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## **Micro and Macro Determinants of Non-performing Loans**

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**ABSTRACT:** In this study we tried to detect the determinants of non-performing loans for a sample of 85 banks in three countries (Italy, Greece and Spain) for the period of 2004-2008. These countries have faced financial problems after the subprime crisis on 2008. The variables used are macroeconomic variables and specific variables to the bank. The macroeconomic variables are included the rate of growth of GDP, unemployment rate and real interest rate with respect to specific variables opted for the return on assets, the change in loans and the loan loss reserves to total loans ratio (LLR/TL). After the application of the method of panel data, we found the problem loans vary negatively with the growth rate of GDP, the profitability of banks' assets and positively with the unemployment rate, the loan loss reserves to total loans and the real interest rate.

**Keywords:** Non-performing loans; Macroeconomic determinants; Bank specific determinants

**JEL Classifications:** E32; E44; F30; G2

### **1. Introduction**

The deterioration in the quality of the loan portfolio of banks was the main cause of problems in the banking system and in financial crises in developed economies. Indeed, the increase in loan defaults, banking mortgage in the United States, underlines the links between macroeconomic and financial shocks and the relationship between the friction in the credit market and the risk of financial instability.

The theme of "non-performing loans" (NPL) has attracted more attention in recent decades. Several studies examined bank failures and find that asset quality is an indicator of insolvency (Demirguc-Kunt, 1989; Barr and Siems, 1994). Banks still have a high level of impaired loans before the bankruptcy. Therefore, the large amount of bad loans in the banking system generally results in a bank failure. The NPL are among the main causes of the problems of economic stagnation. Each impaired loan in the financial sector increases the possibility to lead company to difficulty and unprofitability.

The minimization of NPL is a necessary condition for improving economic growth. When NPL retained permanently, these will have an impact on the resources that are enclosed in unprofitable areas. Thus, NPL are likely to hamper economic growth and reduce the economic efficiency (Hou, 2007). The shocks to the financial system can arise from factors specific to the company (idiosyncratic shocks) or macroeconomic imbalances (systemic shocks). In general, the researches adopted in the developed economies have confirmed that macroeconomic conditions affect credit risk. Initially, this study proposes to know the factors that explain the quality of loans granted by the bank, specifically bad debts. These factors may include macroeconomic and bank-specific variables.

The rest of this paper is arranged as follows: the second section discusses the existing literature on the determinants of NPL namely macroeconomic and bank-specific variables and the effect on the quality of loans. The third section describes the data used and the methodology. The fourth section interprets and analyzes the empirical results. Finally, the conclusion will be the fifth section.

## **2. Literature Review**

In recent years, the literature on non-performing loans has occupied the interest of several authors particularly the attention in understanding of the variables liable to the financial vulnerability (Khemraj and Pasha, 2009). This vulnerability is explained by the role of bad debt as exposed by the strong relationship between NPL and banking crises. Indeed, Sorge (2004) argues the use of such variables (non-performing loans and loan losses provisions) to assess the vulnerability of the financial system tests.

Nkusu (2011) classifies literature into three parts: The first part of the literature has focused on explaining the NPL in credit institutions in the country demonstrating the role of macroeconomic performance, quality of management and political choices (Dash and Kabra, 2010; Espinoza and Prasad, 2010; Louzis et al, 2010). The second part of the literature analyzing the relationship between NPL and macro-financial conditions showing the positive impact of NPL on the probability of crisis and subsequently the key role played by the NPL in predicting banking crises (Caprio and Klingebiel, 1996, Kaminsky and Reinhart, 1999). The third branch of the literature focuses on explaining or predicting the NPL at the macro level. These aggregates may relate to total loans in one economy (total debt) or certain types of loans (Rinaldi and Sanchis-Arellano, 2006; Pesola, 2007; Jappelli et al., 2008; Nkusu, 2011). Therefore, factors explaining NPL may be related to the macroeconomic environment or to the specific characteristics of bank.

The relationship between the macroeconomic environment and the quality of loans has been studied in the literature relating the phases of the business cycle with banking stability. The economic expansion phase is characterized by a relatively small number of bad loans, as consumers and companies have sufficient income and revenue to cover their debts in predetermined deadlines. If the expansion phase continues to exist, then the credit is granted without considering the quality of the receivables. However, in the recession phase, an increase in bad debts it has adverse consequence.

In general, theoretical models of the business cycle with a financial explicit role offer a good basis for modeling NPL because they emphasize the cyclical nature of counter credit risk and business failures (Williamson, 1987). The academic literature provides evidence to suggest a strong relationship between the NPL and many macroeconomic variables. Among factors cited by the literature as significant determinants, there are: the real interest rate, the annual GDP growth, the annual inflation rate, loans growth, the real exchange rate, the unemployment rate, Money supply (M2) etc..

The macroeconomic environment has an impact on the assessment borrowers and their ability to have a loan. An economy in growth is favorable to an increase in revenues and a decrease in financial distress. As a result, real GDP growth and employment are negatively associated with the NPL. Conversely, unemployment is positively related to the NPL. Several empirical studies have found a negative association between NPL and real GDP growth (Salas and Saurina 2002; Fofack, 2005; Jimenez and Saurina, 2006; Khemraj and Pasha, 2009; Dash and Kabra, 2010). The justification provided in the empirical literature of this association is that higher positive level of real GDP growth habitually entails a higher level of income. This improves the capacity of the borrower to pay its debts and contributes to reduce bad debts. When there is a downturn in the economy (slowed or negative growth of GDP) the level of bad debts will increase.

The interest rate affects also the amount of bad debt in the case of floating interest rate. This implies that the effect of interest rates should be positive, and therefore, there is an increase in the debt caused by the increase in payments of interest rates and hence the rise of non-performing loans (Bofondi and Ropele, 2011).

Fofack (2005) argues that economic growth and the real interest rate are important determinants of bad loans in the sub-Saharan African countries. He attributes the relationship between macroeconomic factors and doubtful accounts to the undiversified environment of some economies and their high exposure to external shocks.

For the Spanish banking sector, Jimenez and Saurina (2006) present evidence that the NPL ratio is explained by GDP growth, real interest rates and credit conditions. Based on their model, Khemraj and Pasha (2009) try to find the determinants of NPL in the Guyanese banking sector. They found that the real effective exchange rate (REER) has a positive effect on impaired loans. The result indicates that whenever there is an appreciation of the local currency, the NPL portfolios of credit institutions are expected to be high. Their results demonstrate that GDP growth is negatively associated to the NPL, suggesting that the improvement in GDP leads, in real economy, to decrease NPL. They also

found when banks offering loans with high interest rates and lend too much are expected to acquire higher levels of impaired loans.

Among the authors, who have confirmed that adverse macroeconomic developments are associated with the increase in NPL, we can cite the example of research conducted by Nkusu (2011). The latter studied the feedback between NPL and macro-economic determinants in a panel vector autoregressive (PVAR). According to this author, the NPL have a central role in the relationship between credit market frictions and macro-financial vulnerability. Adebola et al. (2011), explore the factors that explain the NPL of Islamic banks in Malaysia for the period from 2007 to 2009. They employ the ARDL (Auto-Regressive Distributed Lag) to examine the effects of certain macroeconomic variables including the industrial production index, the interest rate and the index of producer prices. The results indicate long-term relationships between variables and note that the interest rate has a significant positive long-term impact on bad loans. The producer prices seem to have a negative impact on bad loans. The results of this study are similar to results of previous studies, including that of Bofondi and Ropele (2011). These authors chose to study on conventional banks in Italy. They analyzed the relationship between loan quality and nature of the borrowers. According to their analysis, the macro-economic variables can affect two different categories of borrowers, namely individuals and businesses. Bofondi and Ropele examine the macroeconomic determinants of the quality of bank loans in Italy over the period 1990Q1-2010Q2, as measured by the ratio of new NPL to outstanding loans in the previous period. According to these authors, the quality of loans to households and businesses can be attributed to a limited number of mainly macroeconomic variables of the general statement of the economy, the important level of debt and to the cost of borrowing. The change in the macro-economic conditions generally affects the quality of loans. Similarly, Vazquez et al. (2012) were interested in the Brazilian case. They exploited a rich database that follows the evolution of bad debts by 78 banks and 21 credit categories for the period from the first quarter 2001 to first trimester 2009. They found that the procyclical behavior of loan quality depend on the type of credit. They suggest that banks with large exposures to highly procyclical credit types tend to suffer a significant deterioration in the quality of their credit portfolios in period of economic downturn.

Regarding Louzis et al. (2010) in the Greek banking sector, they use the method of dynamic panel data to examine the determinants of NPL for each category of loan. A set of basic macroeconomic indicators, namely, the real rate of GDP growth, the unemployment rate and the real interest rate for each loan type are studied. They used a data set of new large Greek banks for the period 2003 to 2009. The results show that impaired loans is related to the macroeconomic variables (GDP, unemployment rate, the interest rate) and to the quality of management. The NPL on mortgages are less sensitive to macroeconomic conditions. This result is consistent with that found by Espinosa and Prasad (2010). Indeed, for a sample of 80 banks in the Gulf Cooperation Council(GCC) countries in 1995 to 2008, they found that the NPL ratio arise when economic growth becomes lower, the interest rate and risk aversion increase. Their model implies that the cumulative effect of macroeconomic shocks over a period of three years is indeed important.

In addition to macroeconomic variables, there are several empirical studies suggest that factors specific to the bank (such as size, efficiency, credit terms) market power and the risk profile are important determinants of NPL, because they can cause risky loans. Macroeconomic indicators are included primarily as control variables and are therefore treated as exogenous (Berger and DeYoung 1997; Bikker and Hu, 2002; Pain, 2003; Jimenez and Saurina, 2006; Quagliariello, 2007). For the case of Spanish banks, Salas and Saurina (2002) found that credit growth, real GDP growth, capital ratio, bank size, and market power are the explained factors of the variations in bad debts.

Concerning the case of India, Rajan and Dhal (2003) showed that the positive macroeconomic conditions and financial variables have a significant effect on NPLs of commercial banks in India. Hu et al. (2004) analyzed the relationship between the ownership structure and impaired loans of banking sector in Taiwan covering the period 1996-1999. The authors have shown that the size of banks is negatively related to the NPL. They also found that when the portion of bank capital is owned by the state, there is a decline in non-performing loans.

Some authors have used the profitability of the bank to explain the behavior of risk managers. Mismanagement may then involve weak monitoring for both operating costs and the quality of loans, and this is supposed to induce high levels of capital losses. Managerial inefficiency may also positively affect the NPL. By analyzing the context of the Czech banking sector for the period 1994-

2005, Podpiera and Weill (2008) concluded that inefficiency is positively associated with future increases in non-performing loans. The authors argue that regulators should focus on managerial performance in order to improve the stability of the financial system. The same result was found by Louzis et al., (2010) in the case of Greek banks.

Under the assumption of mismanagement advanced by Berger and DeYoung (1997), managers do not have the skills to assess and control risks when loans are granted to new customers. The authors studied in this case the existence of a causal link between loan quality, profitability and capital of banks and that using a sample of U.S. commercial banks for the period 1985-1994.

Godlewski (2004) used return on assets (ROA) as a performance indicator. He shows that the impact of banks' profitability is negative on the level of NPL ratio. However, using a panel of 129 banks applied in Spain for the period 1993-2000, Garcíya-Marco and Robles-Fernandez (2008) indicate that high levels of return on equity (ROE) are followed by a greater future risk. They argue that the policy of profit maximization is accompanied by high levels of risk.

Sinkey and Greenwalt (1991) treated the losses of banking sector in the United States. They affirmed that the internal and external factors explain the rate of losses of these banks. These authors found a significant positive relationship between the rate of loan losses and internal factors such as excessive lending, high interest rates. Similarly, Pesola (2007) considers that loan losses are a key factor affecting the proper functioning of credit institutions. He used macroeconomic variables to explain the distribution of losses.

Banks that anticipate high levels of capital losses may create higher provisions to reduce earnings volatility and to strengthen their medium-term solvency. Managers can also use loss provisions to indicate the financial strength of their banks (Ahmad et al. 1999). The loans losses reserves (LLR) reflect the general attitude of the banking system to control risks. The LLR is calculated according to the amount of loan losses provision. The provision is determined by reference to the historical experience of the institution in the field. Hasan and Wall (2004) used a sample of banks belonging to 24 nations for the period from 1993 to 2000; they found that higher levels of non-performing loans are associated with high levels of LLR. Boudriga et al. (2009) studied the determinants factors of NPL and the impact of environmental supervision over the period 2002-2006 for a sample of 59 countries. The authors found that a higher provision appears to reduce the level of impaired loans. They also found an association between non-performing loans and bank-specific variables such as the ratio of total equity assets weighted by risk.

Among bank-specific variables that affect the non-performing loans, we can also mention the credit growth. The literature indicates that rapid credit growth is often related with impaired loans. Bercoff et al. (2002) examined the Argentine banking system and demonstrated that credit growth have an impact on the impaired loans. Indeed, excessive loans offered by banks are habitually considered as a main determinant of impaired loans (Keeton and Morris, 1987; Sinkey and Greenwalt, 1991; Keeton, 1999; Salas and Saurina, 2002; Jimenez and Saurina, 2006). As for Jimenez and Saurina (2006), they attributed the increase of loans to the herd behavior and agency problems that could encourage managers of banks to lend excessively during periods of crisis. Several studies have confirmed the presence of this positive relationship such as the studies of Khemraj and Pasha (2009) and Dash and Kabra (2010).

### **3. The presentation of the Sample and Model**

#### **3.1 The sample**

The sample consists of 85 banks in three countries (Italy, Greece and Spain) for a period of five years (2004-2008). The choice of the three countries is not random since it is a representative sample of countries that have problems after the 2008 crisis and worsening public finances. We opted for a selection of large banks and having a large amount of NPLs. The choice of these three countries is then motivated by the important number of bank defaults in recent years. These countries have been affected by the subprime mortgage crisis and the debt crisis.

#### **3.2. The model**

To implement empirically this study, we used both macro-economic and financial variables. Macroeconomic data are collected from World Development Indicators, Global Development Finance.

For specific banks data, we used Bankscope database. In this study, non-performing loans is explained by three macroeconomic variables and three variables specific to the banks concerning the profitability of assets, the loans losses reserves and the change of the loans granted.

$$\frac{NPL}{TL} i, t = \beta_0 + \beta_1 \Delta GDP_{t-1} + \beta_2 UN_t + \beta_3 RIR_t + \beta_4 ROA_{i,t-1} + \beta_5 \left(\frac{LLR}{TL}\right)_{i,t} + \beta_6 \Delta Loans_{i,t} + \varepsilon_{i,t}$$

$NPL / TL_{i,t}$ : the ratio of non-performing loans to total loans for bank  $i$  in year  $t$ .

$\Delta GDP_{t-1}$ : the annual growth in real GDP at period  $t-1$ .

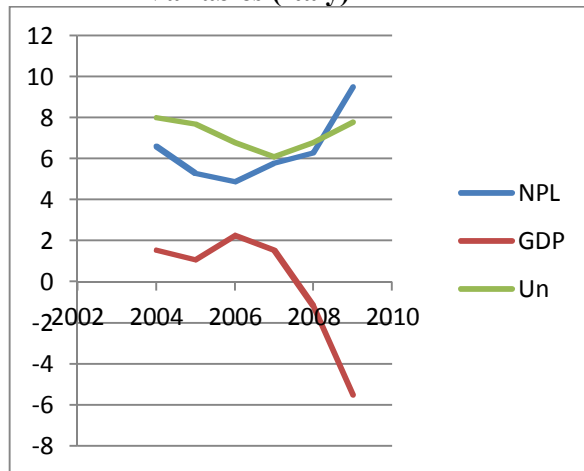
$UN_t$ : the rate of unemployment at period  $t$ .

$RIR_t$ : is the real interest rate at year  $t$ .

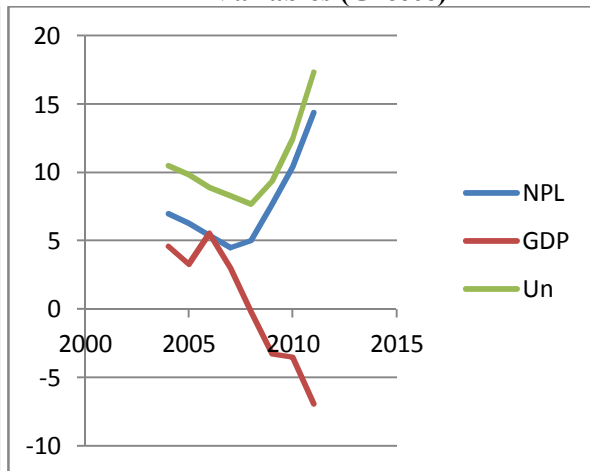
$LLR / TL_{i,t}$ : loan losses reserves for bank  $i$  in year  $t$ .

$\Delta Loans_{i,t}$ : represents loan growth for the bank  $i$  in year  $t$

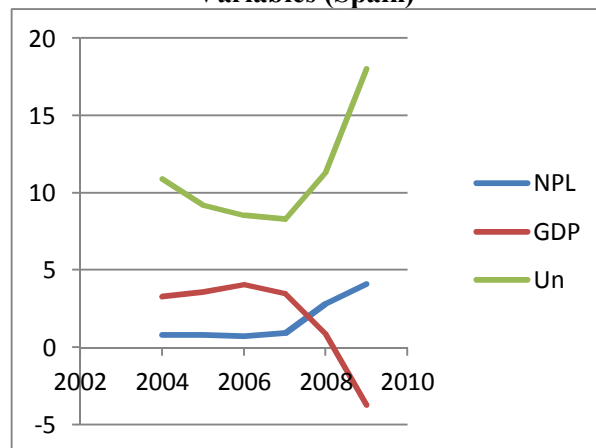
**Figure1. Evolution of NPL and macroeconomic Variables (Italy)**



**Figure2. Evolution of NPL and macroeconomic Variables (Greece)**



**Figure 3. Evolution of NPL and macroeconomic Variables (Spain)**



Representations of the evolution of NPL, GDP growth and the evolution of unemployment rates show that a decrease in GDP and an increase in unemployment rate conduct to increase in NPL. The negative relationship between NPL and the growth rate of GDP and the positive relationship between NPL and the unemployment rate are clearly observed since the crisis 2008. These trends confirm the explanations that we provide regarding the relationship between these three variables (see figure 1, 2 and 3).

#### 4. Analysis of Results

Table 1 presents the Pearson correlation coefficients of different exogenous variables in our model.

**Table 1. The Pearson correlation matrix**

	<i>ΔGDP</i>	<i>UN</i>	<i>RIR</i>	<i>ROA</i>	<i>LLR/TL</i>	<i>ΔLoans</i>
<i>ΔGDP</i>	1.0000					
<i>UN</i>	0.5101	1.0000				
<i>RIR</i>	0.2343	-0.0953	1.0000			
<i>ROA</i>	-0.1083	-0.0497	-0.0380	1.0000		
<i>LLR/TL</i>	-0.0389	-0.0273	0.0598	-0.0473	1.0000	
<i>ΔLoans</i>	0.0101	-0.0878	-0.0221	0.1187	-0.0943	1.0000

Correlation coefficients between the different explanatory variables are low except for the relationship between the growth rate of GDP and the unemployment rate (0,51). Multivariate muticollinearity test can accept the introduction of these two variables together only if the thresholds VIF values are respected (table 2). The results of the tests we conducted show the absence of a multivariate multicollinearity problem, all VIF values are identified less than 4, the threshold cited by Fox (1991). The results of the Hausman test indicate that the fixed effect is preferred to the random effect.

**Table 2. The estimation of the determinants of non-performing loans**

<i>Variables</i>	<i>Coefficients</i>	<i>t-student</i>
<i>ΔGDP</i>	-0.4405459*	-1.73
<i>UN</i>	0.3305912***	3.39
<i>RIR</i>	0.5783274**	2.60
<i>ROA</i>	-0.803046**	-2.05
<i>LLR/TL</i>	1.120132***	4.43
<i>ΔLoans</i>	0.1974659	1.16
<i>Cst</i>	-3.133022**	-2.19
<i>R<sup>2</sup></i>	0.9261	
<i>F</i>	2.99	

Quite consistent with the theory, the results that we found show a significant and negative relationship between the growth rate of GDP, and NPL (Rajan and Dhal, 2003; Fofack, 2005; Jimenez and Saurina, 2006; Khemraj and Pasha, 2009; Dash and Kabra, 2010; Espinoza and Prasad, 2010). The improvement in the real economy is generating a reduction in non-performing loan portfolios of commercial banks.

Concerning the unemployment rate, we found a positive and significant relationship with the ratio of non-performing loans at a level of 1%. In fact, unemployed customers cannot meet their commitments and repay the loans which can increase the level of non-performing loans. In this case, the dynamics of the two variables (growth rate of GDP and the unemployment rate) is closely related to households, companies and the ability to meet their financial obligations. An increase in GDP usually leads to greater flows of household income and a rise in profitability. An increase in the unemployment rate limits the current and future purchasing power of households and is generally associated with a decrease in the production of goods and services. Unemployment negatively affects the cash flows of households and increases the debt burden. Regarding enterprises, rising in unemployment could lead to a decline in production due to the decline in effective demand. This can lead to a decline in revenue and a fragile state debt. In this study, the results are similar to those obtained by Louzis et al. (2010) for the case of Greek banks and Bofondi and Ropele (2011) for Italian banks.

Similar to earlier studies, however, we obtained a significant positive association between non-performing loans (NPL) and the variable real interest rate (RIR) (Fofack, 2005; Jimenez and Saurina, 2006; Khemraj and Pacha, 2009; Dash and Kabra, 2010). The result shows that when a bank rise its real interest rates that can immediately leads to an increase in non-performing loans especially for loans with floating rate. This relationship can also be explained by the decrease in the ability of borrowers to meet their obligations. We also found a significant and negative relationship, at a level of 5%, between the return on assets (ROA) and the amount of NPLs. In fact, a bank with strong profitability has less incentive to generate income and therefore less constrained to engage in risky activities such as granting risky loans. Instead, inefficient banks are obliged to grant credits considered risky and subsequently achieve high levels of impaired loans.

Regarding the relationship between the variable loans losses reserves and non-performing loans, it is positive and significant at the 1% level. Banks that anticipate high levels of capital losses may create higher provisions to reduce earnings volatility and strengthen medium-term solvency. This result is similar to that of Hasan and Wall (2004), contrary to the results found by Boudriga et al. (2009). Finally, the results show that the change in lending by banks does not affect the level of non-performing loans contrary to the results found by Khemraj and Pasha (2009) and Dash and Kabra (2010).

#### **4. Conclusion**

In this study, we attempted to identify variables that can affect and influence doubtful accounts at credit institutions for a sample of European banks. The results show that GDP growth and return on assets of credit institutions have a negative impact on non-performing loans. The unemployment rate and the real interest rate affect impaired loans positively. Furthermore, it was found that the provisions of banks increase with the non-performing loans.

The results show that banks should give interest to many variables when they offer loans in order to decrease the level of nonperforming loans. Principally, banks should consider the international competitiveness of the national economy, because if this competitiveness is low level, this could influence the ability of borrowers to several export sectors to repay debt (Dash and Kabra, 2010). Such bank should also take into account the profitability of the real economy when extending loans. Impaired loans are expected to be important during the period of economic recession. Commercial banks should likewise extend its scope of macroeconomic surveillance to include prudential indicators such as GDP to assess the soundness and stability of the banking system.

Like any research, this study has some limitations. We could for example use other macroeconomic variables such as real exchange rate, inflation and other variables specific to the bank (the size or liquidity). We could also extend the study by breaking non-performing loans by type of loan (Louzis et al, 2010). We can use other econometric methods such as dynamic panel incorporating the lagged non-performing loans among the explanatory variables.

To extend and enrich this study, we can take the NPL as an indicator of banking distress. We will then expand the sample to European banks and use a framework of "macro stress testing." Thus, we can measure the impact of macroeconomic shocks on the level of non-performing loans and then measure the resilience of banks face these shocks.

#### **References**

- Adebola, S.S, Sulaiman, W., Yusoff, W., Dahalan, J. (2011), *An ARDL Approach to the determinants of nonperforming loans in Islamic banking system in Malaysia*. Arabian Journal of Business and Management Review, 1(2), 20-30.
- Ahmad, A.S., Takeda, C., Thomas, S. (1999), *Bank loan loss provisions: A reexamination of capital management, earnings management and signaling effects*. Journal of Accounting and Economics, 28(1), 1-25.
- Barr, R., Siems, T. (1994), *Predicting Bank Failure using DEA to quantify management quality*. Federal Reserve Bank of Dallas, Financial industry Studies Working papers N°94.
- Bercoff, J.J., Giovanni, J.D., Grimard, F. (2002), *Argentinean Banks, Credit Growth and the Tequila Crisis: A Duration Analysis*. Working Paper (Unpublished).
- Berger, A.N., DeYoung, R. (1997), *Problem loans and cost efficiency in commercial banks*. Journal of Banking and Finance, 21(6), 849-870.



- Bikker, J.A., Hu, H. (2002), *Cyclical patterns in profits, provisioning and lending of banks and procyclicality of the new Basel capital requirements*. BNL Quarterly Review, 55, 143-75.
- Bofondi, M., Ropele, T. (2011). *Macroeconomic determinants of bad loans: evidence from Italian banks*. Occasional Papers, 89.
- Boudriga, A., Boulila, N., Jellouli, S. (2009), *Does bank supervision impact nonperforming loans: cross-country determinants using aggregate data?* MPRA Paper No. 18068.
- Caprio, G., Klingebiel, D. (1996), *Bank Insolvencies: Cross Country Experience*, World Bank Policy and Research Working Paper 1574 (Washington).
- Dash, M., Kabra, G. (2010), *The determinants of non-performing assets in Indian commercial bank: An econometric study*. Middle Eastern Finance and Economics, 7, 94-106.
- Demirgüç-Kunt, A. (1989), *Deposit-institution failures: a review of empirical literature*. Economic Review, Federal Reserve Bank of Cleveland, 4, 2-18.
- Espinoza, R., Prasad, A. (2010), *Nonperforming Loans in the GCC Banking Systems and their Macroeconomic Effects*, IMF Working Paper 10/224 (Washington: International Monetary Fund).
- Fofack, H. (2005), *Non-performing loans in sub-Saharan Africa: Causal Analysis and Macroeconomic Implications*. World Bank Policy Research Working Paper n° 3769.
- Fox, J. (1991), *Regression diagnostics: an introduction*. Newbury Park, CA: Sage.
- Garcia-Marco, T., Robles-Fernandez, M. D. (2008), *Risk-taking Behaviour and Ownership in the Banking Industry: The Spanish Evidence*. Journal of Economics and Business, 60(4), 332-354.
- Godlewski, C. (2004), *Capital Regulation and Credit Risk Taking: Empirical Evidence from Banks in Emerging Market Economies*. Finance 0409030, EconWPA.
- Hasan, I., Wall, L.D. (2004), *Determinants of the loan loss allowance: some cross-country comparison*. The Financial Review, 39(1), 129-152.
- Hou, Y. (2007), *The Non-performing Loans: Some Bank-level Evidences*. The 4th Advances in Applied Financial Economics, the Quantitative and Qualitative Analysis in Social Sciences conferences.
- Hu, J.L., Li, Y., Chiu, Y.H. (2004), *Ownership and nonperforming loans: Evidence from Taiwan's banks*. The Developing Economies, 42(3), 405-420.
- Jappelli, T., Pagano M., Marco, M. (2008). *Households' Indebtedness and Financial Fragility*. CSEF Working Paper 208.
- Jimenez, G., Saurina J. (2006), *Credit cycles, credit risk, and prudential regulation*. International Journal of Central Banking, 2(2), 65-98.
- Kaminsky, G., Reinhart, C. (1999), *The Twin Crises: the Causes of Banking and Balance of Payments Problems*, The American Economic Review, 89(3), 473-500.
- Keeton, W.R. (1999), *Does Faster Loan Growth Lead to Higher Loan Losses?* Federal Reserve Bank of Kansas City, Economic Review, 84(2), 57-75.
- Keeton, W., Morris C.S. (1987), *Why do banks' loan losses differ?* Federal Reserve Bank of Kansas City, Economic Review, 72(3), 3-21.
- Khemraj, T., Pasha, S. (2009), *The determinants of non-performing loans: An econometric case study of Guyana*. The Caribbean Centre for Banking and Finance Bi-annual Conference on Banking and Finance, St. Augustine, Trinidad.
- Louzis, D.P., Vouldis, A.T., Metaxas, V.L. (2010), *Macroeconomic and bank-specific determinants of non-performing loans in Greece: a comparative study of mortgage, business and consumer loan portfolios*. Bank of Greece, Working Paper, n°118.
- Nkusu, M. (2011), *Nonperforming Loans and Macroeconomic Vulnerabilities in Advanced Economies*, IMF Working Paper WP/11/161.
- Pain, D. (2003), *The Provisioning Experience of the Major UK banks: A Small Panel Investigation*. Bank of England Working Paper, n° 177.
- Pesola, J. (2007), *Financial fragility, macroeconomic shocks and banks' loan losses: evidence from Europe*. Bank of Finland Research Discussion Papers n°15.
- Podpiera, J., Weill, L. (2008), *Bad Luck or Bad Management? Emerging Banking Market Experience*. Journal of Financial Stability, 4(2), 135-148.
- Quagliariello, M. (2007), *Banks' Riskiness Over the Business Cycle: a Panel Analysis on Italian Intermediaries*. Applied Financial Economics, 17(2), 119-138.

- Rajan, R., Dhal, S.C. (2003), *Non-performing loans and terms of credit of public sector banks in India: An empirical assessment*. Reserve Bank of India Occasional Papers, 24(3), 81-121.
- Rinaldi, L., Sanchis-Arellano, A. (2006), *Household debt sustainability: What explains household non-performing loans? An empirical analysis*. ECB Working Paper, n° 570.
- Salas, V., Saurina, J. (2002), *Credit risk in two institutional regimes: Spanish commercial and savings banks*. Journal of Financial Services Research, 22(3), 203-224.
- Sinkey, J.F., Greenwalt, M. (1991), *Loan-loss experience and risk-taking behavior at large commercial banks*. Journal of Financial Services Research, 5(1), 43-59.
- Sorge, M. (2004), *Stress-testing financial systems: an overview of current methodologies*. BIS Working Papers 165, Bank for International Settlements.
- Vazquez, F., Tabak, B.M., Souto, M. (2012), *A macro stress test model of credit risk for the Brazilian banking sector*. Journal of Financial Stability, 8(2), 69-83.
- Williamson, S. (1987), *Financial Intermediation, Business Failures, and Real Business Cycles*. Journal of Political Economy, 95(6), 1196–1216.