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Determinants of Non-Performing Loans: The Case of Eurozone

Summary: The purpose of the present study is to identify the factors affecting the non-performing loans rate (NPL) of Eurozone's banking systems for the period 2000-2008, just before the beginning of the recession. In our days, Eurozone is in the middle of an unprecedented financial crisis, calling into question the soundness of the banking systems of European countries. Looking at both macro-variables (e.g. annual percentage growth rate of gross domestic product, public debt as % of gross domestic product, unemployment) and micro-variables (e.g. loans to deposits ratio, return on assets, return on equity), we investigate which factors determine NPL on aggregate level. Overall, our findings reveal strong correlations between NPL and various macroeconomic (public debt, unemployment, annual percentage growth rate of gross domestic product) and bank-specific (capital adequacy ratio, rate of non-performing loans of the previous year and return on equity) factors.

Key words: Non-performing loans, Bank specific variables, Macroeconomic variables, GMM difference.

JEL: C23, G21.

During the last two decades, a significant increase of credit growth provided by financial institutions was recorded (e.g. Massimo Cingolani 2013). This growth is attributed to the deregulation process of financial markets and the development of information technologies in the banking industry, which led to the enhancement of financial intermediation (Marie Panopoulou 2005; Laura Rinaldi and Alicia Sanchis-Arellano 2006).

In addition, deregulation process strengthened competition among banks (Vicente Salas and Jesus Saurina 2003) both in domestic and other European markets. More specifically, competition was increased to a large and medium degree within domestic and European banking markets respectively (European Commission 1997). A big strand of literature found that, competition increased banks' credit risk, i.e. affecting their loan portfolios in terms of bad loan screening procedures and relaxing borrowing criteria (e.g. Michael Manove, Jorge A. Padilla, and Marco Pagano 2001; Wilko Bolt and Alexander F. Tieman 2004; Sangjun Jeong and Hueechae Jung 2013).

One of the most common indicators that used to identify credit risk is the ratio of non-performing loans (NPL). Since 2008, the year of the beginning of the global financial crisis, the levels of NPL have significantly increased. In fact, according to analysts, the number of NPLs is expected to increase extremely in the forthcoming years, affecting the liquidity and profitability of banks and thereby the financial sta-

bility of the banking systems. Although valuable efforts were performed to control and reduce NPLs, the index is still in the spotlight for both regulators and banks, as it was linked to bank failures and financial crises, especially in the decade of the '90s.

Considering the NPL as an endogenous variable, our research adds to a growing literature by determining the index through macroeconomic and bank specific factors. More precisely, we exclusively focused on the Eurozone for the period 2000-2008, using aggregate data of 14 countries. Nowadays, Eurozone has been the center of attention due to the ongoing sovereign debt problems that some countries are facing. We focus on the pre-crisis period which was characterized by low interest rates, rising house prices and a stable economic environment. This situation led to the expansion of credit on both demand and supply side.

Several studies examined the determinants of NPLs and problem loans (e.g. Santiago Fernandez de Lis, Jorge Martinez Pagés, and Jesus Saurina 2000; Abdelkader Boudriga, Neila Taktak, and Sana Jellouli 2009a; Raphael A. Espinoza and Ananthakrishnan Prasad 2010). However, contrary to the vast majority of the existing literature, our research is the first empirical study, which presents findings regarding the fragility of the Eurozone banking system. In particular, our study contributes to enriching the existing literature by investigating factors that determine total NPL ratio, on aggregate basis, in the Eurozone. Our findings agree with the literature as both bank-specific and macroeconomic variables appear to exert a powerful influence on the non-performing loans rate.

The rest of the paper is organized as follows. The next section presents the existing literature on problem loans, the NPL index, and its determinants. Section 2 describes the sample and the empirical methodology. Section 3 presents the results of the econometric analysis and Section 4 offers concluding remarks and possible topics for further research concerning problem loans and the NPL rate.

1. Literature Review

In recent years, the interest in non-performing loans and their determinants has greatly increased, since we encounter more published data at bank, country, and aggregate banking system level. Several studies have been conducted on problem loans, the NPL and the similar default rate. The results reveal valuable insights about the quality of loan portfolios and generally the fragility of banks. The study of factors that affect financial vulnerability is a cause of disagreement, since, as mentioned earlier, several banking crises during the 90's were due to the uncontrolled increase of problem loans. Many researchers consider NPL as "financial pollution" with harmful effects for both economic development and social welfare (e.g. Brenda Gonzales-Hermosillo 1999; Levon Barseghyan 2010; Shihong Zeng 2011). Using the NPL as the key unity to measure loan losses, William R. Keeton and Charles Morris (1987) examined a sample of 2,470 insured commercial banks in the United States (US) for the period 1978-1985. They found that local economic conditions in combination with the low performance of various economic sectors are responsible for differences in loan losses recorded by different banks. Therefore, the banking institutions that undertake greater risk show greater losses. Similarly, Joseph F. Sinkey and Mary B. Greenawlat (1991) studying loan losses in commercial banks in the US for the period 1984-1987, agreed that both internal and external factors play a decisive role in the

shaping of the loan loss rate, which is defined as Net loans charge offs plus non-performing loans divided by total loans plus net charge-offs. In an another study, Keeton (1999) studying bank report data for the period 1982-1996 in 50 US states and in the district of Columbia, found that the surge in the credit growth of banks is associated with the low credit standards for loans set by the banks. In the same wave-length moved the study of John McGoven (1993) who found that banks (in US) suffer loan losses due to lax credit standards, unsecured loans and the attitudes of borrowers. Studying the instability of the Argentine banking system in the period 1993-1996 through an accelerated failure time (AFT) model, Jose Bercoff, Julian Giovanni, and Franque Grimard (2002) found that the NPL rate is equally influenced by bank-specific factors including asset growth, operating costs to asset ratio, institutional characteristics related to private and foreign banking, and macroeconomic factors, such as credit growth, foreign interest rate, monetary expansion etc.

In Europe, Fernandez de Lis, Martinez Pagés, and Saurina (2000) econometrically identified loan losses through various banking and macroeconomic factors, using a panel data of Spanish commercial and savings banks for the period 1985-1997. This study showed that gross domestic product (GDP) growth rate has a negative effect on problem loans, confirming that in times of recession, problem loans increase. They also concluded that bank size is negatively related to problem loans, while loan growth, collateral loans, net interest margin and market power positively. Examining a sample of 1,927 Italian banks for the period 2006-2008, Matteo Cotugno, Valeria Stefanelli, and Guiseppe Torluccio (2010) found that the default rate is positively correlated with bank size, ΔGross Loans and functional distance, and negatively with the return on assets (ROA) and ΔGDP_t. Regarding the Greek banking market, Dimitrios Louzis, Aggelos T. Vouldis, and Vasilios L. Metaxas (2010) examined the effect of various macroeconomic and bank-specific factors on the NPL, studying each type of loan in the nine largest Greek banks both overall and separately, for the period 2003Q1-2009Q3. Specifically, Louzis, Vouldis, and Metaxas (2010) found that the real GDP growth rate, unemployment and lending rates have a strong negative effect on the level of NPL, as do the return on equity (ROE) and ROA indicators, interpreting these as a sign of poor bank management.

In contrast to the aforementioned studies, Hipollyte Fofack (2005) did not examine individual banks from a particular country, but individual banks from a group of countries, based on their geographic location. More precisely, he investigated the factors affecting the NPL in Sub-Saharan countries. Using unbalanced panel data of 16 countries with a total of 90 observations for the period 1993-2003, Fofack (2005) found that certain micro and macro factors present a positive covariance with non-performing loans, applying a Granger causality analysis and correlations.

Similarly, Espinoza and Prasad (2010) examined the effect of various macroeconomic and banking variables in the NPL ratio in the countries forming the Gulf Cooperation Council, i.e. Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates. They examined bank level data from 80 banks for the period 1998-2008 using various econometric specifications. From the macroeconomic point of view, non-oil real GDP growth, stock market returns, interest rates, world trade growth, and the VIX index were introduced in their model. They also added various banking variables, which were related to capital adequacy ratio, measures of effi-

ciency (expenses/asset ratio etc.), bank size, net interest margin and lagged credit growth. Their econometric analysis confirmed that both macroeconomic and bank-specific variables determine the level of NPL ratio in Gulf countries.

In addition, Boudriga, Taktak, and Jellouli (2009a), investigated the influence of various macro and micro factors on NPL in a sample of 46 banks from 12 countries ("Middle East and North Africa - MENA Countries") for 2002-2006. Specifically, they found that high credit growth, loan loss provisions and the foreign participation of developed countries affect the levels of NPL. Moreover, they used different institutional variables in their model, which proved to affect significantly NPL rate.

In another study, Boudriga, Taktak, and Jellouli (2009b), using aggregate banking, financial, institutional and legal environment data of 59 countries for the period 2002-2006, they examined whether and which factors determine the NPL rate. Their empirical results showed that the NPL is influenced mainly by bank-specific factors, such as capital adequacy, provisions, and bank ownership, while credit exposure is reduced in countries where legal and institutional conditions are improved.

Additionally, Mwanza Nkusu (2011) analysed the linkage between non-performing loans and macroeconomic performance of 26 advanced economies from 1998 to 2009. In his study, only macroeconomic variables were introduced. Specifically, GDP growth, unemployment, change in the house price index, change in the equity price index, inflation, nominal effective exchange rate, policy rate of interest and credit to the private sector were included in his empirical specification. His findings revealed that a poor macroeconomic performance (i.e. slower GDP growth, higher unemployment or decreasing asset prices) could be associated with increasing non-performing loans in advanced economies.

In contrast to Nkusu (2011), the study of Reinout de Bock and Alexander Demyanets (2012) analyzed the determinants of bank asset quality in 25 emerging countries during 1996-2010, by examining only aggregate macroeconomic and credit indicators. Their findings present that GDP growth rate, exchange rates and loan growth are the main determinants of non-performing loans in the examined countries.

Contrary to the aforementioned studies, the research of Rinaldi and Sanchis-Arellano (2006) is the only so far that addressed the NPL problem in Eurozone. However, is has to be underlined that their findings are limited to a sample of 7 Eurozone countries from 1989Q3 to 2004Q2 and their investigation did not include results for the total NPL of the Eurozone's banking systems, but only for the sectoral household NPL. Rinaldi and Sanchis-Arellano (2006) investigated the linkage between household non-performing loans ratio and various macroeconomic variables. They found that disposable income, households' financial wealth and nominal lending rates exerted significant explanatory power on household NPL. Nevertheless, given the above limitations, their results should be interpreted with care since they examined only sectoral NPL and their sample included a small number of Eurozone countries.

Based on the merits of the aforementioned studies, it is notable that both macroeconomic (e.g. unemployment, house prices indices, inflation, lending rates, credit growth) and bank specific factors (e.g. profitability ratios, capital adequacy, bank size and ownership) seem to determine loan portfolio quality. However, it is obvious that there is a large gap in contemporary literature, regarding the determinants of

NPL in the Eurozone countries, which our empirical investigation hopes to fill in. In this context, the contribution of our article is threefold. Firstly, we focus on financial fragility of the Eurozones' banking systems using aggregate NPL by examining data from the vast majority of the Eurozone countries. Secondly, we examine the total NPL of the Eurozone countries and not a particular subcategory of it. Finally, we include new macroeconomic variables (public finance characteristics) to our research as determinants of NPLs. Therefore, our study extends the existing literature providing safe and valid conclusions for the Eurozones' banking systems.

2. Data and Methodology

2.1 Data

The purpose of the present study is to investigate the factors affecting the NPL in the Eurozone. Literature review provides evidence that both aggregate and disaggregate (individual bank) data are used for similar investigations. Nevertheless, according to Boudriga, Taktak, and Jellouli (2009b), aggregate data for the whole banking system of each country (in contrast to the examination of individual data for each bank) are considered preferable as the risk of non-representativeness of the sample is reduced. Moreover, aggregate data were used by Rinaldi and Sanchis-Arellano (2006) in order to overcome the obstacle of disaggregate data unavailability in the euro area. For these reasons, we chose to examine exclusively aggregate data in our research.

We extracted our data from the databases of the International Monetary Fund (IMF), the World Bank and the Eurostat. Our main objective was to collect data from all 17 countries of the Eurozone, for the longest possible period. However, the nature of the research and the multitude of the examined variables created difficulties in obtaining the required data for all countries. The main target of our study was to investigate the determinants of NPL ratio exclusively on the pre-crisis period. In this context, the final sample consisted of an unbalanced panel of 14 countries with 120 observations for the period 2000-2008. According to Rinaldi and Sanchis-Arellano (2006), unbalanced panel data include more observations and their results are less dependent on a particular period. The distribution of observations is presented in Table 1.

Table 1 Observations per Country

Countries	Number of observations
Greece	9
Italy	9
Portugal	9
Spain	9
France	9
Ireland	9
Germany	9
Belgium	9
Finland	9
Austria	9
Netherlands	7
Luxembourg	9
Estonia	9
Malta	5
Total	**120**

Source: Compiled by the authors from IMF, World Bank and Eurostat.

2.2 Methodology

As mentioned above, this study identifies the factors that affect positively or negatively the NPL rate in 14 of the 17 Eurozone countries. Based on the merits of studies that investigate NPLs, we use a set of explanatory variables that are commonly examined in such models. However, one of our novelties is the inclusion of public finance variables. Additionally, contrary to Boudriga, Taktak, and Jellouli (2009a), Tarron Khemraj and Sukrishnalall Pasha (2009), Cotugno, Stefanelli, and Torluccio (2010), we used a dynamic panel regression method for our analysis. Specifically, in order to provide consistent and unbiased results, we implemented the difference Generalized Method of the Moments (GMM difference) estimation, which is based on first differences and was introduced by Manuel Arellano and Stephen Bond (1991). The choice of this estimation is also in line with the empirical investigations of Gabriel Jimenez and Jesus Saurina (2006), Louzis, Vouldis, and Metaxas (2010) and De Bock and Demyanets (2012). However, we investigate the effect of banking and macroeconomic factors on NPLs for two separate periods, t and $t-1$. Our fist econometric model is expressed as follows:

$$NPL_{it} = a_0 + a_i X_{i,t} + a_i M_{i,t} + \varepsilon_{i,t} \tag{1}$$

where NPL is the aggregate non-performing loans to total gross loans, X denotes the bank specific variables and M the macroeconomic factors, as presented on Table 2. Note that i corresponds to the examined country of the sample and t to the year.

Furthermore, with the purpose of extending our investigation we use one lag for both bank-specific and macroeconomic regressors, targeting to capture the dynamics of explanatory variables over the previous year. Generally, the inclusion of time lags is commonly used in the literature e.g. Jimenez and Saurina (2006), Cotugno, Stefanelli, and Torluccio (2010), Louzis, Vouldis, and Metaxas (2010). Therefore, our second econometric model is expressed as follows:

$$NPL_{it} = a_1 + ai X_{i,t-1} + ai M_{i,t-1} + \varepsilon_{i,t-1}. \tag{2}$$

In order to obtain deeper insight into the relevance of explanatory variables, we estimate Equation (1) and (2) in three different versions; we begin by examining only micro variables as regressors, secondly only macro variables and finally both micro and macro.

For the GMM estimation, we employed first and second period lagged variables as instruments for the explanatory variables, which are in line with the results of Sargan test. In order to check whether our series are autoregressive, we implemented Kao panel cointegration test. The results indicated that the null hypothesis (H_0 = no cointegration) is not rejected (p-value = 0.2547).

One of the examined bank-specific factors is the capital adequacy ratio (CAP). CAP measures the risk that a bank can undertake. Generally, regarding capital adequacy ratios, although they are widely used in similar studies, the results are not clear whether they affect positively or negatively the NPL index (Sinkey and Greenawlat 1991; Bertrand Rime 2001).

Table 2   Presentation of Variables

	Symbol	Explanation	Expected sign
Bank specific variables	NPL	Aggregate non-performing loans to total gross loans	(+)
	CAP	Bank capital and reserves to total assets	(-)/(+)
	LTD	Loans to deposit ratio	(+)
	ROA	Return on assets	(-)
	ROE	Return on equity	(-)
Macroeconomic variables	DEBT	Public debt as % of GDP	(+)
	FISCAL	Government budget deficit or surplus as % of GDP	(-)
	GDP	Annual percentage growth rate of GDP	(-)
	INFL	Annual average inflation rate	(+)/(-)
	UNEMP	% of unemployment	(+)

Source: Compiled by the authors.

In addition, our study included the loans to deposits (LTD) index, which demonstrates the relationship between loans and deposits. LTD index is an important tool, which examines bank liquidity by measuring the funds that a bank has utilized into loans from the collected deposits. According to previous studies such as Louzis, Vouldis, and Metaxas (2010) and Shri B. M. Misra and Sarat Dhal (2010), the LTD index is expected to positively affect NPL.

Apart from these factors, we also examined profitability ratios (variables ROA and ROE). Banks' profitability is linked to the risk-taking behaviour of banks. As highly profitable banks have fewer incentives to engage in high-risk activities, ROA and ROE are expected to display a negative sign.

Finally, in order to test the persistence of non-performing loans, we use the previous year's non-performing loans rate (NPL_{t-1}) as an independent variable and we expect a positive correlation. The inclusion of lagged terms of the dependent variable on the right hand side of the equation violates the exogeneity assumption for regressors, thus more sophisticated and dynamic econometric techniques are required to provide unbiased estimations. In this context, the implementation of difference GMM technique is considered necessary.

Furthermore, we investigated the influence of various macro factors on the dependent variable under consideration. According to Espinoza and Prasad (2010), the foregoing crisis reveals the importance of linking macroeconomic variables to the stability of banking systems. In this context, we added variables, GDP, inflation rate (INFL), unemployment rate (UNEMP), public debt as % of GDP (DEBT), and government budget deficit or surplus as % of GDP (FISCAL), in order to capture the economic conditions prevailing in Eurozone for the period 2000-2008 and how they affected the NPL index.

Variables GDP and UNEMP control for the existing economic activity and highlight the effect of business cycle to loan quality. It is widely accepted that a

healthy economic environment can be linked to rising incomes and reducing unemployment. Consequently, we expect a positive relation between NPL and unemployment and negative correlation with GDP. Moreover, variable INFL stands for annual average inflation rate, which affects borrower's ability paying their loans. According to Nkusu (2011) inflation's impact on loan quality can be ambiguous, thus can demonstrate either negative or positive relationship with NPL.

In some European countries, the current crisis first affected fiscal indices and then extended to the banks. Taking this point into consideration, public finance variables (FISCAL and DEBT) were also included in our investigation. We anticipate a positive association between loan quality and public debt and adverse relationship with government budget deficit/surplus. Specifically, because variable FISCAL has by nature an adverse relationship with DEBT, it is expected to be negatively correlated with NPL.

To the best of our knowledge, this is one of the few studies that examines factors affecting NPL in Eurozone by means of aggregate data.

3. Empirical Results

3.1 Descriptive Statistics

The descriptive statistics of the variables used in this empirical analysis are presented in Table 3. NPL_{it} ranges from 0.2% to 12.3% and NPL_{it-1} from 0.2% to 15.5%. Variables CAP_{it} and $CAPi_{t-1}$ present a minimum of 2.7% and a maximum of 13.3% and 15.5% respectively. In addition, the variables LTD_{it} and LTD_{it-1} record a rather low disparity as their values range from 0.36 to 1.86 and from 0.33 to 1.86 respectively. As far as profitability ratios are concerned, it has to be mentioned that ROE records a relatively high disparity between countries, although the minimum value of both ROA_{it} and ROE_{it} displays a negative sign.

Table 3   Descriptive Statistics of Variables in Equations 1 & 2

Variables	Mean	Median	Min	Max	SD
NPL_{it}	2.563	2.050	0.200	12.300	2.154
NPL_{it-1}	2.745	2.200	0.200	15.500	2.512
CAP_{it}	6.185	5.800	2.700	13.700	2.320
CAP_{it-1}	6.314	5.800	2.700	19.200	2.575
LTD_{it}	1.194	1.245	0.360	1.860	0.340
LTD_{it-1}	1.175	1.235	0.330	1.860	0.338
ROA_{it}	0.741	0.700	-1.300	2.700	0.498
ROA_{it-1}	0.804	0.750	0.000	2.700	0.460
ROE_{it}	12.192	12.900	-36.500	30.000	7.402
ROE_{it-1}	13.498	13.100	0.700	30.000	5.200
$DEBT_{it}$	57.058	58.800	3.700	110.300	30.998

DEBT$_{it-1}$	57.547	58.850	3.700	113.700	31.144
FISCAL$_{it}$	-1.035	-1.050	-9.400	6.900	3.040
FISCAL$_{it-1}$	-0.941	-1.050	-9.200	6.800	2.941
GDP$_{it}$	3.025	2.695	-5.130	11.190	2.584
GDP$_{it-1}$	3.420	3.300	-0.900	11.190	2.474
INFL$_{it}$	2.791	2.600	0.100	10.600	1.292
INFL$_{it-1}$	2.515	2.300	0.100	6.700	1.083
UNEMP$_{it}$	7.249	7.550	1.800	13.900	2.535
UNEMP$_{it-1}$	7.475	7.750	1.800	15.600	2.802

Note: NPL is the aggregate of non-performing loans to total gross loans, CAP is the capital ratio defined as bank capital and reserves to total assets, LTD is the loans to deposit ratio, ROA is the return on assets, ROE is the return on equity, DEBT is the public debt as percentage of GDP, FISCAL is the budget deficit/surplus as a percentage of GDP, GDP is the annual percentage growth rate of GDP, INF is the annual average inflation rate and UNEMP is the unemployment rate. Where i corresponds to the examined country of the sample and t to the year.

Source: Results obtained by the authors.

Variable DEBT$_{it,}$ presents a very high disparity, since its minimum value stands at 3.7% and maximum at 110.3%. Variable FISCAL extends from -9.4 to 6.9 denoting that countries present either deficit or surplus for negative and positive signs, respectively. However, it has to be underlined that both mean and median record negative values. Similarly, GDP shows positive and negative values, indicating that, over the period 2000-2008, some Eurozone countries marked negative growth. Furthermore, INFL$_{it}$ demonstrates a minimum of 0.1% and a maximum of 10.6%. Finally, variable UNEMP$_{it}$ ranges from 1.8% to 13.9% and UNEMP$_{it-1}$ from 1.8% to 15.6%.

3.2 Estimation Results

The results of the difference GMM estimations are presented in Table 4. We present the coefficients of the independent variables and the corresponding p-values. It should be mentioned than we faced no problem with residuals, since, according to the Jarque Bera test, they were found to be normally distributed. Via the examination of the coefficients of the regressors, statistically significant correlations with non-performing loans were demonstrated.

In particular, bank specific variables CAP (Models 4 & 6) and ROE (Models 1 & 3), are negatively correlated, while NPL$_{t-1}$ (Models 1, 3, 4 & 6) is positively associated with loan quality. In addition, macroeconomic variables DEBT (Models 5 & 6) and UNEMP (Models 2, 3 & 5) were also found positively and significantly related to non-performing loans. On the contrary, variable GDP (Model 3) denoted a significant negative relationship. Contrary to our expectations, ROA & LTD and FISCAL & INFL did not show any significant impact on NPL ratio to all model specifications.

Table 4 Regression Results of Equations 1 & 2

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
CAP_{it}	-0.010 (0.914)		-0.076 (0.426)			
CAP_{it-1}				-0.136** (0.050)		-0.114* (0.094)
LTD_{it}	-0.076 (0.922)		-0.039 (0.961)			
LTD_{it-1}				0.646 (0.431)		0.749 (0.356)
NPL_{it-1}	0.2890*** (0.001)		0.270*** (0.002)	0.292*** (0.001)		0.262*** (0.003)
ROA_{it}	0.570 (0.246)		0.618 (0.199)			
ROA_{it-1}				0.484 (0.421)		0.377 (0.513)
ROE_{it}	-0.052** (0.023)		-0.038* (0.092)			
ROE_{it-1}				-0.005 (0.893)		0.003 (0.936)
$DEBT_{it}$		0.015 (0.500)	0.038 (0.867)			
$DEBT_{it-1}$					0.127** (0.000)	0.112*** (0.000)
$FISCAL_{it}$		-0.024 (0.667)	-0.037 (0.511)			
$FISCAL_{it-1}$					-0.062 (0.273)	-0.076 (0.180)
GDP_{it}		-0.071 (0.120)	-0.079* (0.092)			
GDP_{it-1}					-0.055 (0.2794)	-0.053 (0.311)
$INFL_{it}$		0.045 (0.598)	0.039 (0.6416)			
$INFL_{it-1}$					-0.059 (0.521)	-0.081 (0.383)
$UNEMP_{it}$		0.237** (0.011)	0.185* (0.060)			
$UNEMP_{it-1}$					0.146* (0.096)	0.090 (0.320)
No. obs. (after adjustments)	106	106	106	92	92	92

Note: Table shows the coefficients estimates (coefficients in boldface are significant), and p-values of the difference GMM regression model. * Significance at the 10% level, ** significance at the 5% level, *** significance at the 1% level. Where NPL is the aggregate of non-performing loans to total gross loans, CAP is the capital ratio defined as bank capital and reserves to total assets, LTD is the loans to deposit ratio, ROA is the return on assets, ROE is the return on equity, DEBT is the public debt as percentage of GDP, FISCAL is the budget deficit/surplus as a percentage of GDP, GDP is the annual percentage growth rate of GDP, INF is the annual average inflation rate and UNEMP is the unemployment rate, and *i* corresponds to the examined country of the sample and *t* to the year.

Source: Results obtained by the authors.

4. Discussion

Taking into consideration that the basic aim of our study is to investigate the factors that influence non-performing loans, the estimation results of our difference GMM models were quite interesting.

The variable NPL_{it-1} also showed a statistically significant positive correlation in all models. This result is corroborated by the literature, as similar findings were recorded in the studies of Jimenez and Saurina (2006), Manoj K. Dash and Gaurav Kabra (2010), and Misra and Dhal (2010), revealing the persistence of problem loans in the Eurozone.

Contrary to the investigation of Boudriga, Taktak, and Jellouli (2009b), where aggregate country data were used, we record significant relationship between NPL and ROE. More precisely, we identify negative correlation between the aforementioned examined variables and NPL. This result, as expected, indicates that a deterioration of profitability ratios lead to an increase in non-performing loans, confirming the risk-taking behaviour of banks. This negative relationship is also in line with the argument that bad management leads to riskier activities and weak performance. The studies of Boudriga, Taktak, and Jellouli (2009a), Cotugno, Stefanelli, and Torluccio (2010), Louzis, Vouldis, and Metaxas (2010) and which focused on individual banks, have also identified a significant negative correlation between NPL and profitability ratios.

Regarding variable CAP, which determines the risk behaviour of banks, we observe that is statistically significant and displays a negative sign. This relationship is also confirmed by Allen Berger and Robert DeYoung (1997), Salas and Saurina (2002), Espinoza and Prasad (2010). Generally, a risky loan portfolio is marked by a high NPL (equivalent to high credit risk). Both at theoretical and empirical levels as mentioned by Boudriga, Taktak, and Jellouli (2009a, b) and Franco Fiordelisi, David Marques-Ibanez, and Phil Molyneux (2010), the relationship between risk and capital ratio is ambiguous. On one hand, it is argued that a low capital ratio increases the NPL (see Moral Hazard Hypothesis in Berger and DeYoung 1997). On the other hand, it is supported that banks with high capital adequacy ratios are involved in high risk activities, creating risky loan portfolios, and therefore high NPL rates.

Beyond bank-specific variables, interesting results appear for macroeconomic variables, suggesting that the state of the economy in the Eurozone has a significant effect on the NPL index. This fact is also confirmed by the study of Rinaldi and Sanchis-Arellano (2006). However, we examined and detected different macroeconomic variables, which affect loan portfolio quality. Specifically, we found a positive correlation, as expected, between public debt and non-performing loans. This relationship highlights that fiscal problems in Eurozone countries might lead to an important rise of problem loans.

Furthermore, based on our estimations, we recorded that business cycle influences significantly the loan portfolio quality. Specifically, we found strong positive correlation between loan quality and unemployment, revealing that lack of employment weakens borrower's ability to pay their loan instalments. GPD also seems to exert a decisive influence on the NPL index in Eurozone countries, although only in Model 3, revealing that during booming periods the loan quality is improved and adversely. These findings were also corroborated with Martin Brookes, Mike Dicks, and Mahmood Pradhan (1994), Fernandez de Lis, Martinez Pagés, and Saurina (2000), Salas and Saurina (2002), Louzis, Vouldis, and Metaxas (2010), Nkusu (2011), and De Bock and Demyanets (2012), etc.

5. Conclusions

In the present study, we applied an econometric model that helped us to identify factors that influence the rate of non-performing loans in the Eurozone, focused on pre-crisis period. Using aggregate data on a panel of 14 countries for the period 2000-2008 and applying the difference GMM estimation, we found strong correlations between NPL and various macroeconomic and bank-specific factors. It is worthwhile to mention that to the best of our knowledge, it is the first empirical study, which explores possible macroeconomic and bank specific drivers that affect non-performing loans ratio using aggregate level data in Eurozone. According the existing literature aggregate data is considered more preferable, as it substantially reduces the risk of non-representativeness of the sample.

Our findings largely agree with the literature as, in terms of bank-specific variables, the rate of non-performing loans of the previous year, the capital ratio and ROE appear to exert a powerful influence on the non-performing loans rate. At the same time, from macroeconomic perspective, public debt, GDP and unemployment seem to be three additional factors that affect the NPL index, unveiling that the state of the economy of Eurozone countries is clearly linked to loan portfolio quality.

As mentioned above, the study focused on the period 2000-2008, before the beginning of the prolonged recession. The reason that our study did not include more recent data is that information for subsequent periods for all Eurozone countries was not available. In this context, future research could be expanded by including more recent data to determine whether and to what extent the results reported in this study are also confirmed during the prolonged recession. Furthermore, the examined model could be applied not only to the Eurozone but also to the EU27, presenting a more comprehensive view of factors that affect the NPL rate in the European Union in general.

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