Routledge
Taylor & Francis Group

Economic Research-Ekonomska Istraživanja

ISSN: 1331-677X (Print) 1848-9664 (Online) Journal homepage: https://www.tandfonline.com/loi/rero20

Bank-specific and macroeconomic determinants of non-performing loans in the Republic of Macedonia: Comparative analysis of enterprise and household NPLs

Jordan Kjosevski, Mihail Petkovski & Elena Naumovska

To cite this article: Jordan Kjosevski, Mihail Petkovski & Elena Naumovska (2019) Bank-specific and macroeconomic determinants of non-performing loans in the Republic of Macedonia: Comparative analysis of enterprise and household NPLs, Economic Research-Ekonomska Istraživanja, 32:1, 1185-1203, DOI: 10.1080/1331677X.2019.1627894

To link to this article: https://doi.org/10.1080/1331677X.2019.1627894

Published online: 05 Jul 2019.

ECONOMIC RESEARCH-EKONOMSKA ISTRAŽIVANJA
2019, VOL. 32, NO. 1, 1185–1203
https://doi.org/10.1080/1331677X.2019.1627894

Routledge
Taylor & Francis Group

ARTICLE

OPEN ACCESS Check for updates

Bank-specific and macroeconomic determinants of non-performing loans in the Republic of Macedonia: Comparative analysis of enterprise and household NPLs

Jordan Kjosevski[a], Mihail Petkovski[b] and Elena Naumovska[c]

[a]Department financial management, Faculty of macroeconomics, Sport Life, Ohrid, Macedonia; [b]Department of Financial Management, Faculty of Economics, Ss Cyril and Methodius University in Skopje and member of the Council of National Bank of the Republic of Macedonia, Skopje, Macedonia; [c]Department of Financial Management, Faculty of Economics, Ss Cyril and Methodius University in Skopje, Skopje, Macedonia

ABSTRACT

The purpose of this paper is to explore the influence of bank-specific and macroeconomic determinants of all non-performing loans (NPLs) to enterprises and households in the Republic of Macedonia. The analysis is performed for the whole banking sector for the period 2003Q4 to 2014Q4, by applying the Autoregressive Distributed Lag Modelling Approach (ARDL), the co-integration model implementing quarterly time series. The results of the research indicate that the profitability of banks, the growth of loans to enterprises and to households respectively, as well as the growth of GDP, all have a negative impact, while banks' solvency and unemployment have a positive impact on the rise of non-performing loans in both models. In addition, regarding enterprises, we found that the exchange rate has a positive and statistically significant impact on the level of NPLs, while inflation has a negative and statistically significant impact on the increase in non-performing loans to households. The main contribution of this paper is that the results obtained by econometric analysis may be used for forecasting non-performing loans several years in the future, as well as for stress-testing both the entire banking system and the individual banks operating in the Republic of Macedonia.

ARTICLE HISTORY
Received 1 May 2017
Accepted 5 July 2018

KEYWORDS
Non-performing loans; bank-specific determinants; macroeconomic determinants; ARDL model; Republic of Macedonia

JEL CLASSIFICATION
C58; G21

1. Introduction

Non-performing loans are one of the basic indicators of the financial 'health' of banks and constitute the main measure of credit risk in the banking system. The increase in non-performing loans indicates that the number of economic entities that have difficulties in servicing their credit debt is on the rise, increasing the probability of loans not being repaid (credit default). In this case, the bank assets value erodes and its wealth decreases as a result of the losses incurred due to debt write-offs (Morttinen, Poloni, Sandars, and & Vesala (2005). Given that the banks do not function

CONTACT Jordan Kjosevski jordan_kos@yahoo.com

independently and separately from one another, but rather interlace and operate with multiple backlinks, the poor performance of one bank can easily spill over to the entire banking sector and trigger financial instability and stress. At worst, the deteriorated quality of loans in the banking sector creates a threat of systemic risk, panic and deposit outflows, limitations to financial intermediation, and ultimately limitations to investments and growth. Also, experience has shown that the increase of non-performing loans has a key role in the emergence of bank crises (Kunt & Detragiache, 1998; González-Hermosillo, 1999). Considering the previous findings, the issue of non-performing loans, along with the factors they depend on and their effect on the real economy, became a primary concern of almost all countries in the world, and resolving this issue became a precondition for regaining the functionality of financial markets (Klein (2013).

The Macedonian banking system represents an interesting case study among the Central and Eastern European banking systems. All Central and Eastern European countries have experienced tremendous changes in their political, social and economic environment during the transition process. In Macedonia, however, as well as in some other Western Balkan countries, the transition to a market economy has evolved under particularly difficult circumstances, different from those faced by the majority of Central and Eastern European countries. Macedonia has been affected by rapid decline of output and hyperinflation in its early transition, Yugoslav wars, political and economic blockades, a military conflict in 2001, high rise in unemployment (38% in 2005), the global financial crisis in 2008, and a deep domestic political crisis that started in 2015.

The Macedonian banking system has several characteristics: 1) It is relatively conservative and characterised by high capital adequacy ratios, strong liquidity and low reliance on foreign financing. 2) Until the mid-2000s, the loan supply in the Macedonian banking system was limited and the credit market could be described as underdeveloped. 3) As a result of ownership changes in the domestic banking industry, the Macedonian economy experienced rapid credit growth before the global financial crisis. 4) Despite the turbulent transition from a socialist to a market economy, the Macedonian banks were stable in the period analysed. As a result, Macedonia has a relatively low share of non-performing loans to total loans as compared to the other countries in the Western Balkan region. For example, in 2007, the ratio of NPLs in Albania, Croatia and Serbia was 3.4%, 4.8% and 8.4%, respectively, to subsequently rise in 2015 to 18.2%, 16.33%, and 21.58%, respectively. In 2007, the NPLs in Macedonia accounted for 7.5%; in 2015, the percentage of NPLs was 10.33%, while at the end of 2017 it declined to 6.9%. (World Bank data reports)

In estimating the factors that affect non-performing loans in the Republic of Macedonia, it is essential for the National Bank of the Republic of Macedonia to provide a sound and efficient banking sector. This paper is the first attempt to analyse the combined effects of the macroeconomic and sectoral (aggregated) bank determinants of NPLs in Macedonia. We follow the indications of (Berger & Deyoung, 1997; Louzis, Vouldis, & Metaxas, 2010; Makri, Tsagkanos, & Bellas, 2014) that the quality of banks' credit portfolio is influenced by both macroeconomic and bank-specific determinants, which allow for comprehensive observations of the factors that affect

non-performing loans. Another factor that – to the best of our knowledge, has not been analysed until now – is a comparative study of different types of non-performing loans and their respective determinants. With that in mind, in this paper we attempt to perform a systematic and econometric analysis of the determinants of non-performing loans separately for enterprises and for households, using quarterly data for the period 2003Q4–2014Q4 and employing the Autoregressive Distributed Lag Modelling Approach (ARDL), the model of co-integration. The period selected is determined by the need to encompass a period of a relative boom (i.e. an upswing in the economy, downfall, economic crisis), as well as economic recovery.

The basic hypothesis of this study is that bank-specific and macroeconomic determinants have an impact on the non-performing loans to enterprises and to households in the Republic of Macedonia.

This paper is conceptualised in the following manner: Following the introduction, Section 2 reviews the literature on empirical findings relevant to the determinants of non-performing loans. Section 3 focuses on elaboration of the model and the variables, data and methodologies used. Section 4 presents the empirical results, and Section 5 concludes the paper and offers policy recommendations.

2. Literature review

Research related to studying of determinants of banks' credit risk has gained in importance in the last few years, especially after the financial crisis of 2007–2008 (Khemraj and Pasha 2009). However, with regard to modelling in this field, there is no universally accepted rule or principle to be used as a basic tool in all studies.

Since the aim of this part of the paper is to provide a review of the empirical literature, we will present a short summary of the empirical literature that examines the determinants of non-performing loans.

Bofondi and Ropele (2011) examine how macroeconomic determinants affect the quality of the whole credit portfolio of the banking system in Italy during the period 1990Q1–2012Q2, using aggregated data while applying a simple linear regression model. The results obtained in their study indicate that the rates of growth of the real gross domestic product and the prices of houses have an inverse impact on non-performing loans to households, while the rate of unemployment and the nominal interest rate have a positive impact. When they consider enterprises, the increase of non-performing loans is correlated with an increase of the rate of unemployment and the basic interest rate, while as the consumption of durables increases, the non-performing loans decrease. The above mentioned macroeconomic determinants affect the non-performing loans with a different time lag. Louzis et al. (2010) examined the influence of macroeconomic and bank-specific determinants on non-performing loans in the banking sector in Greece. Their study represents an analysis of the nine biggest banks, using quarterly data for the period of 2003Q1 to 2009Q3. Their findings indicate that GDP growth has a negative impact on the growth of all types of non-performing loans, while unemployment and basic interest rate on loans have a positive one. Of the bank-specific determinants, the loans to deposits ratio has a statistically significant negative impact on the growth of non-performing loans, while solvency

has a positive impact on the growth of non-performing loans to enterprises, but a negative one on mortgage loans.

Otašević (2013) explores the impact of macroeconomic and bank-specific determinants on non-performing loans, using a sample of 33 banks in the Republic of Serbia in the period 2008Q3 to 2012Q2. The author performs econometric modelling by using two panel econometric methods: 1) the Method of Fixed Effects, and 2) the Generalized Method of Moments-GMM. The author analyses the non-performing loans to households and to enterprises separately. The findings of this paper indicate that it is only the macroeconomic determinants that have an impact on non-performing loans, while the impact of the bank-specific determinants is statistically insignificant. This is to say that the decrease of the GDP growth and the depreciation of the dinar lead to deterioration of the credit portfolios of the Serbian banks, regarding loans to both enterprises and households. Furthermore, the results of the analysis indicate that inflation affects the rise in non-performing loans to households and to enterprises, while the reference interest rate affects only the non-performing loans to households.

Research related to the examination of the determinants of non-performing loans is still lagging at a preliminary stage in Macedonia. To our knowledge, only Ilievska, Vaskov, and Debnikov (2012) – as a team of the NBRM – have conducted a study that explores the issue of the determinants of non-performing loans in a sample of 16 banks. These authors use the GMM model to analyse the period from 2003Q1 to 2011Q4, implementing only the macroeconomic determinants (GDP growth, basic interest rate, real exchange rate, inflation rate, exports, loans to GDP ratio, unemployment rate, net growth of salaries) that affect non-performing loans. Their findings indicate that inflation and real exchange rate have positive and statistically most important impact on non-performing loans. Furthermore, both the basic interest rate and the loans to GDP ratio have a positive impact on non-performing loans. Of the selected macroeconomic determinants, GDP growth, net increase of salaries and exports have shown to have a negative impact on the growth of non-performing loans.

3. Model and data specification

Most of the literature exploring the factors that determine non-performing loans make use of the linear regression model, while implementing in parallel macroeconomic and bank-specific determinants (Kalirai & Scheicher, 2002; Shu, 2002). Review of the literature analysing these issues suggests that the authors use two types of bank-specific determinants: summarised (aggregated) at the level of the banking sector and at the level of individual or single banks. According to Boudriga, Boulila, and Jellouli (2009), the data aggregated at banking system level are considered more appropriate, considering the fact that the risk of non-representativeness of the sample is thus reduced.

Recognising the previous conclusion within this paper, we will strictly use aggregated data in order to establish which determinants affect non-performing loans in the Republic of Macedonia. An additional reason behind our decision to use

aggregated data is the fact that the data for a portion of the variables are available as a time series at the banking sector level for the period from 2003Q4 to 2014Q4, while the same data are not available for all individual banks for the same period.

The basic model is presented through a linear regression function, which links non-performing loans to the macroeconomic and bank-specific determinants in the following form:

$$\mathrm{NPLt} = \mathrm{f}\ (\mathrm{BSt},\ \mathrm{MEt},\ \text{year dummy})$$

Where:

NPL encompasses the dependent determinants (non-performing loans to enterprises and non-performing loans to households) over period t;

BS includes the bank-specific sector factors for a given period t;

ME includes the macroeconomic factors that have the same impact on the banking sector over a given period t;*year dummy* includes changes in the dependent determinant related to the particular year, and not related to the macroeconomic or sectoral determinants used in the model.

Hereinafter, we are developing the basic regression model (1) and we present it in two specifications, or models, as follows:

3.1. Model 1

$$\begin{aligned}\mathrm{NPLEt} &= \beta 0 + \beta 1(\mathrm{ROA})\mathrm{t} + \beta 2(\mathrm{GROWNPLE})\mathrm{t} + \beta 3(\mathrm{LIQUIDITY})\mathrm{t} + \beta 4(\mathrm{CAR})\mathrm{t} + \\ &\beta 5(\mathrm{HHI})\mathrm{t} + \beta 6(\mathrm{GDPGROWTH})\mathrm{t} + \beta 7(\mathrm{INF})\mathrm{t} + \beta 8(\mathrm{UNEMP})\mathrm{t} + \beta 9(\mathrm{REAEXRATE})\mathrm{t} \\ &+\beta 10(\mathrm{DUM})\mathrm{t} + \varepsilon \mathrm{t} \qquad (2)\end{aligned}$$

3.2. Model 2

$$\begin{aligned}\mathrm{NPLHt} &= \beta 0 + \beta 1(\mathrm{ROA})\mathrm{t} + \beta 2(\mathrm{GROWNPLH})\mathrm{t} + \beta 3(\mathrm{LIQUIDITY})\mathrm{t} + \beta 4(\mathrm{CAR})\mathrm{t} \\ &\beta 5(\mathrm{HHI})\mathrm{t} + \beta 6(\mathrm{GDPGROWTH})\mathrm{t} + \beta 7(\mathrm{INF})\mathrm{t} + \beta 8(\mathrm{UNEMP})\mathrm{t} + \beta 9(\mathrm{REAEXRATE})\mathrm{t} \\ &+\beta 10(\mathrm{DUM})\mathrm{t} + \varepsilon \mathrm{t} \qquad (3)\end{aligned}$$

Where:

NPLE = growth rate of the non-performing loans to enterprises; NPLH = growth rate of the non-performing loans to households; ROA = Return On Equity; GROWNPLE = Growth of loans to enterprises; GROWNPLH = Growth of loans to households; LIQUIDITY = loans/deposits; CAR = capital/total assets; HHI = Concentration of banking sector measured by the Herfindahl-Hirschman index (HHI) index; GDPGROWTH = Growth of real GDP; INF = inflation rate measured by CPI; UNEMP = rate of unemployment as percentage of the total labour force; REALEXRATE = real exchange rates; DUM = dummy variable with value 1 for the period September 2008 to December 2009 and value 0 for the remaining periods.

With regard to the dependent variable, the empirical literature usually suggests usage of two indicators: the ratio of non-performing to total loans (Gasha & Morales, 2004; Jimenez & Saurina, 2006; Fainštein & Novikov, 2011; Festic, Kavkler, & Repina, 2011; Pestova & Mamonov, 2012; Castro, 2012), and the change of the status of non-performing loans or credit losses (Marcucci & Quagliariello, 2008 and 2009). In addition, losses due to unrepaid loans are also used in exploring the credit risk, (Bikker & Hu, 2002; Pain, 2003; Pesola, 2005; Quagliariello 2007; Glogowski, 2008). This credit risk measure, however, often faces an identification problem, as a result of the different polices of managers in different banks during the credit cycle (Pestova & Mamonov, 2012) and its use is therefore more complicated (Fainštein & Novikov, 2011). Hence, the research usually focuses on the first two indicators (i.e., options that include non-performing loans). The fact that the time series is shortened by one period as a result of its differentiation (Fainštein & Novikov, 2011) is considered a downside of the use of changes in non-performing loans.

Having in mind the aforementioned problems of the remaining determinants, in this paper we will use the ratio of non-performing loans to total loans as a dependent variable. Moreover, given the fact that the purpose of this paper is to analyse non-performing loans to enterprises and households separately, we will use two dependent variables: 1) non-performing loans to enterprises to total loans to enterprises, and 2) non-performing loans to households to total loans to households.

Return on Assets (ROA). It is usually expected for banks that are more profitable to have a lower rate of non-performing loans (Swamy, 2012), resulting in a negative correlation. According to (Boudriga et al., 2009), non-efficient banks with lower profitability are tempted to involve themselves into extending less secure and risky loans, in order to raise their profitability and/or to meet the regulators' requirements. The negative correlation between the bank's performance (profitability) and the credit risk is confirmed by (Godlewski, 2004). It is along these lines that (Berger & DeYoung, 1997) explain the hypotheses of 'mismanagement', using the return on assets. Namely, the poor performance of an enterprise can be linked to the characteristics of the managers that result in lower profitability (manifested by low return on assets or equity). This additionally motivates the managers to lend to more risky profiles of debtors, which, logically, leads to an increase in the non-performing loans.

Total loans growth. This determinant shows the propensity for risk taken by banks. To maximise the short-run benefits, managers seek to rapidly expand the credit activities and may hence take inadequate credit exposures (Castro, 2012; Beck et al., 2013; Klein, 2013). Several studies indicate the presence of a positive correlation between credit growth and non-performing loans, such as the study of (Dash & Kabra, 2010). Nevertheless, there are studies, such as (Boudriga et al., 2009; Khemraj & Pasha, 2009; Swamy, 2012), which found a negative relationship between these two variables. According to (Quagliariello, 2007), the negative correlation between credit growth and non-performing loans can be a result of certain specific conditions, regulations or background of the respective bank systems, which make the banks more conservative and cautious in the spread of their loan supply. Hence, the effect on the credit growth can work both ways.

Liquidity. In this paper, the loans to deposits ratio will be used as a measure of the banks' liquidity. This index is an important tool, which is used in the literature as a measure of liquidity of the banks by measuring the funds the bank uses to extend loans from the deposits received. Following the papers of (Louzis et al., 2010; Makri et al., 2014), we expect a positive correlation with non-performing loans.

Capital Adequacy Ratio. The share of capital in the total assets of the banks is a significant determinant of non-performing loans. According to the 'moral hazard' hypothesis, discussed by (Keeton & Morris 1987), banks with relatively low capital respond to moral hazard incentives by increasing the riskiness of their loan portfolio, which in turn results in higher non-performing loans on average in the future. The capital adequacy ratio is calculated by adding Tier 1 capital to Tier 2 capital and dividing the sum by risk weighted assets, as per the guidelines in the Basel accord. In this case, the connection with NPLs is negative (Berger & DeYoung, 1997; Salas & Saurina, 2002; Klein, 2013). On the other hand, positive connection was discovered in the studies of (Rajan & Dhal, 2003; Boudriga et al., 2009; Espinoza & Prasad, 2010). According to empirical research and theory, we expected that these determinants would have an ambiguous correlation with non-performing loans.

Banking concentration. This determinant is measured by the Herfindahl-Hirschman index (HHI). According to (Boyd & De Nicolò, 2005; Jiménez, Lopez, and Saurina, 2013), banks in highly competitive environments will take deliberate steps to minimise risks, including non-performing loans, in order to gain a favourable risk management perception among investors and regulators compared to rival banks. Following this reasoning, countries with a more competitive banking sector should experience fewer non-performing loans. On the other hand, according to (Manove, Padilla, & Pagano, 2001; Bolt & Tieman, 2004), excessive competition can compel banks to engage in risky lending practices, such as reducing their loan screening procedures and using lax lending criteria, which, in turn, increase the likelihood of generating a higher rate of non-performing loans. Given the two competing arguments, we do not have a definite prediction for the association between concentration and non-performing loans.

Real GDP growth rate. The determinants related to GDP are the basic macroeconomic determinants of credit risk. In this context, few variations emerge, such as the annual real GDP growth rate, the production gap, the growth of per capita income, etc. However, the real GDP growth rate is by far the most prevalent macroeconomic variable used, for example, with: (Bonfim, 2009; Zribi & Boujelbene, 2011; Nkusu, 2011; Castro, 2012; Klein, 2013; Beck et al., 2013). Therefore, we include the real GDP growth rate in our analysis. This allows us to examine the effect of the cycle when the economy is at credit risk. According to (Nkusu, 2011), the growing economy relates to growth of the general level of income and smaller financial stresses; therefore, GDP growth should be negatively correlated to credit risk.

Unemployment rate. The next macroeconomic variable that we use in this paper is the unemployment rate as a percentage of the total labour force. Regarding this determinant, it is logical to assume that an increase in unemployment should have negative effects on the cash income of the population, which would ultimately affect people's capability to repay their debts. Regarding the enterprises, an increase in

unemployment can be a signal for them to reduce their production rates, as a result of the fall in effective demand. This can decrease the income, which will further influence the servicing of debt towards the banks. Several empirical studies have examined the relationship between unemployment and non-performing loans and they have all established a positive correlation (Bofondi and Ropele; 2011; Glogowski, 2008; Makri et al., 2014). Therefore, we also expect that an increase of unemployment will result in an increase of non-performing loans.

Inflation. In order to influence the price stability in the model, we include the inflation rate measured through consumption prices, but its influence on non-performing loans is not very clear. Namely, higher inflation can make debt servicing easier as a result of the decrease of the real value of the loans; on the other hand, however, it can weaken the capacity of the clients to service their debts by reducing their real income. The empirical studies conducted also confirm this conclusion. Thus, the studies of (Gunsel, 2008; Rinaldi & Sanchis-Arellano, 2006) established a positive correlation between inflation and non-performing loans in Northern Cyprus and the Eurozone countries, while the studies by (Zribi & Boujelbene, 2011) and (Vogiazas & Nikolaidou, 2011), in the case of the Tunisian and Romanian banking sector, showed negative correlation between inflation and credit risk. Therefore, we cannot determine in advance what kind of correlation with non-performing loans to expect for this determinant.

Real exchange rate. According to (Fofack, 2005; Khemraj & Pasha, 2009; Dash & Kabra, 2010; Nkusu, 2011; Castro, 2012), the real effective exchange rate has a positive influence on non-performing loans. An increase of the real exchange rate implies depreciation of the domestic currency, while a decrease of the real exchange rate indicates its appreciation. Real depreciation is expected to result in expansion of the export-oriented enterprises; however, it has a negative effect on the import-oriented ones (Nucci & Pozzolo, 2001). Furthermore, real depreciation can aggravate the net value of enterprises if they have huge liabilities in foreign currencies and would make them riskier for crediting under circumstances of depreciation, because they will have to obtain additional funds in the domestic currency in order to repay their loans. This will result in difficulties for the enterprises in meeting their obligations to the banks, leading to deterioration of the banks' balance sheets, provoking a credit crunch and ultimately inducing financial crisis followed by a significant decline in economic activity (Pratap & Urrutia, 2004).

Besides the aforementioned real determinants in the empirical models, an additional dummy variable will be added in order to account for the 2007–2008 global economic crisis. This economic crisis commenced in September of 2007 as a financial crisis in the United States, to then successively cascade worldwide. In the Republic of Macedonia, the initial effects of this crisis were felt during the third quarter of 2008 and reached their climax in the course of the 2009 fiscal year. These events led to deterioration of the real sector and caused difficulties for economic agents to reconcile their obligations to banks, resulting in an increase of non-performing loans. Taking the above into consideration, the dummy variable will be set at a value of 1 for the period from September 2008 to December 2009 and at a value of 0 for the remaining periods.

The data for the dependent variables (i.e., non-performing loans to enterprises and non-performing loans to households) were obtained from the website of the National Bank of the Republic of Macedonia. The data for the bank-specific sectorial determinants (i.e., return on assets, credits to deposits ratio, capital to total assets ratio, banks concentration) were acquired from the website of the National Bank of the Republic of Macedonia, expressed as a percentage. The macroeconomic data (i.e., the yearly real GDP growth rate, inflation rate measured through CPI, and the exchange rate) were obtained from the macroeconomic data segment on the NBRM web page. The rate of unemployment figures were taken from the web site of the State Statistical Office. For this analysis, we use quarterly data (45 observations) for the period 2003Q3 to 2014Q4. The chosen timespan for the quantitative analysis is determined by the availability of the comparable data. We can confidently state that the quantum of data is sufficient for quality econometric examination.

3.3. Unit root tests

As the analysis in this article uses time series, we needed to establish integrative features and determine the stationarity or non-stationarity of the implied variables. According to (Gujarati, 2003), a series can be considered stationary if its mean and variance are constant over time and the value of the covariance between two time periods depends solely on the interval between the two time periods, instead on the factual time at which the variance was calculated. To evaluate these characteristics of the time series, two tests were applied to test the stationarity of the variables: Augmented Dickey Fuller (aDF) and the Phillips Peron (PP) test. Both tests were utilised to examine whether the time series has a Unit Root, i.e. that it is non-stationary. In this, a 10% level of importance was used as a critical value for determining whether the time series is stationary. The results of these two tests for stationarity of the time series are presented in Table 1 and will serve for deducing the regressions later in the article.

The results from these two tests suggest that there is a different degree of integrativity between the selected determinants (Table 1) Namely, both stationarity tests indicate that three determinants (NPLE, CAR, HHI and GDPGROWTH) are stationary at level (as indicated by I(0), Table 1), while six determinants become stationary after their first differentiation as indicated by I(1), Table 1). The results obtained for the determinant INF from the two applied tests are inconclusive (as indicated by I(0 or I(1) Table 1).We therefore consider these results as we proceed with our analysis.

3.4. Methodology

In order to obtain economically reasonable findings and results, in terms of methodology in econometric studies, it is very important to select an approach that will correspond to the character and specificity of the data series. In our case, the findings in the previous section indicate that there is a different order of integration in the selected variables (i.e., there are determinants that are stationary at order I (0) or become stationary after the first differentiation I (1)). In this case, if some of the

Table 1. Unit root tests results.

Augmented Dickey Fuller Test –ADF					Phillips-Perron Test -PP				
	At the level		First differentiation		At the level		First differentiation		
Determinants	t-statistics	Critical value of the test for 10%	t-statistics	Critical value of the test for 10%	t-statistics	Critical value of the test for 10%	t-statistics	Critical value of the test for 10%	Conclusion
NPLE	−3.34	2.60		2.60	−2.99	2.60		2.60	I(0)
NPLH	−1.21	2.60	−5.27	2.60	−1.66	2.60	−5.33	2.60	I(1)
ROA	−2.12	2.60	−3.80	2.60	−1.49	2.60	−7.86	2.60	I(1)
GROWNPLE	−1.08	2.60	−6.58	2.60	−1.26	2.60	−6.63	2.60	I(1)
GROWNPLH	−1.60	2.60	−2.70	2.60	−1.12	2.60	−2.75	2.60	I(1)
LIQUIDITY	−2.59	2.60	−3.49	2.60	−2.31	2.60	−3.93	2.60	I(1)
CAR	−3.92	2.60		2.60	−4.71	2.60		2.60	I(0)
HHI	−3.28	2.60			−4.23	2.60			
GDPGROWTH	−4.61	2.60		2.60	−4.70	2.60		2.60	I(0)
INF	−3.54	2.60		2.60	−2.21	2.60	−3.65	2.60	I(0) or I(1)
UNEMP	−0.46	2.60	−2.69	2.60	−1.50	2.60	−2.69	2.60	I(1)
REALEXRATE	0.31	2.60	−6.28	2.60	−1.53	2.60	−13.11	2.60	I(1)

Source: Author's calculations.

determinants in the model are not stationary at their order or have a unit root, then it is necessary to examine the possibility of co-integrative correlation between the selected variables, Rinaldi and Sanchis-Arellano (2006).

Pesaran and Shin (1997) (Caporale & Chui, 1999; Catao & Falcetti, 2002), among others, demonstrate several advantages of the ARDL model in the assessment of co-integrative relationship, as compared to the other models. First, the ARDL model can be applied regardless of the order of the variation integration (it could be I (0) or I (1)) (Pesaran and Pesraran (1997). Secondly, this model is more applicable to smaller sample sizes, consisting of 30 to 80 observations (Pattichis, 1999; Mah, 2000). Thirdly, according to Laurenceson and Chai (2003), the ARDL model allows for a sufficient number of lags throughout the procedure of general-to-specific modelling framework (including the process that generates the series). Lastly, the dynamic error correction model (ECM) can be derived from the ARDL model through a simple linear transformation (Banerjee et al. 1993).

Considering the size of our sample (which includes 45 observations for the period 2003Q1–2014Q4), as well as the integration of the included determinants, we concluded that the ARDL model is the most appropriate econometric technique for our models. As previously determined, the determinants selected in this work are integrated of order I (0) or of order I (1). Additionally, the results of the unit roots tests show that none of the variables in both models are integrated of the second order I (2). This is significant, as – according to Ouattara (2004) – if any of the determinants are integrated of the second order I (2), the ARDL model is inapplicable.

In order to illustrate the ARDL model, we build upon the basic equation (1) and present the ARDL model with the following t equation (4):

$$\Delta y_t = \beta_0 + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \sum_{j=0}^{p} \beta_j \Delta x_{t-j} + \lambda_1 y_{t-1} + \lambda_2 x_{t-1} + \varepsilon_t \quad (4)$$

Where y is the dependent variable, x are the dependent determinants, $\beta$are the short-term coefficients to be calculated, and $\lambda$are the long-term coefficients before the variables, $\boldsymbol{\varepsilon t}$ is the error. Accordingly, the first part of equation (4) represents the short-term dynamics of the model. while the second one is a long-term relationship between the dependent variable and the independent determinants. Prior to the implementation of the ARDL model, a decision on the maximal number of lags to be included is essential. The decision on the optimal number of lags is made based on tests for specification of regressions, as a measure of statistical validity and of the information criteria (Schwartz Bayesian Criterion, SBC, and Akaike Information Criterion, AIC), as a measure of the explanatory power of the regressions.

4. Empirical results and discussions

Using the general-to-specific modelling framework, we developed models with varying numbers of lags for the determinants differentiated (equal number of lags for all determinants). In this paper, the maximal order of the ARDL model was limited to

Table 2. Diagnostic tests and information criteria.

	Model 1		Model 2	
Diagnostic tests	*2 lags*	*1 lag*	*2 lags*	*1 lag*
H0: The residuals are normal Jarque-Bera test (p-statistics)	0.8947	0.000	0.7757	0.6658
H0: The residuals have no serial correlation Breusch-Godfrey Serial Correlation LM Test (p-statistics)	0.7757	0.6658	0.1424	0.0978
H0: The residuals are not heteroscedastic Breusch–Pagan test (p-statistics)	0.8633	0.2409	0.4739	0.3289
Information criteria	*2 lags*	*1 lag*	*2 lags*	*1 lag*
AIC	16.245*	19.007	13.262*	17.698
SBC	20.361*	22.361	16.783*	18.657

Source: Author's calculations.

two lags, due to the small sample size and relatively large number of independent determinants.

The diagnostic analysis showed that a similar specification is obtained with the use of one and two time lags in both models. In both models (with one and with two time lags), the residuals did not show serial correlation. Furthermore, the residuals follow a normal distribution (with the exception of model 1 with a lag of one quarter) and do not display heteroscedasticity. However, the results obtained with the information criteria Akaike, information criterion AIC, and Schwarz Bayesian criterion SBC lead to our selection of two time lags (Table 2).

Next we examined the co-integration relationship between the determinants (i.e., testing the zero hypothesis ($H_{0:}\ \lambda = 1 = \lambda = 2 = \ldots = \lambda_n = \mathbf{0}$). As evident in Tables 3 and 4, the calculated F statistics are 3,70 and 3,77 for the first and second models, respectively. Considering that the F statistic in both models exceeds the upper limit, we reject the zero hypothesis thereby concluding co-integration among the determinants in both models.

After establishing the cointegration between the determinants we proceeded to define the ARDL model (i.e.,optimal number of lags for each determinant). We used the AIC criterion in determining ARDL as AIC delivers a smaller standard deviation when used in the model as compared to the SBC criterion (Pesaran & Pesraran, 1997). Using the AIC criterion, we determined the ARDL model (optimal number of lags for each determinant) for specification 1 ARDL (1,2,0,0,0,0,1,0,1,2,0) and ARDL (1,2,1,1,2,1,1,1,2,0) for the second specification. According to the method described in Pesaran and Pesraran (1997) and our determined ARDL model, we examined long-term relationship (Table 5) and estimated short-term dynamics (i.e., the ECM model).

The results show that the calculated coefficients of the regression equation (4) based on the long-term relationships of the ARDL model (Table 5) indicate several links between the macroeconomic environment, the banking determinants, and the non-performing loans of both specifications (enterprises and households).

Table 3. Results from the cointegration test of model 1.

	10%		5%		2.5%		1%	
F-statistics	Lower limit	Upper limit	Lower limit	Upper limit	Lower limit	Upper limit	Lower limit	Upper limit
3.701873	1.8	2.8	2.04	2.08	2.24	3.35	2.5	3.68

Source: Author's calculations.

Table 4. Results from the cointegration test of model 2.

	10%		5%		2.5%		1%	
F-statistics	Lower limit	Upper limit	Lower limit	Upper limit	Lower limit	Upper limit	Lower limit	Upper limit
3.767836	1.8	2.8	2.04	2.08	2.24	3.35	2.5	3.68

Source: Author's calculations.

Table 5. Long-term coefficients based on the ARDL model.

	Enterprises			Households		
Determinants	Coefficients	Standard error	Probability	Coefficients	Standard error	Probability
ROA	−3.245	0.633	0.0000	−1.608	0.335	0.0003
GROWNPLE	−0.185	0.040	0.0001	−0.077	0.018	0.0013
LIQUIDITY	0.022	0.034	0.5183	0.029	0.023	0.2418
CAR	2.363	0.198	0.0000	0.416	0.113	0.4328
HHI	0.054	0.138	0.1942	0.095	0.249	0.5286
GDPGROWTH	−0.164	0.055	0.0072	−0.068	0.027	0.0259
INF	0.021	0.077	0.7815	0.002	0.033	0.9393
UNEMP	0.413	0.202	0.0525	0.066	0.084	0.0496
REALEXRATE	7.432	2.835	0.0153	8.715	1.376	0.5743
DUM	2.711	0.674	0.0005	0.180	0.381	0.0440
C	−460.9	178.2	0.0165	534.9	85.70	0.0000

Source: Author's calculations.

Bank-specific determinants had limited influence on non-performing loans. The coefficients determined for return on assets (ROA) indicate that profitability has a significant impact on non-performing loans in both models. The calculated ROA coefficient of non-performing loans to enterprises is two-fold larger (3.25) if compared to that in the case of households (1.61). In accordance with the empirical results of Louzis et al. (2010), the negative relationship observed confirms the hypothesis that less profitable banks tend to undertake higher credit risks. Furthermore, these results potentially demonstrate the validity of the hypothesis that poor performance, resulting in reduced profitability, increases the exposure to risk of non-performing loans, as banks hastily attempt to compensate for the underperformance.

The credit growth results indicate a statistically significant and a negative sign of non-performing loans in both models. Based on the coefficients obtained, we can state that a 1% increase of loans to enterprises or to households correlates with an increase of non-performing loans by −0.19% and −0.08%, respectively. These results indicate that, in years of credit expansion, banks in the Republic of Macedonia operate with increased caution when granting new credit products. Furthermore, during these periods, the banks are mostly focused on improving their credit portfolio by cleaning up the non-performing loans, while working to maintain a satisfactory rate of credit growth. These more conservative policies implemented in Macedonia have allowed the banks to maintain the credit risk under control during the period analysed.

The share of capital in total assets, or solvency, achieves statistical significance (at 1% significance level) only in the first model and has an expected positive coefficient of 2.36. In our opinion, this result indicates that Macedonian banks may be pressured to undertake higher risk in order to achieve the profitability level requested by their shareholders. Additionally, larger capital allows for an increased capacity of the banks to accept higher risk (most frequently related to corporate loans), negatively impacting the credit portfolio quality in return. These results are consistent with other research (Rajan & Dhal, 2003).

The results of the Herfindahl-Hirschman index (HHI) show that this determinant is not a statistically significant one of NPLs in the long run. The results are in line with those obtained by Çifter (2014), who investigated how banking concentration affects NPLs, taking a sample of ten Central and Eastern European countries (CEE). He examined this relationship both in the long run and in the short run. In his paper, he did not find concentration to be significant and even its sign was ambiguous. Thus, he concluded that "bank concentration may not affect the systemic stability in the CEE countries."

In regard to macroeconomic conditions, the coefficients obtained show values as expected. GDP growth leads to a decrease of non-performing loans to enterprises and to households, as is observed in both models. These results provide evidence that a 1% increase of economic growth decreases the credit risk (i.e., non-performing loans) by 0.16% in the case of enterprises and 0.08% in the case of households, suggesting pro-cyclicality of the credit risk to both enterprises and households. Our results are consistent with results previously described in the literature (Nkusu, 2011; Castro, 2012; Klein, 2013; and Beck et al. 2013). The notion that economic growth is statistically significant (at 1% significance level) in both models confirms the robustness of the results obtained.

Regarding the rate of unemployment, the results show that this determinant has a positive and statistically significant impact on non-performing loans at the level of 5% in both models. The coefficients obtained indicate that an increase in unemployment of 1% will lead to an increase of 0.41% in non-performing loans to enterprises and of 0.07% in those extended to households. These results imply that the increase in unemployment has a large impact on the increase of non-performing loans to enterprises, as an increase in unemployment results in a decline of effective demand, negatively affecting production as a consequence. Subsequently, a significant decline in production would lead to decreased income for enterprises, influencing their capacity to meet their liabilities. Regarding households, unemployment has a negative impact on cash, as unemployed clients cannot fulfil their obligations to repay the loans, which results in an increase of non-performing loans. The results obtained in this study coincide with the observations shown in Louzis et al. (2010) and Bofondi and Ropele (2011), studies that analyse Greek and Italian banks, respectively.

The macroeconomic variable real exchange rate showed statistical significance solely in the first model (i.e., in the case of non-performing loans to enterprises). Under that model, depreciation of the currency would result in an increase in non-performing loans. More specifically, if the foreign exchange rate depreciates by 1%, non-performing loans will increase by 7.43%. In our opinion, this is primarily due to

Table 6. Short-term dynamics based on ARDL.

	Enterprises			Households		
Determinants	Coefficients	Standard error	Probability	Coefficients	Standard error	Probability
D(ROA)	0.422	0.324	0.2066	−0.616	0.107	0.4581
D(GROWNPLE)	−0.129	0.022	0.0000	−0.023	0.010	−0.0012
D(LIQUIDITY)	0.040	0.064	0.5339	0.158	0.018	0.4732
D(CAR)	1.507	0.466	0.0037	−0.663	0.169	0.5318
D(HHI)	0.742	0.252	0.7423	0.058	0.185	0.2356
D(GDPGROWTH)	−0.053	0.028	0.0777	0.002	0.008	0.9498
D(INF)	−0.005	0.072	0.9450	−0.097	0.023	0.0010
D(UNEMP)	2.351	0.499	0.0001	0.339	0.117	0.0125
D(REALEXRATE)	−1.530	1.045	0.1569	−3.482	0.388	0.1067
D(DUM)	−1.995	0.515	0.0008	0.447	0.155	0.0130
Correction mechanism (eCM)	−0.642	0.131	0.0001	−0.724	0.084	0.0000

Source: Author's calculations.

the notion that a depreciation of the dinar would provoke an outbreak of negative tendencies in the real sector, characterized by a decline in production, increased unemployment, and deepening of deflationary pressures, all negatively influencing the capacity of enterprises to service their debts. The final results are consistent with the results obtained by (Gunsel, 2008; Zribi & Boujelbene, 2011; Castro, 2012).

The dummy variable is statistically significant at the level of 1% in both models. Therefore, this result justifies the introduction of the dummy variable in both models. The results showed that the global economic crisis led to worsening of the quality of bank loans to both enterprises and households. Tables 5 and 6 show that the global economic crisis has had a greater impact on the increase in non-performing loans to enterprises (2.71) as compared to those extended to households (0.18).

We continue our analysis by observing the short-term dynamics of the models in conjunction with the adjustment coefficients shown in Table 6.

The results obtained with short-term dynamics are relatively similar to those observed with long-term dynamics. Similar to what was observed with the long-term model, liquidity and Herfindahl-Hirschman index (HHI) index did not prove to be a statistically significant determinant. On the other hand, coefficients for the other bank-specific and macroeconomic determinants are statistically significant and displayed similar values.

Inflation proved to be a statistically significant determinant with short-term dynamics in the second model (i.e., when the non-performing loans to households is the dependent determinant). This is in contrast to the long-term dynamics model, where no statistical significance was observed in either model. The coefficient obtained indicates that a 1% increase in inflation results in a 0.10% decrease of non-performing loans to households. Therefore, we can conclude that the growth in inflation reduces the real value of the debt. This can be explained using the Phillips curve (the higher the inflation – the lower the unemployment, and *vice versa*), where a lower unemployment rate has a positive effect on the capacity of the debtor to regularly service his debt to creditors. A similar conclusion is reached in (Zribi & Boujelbene, 2011).

The error correction model or ECM (used for balancing the short-term deviation of non-performing loans from the long-term balanced level) is negative and

statistically significant at the 1% level in both models. Thus, a large part of the imbalance in the previous period (quarter) caused by short-term influences (approximately 64% in the first model and 72% in the second) converges back to long-term balance in the current quarter. In other words, the results indicate that, in a relatively short time, all analysed variables in the model succeed to diverge from mutual 'deviating – correlating' and to streamline to a stable long-term balanced relationship. Hence, this model successfully rectifies the vector error (i.e., corrects the ineligible short-term correlation relationship by which it exceeds the endogeneity). This observation provides additional support to the validity of the results obtained under both models in our analysis.

5. Conclusions

This paper's findings confirm the hypothesis that bank-specific and macroeconomic determinants have an impact on the amount of non-performing loans to enterprises and to households in Macedonia. Empirical results provide evidence that from the bank-specific determinants, profitability and credit growth, there is a negative and statistically significant impact on non-performing loans towards the specifications enterprises and households, while capital adequacy ratio has positive and statistically significant impact only to non-performing loans to enterprises. As for the macroeconomic determinants in both specifications, the results indicate that a negative relationship exists between economic growth and growth of non-performing loans, while real exchange rate is a statistically significant determinant only in the first model, (i.e., with the non-performing loans to enterprises). From the macroeconomic determinants, only inflation was not statistically significant with the long-term dynamics model. However, this determinant proved to be statistically significant with short-term dynamics, when we examined non-performing loans to households as the dependent variable.

This paper, according to the knowledge of the authors, is the first study to explore the influence of bank-specific and macroeconomic determinants of non-performing loans (NPLs) to enterprises and households in the Republic Macedonia. We have also seen in the literature review that, generally, there are not many studies which performed comparative analysis of factors influencing different types of non-performing loans in other countries.

Our research does not face significant limitations, but their removal will certainly contribute to a wider range of results. The limited availability of independent variable data for longer time periods constrained our investigation, as well as the use of alternative methodologies for examination and comparison of the results. The lack of a sufficient number of data on non-performing loans to enterprises by sector (i.e., civil construction, trade, industry, etc.), or by category of loans to households (i.e., mortgages, general consumption, car loans, etc.) also limited our analysis.

The main contribution of this paper is that the results obtained from econometric analysis may be used for forecasting non-performing loans dynamics and also for stress-testing both the entire banking system, and the individual banks operating in the Republic of Macedonia. During stress-testing various scenarios can be applied,

where reactions of non-performing loans to enterprises and to households could be monitored by observing fluctuating values of the established determinants. The conclusions presented in this paper could contribute to the development of a valuable bank credit risk index that monetary authorities can consult in order to mitigate credit risk and strengthen financial stability of the country.

Some additional issues remain open for further research. For example. it would be beneficial as a measure of credit risk, to also apply changes in the status of non-performing loans, or bad debt reserves, along with the ratio of non-performing loans over total loans. Furthermore, future studies could provide a breakdown of non-performing loans to enterprises by type of activity and to households by type of loan, to allow for a more detailed analysis. Lastly, econometric techniques, such as generalised method of moments, the Johansen technique of cointegration or panel cointegration can be used to compare results between countries at a similar level of development as the Republic of Macedonia and elucidate the determinants that affect non-performing loans.

References

Banerjee, A., Dolado, J. J., Galbraith, J. W., & Hendry, D. F. (1993). *Cointegration, Error Correction, and the Econometric Analysis of Non-Stationary Data*, Oxford: Oxford University Press.

Beck, R., Jakubík, P., & Piloiu, A. (2013). *Non-performing loans: What matters in addition to the economic cycle*? Working Paper No. 1515. European Central Bank.

Berger, A., & 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 Basle Capital Requirements. *BNL Quarterly Review*, *221*, 143–175.

Bofondi, M., & Ropele, T. (2011). *Macroeconomic determinants of bad loans: evidence from Italian banks*. Questioni di Economia e Finanza (Occasional Papers), No 89. Bank of Italy.

Bolt, W., & Tieman, A. F. (2004). Banking competition, risk and regulation. *Imf Working Papers No 04/11*, doi:10.5089/9781451842814.001

Bonfim, D. (2009). Credit risk drivers: Evaluating the contribution of firm level information and of macroeconomic dynamics. *Journal of Banking & Finance, Elsevier*, *33*(2), 281–299. doi:10.1016/j.jbankfin.2008.08.006

Boudriga, A., Boulila, N., & Jellouli, S. (2009). Does bank supervision impact nonperforming loans: cross-country determinants using agregate data? *MPRA Paper*, *18068*, 1–28.

Boyd, J. H., & De Nicolò, G. (2005). The theory of bank risk taking and competition revisited. *The Journal of Finance*, *60*(3), 1329–1343. doi:10.1111/j.1540-6261.2005.00763.x

Caporale, M. G., & Chui, K. F. M. (1999). Estimating income and price elasticities of trade in a cointegration framework. *Review of International Economics*, *7*(2), 254–264. doi:10.1111/1467-9396.00161

Castro, V. (2012). Macroeconomic determinants of the credit risk in the banking system: the case of the GIPSI. *Economic Modelling*, *31*, 672–683.

Catao, L., & Falcetti, E. (2002). Determinants of Argentina's external trade. *Journal of Applied Economics*, 5(1), 19–57. doi:10.1080/15140326.2002.12040570

Çifter, A. (2014). Bank concentration and non-performing loans in Central and Eastern European countries. *Journal of Business Economics and Management*, *16*(1), 117–137. doi:10.3846/16111699.2012.720590

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.

Espinoza, R., & Prasad, A. (2010). Nonperforming loans in the GCC banking systems and their macroeconomic effects. *IMF Working Papers*, *10*(224), 1. doi:10.5089/9781455208890.001

Fainštein, G., & Novikov, I. (2011). The role of macroeconomic determinants in credit risk measurement in transition country: Estonian example. *International Journal of Transitions and Innovation Systems (Systems)*, *1*(2), 117–137. doi:10.1504/IJTIS.2011.039621

Festic, M., Kavkler, A., & Repina, S. (2011). The macroeconomic sources of systemic risk in the banking sectors of five new EU member states. *Journal of Banking & Finance*, *35*(2), 310–322.

Fofack, H. (2005). *Non-performing loans in Sub-Saharan Africa: Causal analysis and macroeconomic implications.* World Bank Policy Research Working Paper No. 3769, Washington, DC: World Bank.

Gasha, J. G., & Morales, R. A. (2004). Identifying threshold effects in credit risk stress testing. *IMF Working Papers*, doi:10.5089/9781451856996.001

Glogowski, A. (2008). Macroeconomic determinants of Polish banks' loan losses – results of a panel data study. *National Bank of Poland Working Paper, No. 53*.

Godlewski, C. (2004). *Capital Regulation and Credit Risk Taking: Empirical Evidence from Banks in Emerging Market Economies, Finance 0409030*, University Library of Munich, Germany.

González-Hermosillo, B. (1999). Determinants of Ex-Ante banking system distress: A macro-micro empirical exploration of some recent episodes. *IMF Working Papers*, *99*(33), 1.

Gujarati, D. (2003). *Basic econometrics*. 4rth ed. New York: McGraw Hill.

Gunsel, N. (2008). Micro and macro determinants of bank fragility in North Cyprus economy. *African journal of business management*, *6*(4), 1323–1329.

Ilievska, M., Vaskov, M., & Debnikov, P. (2012). *Macroeconomic determinants of non-performing loans in macedonian banking system-panel data analysis.* Working Paper, Skopje: NBRM.

Jimenez, G., & Saurina, J. (2006). Credit cycles, credit risk, and prudential regulation. *International Journal of Central Banking*, 2(2).

Jiménez, G., Lopez, J. A., & Saurina, J. (2013). How does competition affect bank risktaking? *Journal of Financial Stability*, *9*(2), 185–195. doi:10.1016/j.jfs.2013.02.004

Kalirai, H., & Scheicher, M. (2002). Macroeconomic stress testing: Preliminary evidence for Austria. *Austrian National Bank Financial Stability Report*, May, No. 3,

Keeton, W., & Morris, C. (1987). Why do banks' loan losses differ?" Federal Reserve Bank of Kansas City. *Economic Review*, 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.

Klein, N. (2013). Non-Performing Loans in CESEE; Determinants and impact on macroeconomic performance. *IMF Working Papers*, *13*(72), 1. doi:10.5089/9781484318522.001

Kunt, A., & Detragiache, E. (1998). The determinants of banking crises in developing and developed countries IMF Staff Papers. *45*(1), 81–110.

Laurenceson, J., & Chai, J. (2003). *Financial reform and economic development in China*. Cheltenham, UK: Edward Elgar

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. Working Paper No. 118, Bank of Greece. *Journal of Banking & Finance*, *36*, 1012–1027.

Mah, J. S. (2000). An empirical examination of the disaggregated import demand of Korea — The case of information technology products. *Journal of Asian Economics*, *11*(2), 237–244. doi:10.1016/S1049-0078(00)00053-1

Makri, V., Tsagkanos, A., & Bellas, A. (2014). Determinants of non-performing loans: The case of Eurozone. *Panoeconomicus*, *61*(2), 193–206. doi:10.2298/PAN1402193M

Manove, M., Padilla, J. A., & Pagano, M. (2001). Collateral versus Project Screening: A model of lazy banks. *RAND Journal of Economics*, *32*(4), 726–744. doi:10.2307/2696390

Marcucci, I. J., & Quagliariello, M. (2009). Asymmetric effects of the business cycle on bank credit risk. *Journal of Banking & Finance*, *33*(9), 1624–1635. doi:10.1016/j.jbankfin.2009.03.010

Marcucci, J., & Quagliariello, M. (2008). Credit risk and business cycle over different regimes. *Temi di Discussione (Working Papers) No.670*, Banca D'Italia.

Morttinen, L., Poloni, P., Sandars, P., & &Vesala, J. (2005). Analyzing banking sector conditions: How to use macro-prudential indicators. *Occasional Paper Series No. 26, European Central Bank*.

Nkusu, M. (2011). Non-performing loans and macro financial vulnerabilities in advanced economies. *IMF Working Papers*, *11*(161), 1. doi:10.5089/9781455297740.001

Nucci, F., & Pozzolo, A. F. (2001). Investment and the Exchange Rate: an Analysis with Firm-Level Panel Data. *European Economic Review*, *45*(2), 259–283. doi:10.1016/S0014-2921(00)00050-7

Otašević, D. (2013). *Macroeconomic determinants of the quality of banks' loan portfolio in Serbia*. Working Paper Series, National Bank of Serbia.

Ouattara, B. (2004). Modelling the long run determinants of private investment in Senegal, credit Research Paper No. 04/05. Nottingham: Centre for Research in Economics Development and International Trade, University of Nottingham.

Pain, D. (2003). The provisioning experience of the major UK banks: A small panel investigation. *Working Paper no. 177*, Bank of England.

Pattichis, C. A. (1999). Price and income elasticities of disaggregated import demand: results from UECMs and an application. *Applied Economics*, *3*, 1061–1071. doi:10.1080/000368499323544

Pesaran, M. H., & Pesraran, B. (1997). *Working with Microfit 4.0: Interactive econometric analysis*. Oxford: Oxford University Press.

Pesaran, H., & Shin, Y. (1997). An autoregressive distributed lag modelling approach to cointegration analysis. In *Econometrics and Economic Theory in the 20th Century. The Ragnar Frisch Centennial Symposium* (S. Strøm, ed.), 371–413. Cambridge University Press, Cambridge.

Pesola, J. (2005). *Banking fragility and distress: An econometric study of macroeconomic determinants*, Bank of Finland, Research Discussion Papers.

Pestova, A., & Mamonov, M. (2012). *Macroeconomic and bank-specific determinants of credit risk evidence from Russia*. EERC Working Paper Series. Economics Education and Research Consortium. No. 13/10E.

Pratap, S., & Urrutia, C. (2004). Firm dynamics, investment and currency composition of debt: Accounting for the real effects of the Mexican Crisis of 1994. *Journal of Development Economics*, *75*(2), 535–563. doi:10.1016/j.jdeveco.2004.06.009

Quagliariello, M. (2007). Does macro economy affect bank stability? A review of empirical evidence. *Journal of Banking Regulation*, *2*(9), 102–115. doi:10.1057/jbr.2008.4

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*, 81–121.

Rinaldi, L., & Sanchis-Arellano, A. (2006). Household debt sustainability, what explains household non-performing loans? An empirical analysis. *European Central Bank Working Paper Series 570*, European Central Bank.

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. doi:10.1023/A:1019781109676

Shu, C. (2002). The impact of macroeconomic environment on the asset quality of Hong Kong's banking sector. Hong Kong Monetary Authority Research Memorandum.

Swamy, V. (2012). Impact of macroeconomic and endogenous factors on non- performing banks assets. *International Journal of Banking and Finance*, *9*(1), 2.

Vogiazas, S. D., & Nikolaidou, E. (2011). Investigating the determinants of nonperforming loans in the Romanian banking system: An empirical study with reference to the Greek crisis", Hindawi Publishing Corporation. *Economics Research International*, *2011*, 1. *World bank data reports*

Zribi, N., & Boujelbene, Y. (2011). The factors influencing bank credit risk: The case of Tunisia. *Journal of Accounting and Taxation*, *3*(4), 7.