AN EMPIRICAL ANALYSIS OF THE MACROECONOMIC DETERMINANTS OF NON-PERFORMING LOANS IN EU28 BANKING SECTOR

ROMAN Angela[1], BILAN Irina[2]

"Alexandru Ioan Cuza" University of Iaşi, Iaşi, România

Abstract

The paper aims to empirically evaluate the effects of macroeconomic factors on non-performing bank loans in EU countries, for the period 2000-2013. Its value added comes from providing evidence on the macroeconomic factors with impact on bank loans quality for all EU countries, and also by assessing the effects of public finance variables on the ratio of non-performing loans. The empirical results generally confirm previous findings, showing that the GDP growth, unemployment and domestic bank credit are the main determinants of non-performing loans. However, the results also confirm that the quality of public finances is decisive for ensuring the financial soundness of banks, especially after public debt breaches a certain threshold.

Key words: *banks, non-performing loans, macroeconomic determinants, public debt, crisis*

JEL classification: *C23, G01, G21*

1. Introduction

In the EU countries, the banking sector is the main channel of financing the economy, so that its soundness, stability and health affect the economic growth rate and macroeconomic stability. One of the most important

---

[1] *associate professor, Ph.D., Faculty of Economics and Business Administration/Department of Finance, Money and Public Administration, aboariu@uaic.ro*
[2] *assistant professor, Ph.D., Faculty of Economics and Business Administration/Department of Finance, Money and Public Administration, irina.bilan@uaic.ro*

indicators commonly used to analyze the health and financial soundness of the banking sector and to monitor systemic risk is the quality of bank loans, as expressed by the non-performing loans ratio. Analyzing and monitoring the evolution of this rate is of major importance, because the deterioration of loans portfolio quality leads to risks to the solvency of the banking institutions (Evan, O. et al., 2000). When a high ratio of non-performing loans and/or a rapid increase of this ratio are registered, the financial stability could be threatened and banks could no longer be able to act as financial intermediaries. Thus, reducing the ratio of non-performing loans and cleaning-up the banking sector is of major importance and represents a major concern for policy makers at international, European and national levels.

In the years before the crisis, many European countries, especially the new EU member states, have seen a significant expansion of bank credit (even excessive in the Baltic States, Bulgaria and Romania), which led to high private and public sector debt and a rapid increase in its growth rate, increasing borrowers' vulnerability to macroeconomic shocks and the exposure of the banking sector to credit risk.

As the recent international crisis emerged, due to the adverse developments in the real economy, to the tightening of lending rules and the decrease of the value of assets, a significant increase of the amount of non-performing loans has been registered in EU28 countries, which had major negative consequences on the profitability and financial soundness of the banking sector, but also on the economic growth rate and employment. This led to intensifying research efforts towards investigating the determinants of the dynamics of non-performing loans ratio.

On this background, the paper aims to identify and empirically evaluate the effects of different macroeconomic factors that have an impact on bank loans quality, as expressed by the ratio of non-performing loans to total loans, in EU28 countries and for a period of 14 years (2000-2013). Thus, our study adds to existing literature on the macroeconomic and microeconomic determinants of the quality of bank loans portfolio in EU countries.

Given the realities of recent years, when it was proven that the quality of one country's public finances can affect the well-functioning of its financial and banking sector, unlike most previous studies on the issue macroeconomic factors with impact on non-performing loans we have included into our analysis, along with other, more common macroeconomic determinants, two public finance variables, namely the general government budget balance and

public debt. The value-added of our study also comes from the design of our econometric model, where we have taken into consideration that the impact of public debt on the non-performing loans ratio could be a non-linear one, implying that a higher public debt leads to a higher non-performing loans ratio only after a certain debt threshold is breached.

The rest of this paper is organized as follows. Section 2 overviews the empirical literature on the macroeconomic determinants of non-performing loans. In section 3 we present the methodology and we discuss the data (the variables and their expected impact, the sources of data). In section 4 we present the descriptive statistics of the variables included in our econometric model and the results of the empirical analysis, discussing their potential implications for public policy-making. The paper ends with conclusions.

2. Literature review

The significant increase of the non-performing loans ratio in the context of the recent global crisis and its major negative consequences on the economy have brought into researchers' attention the need to investigate the determinants of the quality of bank loans.

The review of the literature on the issue we address in this paper reflects the existence of a large number of studies, both theoretical and empirical ones, that investigate the determinants of the dynamics of non-performing loans ratio, either for a particular country or for a panel of countries. Some researches focus only on investigating the impact of economic factors (such as GDP growth, unemployment, inflation, exchange rate, interest rate, private sector credit to GDP ratio), while others also take into consideration the action of bank-specific factors (e.g. capital adequacy, profitability, loans-to-assets ratio, loans' growth, bank size, ownership).

Baboušek and Jančar (2005) empirically investigate, using VAR methodology, the impact of some macroeconomic variables (the real GDP growth rate, exports, imports, the rate of unemployment, inflation, interest rates, aggregate bank loans, the real effective exchange rate) on the quality of bank loans in the Czech Republic, for a period of 11 years. Their study shows that the growth of real GDP reduces the non-performing loans ratio, while rising unemployment and inflation lead to a deterioration of the quality of bank loans portfolio.

Boudriga et al. (2009) focus on analyzing the impact of the bank-specific but also of the business and institutional environment factors on the

amount of non-performing loans for a sample of 46 banks from 12 countries in the MENA region, for the period 2002 to 2006. Their empirical results reveal that the foreign participation, coming especially from developed countries, the credit growth, the loan loss provisions and the institutional environment have a significant impact on the level of non-performing loans.

Using a dynamic panel data model, Kastrati (2011) examines the determinants of non-performing loans in 15 transition economies (Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Georgia, Bulgaria, Croatia, Macedonia, Moldova, Montenegro, Kosovo, Romania, Serbia and Ukraine), for the period 1994-2009. The study highlights, on the one hand, the high persistency of non-performing loans from one year to another, and, on the other hand, that the real economic growth rates, inflation rates and competition have a significant impact on the rate of non-performing loans.

Espinoza and Prasad (2010) investigate the main determinants of the ratio of non-performing loans, as well as the macroeconomic consequences its increase, for a sample of 80 banks of the Gulf Cooperation Council (GCC) region. The authors find that some macroeconomic variables have a significant impact on the non-performing loans ratio, especially non-oil GDP and interest rates. They also find that there are some bank-specific factors with impact on non-performing loans ratio, in particular the size of capital, credit growth and efficiency. Also, the results of the study suggest a strong, although short, feedback effect from the banking sector to the real economy.

Louzis et al. (2010) investigate the determinants of non-performing loans in the Greek banking sector for different types of loans (consumer, business and mortgage loans). The findings of the study reveal that the NPLs of consumer loans are more sensitive to the change of the real growth and real lending rates, the NPLs of business loans are more sensitive to the change of the unemployment rate, while the NPLs of mortgage loans are less sensitive to changing macroeconomic conditions.

The macroeconomic determinants of non-performing loans are also investigated by De Bock and Demyanets (2012), which consider a panel of 25 emerging markets, for the period 1996 to 2000. The authors find that the economic growth, the exchange rate, the capital flows and the trade based on goods have an important impact on the non-performing loans.

Kasselaki and Tagkalakis (2013) investigate the impact of the recent financial crisis on some relevant indicators for the financial soundness of the banking sector (e.g. capital adequacy, asset quality and profitability) for 20

advanced OECD economies, during 1997-2009. With regard to bank assets quality, the study reflects a dramatic increase of the non-performing loans ratio in the context of the financial crisis, as a result of worsening economic conditions, increasing real short and long term interest rates, but also of the high level of financial intermediation in the years before the emergence of the crisis. Overall, it is worth mentioning that the authors bring into question the need for policy makers to consider the development of early warning systems in order to identify if banking sector stability is fragile and threatened. The authors also emphasize the importance of better regulation and supervision of the financial markets for limiting the risks arising from the financial sector.

The empirical study conducted by Messai and Jouini (2013) focuses on identifying the main macroeconomic and bank-specific factors that have an impact on the non-performing loans ratio for a sample of 85 banks in Greece, Italy and Spain, for 2004-2008. The authors found a significant relationship between NPL ratio and some macroeconomic and financial variables, such as the growth rate of GDP, the unemployment rate, the real interest rate, the return on assets and the loans losses reserves.

Other empirical studies of interest for the euro area countries (Castro, 2013; Makri et al., 2014) also reveal the existence of significant correlations between the macroeconomic environment and the dynamics of non-performing loans. Furthermore, such studies take into consideration a possible impact of public finance variables (the government budget balance and debt) on the quality of bank loans portfolio.

Caporale, et al. (2014) analyze the macroeconomic and financial determinants of non-performing loans for the Italian banking sector and empirically investigate, for the period 2008 to 2012, if the high amount of bad loans during recessions is due to the excessive amount of credit granted during economic growth periods. The results show that the bad loan surplus recorded during economic recessions is due to deteriorating economic conditions and the lending policies promoted by Italian banks in the pre-crisis years.

Using a dynamic panel data approach, Chaib and Ftiti (2015) examine the key macroeconomic and bank-specific determinants of credit risk, measured by non-performing loans, in a market-based economy (represented by France) compared with a bank-based economy (Germany), for the period 2005 to 2011. The authors find that all considered macroeconomic factors (with the exception of inflation) have a significant impact on non-performing loans in both economies. With regard to bank-specific factors, the study

reveals only two bank-specific determinants of non-performing loans common to both economies, namely the size and profitability of banks. Overall, the empirical analysis shows that credit risk is higher in a market-based economy compared to a bank-based economy.

Some studies empirically investigate the determinants of non-performing loans for Central, Eastern and South-Eastern European countries (Jakubik and Reininger, 2013; Klein, 2013; Skare, 2014). Their results confirm previous findings, that the evolution of the real economy has a major impact on the dynamics of non-performing loans in considered countries.

Erdiç and Abazi (2014) analyze, for a panel of 20 European emerging market countries, the macroeconomic and bank-specific factors that influenced the dynamics of non-performing loans in the period 2000 to 2011. The results show that the real GDP growth rate, inflation, bank profitability and lending interest rates had a significant impact on the dynamics of non-performing loans. The study also reveals that rapid credit growth, high lending rates and interest rate spreads may signal for subsequent NPL growth, which could be of great interest to the regulators.

Overall, the literature review shows that one of the common features of previous studies dealing with the issue of macroeconomic determinants of non-performing bank loans is that they point to the existence of a strong relationship between macroeconomic factors (mainly GDP growth and unemployment) and the quality of bank loans portfolio.

However, there still are gaps in investigating the determinants of non-performing loans dynamics for all EU28 Member States. Also, public finance variables have only rarely been taken into consideration as macroeconomic determinants of non-performing loans (to our knowledge, there are only two studies including government budget balance and/or public debt variables, namely the ones of Makri, Tsagkanos and Bellas (2014) and Castro (2013)), although recent developments in the EU countries highly affected by the sovereign debt crisis fully proved that the soundness of a country's public finances is a key issue for the well-functioning of its bank sector.

Thus, our study contributes to developing existing literature on the macroeconomic determinants of non-performing loans by providing empirical evidence on the main macroeconomic factors that have an impact on bank loans quality at the level of EU countries and also by assessing the effects that public finance variables may have on the ratio of non-performing bank loans.

3. Methodology and data

The paper evaluates the effects of several macroeconomic variables on the non-performing loans rate in the 28 EU member states. To reflect a realistic image of the impact of different factors on the quality of bank loans portfolio in our country group, the study covers an extended period of time, of 14 years (2000-2013), thus referring to both pre-crisis and crisis conditions. The analysis was conducted on annual macroeconomic data coming from datasets and reports of international financial institutions, namely the International Monetary Fund (IMF country reports), the World Bank (World Development Indicators) and the European Commission (Eurostat Database).

Our model is a simple linear regression model, linking the quality of bank loans portfolio (expressed by the ratio of non-performing loans to total loans) to key macroeconomic variables that could affect it. The general regression equation is the following:

$$Y_{i,t} = \alpha + \beta Y_{i,t-1} + \delta_K Xk_{i,t} + v_i + e_{i,t} \qquad (1)$$

where:
- i refers to the country ($i = \overline{1,28}$)
- t refers to year ($t = \overline{1,14}$)
- Y is the dependent variable (the ratio of non-performing loans)
- X_k are the explanatory variables (macroeconomic factors with potential impact on bank loans quality)
- δ_k are the coefficients of the explanatory variables
- α is the constant term
- v_i are the country-specific intercepts
- $e_{i,t}$ are the observation-specific errors

Given the quite large number of cross-sectional units of our panel data, heterogeneity could be an issue, so country-specific intercepts (v_i) were introduced into the model to capture the effects of unobserved country-specific variables that do not change over time (such as institutional or cultural factors).

In our model, the dependent variable is represented by the ratio of non-performing loans (*npbl*), calculated as the share of non-performing loans (as loans more than 90 days past due) to total bank loans, a proxy for credit risk and a measure of banks' asset quality and of the soundness of their credit portfolio. Data on non-performing loans are aggregated data for the entire

banking sector in each EU country included in our analysis. As non-performing loans generally prove to be highly persistent over time (Kastrati, 2011; Beck et al., 2013), a lagged value of the dependent variable ($L.npbl$) was introduced into the right-hand side of the equation (1), thus transforming our model into a dynamic panel data model, which calls for more complex estimation techniques.

Along with the lagged value of the non-performing loans rate, six other macroeconomic factors were included in our model as explanatory variables, capturing the effects of macroeconomic conditions on bank loans quality in EU countries, namely the real GDP growth rate (*gdp*), the inflation *(infl)* and unemployment *(unemp)* rates, the domestic credit *(dcp)* and two public finance variables, the government budget balance *(bug)* and public debt *(debt)*. The variables have been selected on the criteria of representativeness and availability of data for all EU member states. Details on the selected variables, the expected relationship between different macroeconomic factors and our dependent variable and the sources of data can be found in table 1.

According to the results of previous empirical studies on the issue of macroeconomic determinants of non-performing loans, and in consistency with economic theory, lower economic growth and higher unemployment are expected to lead to the increase of the non-performing loans rate, while inflation has an unclear (see ambiguous) impact, meaning that the relationship between this variable and the non-performing loans rate could be either a positive or a negative one. On the one hand, the rise of inflation makes it easier for borrowers to service their debts, so the quality of bank loans portfolio may improve, but, on the other hand, when inflation rises real incomes decrease, so the ability of borrowers to service their debts deteriorates and the non-performing loans rate may increase.

Table 1: The variables and their expected relationship

Variable	Symbol	Description	Unit of measurement	Data sources	Expected effect[1]
Dependent					
Non-performing loans	npbl	the ratio of non-performing loans to total bank loans	%	World Bank (World Development Indicators) and IMF Country Reports	

Explanatory					
Economic activity	gdp	annual real GDP growth rate	%	European Commission (Eurostat)	-
Inflation	infl	inflation rate (annual average rate of change)	%	European Commission (Eurostat)	+/-
Unemployment	unemp	harmonized unemployment rate	%	European Commission (Eurostat)	+
Government budget balance	bug	general government budget balance /deficit (-) or surplus (+)	% of GDP	European Commission (Eurostat)	-
Public debt	debt	general government consolidated gross debt	% of GDP	European Commission (Eurostat)	+
Domestic credit	dcp	domestic bank credit to private sector	% of GDP	World Bank (World Development Indicators)	+

1. according to the results of previous empirical studies
Source: the authors

As for domestic bank credit to private sector as percentage of GDP (expressing the degree of financial intermediation), a high value of this variable may lead to a large amount of non-performing loans. However, since domestic credit' s effects could occur with some delay, meaning that the growth of domestic bank credit as percentage of GDP this year may lead to rising non-performing loans rate the following year, the first lag of this variable *(L.dcp)* was introduced into our model.

With respect to public finance variables, previous studies, although few in number, found evidence of a negative correlation between government budget balance and non-performing loans and a positive one between public debt and non-performing loans. As far as public debt variable is concerned, in addition to previous studies, we took into consideration the possibility that such a relationship is a non-linear one, meaning that a high public debt leads to rising non-performing loans only after a certain debt threshold is breached. So, in a subsequent model we have included as regressors both debt and debt squared *(debt²)* variables, expecting for a negative coefficient of the debt variable and a positive one for the debt squared variable.

Also, according to previous studies (Espinoza and Prasad, 2010; Nkusu, 2011; De Bock and Demyanets, 2012; Klein, 2013; Filip, 2014), the relationship between the economic growth rate and the non-performing loans rate was expected to be a bidirectional one (the GDP growth rate is usually found to have a significant impact on bank loans quality, but there might also be feedback effects from the banking sector to the real economy). Therefore, in our model the *gdp* variable was assumed to be correlated with the error term, which called for the use of instrumental variable (IV) estimation techniques, to deal with the issue of endogeneity.

To estimate the parameters of our model, we resorted to three different estimation techniques considered fitted for fixed-effects panel data models with endogenous explanatory variables. Disregarding the dynamic nature of our econometric model, we firstly appealed to more traditional IV estimation techniques, namely two-stage least squares (2SLS) and two-step GMM. The regression analysis was conducted using xtivreg2 command for Stata developed by Schaffer (2010). The gdp growth rate was instrumented with its first and second lagged values to control for endogeneity.

However, it is generally accepted that some econometric bias can arise when using traditional panel data estimation techniques in the context of dynamic panel data models. This is because, by construction, the lagged value of the dependent variable ($L.npbl$) is correlated with the unobserved country-specific effect (v_i). To eliminate this bias, we used difference GMM, a method developed for dynamic panel data models by Arellano and Bond (1991), which is appreciated to be more efficient. The dynamic panel data regression analysis was conducted using D. Roodman's xtabond2 command for Stata (Roodman, 2009). The predetermined variable, the lagged value of the dependent variable (*L.npbl*), was instrumented with its first lag, the real GDP growth rate (*gdp*), as endogenous variable, was instrumented with its second lag, while the rest of the explanatory variables, considered exogenous, entered the instrument matrix on their own.

When using instrumental variable methods, as in our case, it is particularly important to evaluate the validity of selected instruments. Therefore, as standard approach, we reported the results of Hansen's test for joint validity of the instruments, having as null hypothesis that the instruments used are valid (uncorrelated with the error term), and that the excluded instruments are correctly excluded from the estimated equation. When using

difference GMM, the results of Arellano-Bond test for autocorrelation, having a null hypothesis of no autocorrelation, were also reported.

4. Results and discussions

The descriptive statistics of the variables included in our study is presented in table 2. It results that the non-performing loans rate recorded for EU member states an average value of 5.37% and a significant disparity between countries, ranging between 0.08% (the case of Sweden, in 2007) and 33.68% (Cyprus, in 2013). The annual real GDP growth rate recorded an average of 2.22% and also high deviations from this average, with a minimum value of -17.70% (Latvia, in 2009) and maximum value of 11% (Latvia, in 2006). As concerns the rate of inflation, it recorded an average of 3.27%, while the minimum value was -1.7% (Hungary, in 2012) and the maximum one 45.70% (Romania, in 2000). The average unemployment rate in the UE28 member states was 8.87%, unemployment ranging between a minimum value of 1.9% (Luxembourg, in 2001), and a maximum value of 27.5% (Greece, in 2013).

Table 2: Descriptive statistics of the variables used in our empirical analysis

| Variables	Mean	Min	Max	Std. dev.
Non-performing loans (npbl)	5.37	0.08	33.68	5.53
Annual real GDP growth rate (gdp)	2.22	-17.70	11.00	3.71
Inflation rate (infl)	3.27	-1.70	45.70	3.66
Unemployment rate (unemp)	8.87	1.90	27.50	4.27
Government budget balance (bug)	-2.89	-32.40	6.90	3.81
Public debt (debt)	52.89	3.70	174.90	30.30
Domestic credit (dcp)	101.52	7.12	304.95	57.47

Source: authors' calculations

With regard to public finance variables, the average value of the government budget balance over the period 2000-2013 was a deficit of 2.89% of GDP, while individual country values ranged between a high budget deficit of 32.4% of GDP (Ireland, in 2010) and a much smaller budget surplus of 6.9 % of GDP (Finland, in 2000). At the same time, in many European countries public debt registered high, unsustainable levels, with a maximum of 174.9%

of GDP (Greece, in 2013). The degree of financial intermediation, reflected by the domestic bank credit to private sector, reached an average value of 101.52% of GDP, while also showing an extremely large disparity, from a minimum value of 7.12% of GDP (Romania, in 2000) to a maximum value of 304.95% of GDP (Cyprus, in 2012).

Looking at the dynamics of the average non-performing loans rate in EU28 member states over the period 2000-2013 (Figure 1), we can see that a significant deterioration of the quality of bank loans portfolio was registered as of 2008, once the global economic crisis emerged triggering economic recession, rising unemployment, lower incomes, the depreciation of some national currencies and the decrease of assets value, especially real estate ones. The most dramatic increases of the rate of non-performing loans over the period 2008-2013 were recorded in Ireland, Latvia, Romania, Cyprus, Bulgaria, Greece, Hungary, Lithuania and Denmark.

Figure 1: The dynamics of the average non-performing loans rate in EU28 over the period 2000-2013
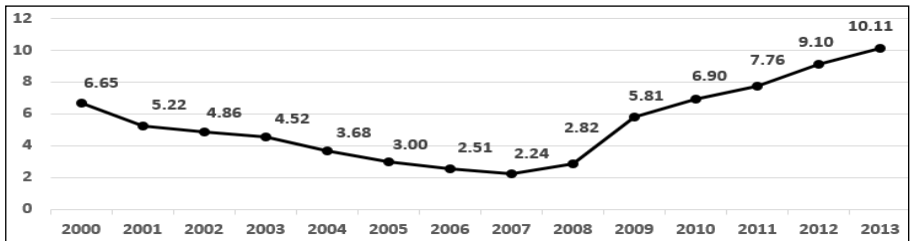
Source: authors' calculations based on World Bank, World Development Indicators

The results of our panel data regression analysis, using various estimation techniques, are presented in table 3. While in models (1), (3) and (5) we included, along with other macroeconomic variables explaining for the dynamics of non-performing loans, only the *debt* variable, in models (2), (4) and (6) both the *debt* and $debt^2$ variables were included, to capture possible non-linear effects of public debt on the quality of bank loan portfolio in our group of countries.

We can see that all our specifications comfortably pass the Hansen J-tests of over-identifying restrictions at the 0.01 level of significance. Also, for both models (5) and (6) the results of Arrelano-Bond test for AR(2) in first

differences do not reject the null of no serial correlation, implying that using lags as instruments was a reasonable strategy.

Overall, the models fit quite well our data. In annex 1, the actual and fitted values of the non-performing loans rate according to model (6) are represented. It results that the selected macroeconomic variables explain for a large part of the change in non-perfoming loans rate over the period of our analysis for most of the EU member states, with some exceptions, among which Romania, Luxembourg or Spain.

Table 3: Results of panel regression analysis

((1)-4.30	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Estimation technique	*2SLS¹*	*2SLS¹*	*GMM¹*	*GMM¹*	*A-B difference GMM²*	*A-B difference GMM²*
L.npbl	0.8105029*** (17.28)	0.8220323*** (17.88)	0.8179265*** (17.83)	0.8357797*** (18.87)	0.7277123*** (4.79)	0.714282*** (5.09)
gdp	-0.4205137*** (-4.24)	-0.3968063*** (-4.01)	-0.4340865*** (-4.45)	-0.4212193*** (-4.36)	-0.2548677*** (-2.82)	-0.2792566*** (-3.31)
infl	-0.0216284 (-0.30)	-0.0369805 (-0.53)	-0.0146879 (-0.20)	-0.027298 (-0.39)	-0.0369336 (-0.37)	-0.0354977 (-0.50)
unemp	0.1613059** (2.14)	0.1343446** (1.97)	0.1712725** (2.30)	0.1518075** (2.28)	0.3060549* (2.03)	0.3423025** (2.35)
bug	0.1298579** (2.10)	0.0878011 (1.40)	0.1459062** (2.51)	0.1154993** (2.00)	0.0696911 (1.44)	0.0493181 (1.03)
debt	0.0152843 (1.07)	-0.0456471* (-1.82)	0.0153982 (1.08)	-0.0419308* (-1.69)	-0.0189972 (-0.51)	-0.1193858** (-2.41)
debt²		0.0003976*** (2.64)		0.0003602** (2.45)		0.0006151** (2.46)
L.dcp	0.0168782** (2.18)	0.0174299** (2.32)	0.0181555** (2.40)	0.0195551*** (2.69)	0.0348563*** (3.49)	0.0291779*** (2.99)
N	336	336	336	336	336	336
No. of instruments					29	30
AR(1)test p-value					0.149	0.167
AR(2)test p-value					0.406	0.271
Hansen J test p-value	0.4423	0.2579	0.4423	0.2579	0.523	0.695

Notes:

1. heteroskedasticity- and autocorrelation-robust standard errors

2. two-step difference GMM estimators with Windmeijer-corrected cluster–robust errors

AR(1) – Arellano-Bond test for AR(1); *AR(2)* - Arellano-Bond test for AR(2)
t-statistics in parenthesis
$* p < 0.1, ** p < 0.05, *** p < 0.01$
Source: authors' calculations using Stata

Our findings confirm that the annual real GDP growth rate *(gdp)* has a major impact on the rate of non-performing loans. The coefficients of the variable are statistically significant and negative, in line with our expectations and consistent with the results of Espinoza and Prasad (2010), Louzis et al. (2010), Castro (2013), Jakubík and Reininger (2013), Kasselaki and Tagkalakis (2013), Klein (2013), Messai and Jouini (2013), Erdiç and Abazi (2014), Makri et al. (2014), Škarica (2014), Chaibi and Ftiti (2015). When economic activity deteriorates, the incomes of borrowers and the value of their collaterals decrease, which may entail the increase of the non-performing loans rate. According to our results, a 1% decrease in the GDP growth rate leads to the increase of the non-performing loans rate with 0.26 to 0.43%.

Unemployment *(unemp)* also has an important impact on non-performing loans, similar to the one of the GDP growth rate. The coefficients are statistically significant and positive, in line with our expectations and in accordance to the results found by Louzis et al. (2010), Klein (2013), Castro (2013), Makri and Bellas (2014), Messai and Jouini (2013), Škarica, (2014), Chaibi and Ftiti (2015). High unemployment leads to larger amounts of non-performing loans, due to revenue shortfalls and lower ability of borrowers to honor their debts. Our estimates show that a 1% increase in the unemployment rate would result in the increase of the non-performing loans rate with 0.13% to 0.34%.

With respect to inflation *(infl)*, the estimated coefficients are negative, in agreement with the result of Castro (2013), Klein (2013), Erdiç and Abazi (2014), Chaibi and Ftiti (2015). The explanation for the negative relationship between inflation and the non-performing loans rate is that high inflation rates can reduce the real value of outstanding loans, thus making it easier for borrowers to service their debts. However, the coefficients are not statistically significant, in line with the results of Kasselaki and Tagkalakis (2013) and Makri et al. (2014). According to Castro (2013), the impact of inflation is not relevant because higher inflation reduces the real value of outstanding loans, but also diminishes the real income of borrowers. So, as one effect is compensated by the other, the final impact of inflation may be null.

Also, the relationship between the domestic credit variable *(L.dcp)* and the non-performing loans rate is positive, in line with our expectations and the findings of Espinoza and Prasad (2010), De Bock and Demyanets (2012), Jakubík and Reininger (2013), Kasselaki and Tagkalakis (2013) and Erdiç and Abazi (2014). A significant and rapid increase of the bank loans to private sector as a share of GDP, which could signal excessive risk-taking, can lead to a significant (even alarming) increase of the non-performing loans rate, when the economy is confronted to deteriorating economic activity or sudden macroeconomic and financial shocks. The coefficients of this variable are statistically significant in all our models and, according to our estimates, the increase of the domestic credit granted by banks to GDP ratio with 1% this year would lead to the increase of the non-performing loans rate with 0.017% to 0.035% the following year. On the contrary, in the above mentioned empirical studies the coefficient is not, in general, statistically significant, possibly due to the particularities of the economic environment of the countries included in the sample or of the time framework of the analysis. The significant impact of the variable *L.dcp* we found in our analysis could be explained by the fact that in the years before the crisis some EU countries (in particular Latvia, Lithuania, Romania and Bulgaria) have recorded a significant and rapid (even unsustainable) increase of the bank loans ratio. According to Jakubik and Reininger (2013), the growth of the bank credit to GDP ratio, due to a higher credit growth pace compared to GDP growth, could suggest a sustainable process of financial deepening, but also an excessive, unsustainable increase of bank credit.

More interesting results are found with respect to the effects of public finance variables. The ratio of government budget balance to GDP *(bug)* is found, opposite to other studies (Makri et al., 2014), to have a positive effect on the ratio of non-performing loans (although the coefficients are not statistically significant for all of our models), meaning that budgetary consolidation measures, resulting in lower budget deficits of higher budget surpluses, lead to the deterioration of bank loans quality. As budgetary consolidation results from either lower budgetary expenditures (e.g. with the remuneration of public employees, pensions and other social expenditures) and/or higher budgetary revenues (by means of increasing existing taxes or introducing new ones), it makes perfect sens that such measures could lead to lower incomes, lower ability of borrowers to repay debts and a higher non-performing bank loans ratio.

As for public debt, although, at first sight, the relationship appears to be uncertain and statistically insignificant (models 1, 3 and 5), when both *debt* and *debt²* variables are included (models 2, 4 and 6), results change substantially. Overall, it results that our assumption of a non-liniar (quadratic) relationship between public debt and the ratio of non-performing loans is confirmed. Also, the coefficients are statistically significant in all cases and have the expected signes, resulting that a higher public debt leads, after a certain threshold, to a higher ratio of non-performing loans. The most rationale explanation for this situation is that a high public debt may lead to lower confidence of investors, higher interest rates and, thus, a lower ability to repay debts, although austerity measures imposed by large amounts of public liabilities may also play an important role. According to model (6), the debt threshold is about 97% of GDP, which is below the actual level of public debt registered in many European countries, among them Greece, Portugal, Italy, Ireland. Although the accuracy of this threshold must be carrefully addressed, our study confirms the imperative of keeping public debt at acceptable levels, by appropriate public debt reduction policies. As promoting budget surpluses was proved to lead to a higher ratio of non-performing loans, when there are real threats to the financial soundness of the banking sector alternative options should also be considered, such as the sell of public (non-financial and, especially, financial) assets.

5. Conclusions

The general results of our study confirm that macroeconomic conditions have a strong and decisive influence on the quality of bank loans portfolio in EU member states over the period of our analysis (2000-2013). The ratio of non-performing loans increases when the real economic growth rate decreases and unemployment rises. Also, a significant and rapid increase of the bank loans to private sector expressed as a share of GDP, signaling excessive risk-taking, can lead to the increase of the non-performing loans rate.

Public finance variables, at their turn, may affect the quality of bank loans as, once the general government debt breaches a certain threshold (estimated at about 97% of GDP), investors lose confidence and interest rates rise, and along with them the non-performing loans rate. Austerity measures, aimed at reducing negative budget balances, may also have harmful effects for the financial soundness of banks' credit portfolio, if such measures (implying

budgetary expenditure cuts or higher taxes) result in lower incomes and, thus, lower ability of borrowers to repay their debts.

The findings of our study prove that European and national authorities should put great emphasis on structural measures aimed at supproting economic growth and employment, but also at reducing public debt to sustainable levels, as means of ensuring the health and financial soundness of banks.

One of the limits of our study results from the data on non-performing loans rate which, although retrieved from World Banks' databases, are finally coming from national sources, so that they should be interpreted with caution, due to a certain heterogeneity of national definitions. As future research directions, we indend to expand this analysis conducted on EU member states by taking into consideration the bank-specific factors that may affect the quality of bank loans and also by empirically assessing the feedback effects from the banking sector to the real economy.

6. References:

- Arellano, M.; Bond, S. (1991) Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations, *Review of Economic Studies*, 58, p. 277–297.
- Babouček, I.; Jančar, M. (2005) A VAR analysis of the effects to macroeconomic shocks to the quality of the aggregate loan portfolio of the Czech banking sector. *Working paper series*, no. 1, Czech National Bank.
- Beck, R.; Jakubik, P.; Piloiu, A. (2013) Non-performing loans. What matters in addition to the economic cycle?, *ECB Working Paper Series*, no. 1515, February.
- Boudriga, A.; Taktak, N.B.; Jellouli, S. (2009) Bank Specific, Business and Institutional Environment Determinants of Nonperforming Loans: Evidence from MENA Countries, *Economic Research Forum*, Working Paper 547.
- Caporale, G.M.; Di Colli, S.; Lopez, J.S. (2014) Bank lending procyclicality and credit quality during financial crises, *Economic Modelling*, 43, p. 142–157.
- Castro, V. (2013) Macroeconomic determinants of the credit risk in the banking system: The case of the GIPSI, *Economic Modelling*, 31, p. 672–683.

- Chaibi, H.; Ftiti, Z. (2015) Credit risk determinants: Evidence from a cross-country study, *Research in International Business and Finance*, 33, p. 1–16.
- De Bock, R.; Demyanets, A. (2012) Bank Asset Quality in Emerging Markets: Determinants and Spillovers, *IMF Working Paper*, 71, March.
- Erdiç D.; Abazi E. (2014) The Determinants of NPLs in Emerging Europe, 2000-2011, *Journal of Economics and Political Economy*, 1(2), p. 112-125.
- Espinoza R.; Prasad, A. (2010) Nonperforming Loans in the GCC Banking System and their Macroeconomic Effects, *IMF Working Paper* 224.
- Evans, O.; Leone, A.M.; Gill, M.; Hilbers P. (2000) Macroprudential Indicators of Financial System Soundness, *IMF Occasional Paper*, no. 192.
- Filip, B.F. (2014) Non-performing loans - dimension of the non-quality of bank lending/loans and their specific connections, *Theoretical and Applied Economics*, 5(594), p. 127-146.
- Jakubík, P.; Reininger, T. (2013) Determinants of Nonperforming Loans in Central, Eastern and Southeastern Europe, *Focus on European Economic Integration*, Q3, Oesterreichische Nationalbank (OeNB).
- Kasselaki, M.Th.; Tagkalakis, A.O. (2013) Financial soundness indicators and financial crisis episodes, *Working paper* 158, May, Bank of Greece.
- Kastrati, A. (2011) The Determinants of Non-Performing Loans in Transition Countries, *Financial Stability Report*, June, Central Bank of the Repubic of Kosovo.
- Klein, N. (2013) Non-Performing Loans in CESEE: Determinants and Impact on Macroeconomic Performance, *IMF Working Paper*, 72, March.
- Louzis, D.P.; Vouldis, A.T.; Metaxas, V.L. (2010) Macroeconomic and bank-specific determinants of nonperforming loans in Greece: a comparative study of mortgage, business and consumer loan portfolios, *Working paper*, September, Bank of Greece.

- Makri, V.; Tsagkanos, A.; Bellas, A. (2014) Determinants of Non-Performing Loans: The Case of Eurozone. *Panoeconomicus*, 61 (2), p. 193-206.
- Messai, A.S.; Jouini, F. (2013) Micro and Macro Determinants of Non-performing Loans, *International Journal of Economics and Financial Issues*, 3 (4), p. 852-860.
- Nkusu, M. (2011) Nonperforming Loans and Macrofinancial Vulnerabilities in Advanced Economies, *IMF Working Paper*, 161, July.
- Roodman, D. (2009) How to do xtabond2: An introduction to difference and system GMM in Stata. *The Stata Journal*, 9(1), p. 86-136.
- Schaffer, M. E. (2010) xtivreg2: Stata module to perform extended IV/2SLS, GMM and AC/HAC, LIML and k-class regression for panel data models, available at http://ideas.repec.org/c/boc/bocode/s456501.html
- Škarica, B. (2014) Determinants of non-performing loans in Central and Eastern European countries, *Financial theory and practice*, 38 (1), p. 37-59.

Acknowledgement

Annexes

Annex 1. Actual and fitted values of the non-performing loans rate in EU member states

Graphs by Country

127