DOI: 10.47743/ejpar.2024-3-5

STABILITY OF THE BANKING SECTOR AND MACROECONOMIC PERFORMANCE IN THE COUNTRIES OF THE EUROPEAN UNION

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Abstract
The paper aims to discuss the current challenges of the banking sector in terms of risks in bank lending and to highlight the importance of effective risk management. The analysis spans a 21-year period (2000-2020) and focuses on three groups of countries, namely all European Union (EU) countries, euro area countries and non-euro area countries. Using a multiple linear regression model and the Generalized Method of Moments (GMM) we empirically investigate the impact of macroeconomic factors on the stability of the banking sector, as measured by the non-performing loan (NPL) ratio. Our contribution consists in empirically analyzing the impact of macroeconomic factors on credit risk as measured by the NPL ratio and identifying its key determinants, while also assessing the stability of the banking sector.
Keywords: *banking sector, non-performing loans, macroeconomic factors, EU countries.*
JEL Classification: G21, C33, O52.

1. INTRODUCTION

The banking sector is a significant component of the financial system and plays a fundamental role in the evolution and development of an economy, being a basic pillar in its financial intermediation and financing activity. Any operation carried out in this sector also involves risk, which may be greater or lesser, depending on the scale and scope of the activity. The concept of risk has become an increasingly common and ubiquitous phenomenon in the work of any entity as digitalization and innovation processes have intensified. Years ago, some risks that are of particular importance today were not discussed and included in

banks' reports, such as climate risks or cyber risks, but were mainly focused on credit risk, interest rate risk, liquidity risk, and traditional risks.

The research topic of our paper is important because the possibility of the manifestation of risks has gradually become a threat to banks, on the one hand, but also to borrowers. At the same time, the knowledge of the effects that may occur because of bank mismanagement, as well as the measures to be adopted in order to prevent or recover from such events, is also a topic of interest. In this way, it is essential that the risks involved in the activities carried out by banks are discovered and that there is involvement in the process of managing them, tailored to their specific features. There is a diversity of risk quantification methods, and they are not universal in nature, which requires extra care in finding the right one.

The main objective of our study is to empirically investigate the impact of macroeconomic factors on the stability of the banking sector, as measured by the non-performing loan ratio. In addition, we aim to identify which of the analyzed macroeconomic variables would have a significant impact on banking stability. The analysis covers the period 2000-2020 and focuses on three groups of countries, i.e. all European Union (EU) countries, euro area countries and non-euro area countries.

Our research is structured as follows: section 2 reviews the literature, focusing on the determinants of non-performing loans; section 3 presents the data, describes the variables and the research methodology; section 4 presents and discusses the results of the empirical estimations and section 5 contains some concluding remarks.

2. LITERATURE REVIEW

In the literature, the determinants of credit risk are grouped into two categories, namely: macroeconomic factors (Manz, 2019; Umar and Sun, 2018; Fakhrunnas *et al*., 2022; Lemma-Lalisho, 2022) and bank-specific factors (Khan, Siddique and Sarwar, 2020; Manz, 2019; Umar and Sun, 2018; Lemma-Lalisho, 2022).

Analyzing risks in bank lending is a subject of great interest, and there are countless studies conducted by various renowned authors to identify the problems underlying the increase in credit risk, influencing the bank's functioning, profitability, and the increase in the number of non-performing loans. Through the studies, the authors develop models that can be applied to make this phenomenon as insignificant as possible. In the context of the recent international financial crisis, the pandemic crisis of 2020-2022 and other borderline situations, it has been shown how important it is to have effective bank management in a banking system, whether in a developed or developing country.

Thus, over time, studies have mainly focused on analyzing the relationship between the non-performing loan rate, on the one hand, and the action of bank-specific and/or economic factors, on the other. Moreover, it is worth noting that some studies on bank credit risk have focused on a single country or only those in developed economies, which does not reflect the same representativeness as when analyzing a considerable number of countries or countries that fall between two extreme categories. For example, in their paper Ahmad and Ariff (2008) chose to study the link between non-performing loans and bank-specific factors, i.e. management efficiency, loan loss provisions, loan-to-deposit ratio, funding costs, liquidity, regulatory capital. The authors drew a parallel between banking systems in developing and developed economies. The authors emphasized that credit risk is a greater threat in developing economies than in developed economies and that the number of factors influencing the occurrence of credit risk is more prominent compared to banking systems in developed countries. If we have previously presented the link between non-performing loans and bank-specific factors, Roman and Bilan (2015) analyze the effects of macroeconomic factors on the rate of non-performing loans, with the selection of European Union countries in the period 2000-2013. It is highlighted that the growth of GDP, unemployment rate and domestic credit are factors that have a large influence on the evolution of non-performing loans.

Another study (Kjosevski and Petkovski, 2017) focuses on the relationships between macroeconomic and bank-specific determinants of non-performing loans and their influence on macroeconomic performance in the Baltic States for a group of 27 banks over the period 2005-2014. The two authors examined the feedback between the rate of non-performing loans and their macroeconomic determinants. The results suggested that the real economy reacted to doubtful loans and that there are strong feedback effects between macroeconomic conditions such as domestic credit to the private sector, GDP growth, unemployment rate, inflation and non-performing loans.

Alihodžić and Ekşşï (2018) conducted an analysis at the level of Western Balkan countries and credit policy in Turkey to identify the factors influencing the credit growth rate. While in previous works the dependent variable is the non-performing loan growth rate, in this paper it is the credit growth rate, and return on equity, deposit growth rate, real GDP growth rate and non-performing loan rate were considered as independent variables. It was found that there is an inverse relationship between the credit growth rate and the non-performing loan rate for the countries considered. At the same time, there is a positive relationship between the growth rate of loans and the growth rate of deposits because lending is based on deposits attracted.

Golitsis, Fassas and Lyutakova (2019) were concerned with the Bulgarian banking system from 2001-2015 and analyzed a set of determinants of credit risk. Of the 91 determinants tested, credit risk is influenced by macroeconomic

factors such as interest rates, unemployment, construction index, wages. At the same time, leverage, foreign currency borrowing, credit growth, banks' return on assets, capital adequacy and profitability also have a significant impact on credit risk indicators. The final findings show that both bank-specific and institutional factors have a remarkable influence on credit risk in the Bulgarian banking system.

Kukk and Levenko (2019) add a novel element and analyze the relationship between credit quality and indicators of macroeconomic imbalance. They sample three groups of countries, namely Western European countries, Central and Eastern European countries and Southern European countries. Macroeconomic risks can be assessed using macroeconomic imbalance indicators, which are defined as "deviations of an indicator from its long-term trend or cyclical components". The results of the study show that an increase in the deviation of GDP is accompanied by an increase in non-performing loans in all three groups of countries, while the volume of non-performing loans responds to the unemployment rate in the countries of Central and Eastern Europe and Southern Europe.

In a more recent study, Staehr and Uusküla (2020) conduct research to see to what extent different macroeconomic and macro-financial factors have an influence on the share of non-performing loans in total loans and one contribution would be that they evaluate different models to be able to forecast problem loans even a few years in advance. The analysis was carried out for all EU countries, divided into two groups, Western Europe and Central and Eastern Europe, over a 20-year period, and showed that many of these factors are indeed key indicators for the countries analyzed. Thus, GDP growth, low inflation and lower public debt are prerequisites for a non-problematic rate of non-performing loans. Another shortcoming of the study is that the estimates were made at the level of groups of countries in the European Union and thus the results can be considered as averages for the countries concerned and there is a risk that they do not apply to each country individually.

In a study of 40 banks in Indonesia, authors Havidz and Obeng-Amponsah (2020) use three different approaches to investigate the determinants of credit risk. The results showed that bank-specific factors influence credit risk more than macroeconomic variables, which would imply that banks are more resilient to macroeconomic changes than bank-specific factors, but even in these situations, rigorous management is still maintained in controlling credit risk.

The paper by Khairi, Bahri and Artha (2021) proposes to analyze the effects of macroeconomic shocks on the default rates of three types of bank loans on the case of the United States. Most of the studies find a relationship between macroeconomic conditions and credit vulnerability, thus the importance of high volume of non-performing loans on economic stagnation and financial fragility is observed.

Gjini (2018) analyzes the financial system in Albania, where a key component is the banking system, having a particular importance on the country's financial and economic equilibrium. At the end of 2016, banking sector assets amounted to 95.8% of GDP, demonstrating that the banking system is closely correlated with the state's business cycle and sensitive to economic changes. From his perspective, the factors that determine credit risk are grouped into four categories: macroeconomic factors, creditor-related factors, solvency-related factors, and factors related to the structure of assets and liabilities of the banking system. From the analysis it is concluded that there are close relationships between the economic indicators and the NPL ratio in Albania. Thus, there is an inverse relationship between GDP and the level of non-performing loans, so that an increase in GDP leads to a considerable decrease in doubtful loans. In relation to the other variables, non-performing loans are negatively related to interest rate and inflation rate and positively related to unemployment rate.

The issue of credit risk, materialized by the rate of non-performing loans, is widely studied by numerous authors, who try to illustrate as truthfully as possible the effects, relationships, impact of macroeconomic determinants and/or bank-specific factors. Each individual author brings an element of novelty, either in terms of the variables used, the sample used, or the methods used to test hypotheses. Research is carried out to find out what is at the root of the materialization of certain phenomena and to learn how to avoid or at least minimize the effects as far as possible. At the same time, they also have several shortcomings and need to be supplemented, because a study cannot cover absolutely all the defining elements, developments, effects and implications. It is important for the banks to be aware of the risks, the determining factors and to adopt the most effective measures for economic and financial harmonization.

3. DATA, VARIABLES AND RESEARCH METHODOLOGY

The main objective of our study is to empirically investigate the impact of macroeconomic factors on the stability of the banking sector, as measured by the non-performing loan ratio. The analysis focuses on three groups of countries, i.e. all European Union (EU) countries, euro area countries and non-euro area countries. At the same time, we seek to identify the extent to which these determinants influence the dependent variable (the NPL ratio) and the underlying causes of their onset. In carrying out this study on the identification of the factors influencing the materialization of credit risk, we make use of a balanced panel of the 27 countries of the European Union. The advantages of using panel data are that it provides a more consistent volume of information, a high degree of efficiency and can reveal effects that cannot be detected by other analyses. As regards data collection, data were selected according to macroeconomic variables with a potential impact on the evolution of the share of

non-performing loans, while also materializing credit risk, considering data availability. The period has been set taking data availability into account, so that for each of the variables data are available for the same time interval, and the analysis is carried out at an annual frequency over the period 2000-2020, totaling 21 years. It should be noted that this period also includes two crises (the financial crisis and the Covid-19 pandemic crisis) that have marked the economic evolution of each country, which is why we expect this impact to be visible in the econometric analysis. The research has been carried out using data that come from the sets of international financial institutions such as the World Bank (World Development Indicators) and the European Commission (Eurostat Database). In conducting the research, we use independent variables such as economic growth measured by GDP per capita growth (GDP per capita growth), inflation rate (infl), unemployment rate (unemp), domestic credit granted by banks to the private sector (DCPSB), budget deficit (gds), public debt (debt), exchange rate (exch) and a dependent variable being credit risk measured by the non-performing loans (NPL) rate. The model used in the analysis consists of a multiple linear regression model and its general equation is represented below:

$$NPLi,\ t = \beta0+\beta1(GDPgrowth)i,\ t+\beta2(INFL)i,\ t+\beta3(UNEMP)i,\ t+\beta4(DEBT)i,\ t+ \beta5(GDS)i,\ t+\ \beta6(EXCH)i,\ t+\ \beta7(DCPSB)i,\ t+\ \varepsilon i,\ t$$

Where, i = country, i = 1,2,.....,27; t = year, t = 2000,2001,.....,2020; β0 = constant (the free term of the equation); NPL = is the dependent variable; β1,..... βk - coefficients of the independent variables; (GDPgrowth), (INFL), (UNEMP), (DEBT), (EXCH), (DCPSB) = are the independent variables included in the econometric analysis; ε = the error term of the equation.

A main objective of the empirical analysis is to highlight the influences that different macroeconomic factors have on credit risk and in what direction they affect. The variables that will help us during this paper belong to several conceptual areas, thus we have determinants from the banking sector (domestic credit granted to the private sector by banks, non-performing loans rate), from the macroeconomic level (inflation rate, unemployment rate, exchange rate, GDP per capita growth rate) and from the public finance (public debt, budget deficit). A brief description of the variables included in the study is presented in Table 1.

The *rate of non-performing loans* (npl) is a key indicator of the credit risk propagating on loans granted by banks to individuals and legal entities. Doubtful loans occur because of the manifestation of some factors on the borrowers and thus their financial capacity diminishes, and they remain in arrears, in this situation they either inform the bank about the difficulties and thus ways are found to resolve them, or they choose not to communicate, and legal procedures are applied, finally the loan becomes problematic. In line with other studies

dealing with the link between the non-performing loan rate and macroeconomic determinants, we observe that the latter influence the evolution of our dependent variable, highlighting that credit risk is an increasingly present one (Klein, 2013; Castro, 2013; Staehr and Uusküla, 2020; Foglia, 2022).

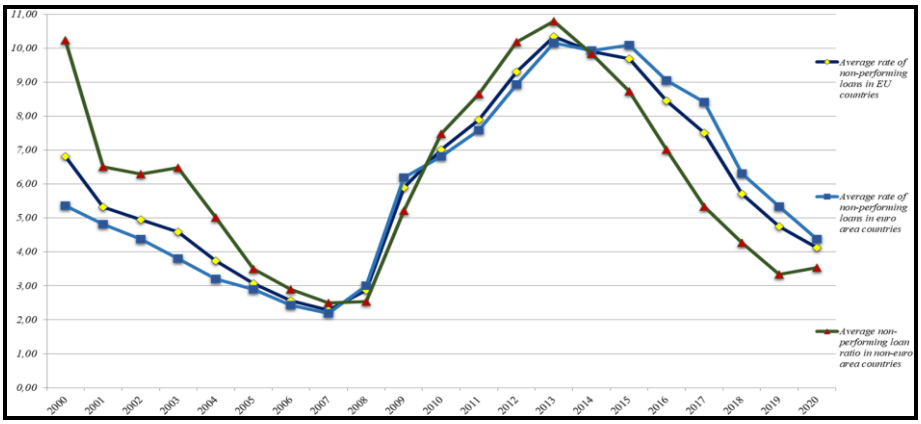
Table 1. Description of selected variables and expected impact

Variable	Symbol	Unit of measurement	Description of variables	Expected effect	Data source
Dependent variable					
Non-performing loans rate	npl	%	The ratio of non-performing loans to total bank loans		World Bank Data (World Bank Indicators)
Independent variables					
Economic growth	gdp growth	%	GDP per capita growth	-	World Bank Data (World Bank Indicators)
Inflation	infl	%	Inflation, GDP deflator	+/-	World Bank Data (World Bank Indicators)
Unemployment	unemp	%	Unemployment rate as percentage of total workforce	+	World Bank Data (World Bank Indicators)
Domestic credit	dcpsb	%GDP	Domestic credit to the private sector	+/-	World Bank Data (World Bank Indicators)
Budget deficit	gds	%GDP	Government deficit/surplus, debt and related data	-	European Commission (Eurostat)
Public debt	debt	%GDP	General government gross debt	+	European Commission (Eurostat)
Exchange rates	exch	Index, 2010=100	Real exchange rate (consumer price index - 27 trading partners)	+/-	European Commission (Eurostat)

Source: processed by the authors

If we analyze the dynamics of the non-performing loans rate at the European Union, euro area and non-euro area level over the years 2000-2020 (Figure 1), we observe that the evolutions follow approximately the same trend and there are small fluctuations that differentiate them. So, there are clear minima and maxima. There was a decline in the volume of lending from 2008 onwards, caused by the global financial and economic crisis, also known as the Great Recession. Since 2008 these effects have been noticeable and peaked in 2013, followed by declines which may be due to the effectiveness of the recovery measures adopted. The effects of the crisis are diverse and have had a significant impact, for example the unemployment rate has risen due to the bankruptcy of many businesses and thus incomes have fallen, reducing the ability of debtors to pay. In 2013, it was 10.34% in the European Union, 10.16% in the euro area and 10.79% in the non-euro area, while in 2008 it started from 2.87%, 3.00% and 2.54%. At the same time, the average for the countries that have not adopted the euro started from the lowest value of the three in 2008 but became the highest compared to the other two values in 2013, which shows a higher impact in this category, demonstrating a weaker management of this global event.

From the perspective of Foglia (2022), the relationship between *economic growth* (gdp growth) and the rate of non-performing loans is expected to be negative because under conditions of increasing GDP there is also an increase in the income of firms and the population, which would lead to honoring payment obligations, thus a decrease in doubtful loans. A negative relationship is also expected in other studies, such as Roman and Bilan (2015) where a decrease in the value of GDP is marked by an amplification of problem loans. In line with the expected results are also the studies by authors (Nkusu, 2011; Havidz and Obeng-Amponsah, 2020; Jabbouri and Naili, 2019).



Source: own calculations and processing based on World Bank Database (2022)

Figure 1. The dynamics of the non-performing loan ratio in the EU, euro area and non-euro area, 2000-2020

In many analyses, the impact of the *inflation rate* (infl) is viewed in two ways: negative and positive. From the perspective of Havidz *et al*. (2020) the positive link is observed when a high value of it materializes in a decrease in the real value of borrowers' income and thus repayment deficiencies occur and non-performing loans increase. On the other hand, the negative relationship arises when inflation would reduce the real value of the credit contracted and in this way its repayment becomes easier and thus a decrease in the rate and implicitly an improvement in the loan portfolio. In line with this view is the study by Nkusu (2011) who in addition to what is already mentioned, he states that inflation can also affect a borrower's debt service when interest rates on loans are variable and thus there is the possibility of a change in the borrower's debt burden, because of the fact that, lenders fold rates in such a way that they preserve their real yields or to transfer the effects of decisions taken to combat inflation. Along the same lines are the studies belonging to the authors (Roman and Bilan, 2015; Kjosevski and Petkovski, 2017; Bayar, 2019).

If we relate to the *unemployment rate* (unemp), we expect the relationship to be positive as borrowers are left without sources of income and thus will default, so this will increase the rate of non-performing loans, which is also emphasized by Bayar (2019). Nkusu (2011) in his study mentions that unemployment is positively correlated with the volume of bad loans, similarly (Ghosh, 2015; Golitsis, Fassas and Lyutakova, 2019; Kjosevski and Petkovski, 2017). According to Foglia's (2022) hypothesis, unemployment also has a positive relationship with our dependent variable, as an increase in the unemployment rate leads to a decrease in household purchasing power and hence to defaulting on payments to the bank.

Regarding the *domestic credit* (dcpsb), it expresses the degree of financial intermediation and if the value of this determinant is high then the probability of the volume of non-performing loans is also higher, hence we have a positive relationship between these two variables Roman and Bilan (2015). On the other hand, in Kuzucu and Kuzucu (2019) authors' paper they mention that this relationship in relation to the ratio of non-performing loans can be both positive and negative depending on the context. Thus, among customers, if the size of credit within a country were to increase then the leverage ratio would also be higher at the household level. This deteriorates debt servicing, because if a household takes out more than one loan, conditions permitting, in unforeseen circumstances at least one of the loans would be problematic and lead to an increase in the latter. But a negative link, from the banks' perspective, would be if they lower their lending standards, leading to an increase in non-performing loans.

In the literature, *exchange rate* (exch) relationships are ambiguous. Thus, there can be positive or negative effects depending on the context. In this way, an appreciation of the exchange rate disadvantages export-oriented firms as higher costs arise and the ability to repay debts decreases, while a negative relationship arises when, in the context of a foreign currency loan and an appreciation of the currency, the borrower's financial situation improves. In another idea, this variable has a negative relationship with, the exchange rate, thus a decrease in the exchange rate will lead to an increase in the bank's credit risk (Havidz and Obeng-Amponsah, 2020).

At the *public finance* area level, we used public debt (debt) and budget deficit (gds) as independent variables. Regarding *public debt*, in the study by Fallanca, Forgione and Otranto (2020) states that the return of public debt to a lower level than before would put pressure on the bank to finance in international markets and at the same time credit institutions are forced to reduce lending. From Foglia's (2022) perspective, public debt would have a positive impact on the non-performing loan ratio, arguing that an important role is played by crises, because at such times liquidity is low and banks are forced to restrict lending and refinance loans. So, if public debt were to increase, this would be

reflected in the quality of the assets that banks hold. If there is a positive relationship between government debt and the non-performing loan ratio, we find in the literature that there is a negative relationship between the *budget deficit* and the non-performing loan ratio.

The budget deficit (gds) is included for analysis in the study by Kukk and Levenko (2019), they expect a negative relationship between the non-performing loan (NPL) ratio and the budget deficit, as they argue that to cover this deficit the government borrows from financial markets and thus the private sector benefits from unfavorable lending conditions. As a result, the budget deficit falls but the non-performing loan ratio rises.

4. EMPIRICAL RESULTS AND DISCUSSION

Concerning the computational method, by analyzing the literature related to the topic of analysis, we noticed that authors often use the least squares method (LS) and the generalized method of moments (GMM) with fixed effects. In carrying out the empirical study I applied both methods and the results are similar, therefore and due to their high utilization, I chose to use the latter. In the analysis we decided to divide the 27 countries of the European Union according to the euro adoption criterion, thus we have euro area countries and non-euro area countries. We have chosen this criterion because credit risk can have distinct influences on the two categories and the non-performing loan ratio can differ. The euro area countries, being more homogeneous in some respects, such as national currency, degree of development of the country and monetary policy applied, may be statistically significantly affected by only some of the variables used, while in non-euro area countries the determinants that have a key impact may be more important. Explicitly these developments will be presented and described during the descriptive statistics representation and the estimation of equations at the EU, euro area and non-euro area levels.

The descriptive statistics of the variables used in the empirical analysis of the EU, euro area and non-euro area countries are highlighted in Table 2.

Based on the data, it can be observed that euro area countries have a lower non-performing loan ratio than non-euro area countries. We also observe that the public debt in the euro area is higher than outside the euro area, which can be justified by the extremely high debts of some countries, which in these circumstances do not significantly affect their continuity, while in non-euro area countries public debt is low. About public finance variables, the average government budget balance over 21 years for euro area countries is -2.64%, while for non-euro area countries it is -2.20%, which is relatively close. The degree of financial intermediation, illustrated by domestic bank loans to the private sector, reached an average of 101.98% of GDP at the euro area level.

Going further, we observe that the EU countries deviate from the average NPL ratio by 6.96%, while the non-euro area countries deviate by 5.58% and the

euro area countries by only 7.48%. Table 2 also reflects information regarding the skewness and skewness indicators, thus in the case of the dependent variable, Skewness presents positive values, at the level of the three groups of countries, which indicates a right skewness, while in the case of the other variables we also find negative values, but the majority are positive, indicating that the model has a right skewness distribution. The positive values of the Kurtosis indicator for all variables and in all country, groups suggest a leptokurtic distribution, the values of the 8 variables are close to their means, thus they are individually homogeneous.

Table 2. Descriptive statistics of the variables

	NPL	GDP growth	Unemp	Infl	Debt	Gds	Depsb	Exch
Total EU countries								
Mean	6,0365	1,9976	8,6473	2,6827	58,4764	-2,5139	92,8312	97,9762
Median	3,6864	2,0035	7,5400	2,0095	52,4000	-2,3000	85,3563	99,7574
Max.	47,478	23,9990	27,4700	43,1807	206,3000	6,9000	304,9514	115,2981
Min.	0,0820	-14,4643	1,8100	-9,6661	3,7000	-32,1000	7,1154	60,1648
Std. Dev.	6,9697	3,9633	4,3718	3,6602	34,8289	3,5978	52,4492	6,6965
Skewness	2,7053	-0,1995	1,4452	5,1055	1,0444	-1,4055	1,0743	-2,1289
Kurtosis	12,4536	6,5311	5,3518	48,1386	4,4873	11,0688	4,2661	9,8407
Jarque-Berra	2803,049	298,3487	328,0499	50599,14	155,3457	1724,834	146,9411	1533,869
Obs.	567	567	567	567	567	567	567	567
Euro area countries								
Mean	5,9653	1,7236	8,8393	2,1678	64,7651	-2,6423	101,9812	99,0702
Median	3,3638	1,7375	7,7600	1,8779	61,2000	-2,4000	95,0085	100,1464
Max.	47,7478	23,9990	27,4700	20,0614	206,3000	6,9000	304,9514	112,9346
Min.	0,1000	-14,4643	1,8100	-9,6661	3,7000	-32,1000	13,1648	60,1648
Std. Dev.	7,4831	4,1688	4,5477	2,4569	38,2506	3,8100	50,5369	5,9394
Skewness	2,8969	-0,0321	1,4668	1,4017	0,7302	-1,6340	1,1793	-2,9750
Kurtosis	12,8701	6,9260	5,5512	14,0625	3,6375	11,8432	4,8663	16,9631
Jarque-Berra	2177,180	256,3221	242,1635	2165,229	42,2157	1477,708	150,4064	3829,973
Obs.	399	399	399	399	399	399	399	399
Countries outside the euro area								
Mean	6,2056	2,6484	8,1911	3,9054	43,5407	-2,2089	71,1000	95,3779
Median	4,3146	3,1340	7,1350	2,6211	40,3500	-2,1500	52,5453	97,3154
Max.	29,3000	11,1442	19,9200	43,1807	87,3000	5,0000	223,8336	115,2981
Min.	0,0820	-7,7007	2,0100	-1,4253	12,3000	-9,3000	7,1154	70,1279
Std. Dev.	5,5804	3,3484	3,8974	5,3742	17,4781	3,0236	50,6125	7,6329
Skewness	1,2973	-0,6570	1,2366	4,6074	0,5280	-0,0578	1,3226	-1,1016
Kurtosis	4,2995	3,9160	4,0646	29,3565	2,8004	2,7047	3,8033	4,4963
Jarque-Berra	58,9451	17,9619	50,7560	5457,058	8,0870	0,7039	53,5020	49,6575
Obs.	168	168	168	168	168	168	168	168

Source: own calculations in Eviews 12 based on World Bank Database and Eurostat (2022)

The empirical results can be followed in Table 3.

The application of the GMM model helps us to observe the implications that the independent variables have on the dependent one and the degree of representativeness. Thus, in the case of the inflation rate, we find that at the level of non-euro area and EU countries the links are negative and representative with

a probability of 99% for non-euro countries and 95% for EU countries for the variable non-performing loan rate. For euro area countries there is a positive but unrepresentative relationship. The effects of inflation are therefore both positive and negative, results which are in line with several studies by authors who have analyzed macroeconomic determinants.

Table 3. Empirical results

	NPL	GDP growth	Unemp	Infl	Debt	Gds	Dcpsb	Exch
Total EU countries								
Mean	6,0365	1,9976	8,6473	2,6827	58,4764	-2,5139	92,8312	97,9762
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Median	3,3638	1,7375	7,7600	1,8779	61,2000	-2,4000	95,0085	100,1464
Max.	47,7478	23,9990	27,4700	20,0614	206,3000	6,9000	304,9514	112,9346
Min.	0,1000	-14,4643	1,8100	-9,6661	3,7000	-32,1000	13,1648	60,1648
Std. Dev.	7,4831	4,1688	4,5477	2,4569	38,2506	3,8100	50,5369	5,9394
Skewness	2,8969	-0,0321	1,4668	1,4017	0,7302	-1,6340	1,1793	-2,9750
Kurtosis	12,8701	6,9260	5,5512	14,0625	3,6375	11,8432	4,8663	16,9631
Jarque-Berra	2177,180	256,3221	242,1635	2165,229	42,2157	1477,708	150,4064	3829,973
Obs.	399	399	399	399	399	399	399	399
Countries outside the euro area								
Mean	6,2056	2,6484	8,1911	3,9054	43,5407	-2,2089	71,1000	95,3779
Median	4,3146	3,1340	7,1350	2,6211	40,3500	-2,1500	52,5453	97,3154
Max.	29,3000	11,1442	19,9200	43,1807	87,3000	5,0000	223,8336	115,2981
Min.	0,0820	-7,7007	2,0100	-1,4253	12,3000	-9,3000	7,1154	70,1279
Std. Dev.	5,5804	3,3484	3,8974	5,3742	17,4781	3,0236	50,6125	7,6329
Skewness	1,2973	-0,6570	1,2366	4,6074	0,5280	-0,0578	1,3226	-1,1016
Kurtosis	4,2995	3,9160	4,0646	29,3565	2,8004	2,7047	3,8033	4,4963
Jarque-Berra	58,9451	17,9619	50,7560	5457,058	8,0870	0,7039	53,5020	49,6575
Obs.	168	168	168	168	168	168	168	168

Note: * p < 0.01, ** p < 0.05, *** p < 0.10.

Source: own calculations in Eviews 12 based on World Bank Database and Eurostat (2022)

A negative relationship between inflation and the rate of non-performing loans could be explained by the fact that, the increase in this independent variable leads to a decrease in the real value of the loan taken out and thus benefits borrowers because they can easily repay the loan (Roman and Bilan, 2015; Gjini and Koprencka, 2018; Bayar, 2019). On the other hand, a positive relationship is observed when an increase in the inflation rate spills over to the fall in real income (if not indexed to the inflation rate) and thus the ability of borrowers to service their debt worsens, leading to an increase in non-performing loans. In the literature, the positive relationship of inflation with the volume of problem loans is also analyzed in terms of interest rates. Thus, an important aspect is the type of interest rate practiced by banks when granting

loans (fixed or variable interest rate), because under conditions of rising inflation rate, amid monetary policy to combat it, banks will set higher interest rates and the rate of non-performing loans is higher for variable interest rates than for fixed ones (Jabbouri and Naili, 2019). In this way, an increase in the interest rate, spurred by an increase in inflation, affects the ability of borrowers to meet their payment obligations and this will be observed in a higher volume of non-performing loans. Along the same line, of the positive relationship between these two variables, are the opinions of authors (Kjosevski and Petkovski, 2017; Staehr and Uusküla, 2018; Kukk and Levenko, 2019). In some studies, inflation is a macroeconomic determinant that does not significantly influence the evolution of the bank's credit risk, because its effects affect the real value of the loan, but at the same time also the real income of borrowers, so it would not be a benefit, but the result would be insignificant (Havidz and Obeng-Amponsah, 2020). In our study, we find a positive and insignificant relationship at the level of euro area countries, which shows that inflation is not necessarily a threat, because they in terms of currency, monetary regulations, price stability are more homogeneous than non-euro countries, where every change in the economy generates effects. Although there are more countries in the euro area than in the non-euro area, we note that the result for the EU is negative and representative (with 95% probability), which means that the inflation rate in the 8 countries that have not abandoned the national currency is quite strongly influenced. In line with these results, we can also add that inflation in the euro area has fluctuated within the targets set by the European Central Bank, while in the non-euro area countries inflation has not respected the ranges of the countries' National Banks, with the effects being felt on credit and affecting representativeness at EU level.

In terms of economic growth, the results are heterogeneous, with a negative correlation for non-euro countries and all EU countries and a positive correlation for euro area countries. A change in GDP leads to changes in the NPL ratio for non-euro countries (99% probability) and does not lead to changes for euro countries and the EU (this variable is unrepresentative for these two categories). The negative links between this independent and dependent variable are consistent with numerous empirical studies (Roman and Bilan, 2015; Kjosevski and Petkovski, 2017; Gjini and Koprencka, 2018; Staehr and Uusküla, 2018; Kukk and Levenko, 2019). A negative relationship between GDP and NPL ratio is normal because an increase in GDP means better macroeconomic development, accompanied by a high financial capacity of borrowers and thus borrowers will service their debt, leading to a decrease in NPLs, as banks are no longer exposed to credit risk to a significant extent. For the other two categories, the euro area countries and the EU, these links are not statistically representative, meaning that a change in GDP does not lead to a change in the NPL ratio. These effects are likely to occur if there are drastic negative changes

in GDP, which is unlikely because there are highly developed countries in the euro area with good financial capacity.

The unemployment rate also has a key influence on the evolution of non-performing loans. The empirical results are as expected, thus there are positive and statistically significant relationships with the NPL ratio across the three country groups. An increase in the unemployment rate implies an increase in problem loans, because borrowers, due to unforeseen events that occur in an economy, lose their jobs and hence the income on which they depend so heavily to live, pay their debts and, if they remain, to invest. In line with these results are also the analyses by other authors (Roman and Bilan, 2015; Kjosevski and Petkovski, 2017; Staehr and Uusküla, 2018; Bayar, 2019; Jabbouri and Naili, 2019). In firms, an increase in the unemployment rate manifests itself in a decrease in output due to a decreased demand for goods because of a lack of income of the population. In this case, the profit of the firm decreases significantly and in turn it will have problems in meeting its payment obligation (Kjosevski and Petkovski, 2017).

From the empirical analysis, domestic credit is positively related to the dependent variable, while for non-euro countries the relationship is positive but insignificant. The positive relationships may point to a tendency of excessive lending practiced by banks, which often represents easier access to loans for most individuals, manifested in lower lending standards and lower collateral requirements. At the same time, these lending booms may set the stage for future crises (Foglia, 2022). Banks' openness to lending also implies that they assume the risks involved in these activities. The positive relationship and the statistically unrepresentative nature of this variable for non-euro countries can be explained by the unstable economic environment, where economic shocks can have much more severe effects, as individuals may take out loans, the number of which is increasing, but in the case of unexpected conditions, they may become non-performing. The empirical results are consistent with those of some studies (Roman and Bilan, 2015; Kjosevski and Petkovski, 2017). Therefore, as the volume of domestic loans increases, the risk that some of them will become non-performing also increases, as many of them may be committed to unsuccessful investments or taken out by individuals whose income has declined so that they are unable to meet repayment conditions due to unexpectedly manifested phenomena.

According to the results, government debt is statistically significant in all three groups of countries, but it is positively related only for euro area countries and the EU, while for non-euro area countries the relationship is negative. Public debt is the money owed by the government to other countries, other creditors, businesses or individuals. Positive relationships are to be expected because when a country has high public debt this is observed in the income of the population, mainly on wages as a component of public spending, in this way debtors will

find it more difficult to repay the loans taken out because they have lower incomes, leading to a higher volume of doubtful ones. Public debt increases greatly in times of crisis to recover the economy through various reforms and to support the population by providing subsidies and salaries necessary for subsistence, while at the same time economic activity stagnates as a result of instability. So, to repay public debt, governments will increase their own revenues by raising taxes and cut spending by eliminating subsidies. These measures will have a negative impact on wages which will reduce the repayment capacity of borrowers, leading to an increase in non-performing loans (Jabbouri and Naili, 2019). The negative relationship between these two variables can be reflected when a reduction in public debt would encourage consumption reflected by borrowing and thus increasing the demand for borrowing, the credit risk that these operations are accompanied by is multiplied, leading to a higher probability that some of those loans taken out will become non-performing in the event of an increase in public debt or unexpected crises (Foglia, 2022).

The budget deficit, in our case, is positively related to the non-performing loan (NPL) ratio in the EU, euro area and non-euro area countries. These relationships can be explained through fiscal consolidation measures, initiated with the aim of lower budget deficits or higher budget surpluses, which lead to a deterioration in the quality of the bank loan portfolio. Like what we mentioned above on public debt, the government, to reduce these imbalances, resorts to either decreasing public spending (such as social spending, civil servants' salaries) or increasing revenues by increasing the amount of already existing taxes or introducing new ones. These measures are expected to affect the ability of borrowers to repay the contracted credit and the related interest, which contributes to the increase in non-performing bank loans (Roman and Bilan, 2015). In the analysis by Beck, Jakubik and Piloiu (2015) at the level of Western European countries, the budget deficit exerts a negative influence, among Central and Eastern European countries, but statistically insignificant. In the case of Southern European countries, the independent variable would have an impact on the non-performing loans rate.

The exchange rate shows positive but unrepresentative relationships across EU, euro area and non-euro area countries. At least for countries that have not adopted the euro, it would have been expected to be influenced by this variable, as banks lend in one economy and in different currencies, which implies the exchange rate. However, these results can be explained by the fact that overall banks grant more loans in national currency and fewer in other currencies. In line with studies by Fallanca, Forgione and Otranto (2020) and Beck, Jakubik and Piloiu (2015), the exchange rate variable was not statistically representative.

Therefore, the overall results of the empirical study demonstrate that the dynamics of the determinants of the macroeconomic environment can influence the evolution of non-performing loans. Thus, an increase in the unemployment

rate, domestic credit, public debt and the budget deficit led to an increase in these problem loans in EU and euro area countries, while a decrease in the inflation rate is reflected in a higher volume of doubtful loans in EU countries, which are also statistically representative variables. At the level of non-euro area countries, there are negative and representative links between the inflation rate, GDP growth and public debt with respect to the dependent variable, while an increase in the unemployment rate will also lead to more bad loans.

5. CONCLUSIONS

The issue of the stability of the banking sector has been increasingly researched and analyzed in recent years, particularly in the context of the recent international financial crisis, the pandemic crisis, but also in the context of the ongoing digitalization process. This phenomenon is of interest both to banking companies, supervisory authorities and, more specifically, to the authors, whose studies include useful findings that can make a significant contribution as a starting point or benchmark for measures to be adopted. At the level of some of the studies, the authors invite us to reflect and urge us to continue the research they have begun, because no analysis can be complete, there is always a "loophole" left, which must be exploited by us, the readers. In the same vein, change has become a feature of this century and from day to day there are elements of novelty, which is why everything is unpredictable, as is the materialization of risks. In view of the economic imbalances they can cause, banking risks are of particular importance, being at the heart of the concerns of banking institutions, but also in the operations they carry out through their main functions, which are to collect resources and make investments.

Our study aimed to empirically examine the impact of macroeconomic factors on the stability of the banking sector, as measured by the non-performing loan ratio. The analysis of the non-performing loan ratio in the EU, euro area and non-euro area countries shows that the variations followed the same trend, with peaks in 2000 and 2013 in non-euro area countries, followed by subsequent decreases, below the average of the other groups of countries, which can be explained by the effectiveness of the measures adopted to reduce these values. In terms of economic growth, for non-euro area countries the relationship is negative and statistically significant, which shows that an increase in GDP will lead to a decrease in the non-performing loans rate, which is natural, as this is reflected in a better financial capacity of borrowers. For the other groups of countries this variable is not significant, which can be explained by the degree of development of the euro area countries. Inflation rates show inverse and significant relationships for countries outside the euro area and the EU, while within the euro area inflation shows a positive and insignificant relationship. As for the exchange rate, it is insignificant in all three groups of countries, but we would have expected it to be statistically significant in non-euro countries, as

without the single currency they would have been more exposed to exchange rate risk, but this can be explained by more lending in domestic than in foreign currency.

The unemployment rate is another important macroeconomic determinant, where representativeness and relationships are unanimous, positive and significant relationships exist across all country categories. They share the same idea that high unemployment influences the development of non-performing loans, manifesting credit risk.

Another key independent variable with a significant impact is domestic credit, which according to the analysis is statistically significant for EU and euro area countries and the positive relationship is present for all countries. The non-performing loan ratio could increase due to credit booms that may be the precursors of future Foglia crises (2022).

Overall, the results of the econometric research are in line with those of other authors studied along the way, thus demonstrating that macroeconomic determinants can influence the evolution of the non-performing loans rate. The importance of this empirical analysis derives from uncovering and gaining insight into the influential factors, as well as revealing the underlying causes behind their manifestation. Structuring the 27 countries of the European Union has helped us to observe the differences between the groups of countries selected in the analysis, so that while in the case of the euro area countries all the relationships are positive in relation to the NPL ratio, there are also inverse relationships in the other two categories.

The limitations of the study would be summarized by the selection of a single variable specific to the banking sector, namely domestic credit, which is not enough, and some information could be distorted, so if there were more determinants related to it, the degree of veracity would be more significant. At the same time, the study could be extended beyond the borders of the European Union for a more in-depth analysis of this everyday phenomenon, encountered in every operation carried out by banking companies. In this way, it would also be possible to observe the impact of the risks associated with bank lending in other macroeconomic environments and the ways of managing them, as well as the degree of efficiency.

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