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What Triggers Loan Losses? An Empirical Investigation of Greek Financial Sector

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Abstract

The aim of this study is to investigate which factors influence loan quality in Greece. In this context, it is examined the effect of various accounting and macroeconomics indices to loans loss provisions (LLP) and loans loss reserves (LLR) ratios. The empirical analysis is carried out at both individual bank and banking system level data by using dynamic regression techniques. The findings extend the existing literature and confirm all the examined hypotheses, since macroeconomic environment (unemployment, public debt, economic growth and inflation) and accounting factors (past performance of loan quality, capital adequacy, liquidity and profitability) seem to influence credit risk in Greece.

JEL: G21, M41.
Key words: Credit Risk, Loan Quality, Loan Loss Provisions, Loan Loss Reserves, Accounting Factors, Macroeconomic Factors.

1. Introduction

One of the most important banks' activities is the transmission of economic resources to various productive economic units, in order to transform savings into investments. There seems to be no compelling reason to argue that loans constitute the main source of credit risk, which is defined as the risk of promised cash flows from loans and securities held by financial institutions may not be paid in full (Saunders and Cornet, 2008). On these grounds, credit risk is associated with bank asset quality and considered responsible for bank failures (e.g. Gup and Kolari, 2005; Samad, 2012) and instability in the banking system and overall the financial sector (Desmet, 2000; Calomiris, Klingebiel and Laeven, 2004 and Ninimaki, 2012). Loan portfolio quality can be measured by various indices drawn from banks' financial statements such as Non Performing Loans to Total Loans (NPL), Loan Loss Provision to total loans (LLP) and Loans Loss Reserves to total loans (LLR). In the present study, bank loan quality is expressed through LLP and LLR.

The issue under scrutiny of this empirical research is the investigation of factors that affect bank loan quality in Greece. The main reason that the current study is focused on Greece, is that loan quality has recorded a sharp deterioration the last decade. For example, NPL in Greece is constantly above the average of European Monetary

Union (EMU). More precisely, NPL in EMU ranged from 5.3% in 2000 to 10.6% in 2013, while in Greece from 12% to 32%, respectively. Additionally, it is known that the last five year Greece is under severe debt crises that threatens its financial stability and creditability. In this context, it might be convincingly argued that this economic uncertainty might have put the Greek banking system on tremendous risk. Moreover, Kalfaoglou (2006) illustrated that credit risk impact on Greek banks is greater comparing to other types of risk (e.g. market risk). Therefore, for all the aforementioned reasons and given that Greek economy remains in the global spotlight by trying to stay solvent in the Eurozone, it was imperative to implement a study for loan quality determinants in Greece.

The Greek banking system, during the last twenty years has undergone essential reforms, which occurred, to some extent, because of Greece participation on European Monetary Union. In 2015, there are 41 credit institutions (apart from the central bank) operating in the Greek banking sector, from which the vast majority is commercial banks (i.e. 9 domestic commercial banks, 10 cooperatives banks, 1 Consignment Deposits and Loans Fund and 21 commercial banks substitutes of foreign countries). Since the 2000s, Greek banking system can be declared as a mature financial sector, where its function is based on market forces (Louzis, Vouldis and Metaxas, 2010).

The current study is concentrated on both aggregate and individual loan quality indicators as an attempt to address the issue of credit risk determinants' in Greece. Specifically, it is explored which accounting and macroeconomic indices are responsible for changes in bank loan quality of Greek banks and the overall banking system. The examining period is extended from 2000-2012, in order to cover both economic growth and recession.

In recent years, research on loan portfolio quality has become very popular (e.g. Cavallo and Manjoni, 2001; Bikker and Metzemarkes, 2005; Makri, Tsagkanos and Bellas, 2014). To the author´s best knowledge, there is a large gap in the literature regarding the credit risk determinants in Greece, since only Louzis et al. (2010) have discussed this issue. Consequently, there are still some interesting and relevant issues to be addressed. A key limitation of Louzis et al. (2010) is that they used only NPL ratio in order to quantify credit risk. As reported by Balás (2009), although NPL can depict trends in changes to loan portfolio quality, it demonstrates weaker correlation with loan losses. To solve this issue, in order to measure credit risk, instead of NPL index, LLP and LLR ratios are implemented (according to data availability). Furthermore, this analysis differentiates from previous literature, since both aggregate and individual data are analyzed and the sample period is extended to include prolonged recession in the results. Finally, the impact of some macroeconomic factors (i.e. public debt and inflation) on credit risk has never been investigated at both individual and aggregate level in Greece.

The remainder of the paper is organized as follows. Section 2 presents the relevant empirical literature. Section 3 provides the implemented methodology and section 4 the sample and data. Section 5 includes the empirical findings followed by their discussion on section 6. Finally, section 7 demonstrates a brief summary and concluding remarks.

2. Literature Review

It is widely accepted that credit risk considered one of the majors threats that banks have to confront. Several studies had focused on the credit risk's impact and revealed valuable insights about bank loan portfolio quality and the vulnerability of financial sector. The literature has shown that various indices like NPL, probability of default rate (PD), loan losses, LLP and LLR were used in order to quantify credit risk, both at individual bank and aggregate system level.

Firstly, Keeton and Morris (1987) used loan losses as a main indicator of problem loans. In particular, they investigated why loan losses vary considerably among financial institutions, in a sample of 2500 commercial banks, in seven states in the US for the period 1979 - 1985. Their analysis found that loan losses deviations' are linked to local economic conditions and low efficiency of various economic sectors. In addition, they suggested that banking institutions that were prone to taking more risks had recorded more loan losses. Similarly, Sinkey and Greenawlat (1991) were focused on loan losses of US commercial banks for the period 1984-1987. They demonstrated that both internal and external factors have a decisive impact on loan quality.

Cavallo and Manjoni (2001) studied the relationship between LLP and various banking, macroeconomic and legal - institutional factors. For their empirical survey, they collected data from 1,176 banks in 36 countries during 1988 to 1999. Overall, the findings supported that loans to total assets ratio and profitability index interact positively with provisions. Conversely, a negative correlation was recorded for Δloans and public debt.

Furthermore, Hasan and Wall (2004) determined exclusively the bank specific determinants of loan losses allowances (LLA), using information from USA, Canada and Japan for the period 1993 - 2000. Each country's findings revealed several common points, but also important differences. Specifically, although LLA index is shown positive interaction with non-performing loans in all the models, write offs and loans to total assets indices were found important only in USA and earnings before tax and provisions only in USA and Japan.

The scientific work of Bikker and Metzemarkes (2005), which is based primarily on Laeven and Manjoni (2003) and Cavallo and Manjoni (2001), examined LLP and LLR determinants in 29 OECD countries for the period 1991-2001. Their results confirmed the existence of procyclicality and the deterioration of loan portfolio quality, when capital ratios are being kept low.

Moreover, the impact of micro and macro variables on loans provisions and new bad debts was the main subject of Quagliariello (2007). In his sample, were included data from 207 Italian banks between 1985 to 2002, estimated through static and dynamic regression models. His findings showed that LLP and new bad debts moved cyclically. In addition, it is recorded a decisive contribution of macroeconomic factors, like the difference amongst lending and deposit rate and the interest rate of 10-year Italian bond. With regard to micro factors, credit expansion, cost to income ratio, interest margin to total assets and equity capital to total assets proved to exert significant influence on credit risk.

Glogowski (2008) investigated exclusively the association of macroeconomic indices with loan provisions and loan losses in Poland. His research covered 2661

observations of 108 commercial banks from 1997 to 2006 and analyzed through Fixed and Random Effects estimations. The results documented that loans loss provisions have a positive correlation with unemployment and real interest rates, while negative with employment and GDP growth. Apart from macroeconomic environment, the structure of loan portfolio was identified as a key factor.

Angklomkliew, George and Packer (2009), explored the effect of various micro and macro indices on loan loss provisions of the banking systems in eight Asian countries. By applying OLS Fixed regression method, they collected data from 1998 to 2008. Their results demonstrated a negative interaction between LLP and profitability ratio, capital adequacy ratio and Δloans to GDP, confirming the existence of procyclicality.

Cotugno, Stefanelli, and Torluccio (2010), while investigated a sample of 1,927 Italian banks for the period 2006 - 2008, they found that default rate is positively correlated with bank size, ΔGross Loans and functional distance and negatively with ROA and ΔGDPt. Moreover, Nkusu (2011) studied the relationship among nonperforming loans and macroeconomic performance in 26 advanced economies from 1998 to 2009. His findings revealed that a poor macroeconomic performance could be associated with increasing non-performing loans.

De Bock and 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 presented that GDP growth rate, exchange rates and loan growth were the main determinants of non-performing loans.

Makri, et al. (2014) focused on the accounting and macroeconomic factors that influence non-performing loans rate in Eurozone's banking systems from 2000 to 2008. Their findings revealed important associations among NPL and various macroeconomic (public debt, unemployment, annual percentage growth rate of gross domestic product) and bank-specific indices (capital adequacy ratio, rate of nonperforming loans of the previous year and return on equity).

Regarding Greece, Louzis, et al. (2010) identified the impact of various macroeconomic and bank-specific factors on NPL, by studying individual bank level data from 2003Q1 to 2009Q3. Their results suggested that real GDP growth rate, unemployment, lending rates, ROE and ROA have an important negative relationship with NPL.

Based on the aforementioned studies, accounting and macroeconomic factors seem to influence bank loan quality. Moreover, although there are many studies concerning the factors that influence bank loan quality (NPL, LLP and LLR, etc.), it is documented that this subject has been scarcely investigated into the Greek banking industry. In this context, to the author´s knowledge, this is the first empirical research that explores accounting and macroeconomic factors of LLP and LLR, at both banking system and individual bank level data, by taking into account booming and financial crisis periods of the Greek economy.

3. Methodology

3.1. Methodological Issues

Generally, the assessment of credit risk is characterized from the existence of dynamic relationships (Castro, 2013; Louzis et al., 2010), which are identified from the presence of the lagged dependent variable as one of the independent variables (Baltagi, 2001). However, due to the dynamic relationships, ordinary least squares estimation methods (simple models OLS and Fixed OLS) are not considered appropriate and therefore the implementation of more sophisticated econometric estimations is inevitable (Baltagi, 2001 and Quagliariello, 2007). The Generalized Method of Moments (GMM) is an appropriate method to address the aforementioned methodological issues (Quagliariello, 2007).

The simple GMM estimator is firstly developed by Hansen (1982) and is increasingly popular in economics. This method is extremely innovative, as it can be applied to both time series and panel data. Furthermore, it is worthwhile to mention that GMM method is a sufficiently flexible econometric approach, as it provides correct standard errors even if autocorrelation and heteroskedasticity exists in econometric models (Cragg, 1983).

In the present empirical analysis, both time series and panel data are analyzed for the investigation of credit risk determinants. GMM Difference estimator can deal effectively with the above methodological problems, when panel data is analyzed. This econometric specification was implemented by Holtz-Eakin, Newey and Rosen (1988) and Arellano and Bond (1991) and extended by Arellano and Bover (1995) and Blundell and Bond (1998). As underlined by Nickell (1981) GMM difference estimator, is suitable for dynamic models, since it controls for endogeneity problems and inconsistent results (fixed or random effects estimations). Generally, the application of GMM estimator requires the inclusion of instrumental variables. According to Arellano and Bond (1991), GMM method entailed better results when lagged values of dependent and independent variables used as instruments. Similarly, Roodman (2009) argued that instruments might be derived from the dataset itself and corresponded to lagged variables. However, the validity of instruments is detected through Hansen J statistics, usually known as Sargan/Hansen test for overidentifying restrictions. Baum (2006) supports that the Hansen J test is the most commonly used diagnostic in GMM procedure for evaluation of the suitability of the model. Additionally, AR statistical tests are performed in order to control for serial correlation in the residuals.

3.2. Methodological framework

Given the findings of the existing literature, it was considered appropriate to examine whether the loan portfolio quality could be determined by loan quality of previous periods, various bank specific indicators and the macroeconomic environment. In the present study, loan quality is measured through LLP and LLR. Loan loss provisions are the outcome of banks' financial activities and reflect the ratio of arrears, insolvent loans and loan losses after the reclamation of possible collateral (Kearns, 2004; Anandarajan et al., 2007; Balás, 2009 etc.). On the contrary, loan loss reserves are

banks' estimations arising from changing economic conditions, credit risk and loan quality (Walter, 1991; Ahmed et al., 1999, Balla and Mckenna, 2009). It is worthwhile to mention that in this research LLP and LLR were not limited to a particular category of problem loans (e.g. business, consumer or housing loans) so as to present more representative results for total loan quality. Consequently, the basic econometric model is described as follows:

$$CreditRisk_t = CreditRisk_{t-j} + ACC_{t-j} + MAC_{t-j} \quad (1)$$

Where CreditRisk is various loan quality indicators, ACC denotes accounting/bank specific factors, MAC corresponds to macroeconomic indices and t-j to examining period.

According to the literature there are two different approaches regarding the investigation of loan quality determinants. On one hand, some studies (e.g. Berger and De Young, 1997; Salas and Saurina, 2002; Fuertes and Espinola, 2006; Espinoza and Prasad, 2010; Fiordelisi and Mare, 2013) use data for each bank separately (individual bank level data) and on the other hand there are studies (e.g. Brookes et al. 1994; Marcucci and Quagliariello, 2008; Festić and Romih, 2008; Jakubik and Reininger, 2013; Castro, 2013) which use data for the overall banking system (aggregate bank level data).

Additionally, various accounting and macroeconomic indicators have been explored as possible determinants of credit risk. These variables have been examined at both current time (t) and / or previous periods (t-j) on the same econometric models. This concept is based on the assumption that the current quality of the loan portfolio may be affected not only by current accounting and macroeconomic variables but also by micro and macro variables of previous periods as the impact of some of them can be either direct or present a time lag. This is the reason why the basic econometric model (model 1) is calculated twice. Once by including micro and macro variables of current period (t) and another with those of previous periods (t-j). Model (1), is always estimated in t and t-j, not only for having a clear picture of the accounting and macroeconomic factors affecting at both t and at t-j period, but also for reducing any econometric problems by the presence of the same variables several times in the same equation. Moreover, our basic model was presented in three different versions. In the first one, both accounting and macroeconomic variables are included in the same equation. However, in order to receive greater information for the relationship between the explanatory variables with loan quality, accounting and macroeconomic factors were also examined separately. Table 1 presents the examined variables which were used in the econometric models and their expected sign according to the economic theory and literature.

Table 1: Presentation of Variables

	Symbol	Explanation	Expected Sign
Loan Quality of previous periods	LLP_{t-j}	Loans Loss Provisions as % of Total Loans	(+)
	LLR_{t-j}	Loans Loss Reserves as % of Total Loans	(+)
Accounting Variables	CAP	Bank Capital and Reserves to Total Assets	(+)/(-)
	LtD	Bank Liquidity: Total Loans to total Deposits	(+)
	ROA	Performance indicator: Returns on Assets	(-)
Macroeconomic Variables	GDP	GDP Growth Rate	(-)
	UNEMP	Unemployment Rate	(+)
	INFL	Average Inflation Rate	(+)/(-)
	DEBT	Public Debt as % of GDP	(+)

As mentioned before, credit risk is characterized by the existence of dynamic relationships. Considering this, it is necessary to investigate whether the decisions of previous periods determine the current level of loan quality. In this context, LLP and LLR of previous periods (t-j) were included in the right hand of econometric equations. Therefore, the first research hypothesis (H_1) is formulated as follows:

H_1: Loan quality of prior periods is positively related with the current loan portfolio quality indices.

Apart from the dynamic behavior of credit risk, various accounting ratios, which are derived from financial statements, were added to the econometric estimations. One of the most popular indices, which is used as a proxy variable of capital adequacy and reflects the risk attitude of a bank, is capital ratio (CAP). However, the sign of the relation between capital ratio and loan quality is ambiguous (e.g. Shrieves and Dahl, 1992; Fiordelisi et al., 2010). On one hand, Berger and De Young (1997), based on moral hazard hypothesis, underlined that banks with low capital ratios correspond easily to moral hazard incentives and increase the riskiness of loan portfolio. On the other hand, according to Berger and De Young (1997) a positive relationship is also possible because banks might increase their capital base in advance in order to protect from rising problem loans. Towards to this direction, Orgler and Taggart (1983) report that financial institutions, due to bank collapse risk, may increase (decrease) their capital ratios when credit risk is increased (reduced).

Bank liquidity, measured by loans to deposits (LtD), is also included on the econometric models. LtD reflects the bank resources (deposits), which are converted into loans. The lack of liquidity is linked to severe bank collapses (Sinkey and Greenwalt, 1991; Khemraj and Pasha, 2009; Festić and Repina, 2009; Dash and Kabra, 2010; Dimitropoulos, Asteriou and Koumanakos, 2010 and Cotugno et al., 2010). In this context, a high value of LtD index equals to low bank liquidity. This indicator is expected to show a positive influence reflecting the risk behavior of banks

(Guy and Lowe, 2011 and Louzis et al. 2010), as high (low) LtD indicates high (low) exposure to credit risk.

The effect of bank profitability on credit risk is also investigated via ROA. As argued by Sinkey (1998), banks with increased level of problem loans, have to make high provisions, which consist a basic expense and are responsible for reducing their profitability. Based on this argument, the effect of profitability on credit risk is expected to be negative. The negative influence can also be connected with bankers' risk behavior. Specifically, banks with high profitability ratios have less pressure to generate revenues, so they do not embark into risky lending activities. Conversely, low-profit banks have more incentives to increase their income and thus more incentives to provide credit to less trustworthy customers. Additionally, low profit banks may have more difficulties in monitoring their operating costs and the quality of borrowers (Boudriga et al., 2009a and b). Taking into account all the examined accounting variables, the second hypothesis is shaped as follows:

H_2: The accounting variables significantly affect loan quality indicators.

The existing macroeconomic conditions seem to play an important role on the evolution of loan quality, since various studies have linked macro environment with credit risk. Considering this, the inclusion of macroeconomic factors on econometric specifications is considered necessary. Firstly, GDP growth rate was included in order to investigate the connection of economic activity and business cycle with loan quality. In periods of economic growth, the banking system records low indicators of problem loans, as households and businesses have sufficient income to pay for their loan obligations. As prosperity period continues, loans demand is increasing, banks due to intense competition proceed to a relaxation of credit standards and provide credit to low quality borrowers. When adverse economic conditions arise, the borrowers' financial condition is deteriorating, as a result NPLs and default loans are being increased. At the same time, banks profitability is considerably reduced (due to loan losses) and the financing of new investment projects (credit crunch) is restrained, which further exacerbates the existing bad economic conditions. The above negative relationship, confirms the existence of procyclicality.

Similarly, unemployment ratio (UNEMP) was added to econometric analysis in order to account for economic conditions. On logical grounds, an improvement of economic climate leads to a reduction in unemployment and an increase on incomes. On the contrary, when the number of unemployed increased, a considerable drop of disposable income is recorded, which cause important difficulties in meeting their loan obligations. Based on the premises of economic theory and empirical research (Brookes et al., 1994; Bikker and Metzemarkes, 2005; Glogowski, 2008 etc.), it is expected a positive effect amongst unemployment and loan quality indicators.

Moreover, the level of inflation affects the borrower's ability to pay for their loans. In spite of that, the sign of the relationship between inflation and loan quality is not clear. On one hand, the existence of high inflation reduces borrowers' real incomes (when wages and salaries remain constant), which makes loan repayment difficult. On the other hand, high inflation may facilitate payment by reducing the real value of loans (Babihuga, 2007; Jakubík and Schmieder, 2008; Nkusu, 2011; Castro, 2013). This means that the effect of inflation can be either negative or positive.

Finally, although it is established that debt and banking crises have a significant degree of interdependence (Furceri and Zdzienicka, 2012; Tagkalakis, 2014), the vast majority of studies have poorly investigated the relation of public debt with credit risk, especially in Greece. In this direction, in order to investigate the contribution of the country's financial condition in credit risk, public debt to GDP ratio (DEBT) is included to the econometric models. The deterioration of a country's financial condition affects its own credit liability and has crucial impact on its banking system, since banks might face significant liquidity problems (Reinhart and Rogoff, 2010). Furthermore, in periods of public debt expansion, governments are forced to take strict fiscal measures in order to limit their expenses (abolition or reduction social benefits). As a result, the disposable income is reduced considerably, which makes loan repayment more and more difficult (Perotti, 1996). Therefore, it is expected a positive correlation between public debt and loan quality indicators. Based on the above analysis, the third hypothesis is formulated as follows:

H_3: The macroeconomic environment significantly affects bank loan portfolio quality.

3.3. Econometric Specifications

As mentioned above, the purpose of the current study is to reveal the factors are responsible for variations in loan quality. Literature review provides strong evidence that both individual bank level and aggregate data are used for similar investigations. Therefore, the empirical research consists of two separate case studies. The examined econometric models of the two cases studies are presented below.

3.3.1 Individual Bank Level Data

In this case study, it is attempted to investigate the explanatory factors of LLP and LLR of Greek banks, via individual level data for the period 2000-2011. Based on the methodological framework, regarding LLP, the first model tested is:

$$LLP_{it} = a_0 + a_1 LLP_{i,t-1} + a_2 CAP_{it} + a_3 LtD_{it} + a_4 ROA_{it} + a_6 GDP_{it} + a_7 UNEMP_{it} + a_8 INFL_{it} + a_9 DEBT_{it} + \varepsilon_{i,t} \quad (2)$$

Where LLP is the loans loss provisions to total loans ratio and stands for credit risk, i corresponds to the examined bank and t to he examined year. All the investigated independent variables along with their expected signs are briefly presented on Table 1. In order to examine micro and macro factors separately, econometric specifications are formulated as follows:

$$LLP_{it} = a_0 + a_1 LLP_{i,t-1} + a_2 CAP_{it} + a_3 LtD_{it} + a_4 ROA_{it} + \varepsilon_{i,t} \quad (2a)$$

$$LLP_{it} = a_0 + a_1 GDP_{it} + a_2 UNEMP_{it} + a_3 INFL_{it} + a_4 DEBT_{it} + \varepsilon_{i,t} \quad (2b)$$

In addition, in order to consider whether the current level of LLP index is determined by micro and macro variables of previous year, the following models are examined:

$$LLP_{it} = a_0 + a_1 LLP_{i,t-1} + a_2 CAP_{it-1} + a_3 LtD_{it-1} + a_4 ROA_{it-1} + a_6 GDP_{it-1} + a_7 UNEMP_{it-1} + a_8 INFL_{it-1} + a_9 DEBT_{it-1} + \varepsilon_{i,t-1} \quad (3)$$

$$LLP_{it} = a0 + a_1 LLP_{i,t-1} + a_2 CAP_{i,t-1} + a_3 LtD_{i,t-1} + a_4 ROA_{i,t-1} + \varepsilon_{i,t-1} \quad (3a)$$

$$LLP_{it} = a0 + a_1 GDP_{it-1} + a_2 UNEMP_{it-1} + a_3 INFL_{it-1} + a_4 DEBT_{it-1} + \varepsilon_{i,t-1} \quad (3b)$$

Similarly, the equations, which were account for LLR index, are:

$$LLR_{it} = a_0 + a_1 LLR_{i,t-1} + a_2 CAP_{it} + a_3 LtD_{it} + a_4 ROA_{it} + a_6 GDP_{it} + a_7 UNEMP_{it} + a_8 INFL_{it} + a_9 DEBT_{it} + \varepsilon_{i,}t \quad (4)$$

$$LLR_{it} = a_0 + a_1 LLR_{i,t-1} + a_2 CAP_{it} + a_3 LtD_{it} + a_4 ROA_{it} + \varepsilon_{i,t} \quad (4a)$$

$$LLR_{it} = a_0 + a_1 GDP_{it} + a_2 UNEMP_{it} + a_3 INFL_{it} + a_4 DEBT_{it} + \varepsilon_{i,t} \quad (4b)$$

$$LLR_{it} = a_0 + a_1 LLR_{i,t-1} + a_2 CAP_{it-1} + a_3 LtD_{it-1} + a_4 ROA_{it-1} + a_6 GDP_{it-1} + a_7 UNEMP_{it-1} + a_8 INFL_{it-1} + a_9 DEBT_{it-1} + \varepsilon_{i,t-1} \quad (5)$$

$$LLR_{it} = a_0 + a_1 LLR_{i,t-1} + a_2 CAP_{i,t-1} + a_3 LtD_{i,t-1} + a_4 ROA_{i,t-1} + \varepsilon_{i,t-1} \quad (5a)$$

$$LLR_{it} = a_0 + a_1 GDP_{it-1} + a_2 UNEMP_{it-1} + a_3 INFL_{it-1} + a_4 DEBT_{it-1} + \varepsilon_{i,t-1} \quad (5b)$$

All the above equations are analyzed through GMM difference method. Previous periods variables (time lags) are used as instruments and their validity was controlled through Hansen J statistics. Finally, statistical tests AR1 and AR2 are performed so as to control for serial correlation in the residuals of first differences.

3.3.2. Aggregate Level Data

Based on the concept that aggregate data eliminate the risk of non-representativeness of the sample (Boudriga et al., 2009b), a second case study implemented for the entire Greek banking system. Contrary to the first case study, in the present investigation, in order to capture the dynamic adjustment of credit risk, were used quarterly instead of annual observations. Hence, the econometric equations for the Greek banking analysis are formulated as follows:

$$LLP_t = a_0 + a_1 LLP_{t-1} + a_2 CAP_t + a_3 LtD_t + a_4 GDP_t + a_5 UNEMP_t + a_6 INFL_t + a_7 DEBT_t + \varepsilon_t \quad (6)$$

$$LLP_t = a_0 + a_1 LLP_{t-1} + a_2 CAP_t + a_3 LtD_t + \varepsilon_t \quad (6a)$$

$$LLP_t = a_0 + a_1 GDP_t + a_2 UNEMP_t + a_3 INFL_t + a_4 DEBT_t + \varepsilon_t \quad (6b)$$

Where t=Q12001,…,Q42012).

The explanatory variables are defined as in the previous case study. It is worthwhile to mention that profitability index ROA was not included as an independent variable, due to the fact that the central Bank of Greece (BoG), does not provide information on a quarterly basis. Since quarterly observations are used, the econometric equations were also calculated for the periods t-1, t-2 and t-3 (i.e. with a lag of 3, 6 and 9 months, respectively). Therefore, the additional econometric models for the Greek banking research are shaped below:

$$LLP_t = a_0 + a_1 LLP_{t-1} + a_2 CAP_{t-1} + a_3 LtD_{t-1} + a_4 GDP_{t-1} + a_5 UNEMP_{t-1} + a_6 INFL_{t-1} + a_7 DEBT_{t-1} + \varepsilon_{t-1} \quad (7)$$

$$LLP_t = a_0 + a_1 LLP_{t-1} + a_2 CAP_{t-1} + a_3 LtD_{t-1} + \varepsilon_{t-1} \quad (7a)$$

$$LLP_t = a_0 + a_1 GDP_{t-1} + a_2 UNEMP_{t-1} + a_3 INFL_{t-1} + a_4 DEBT_{t-1} + \varepsilon_{t-1} \quad (7b)$$

$$LLP_t = a_0 + a_1 LLP_{t-2} + a_2 CAP_{t-2} + a_3 LtD_{t-2} + a_4 GDP_{t-2} + a_5 UNEMP_{t-2} + a_6 INFL_{t-2} + a_7 DEBT_{t-2} + \varepsilon_{t-2} \quad (8)$$

$$LLP_t = a_0 + a_1 LLP_{t-2} + a_2 CAP_{t-2} + a_3 LtD_{t-2} + \varepsilon_{t-2} \quad (8a)$$

$$LLP_t = a_0 + a_1 GDP_{t-2} + a_2 UNEMP_{t-2} + a_3 INFL_{t-2} + a_4 DEBT_{t-2} + \varepsilon_{t-2} \quad (8b)$$

$$LLP_{it} = a_0 + a_1 LLP_{i,t-3} + a_2 CAP_{it-3} + a_3 LtD_{it-3} + a_4 GDP_{t-3} + a_5 UNEMP_{t-3} + a_6 INFL_{t-3} + a_7 DEBT_{t-3} + \varepsilon_{t-3} \quad (9)$$

$$LLP_t = a_0 + a_1 LLP_{t-3} + a_2 CAP_{t-3} + a_3 LtD_{t-3} + \varepsilon_{t-3} \quad (9a)$$

$$LLP_t = a_0 + a_1 GDP_{t-3} + a_2 UNEMP_{t-3} + a_3 INFL_{t-3} + a_4 DEBT_{t-3} + \varepsilon_{t-3} \quad (9b)$$

Where t=Q12001,…,Q42012.

Main priority of the analysis was to examine not only LLP index but also LLR. Nevertheless, given that BoG does not publish data of aggregate LLR on a quarterly basis, only LLP was used as proxy variable of credit risk.

All the above equations are analyzed through simple GMM method and previous periods variables (time lags) are used as instruments. Their validity was controlled through Hansen J statistics.

4. Sample and Data

4.1. Individual Bank Level Data

The first case study includes individual bank level data and consists of an unbalanced panel data of 11 Greek banks with 105 annual observations for both LLP and LLR. Specifically, the examined period is extended from 2000-2011 including both economic growth and recession of the Greek economy. The accounting information is drawn from Thomson Reuters Datastream and the macroeconomic ratios from Eurostat.

4.2. Aggregate Data

The second case study includes aggregate level data. Aggregate accounting data and information for the Greek banking sector is published exclusively by the central Bank of Greece (BoG), on a monthly basis. The aim of the study was to collect monthly data. However this was not possible, since some macro indicators (e.g. GDP and public debt) are published only on a quarterly basis. Given data availability, the final sample consisted of 48 quarterly observations for 2001Q1 - 2012Q4. In accordance with the previous case study, sample period covers both economic growth and recession. On the contrary, it is valuable to clarify that in this case study, due to the nature of the empirical analysis, time series data is used instead of panel data.

5. Estimation Results

The empirical results of both case studies are presented in the tables of the following paragraphs. Specifically, subsection 5.1 records the results of the first case study, in which individual bank level data were used with LLP and LLR as proxy measure of credit risk. Furthermore, subsection 5.2 presents the findings of the second case study, in which aggregate level data were used with LLP as proxy for loan quality.

5.1 Individual Bank Level Data

The empirical results of the determinants of LLP and LLR of the Greek commercial banks are presented in Tables 2 and 3, respectively. Each table reflects the coefficients of the independent variables with their corresponding p-values and statistical tests AR1, AR2 and Hansen J. It is worthwhile to mention that in the majority of the models, the tests indicate acceptable values. With regard to control whether our series are autoregressive, Kao panel cointegration test is implemented, in which the results show that the null hypothesis (H_0: no cointegration) is not rejected (p-value = 0.296).

The analysis of LLP ratio, for period t, revealed that unemployment and profitability could interpret changes in credit risk. In particular, it was found a positive relationship between provisions and unemployment (Model 2b), while an inverse with ROA (Model 2). The explanatory variables for the period t-1 recorded different statistical significances. Their results show that the current level of provisions is linked to macro indicators of the previous year. Indeed, previous year's inflation and public debt are found positively and significantly related to loan quality (Models 3 and 3b) and that of economic activity negatively (Model 3b).

Table 2: Empirical results individual bank level – LLP ratio

	t			**t-1**		
Variables	Model (2)	Model (2a)	Model (2b)	Model (3)	Model (3a)	Model (3b)
LLP_{it-1}	-0.080 (0.701)	0.269 (0.268)		-0.310 (0.631)	0.747 (0.133)	
CAP_{it}	-0.069 (0.648)	-0.200 (0.462)				
CAP_{it-1}				0.151 (0.305)	-0.104 (0.674)	
LtD_{it}	-0.022 (0.169)	-0.036 (0.132)				
LtD_{it-1}				-0.018 (0.362)	0.012 (0.660)	
ROA_{it}	**-0.271* (0.055)**	-0.310 (0.169)				
ROA_{it-1}				0.135 (0.500)	0.306 (0.275)	
GDP_{it}	-0.032 (0.613)		-0.022 (0.748)			
GDP_{it-1}				-0.114 (0.242)		**-0.101* 0.095**
$UNEMP_{it}$	0.157 (0.187)		**0.295** (0.011)**			
$UNEMP_{it-1}$				0.023 (0.884)		0.172 (0.274)
$INFL_{it}$	-0.086 (0.355)		-0.121 (0.206)			
$INFL_{it-1}$				**0.478*** (0.002)**		**0.272** (0.014)**
$DEBT_{it}$	0.015 (0.447)		0.021 (0.336)			
$DEBT_{it-1}$				**0.117*** (0.006)**		**0.065*** (0.001)**
AR1 *(p-value)*	0.079	0.009	0.033	0.016	0.054	0.029
AR2 *(p-value)*	0.812	0.222	0.604	0.319	0.773	0.555
J statistic *(p-value)*	0.688	0.880	0.243	0.664	0.754	0.239

*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 LLP is the ratio of loan loss provisions to total loans, LLR is the loan loss reserves to total loans, CAP is the capital ratio which is defined as capital and reserves to total assets, LtD is the loans to deposits ratio, ROA is the profitability ratio: return on assets, GDP is the annual percentage growth rate of GDP, UNEMP is the annual unemployment rate, INFL is the annual rate of inflation and DEBT is the public debt as percentage of GDP. Where i corresponds to the examined bank and t to the year.*

Table 3 presents the determinants of LLR ratio. The evaluation of models (4), (4a) and (4b) showed that unemployment is the only macroeconomic factor that affects significantly problem loans. In fact, unemployment rate is noted positive and within acceptable statistical significance values (Models 4 and 4b). Along with unemployment, capital ratio exerts a negative statistical significant influence on LLR (Models 4 and 4a). Simultaneously, estimations (4) and (4a) indicate the dynamic persistence of credit risk.

Table 3: Empirical results individual bank level – LLR ratio

	t			**t-1**		
Variables	Model (4)	Model (4a)	Model (4b)	Model (5)	Model (5a)	Model (5b)
LLR_{it-1}	**0.637*** (0.006)**	**1.236*** (0.005)**		-0.013 (0.975)	**0.966** (0.018)**	
CAP_{it}	**-0.534** (0.038)**	**-0.988** (0.035)**				
CAP_{it-1}				0.087 (0.676)	-0.038 (0.893)	
LtD_{it}	-0.027 (0.366)	-0.033 (0.518)				
LtD_{it-1}				-0.028 (0.278)	-0.014 (0.718)	
ROA_{it}	0.078 (0.760)	0.079 (0.888)				
ROA_{it-1}				-0.030 (0.917)	0.054 (0.885)	
GDP_{it}	-0.044 (0.725)		-0.127 (0.238)			
GDP_{it-1}				-0.144 (0.336)		**-0.200* (0.071)**
$UNEMP_{it}$	**0.420* (0.087)**		**0.994*** (0.000)**			
$UNEMP_{it-1}$				0.296 (0.408)		0.436 (0.120)
$INFL_{it}$	-0.312 (0.184)		-0.165 (0.272)			
$INFL_{it-1}$				**0.563** (0.013)**		0.270 (0.167)
$DEBT_{it}$	0.020 (0.622)		-0.034 (0.326)			
$DEBT_{it-1}$				**0.152*** (0.000)**		**0.119*** (0.001)**
AR1 *(p-value)*	0.064	0.083	0.012	0.063	0.009	0.071
AR2 *(p-value)*	0.778	0.876	0.378	0.334	0.283	0.784
J statistic *(p-value)*	0.313	0.320	0.129	0.703	0.885	0.022

*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 LLP is the ratio of loan loss provisions to total loans, LLR is the loan loss reserves to total loans, CAP is the capital ratio which is defined as capital and reserves to total assets, LtD is the loans to deposits ratio, ROA is the profitability ratio: return on assets, GDP is the annual percentage growth rate of GDP, UNEMP is the annual unemployment rate, INFL is the annual rate of inflation and DEBT is the public debt as percentage of GDP. Where i corresponds to the examined bank and t to the year.*

The examination of estimations (5), (5a) and (5b) demonstrate that public debt, inflation and GDP of previous year are explanatory variables of the current level of credit risk. Specifically, $DEBT_{it-1}$ (Models 5 and 5b) and $INFL_{it-1}$ (Model 5) record a significant positive interaction, while GDP_{it-1} (Model 5b) a negative one. Finally, it is noted that the dynamic persistence of credit risk is also confirmed as LLR_{it-1} is positively related with the current level of loan loss reserves (Model 5a).

5.2. Aggregate Data

Contrary to the subsection 5.1, in the present case study are tabulated the estimation results of the aggregate level data, in which were used quarterly observations. The econometric models for periods t and t-1 (i.e. with a lag of 3 months) are shown in Table 4 and that for t-2 and t-3 (i.e. with a lag of 6 and 9 months, respectively) in Table 5. Clearly, for each econometric model are shown the coefficients of independent variables with their corresponding p-values, the adjusted R^2 and the statistical test J. In all estimations, the adjusted R^2 is quite high and the J test records acceptable values, suggesting the validity of the instrumental variables.
The results for period t highlight that unemployment significantly determines LLP, as it is observed a positive relationship between the two variables (Models 6 and 6b). Furthermore, the current level of inflation seems to be associated negatively with loan quality (Model 6). Besides macroeconomic indicators, accounting ratios exercise significant influence on problem loans. In particular, capital and liquidity ratio are found to have a significant negative and positive correlation respectively (Model 6a). Moreover, the dynamic performance of credit risk is confirmed, since it is found a positive significant relation between LLP_t and LLP_{t-1} (Models 6 and 6a).

Table 4: Empirical results individual bank level - LLP ratio (t and t-1)

	t			**t-1**		
Variables	Model (6)	Model (6a)	Model (6b)	Model (7)	Model (7a)	Model (7b)
LLP_{t-1}	**0.889*** (0.000)**	**1.124*** (0.000)**		**0.756*** (0.000)**	**1.070*** (0.000)**	
CAP_t	-0.105 (0.957)	**-0.099*** (0.000)**				
CAP_{t-1}				**-0.212** (0.011)**	**-0.122*** (0.000)**	
LtD_t	0.002 (0.196)	**0.005* (0.064)**				
LtD_{t-1}				0.003 (0.430)	**0.009*** (0.006)**	
GDP_t	0.001 (0.977)		-0.033 (0.342)			
GDP_{t-1}				0.009 (0.671)		**-0.072* (0.065)**
$UNEMP_t$	**0.081*** (0.003)**		**0.394*** (0.000)**			
$UNEMP_{t-1}$				**0.158*** (0.000)**		**0.389*** (0.000)**
$INFL_t$	**-0.892** (0.045)**		-0.671 (0.694)			

$INFL_{t-1}$				-0.359 (0.301)		-1.287 (0.531)
$DEBT_t$	0.007 (0.361)		0.001 (0.988)			
$DEBT_{t-1}$				0.008 (0.116)		0.003 (0.741)
Adjusted R^2	0.983	0.981	0.943	0.989	0.983	0.948
J statistic *(p-value)*	0.412	0.673	0.381	0.227	0.346	0.376

*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 LLP is the ratio of loan loss provisions to total loans, CAP is the capital ratio which is defined as capital and reserves to total assets, LtD is the loans to deposits ratio, GDP is the growth rate of GDP, UNEMP is the unemployment rate, INFL is the rate of inflation and DEBT is the public debt as percentage of GDP. Where t corresponds to the examined quarter.*

Econometric equations for period t-1 examine whether the current level of provisions can be explained from indicators of previous quarter. Macroeconomic indices of previous quarter (t-1) exert significant power as unemployment (Models 7 and 7b) and economic activity (Model 7b), are presented with positive and negative sign, respectively. Regarding accounting determinants, capital and liquidity ratios of previous quarter show significant negative (Models 7 and 7a) and positive correlation (Model 7a) with provisions, respectively. In addition, it is recorded that LLP of previous quarter determine significantly the current level of provisions (Models 7 and 7a).

Moving forward to the findings for period t-2 (Table 5) it appears that macroeconomic factors of previous semester can affect significantly the current level of credit risk. Especially, unemployment rate (Models 8 and 8b) and GDP (Model 8b) continue to exhibit significant positive and negative effect, respectively. Simultaneously, public debt is identified as statistically significant, as the level of the previous semester influence positively the current level of LLP (Model 8). Alongside with macroeconomic environment, capital ratio demonstrates a significant negative relationship, while liquidity a positive one (Models 8 and 8a). From econometric equations (8) and (8a) is derived that past (six months) loan quality is positively linked to current LLP.

Finally, the econometric estimations for period t-3 indicate similar results with that of t-2. Specifically, from Models (9), (9a) and (9b) it is suggested that unemployment, public debt, economic activity, capital ratio, liquidity ratio and provisions affect the level of LLP nine months later.

Table 5: Empirical results individual bank level - LLP ratio (t-2 and t-3)

	t-2			t-3		
Variables	Model (8)	Model (8a)	Model (8b)	Model (9)	Model (9a)	Model (9b)
LLP_{t-2}	**0.339*** (0.001)**	**1.165*** (0.000)**				
LLP_{t-3}				**0.305*** (0.008)**	**1.449*** (0.000)**	
CAP_{t-2}	**-0.461*** (0.000)**	**-0.204*** (0.000)**				
CAP_{t-3}				**-0.586*** (0.000)**	**-0.348*** (0.000)**	
LtD_{t-2}	**0.006** (0.029)**	**0.014** (0.016)**				
LtD_{t-3}				0.003 (0.454)	**0.017** (0.018)**	
GDP_{t-2}	0.002 (0.917)		**-0.115*** (0.005)**			
GDP_{t-3}				-0.010 (0.665)		**-0.110** (0.013)**
$UNEMP_{t-2}$	**0.365*** (0.000)**		**0.367*** (0.000)**			
$UNEMP_{t-3}$				**0.456*** (0.000)**		**0.330*** (0.000)**
$INFL_{t-2}$	0.185 (0.648)		-2.292 (0.247)			
$INFL_{t-3}$				-0.250 (0.607)		-0.638 (0.210)
$DEBT_{t-2}$	**0.018*** (0.001)**		0.009 (0.308)			
$DEBT_{t-3}$				**0.024*** (0.000)**		**0.023** (0.030)**
Adjusted R^2	0.981	0.953	0.928	0.984	0.924	0.706
J statistic *(p-value)*	0.749	0.387	0.348	0.482	0.077	0.791

*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 LLP is the ratio of loan loss provisions to total loans, CAP is the capital ratio which is defined as capital and reserves to total assets, LtD is the loans to deposits ratio, GDP is the growth rate of GDP, UNEMP is the unemployment rate, INFL is the rate of inflation and DEBT is the public debt as percentage of GDP. Where t corresponds to the examined quarter.*

6. Discussion

The econometric results from both case studies documented the existence of strong relationships between accounting and macroeconomic factors with loan defaults/credit risk (LLP and LLR). Concerning macroeconomic environment, several interesting results were identified. Firstly, it is revealed that the current values of unemployment rates and those up to nine months before are positively correlated with the current level of loan portfolio quality. Therefore, it seems that high unemployment in Greece affects drastically the banking sector, as the number of unemployed is increased, a fall

of their disposable income is being placed which makes more difficult to meet their loan obligations.

Public debt is another crucial explanatory factor of loan quality with positive effect. However, contrary to unemployment, it seems that does not exert a current impact, since the current level of public debt explains credit risk after six months and continuing up to one year later. This fact support the view that fiscal problems have significant influence on loan quality partly because of the strict measures which governments have to impose (Perotti, 1996) and the liquidity problems of banks due to credit ratings (Reinhart and Rogoff, 2010). It is worthwhile to highlight that the relationship between public debt and loan quality indicators is underestimated by researchers and mostly in Greece. Therefore, this finding may open up a new field for further investigation in other countries, especially those with high public debt, deficits and generally great fiscal problems.

Another macroeconomic indicator that exerts significant but negative impact on credit risk is the GDP growth rate. It was found that the current level of loan quality is determined by the values of previous periods' economic activity (from previous quarter up to one year). Generally, in times of economic distress (development), loan quality indicators increased (reduced) and the loan portfolio quality worsens (improves). This result demonstrates the existence of procyclicality in Greece. Specifically, in growth periods, given that households and firms have sufficient income to repay their loans, problem loans indicators are kept low. In contrast, during recession, borrowers' economic situation is deteriorated and therefore bank loan quality indicators are increased gradually.

Besides the aforementioned factors, inflation is another macro indicator that seems to plays important role in explaining changes on loan portfolio quality. Based on the merits of economic theory, the relationship between inflation and credit risk is ambiguous. Although the findings of the research are also not very clear (especially for time t), it is recorded that its effect is positive with one-year lag. It should be outlined that, contrary to the majority of studies in other countries, the examination of relationship between inflation and loan quality in Greece, is at a very early stage. In this context, the present study provide evidences that an increase (decrease) in inflation worsens (improves) loan quality indicators of the following year. From the above discussion it is strongly supported that hypothesis H3 is fully acceptable.

Apart from macroeconomic conditions, dynamic persistence of loan quality indicators can also explain changes in credit risk. From both case studies, it was demonstrated that past performance of LLR and LLP show a significant positive correlation with the current level of credit risk. Consequently, hypothesis H1 is also confirmed.

Interesting findings were presented amongst other accounting variables, too. The examination of econometric models outlined that capital ratio is a significant factor, since its current values and those up to nine months before are negatively correlated with the current level of loan portfolio quality. This negative relationship indicates that Greek financial institutions with low (high) capital ratios have increased (decreased) problem loans, supporting the moral hazard hypothesis (MHS). Based on MHS, banks with low capital ratios might correspond more easily to moral hazard incentives and increase the riskiness of their loan portfolio. In other words, banks with low capital ratios are willing to take additional risk because they have relatively less capital to lose in a possible collapse, while managers have more to earn if an increase in profitability is achieved (Berger and DeYoung, 1997).

Although liquidity ratio it seems that is an additional explanatory accounting factor, statistically significant correlations were noted only in the second case study, where the current level of LLP ratio is positively associated with the current and up to nine months values of LtD. This impact supporting the view that low liquidity leads to deterioration of loan quality, reflecting banks' risk behavior.

Finally, profitability ratio was also identified as a determinant of LLP. However, this result should be treated with caution, since the variable ROA, due to data availability, was examined only in the first case study. Nevertheless, it was found that the current level of LLP is negatively related to the current values of ROA. This negative correlation may reflect bank behavior towards risk as institutions with low (high) profitability ratios are more (less) pressure to increase their revenues and apparently more (less) incentive to grant higher-risk loans. In addition, banks with low profitability may face more difficulties in monitoring the borrowers' quality and their operating expenses (Boudriga et al., 2009a and b). Based on the above findings, it seems that accounting factors significantly affect loan portfolio quality in Greece and therefore hypothesis H2 is confirmed.

It has to be underlined that bank size was not included in our models as a possible determinant of Greek loan portfolio quality for several reasons. In Greece, the size of commercial banks does not exhibit considerable variations. Consequently, due to the small Greek financial sector, the similar bank size and the possible econometric problems arising from the increase of instrumental variables, bank size was not examined in the estimation models1. Nevertheless, as a robustness test, we controlled whether the size of the banks is a possible determinant of Greek loan portofolio quality. From untabulated results it was found that the inclusion of this variable did not recorded as a significant factor neither differentiate the concluded results.

7. Conclusion

This paper is a modest contribution to the ongoing discussions about loan quality in Greece. The main objective is to provide evidence about the determinants of credit risk in the country over the period 2000-2012. The author´s attention was focused not only on individual banks but also on aggregate banking system level. Based on the results, it can be concluded that the research into the subject has been very successful. It has been demonstrated that both accounting and macroeconomic indicators seem to define credit risk. The findings largely agree with the literature, as in terms of macroeconomic factors, unemployment, public debt, GDP and inflation, appear to exert a significant influence. Simultaneously, from accounting perspective, past performance of loan quality, capital ratio, liquidity and profitability have considerable impact on loan defaults.

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[1] It must be noted that a significant number of mergers and acquisitions among Greek banks, that resulted in the formation of large banking groups, initiated from 2012 and afterwards, period that is not included on this empirical study.

Appendix

A.1: Descriptive Statistics - Individual Bank level data

Variables	Mean	Median	Max	Min	SD
LLP_{it}	1.254	0.810	11.670	0.000	1.796
LLP_{it-1}	0.913	0.730	9.310	0.000	1.041
LLR_{it}	4.081	3.060	31.520	0.930	3.941
LLR_{it-1}	3.458	2.770	18.640	0.730	2.693
CAP_{it}	6.052	6.130	15.560	-4.310	2.865
CAP_{it-1}	6.646	6.260	24.230	-2.140	3.213
LtD_{it}	120.813	121.280	227.080	55.440	31.757
LtD_{it-1}	114.302	112.610	208.390	47.600	29.889
ROAit	-0.018	0.580	7.380	-21.210	3.124
ROA_{it-1}	0.683	0.720	7.380	-9.000	1.658
GDP_{it}	1.453	3.000	5.900	-7.100	3.992
GDP_{it-1}	2.444	3.400	5.900	-4.900	3.103
$UNEMP_{it}$	10.088	9.800	17.700	7.700	2.170
$UNEMP_{it-1}$	9.670	9.500	12.600	7.700	1.260
$INFL_{it}$	3.330	3.400	4.700	1.300	0.884
$INFL_{it-1}$	3.209	3.300	4.700	1.300	0.866
$DEBT_{it}$	114.413	106.100	170.300	97.400	19.939
$DEBT_{it-1}$	108.089	103.700	148.300	94.000	13.102

Note: Where LLP is the ratio of loan loss provisions to total loans, LLR is the loan loss reserves to total loans, CAP is the capital ratio which is defined as capital and reserves to total assets, LtD is the loans to deposits ratio, ROA is the profitability ratio: return on assets, GDP is the annual percentage growth rate of GDP, UNEMP is the annual unemployment rate, INFL is the annual rate of inflation and DEBT is the public debt as percentage of GDP. Where i corresponds to the examined bank and t to the year.

Table A.2: Descriptive Statistics - Aggregate level data

Variables	Mean	Median	Max	Min	SD
LLP_t	4.356	3.675	11.580	2.570	2.075
LLP_{t-1}	4.202	3.670	10.580	2.570	1.800
LLP_{t-2}	4.063	3.660	9.810	2.570	1.546
LLP_{t-3}	3.936	3.650	8.960	2.570	1.295
CAP_t	8.219	7.930	11.450	6.130	1.054
CAP_{t-1}	8.150	7.930	10.530	6.130	0.951
CAP_{t-2}	8.098	7.915	10.360	6.130	0.892
CAP_{t-3}	8.112	7.930	10.360	6.130	0.897
LtD_t	93.160	87.620	148.780	55.820	25.275
LtD_{t-1}	92.117	87.530	148.780	55.820	24.483
LtD_{t-2}	90.905	87.395	148.780	55.820	23.284
LtD_{t-3}	89.619	87.260	146.930	55.820	21.832
GDP_t	0.583	2.600	7.900	-9.200	4.931
GDP_{t-1}	0.700	2.700	7.900	-9.200	4.917
GDP_{t-2}	0.883	2.700	7.900	-9.200	4.807
GDP_{t-3}	1.067	2.700	7.900	-9.200	4.695
$UNEMP_t$	11.670	10.115	26.430	7.470	4.672
$UNEMP_{t-1}$	11.356	10.000	25.470	7.470	4.179
$UNEMP_{t-2}$	11.049	10.000	23.630	7.470	3.651
$UNEMP_{t-3}$	10.769	10.000	21.670	7.470	3.156
$INFL_t$	0.255	0.270	0.670	-0.170	0.189
$INFL_{-1}$	0.260	0.270	0.670	-0.170	0.189
$INFL_{t-2}$	0.266	0.270	0.670	-0.170	0.186
$INFL_{t-3}$	0.270	0.270	0.670	-0.170	0.186
$DEBT_t$	117.492	107.950	170.600	97.300	21.249
$DEBT_{t-1}$	116.653	107.900	170.600	97.300	20.660
$DEBT_{t-2}$	115.872	107.800	170.600	97.300	20.174
$DEBT_{t-3}$	115.131	107.700	170.600	97.300	19.759

Note: Where LLP is the ratio of loan loss provisions to total loans, CAP is the capital ratio which is defined as capital and reserves to total assets, LtD is the loans to deposits ratio, GDP is the annual percentage growth rate of GDP, UNEMP is the annual unemployment rate, INFL is the annual rate of inflation and DEBT is the public debt as percentage of GDP. Where t corresponds to the examined quarter.

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