GDP) and domestic credit to the private sector (% of GDP) factors have a significant impact on NPL.

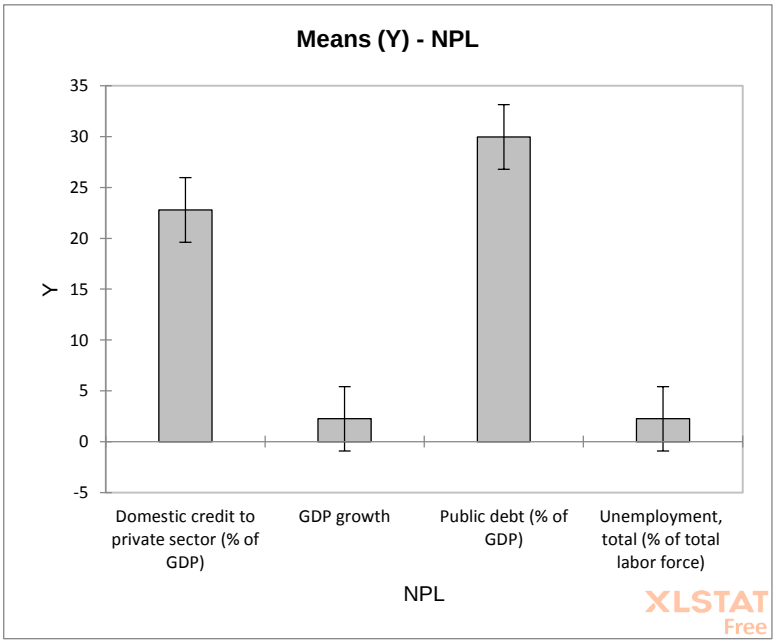


**Figure 2. LS Means for factor NPL**

In conclusion, the model's results show that the explanatory variable explains 87% of the variability of the dependent variable Y. Given the p-value of the F statistic computed in the ANOVA table and the significance level of 5%, the information provided by the explanatory variables is significantly better than what an essential mean would provide.

## 4 Conclusion

Thus, we can conclude that the banking system's resilience should be understood as the ability of the system to return to a balanced (stable) state and perform its primary functions after causing any destabilizing impact. Moreover, monitoring the banking system's resilience must be carried out for a certain period of time, sufficient to determine whether the system has reached a state of equilibrium (at least one year). Only after this can we talk about the banking system's stability and readiness to adequately respond to external or internal threats. Based on historical experience, we can confidently say that the resilience of the banking system of the Republic of Moldova or another country directly correlates with the state's economic development level. If the resilience of the banking sector is disturbed, this situation can seriously threaten the financial security of the state, which will negatively affect the socio-economic condition of the population and the real sector of the economy. As a result, modern banking practice requires assessing the banking system's resilience and determining the impact of both endogenous and exogenous factors.

Modern banking practice requires the assessment of financial stability in the following areas: assessment of the macroeconomic situation and development trends of the banking system, assessment of the sufficiency of the number of banks and the size of their branch network in terms of the need for banking services from the population and businesses; monitoring the activity of banks;

analysis of bank statements by the implementation of certain norms and rules established by the Central Bank.

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