

## ANALYSIS ON THE DETERMINANTS OF CREDIT RISK IN THE EUROPEAN BANKING SECTOR

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**JEL classification: G32, G21**

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### *Abstract*

*The recent financial crisis started in the US in 2007, the main cause being the secured mortgage loans. The purpose of the empirical research was to study the factors that determine the credit risk, respectively the quality of the credit portfolio. The analysis was carried out on a unique sample bank-specific data comprised of 70 banking institutions from 13 European countries (Austria, Belgium, Cyprus, Germany, Greece, Italy, Norway, Poland, Portugal, Spain, Sweden, Denmark and Switzerland) with high incomes during 2005q1-2011q4. The ratio between the allowance for the granted credits and the total credits granted were used as a bank-lending indicator. The main results obtained were that the credit risk's determinants were the indicator of capital adequacy, GDP, the unemployment rate, the inflation rate, government debt and the financial crisis. The main estimated equation includes specific variables of the banking institutions (the accumulated credit risk and the capital adequacy indicator), macroeconomic variables (GDP, the unemployment rate, the inflation rate, government debt), bank specific variables (banking concentration) and the control variables (the financial crisis). Compared to the previous period, the accumulation of the reserves for the credits granted of the total of the credits granted, had a positive impact on the dependent variable. The borrowing decisions from the previous period define changes at the current level of the quality of the bank loan portfolio.*

*Keywords: credit risk, reserves, factors, total credits, variables, causes*

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## 1. Introduction

The recent financial crisis began in 2007 in the US, whose main cause was the loss of investor confidence in secured mortgage loans. The market titles issued did not have the potential of trading which caused a shortage of the liquidity marked by tightening the necessary conditions for getting a bank loan.

Although the financial crisis' pole of 2007 was the United States, its effects have been propagated like a 'snowball' and affected all the economies from countries all over the world. The Governments of the affected countries have had at their disposal a wide range of tools and different strategies to approach, all with one goal, namely, to maintain banking stability. They were tailored depending on the policy adopted by the bank, the relationship of the Central Bank

and the Government, all for one purpose, namely to remove the bank sector from collapse. Because of this approach, the pressure was, of course, on the Governments of the affected countries, who had to solve the arisen situation. Just to avoid banking contagion, public investments in the banking sector were significant.

Measures and specific strategies have been identified and implemented by various countries. Their specificity have caught the financial crisis better and the results were much better quantified. Some countries such as Ireland recorded high expenses compared to other countries like Denmark, where the investments that were made to maintain the banking sector's stability have been reduced. These expenses were also influenced by the size of the banks that needed to be saved, by the invested capital in them, by its corporate form and by the health of the relationship between the public authority and the bank.

In this context, we believe it is essential that before looking at the causes of banking crises, it is necessary to focus our attention on the risk of bank lending and, in particular, on the quality of the bank loan portfolio. In specialty literature it can be found a range of factors that can influence the risk of Bank lending: factors that influence the risk of systematic lending, and factors that influence the risk of unsystematic lending (Ahmad, Ariff, 2007) [1].

The analysis of the carried out study was done on a unique sample of specific banking data consisting of 70 banking institutions from 13 European countries, over a period of 7 years with a quarterly data frequency. The ideas to be addressed in this paper are related to the indicator Credit Reserves / Total Credits, which was used as an indicator of the bank credit. In fact, we are looking at the factors with positive impact or the factors with significant negative impact on the credit risk.

## **2. The degree of investigation of the problem at the moment, and the purpose of the research**

The purpose of the empirical research was to study the factors that determine the credit risk, respectively the quality of the credit portfolio. The analysis was carried out on a unique sample of specific banking data consisting of 70 banking institutions from 13 European countries with high incomes during 2005q1-2011q4. The countries considered were Austria, Belgium, Cyprus, Germany, Greece, Italy, Norway, Poland, Portugal, Spain, Sweden, Denmark and Switzerland.

An indicator of bank lending has been identified as the ratio of the allowance for loans losses and the total loans granted: Loan Reserves / Total Loans (Total Loans). The proposed data source consists of data collection from Worldscope, Eurostat, the International Monetary Fund, the World Bank and the Global Financial Development as well as from the article of Petrovic and Tutsch (2009) [14].

There are a number of theoretical and empirical articles in the specialty literature the purpose of which is to study the package of the rescue measures undertaken by states during financial crises. Among the most recent and relevant articles we mention: Dietrich and Hauck (2012) [8], Wegner (2013) [17], Grossman and Woll (2013) [18], Hryckiewicz (2014) [11].

The result of Wegner (2013) [17] simulations shows that the government intervention leads to a higher percentage of indirect bankruptcies in the total cases of bank stress and the effect is less stronger as the economy is less developed.

Dietrich and Hauck (2012) [8] propose a theoretical model that compares various measures taken by governments on a large scale, and analyses how these measures stimulate banks to provide new loans as well as their impact on the capital structure.

Numerous empirical studies analysed the impact of the macroeconomic factors on the bank credit risk taking into account a panel of banking institutions from both a single country and a specific sample of countries. Among the most relevant ones are: Salas and Saurina (2002) [15], Jakubík (2007) [12], Aver (2008) [2], Bohachova (2008) [4], Bonfim (2009) [5], Kattai (2010) [10], Castro (2013) [7].

### **3. Methods and materials applied**

The factors influencing the systematic credit risk are: (i) macroeconomic factors such as the employment rate, GDP growth, the inflation rate, the foreign exchange rate, (ii) changes in economic policies such as changes in the monetary and fiscal policy, legislative changes, incentives or restrictions on imports and exports, and (iii) political changes or changes in political guidelines. All of these variables can have an important influence on the debtors' likelihood to pay off their debts.

The factors that influence non-systematic lending risk are the factors specific to (i) individuals / borrowers such as: their own personality, financial solvency and capital, credit insurance, (ii) banking companies / institutions such as management, financial position, or the factors specific to the banking industry. Banking industry-specific factors may include the structure and the economic success of the industry, stability and maturity of the industry.

This study proposes a research on commercial banks in Europe in the period 2011q4 2005q1. The analysed bank sample consists of 70 banks in 13 European well-developed countries: Austria, Belgium, Cyprus Germany, Greece, Italy, Norway, Poland, Portugal, Spain, Sweden, Denmark and Switzerland. In order to identify the factors influencing bank credit risk, the OLS estimator was used for robust regressions with robust standard errors and clustered standard errors for correcting heteroscedasticity and correlation at the level of each country.

The indicator that reflects the credit risk was determined as follows: the dependent variable was calculated as the ratio between the allowance for loan losses and the total loans. Credit risk and credit portfolio quality are two interdependent concepts. Credit risk means the risk that the cash flow associated with the credit will not be paid to the bank (Saunders and Cornet, 2008) [16]. The level of the granted loan allowance /total loans granted reflects the risk exposure and the quality of the lending portfolio as a result of the close links with credit provision and losses resulting from the lending (Gebhardt and Novotny-Farkas, 2011) [9].

The liquidity indicators described above were determined on the basis of data provided by Worldscope for 70 commercial banks during the 28 consecutive quarters for a period of 7 years.

The explanatory variables include macroeconomic indicators, market indicators, as well as bank-specific indicators.

Within the category of macroeconomic indicators, the influence of the following variables was tested: 1. GDP (the growth rate compared to the previous gross domestic product (unit of reference, 2005 = 100, considered negative); 2. The unemployment rate (unit of measure: number of persons per total work force, considered positive); 3. The inflation rate (Consumer price index, reference year 2005, considered positive), 4. Government debt (% GDP, is considered positive). From the category of market indicators the influence of the following variables was tested: 1. Banking concentration (the percentage of assets held by the top five banks in the total assets of the banking sector may be considered positive or negative).

From the category of indicators specific to the banking sector the influence of the following explanatory variables was analyzed:

1. Capital adequacy - the ratio of equity to total assets (estimated effect: can be considered positive);
2. Credit risk from the previous period (allowance for loans granted / Total credits, can be considered positive).

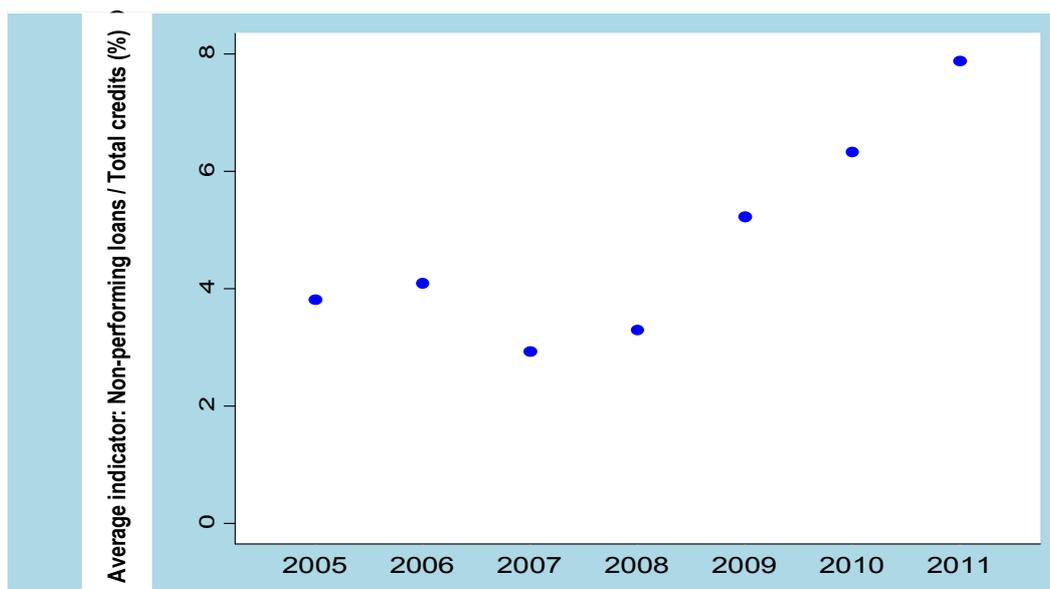
In the regression model, a dummy variable for the financial crisis was introduced. (Dummy variable that takes the value 1 for the 2007Q3-2009q2 analysis period and that takes zero value (0) in other cases). These variables were determined on the basis of data provided by Worldscope (bank-specific indicators) or those provided by the International Monetary Fund and Eurostat (macroeconomic and market indicators).

In order to identify the determinants of bank lending, a panel of 70 commercial banks in Europe, analysed over a period of 28 consecutive quarters, namely Q1 2005 - Q4 2011, was used. The OLS estimator has been applied on the regressions, completed with robust standard errors and clustered standard errors in order to correct the heteroscedasticity and the correlation in each country. The impact of explanatory variables on the bank lending is determined on the basis of frequent quarterly data in the following manner: Credit risk  $i, t-1 = \beta_0 + \Phi \times \text{Rescue measures}_{j, t-1} + \text{Banking control variables}_{i, t-1} + \Theta \times \text{Macro control variables}_{j, t-1} + \Omega \times \text{Market control variables}_{j, t-1} + \delta \times \text{Other control variables}_{j, t-1} + \varepsilon_{i, t}$  (Equation 1), was used for all explanatory variables.

During the financial crisis, the quality of the loan portfolio deteriorated significantly, so that the European banking system recorded significant increases in non-performing loans (Figure 1), with direct consequences on the increase of the allowances created for the loans granted, the reduction of the opportunities for profits and determined pressures on the adequacy of bank capital.

Figure 1 shows the evolution of the Non-performing Loans indicator in Total Loans (%) for the period 2005-2011 for the sample of countries considered in the empirical analysis, respectively: Austria, Belgium, Denmark, Cyprus, Germany, Greece, Italy, Norway, Poland, Portugal, Spain, Sweden and Switzerland.

Figure 1. Evolution of credit risk on the European financial markets during 2005-2011, resulted from the average indicator: non-performing loans / Total credits (%).



Source: the author's own RSA data processing based on the data provided by Global Financial Development Database (GFDD)

#### 4. Results obtained and discussions

Bank credit risk was estimated as a ratio between the Allowances for Loan reserves (allowance for loan losses) Loans / Total Loans granted according to the explanatory variables and it was obtained that the factors that determine the credit risk are the indicator of capital adequacy, GDP, the unemployment rate, the inflation rate, government debt and financial crisis.

Unlike the existing empirical articles, we set out to analyse the impact of rescue measures taken by European governments on the quality of the bank credit / credit risk portfolio. The individuality of this article, unlike other existing empirical articles, analyses the impact of rescue measures taken by European governments on the quality of the the bank credit / credit risk portfolio. As a dependent variable, it was taken into account the ratio between Loan reserves (allowance for loan losses) / Total loans.

This indicator reflects the risk of Bank lending through the quality of Bank loan portfolio granted by banks. The impact of financial assistance measures on Bank lending is determined on the basis of quarterly frequency data, in the following manner: Credit risk  $i, t-1 = \beta_0 + \Phi \times \text{Rescue measures}_{j, t-1} + \text{Banking control variables}_{i, t-1} + \Theta \times \text{Macro control variables}_{j, t-1} + \Theta \times \text{Market control variables}_{j, t-1} + \delta \times \text{Other control variables}_{j, t-1} + \varepsilon_{i, t}$  (Equation 1). This equation can be represented in greater detail by the following manner: Loan reserves (allowance for loan losses) / Total loans =  $\beta_0 + \beta_1 \times \text{Rescue measures}_{j, t-1} + \Phi \times \text{Banking control variables}_{t-1} + \Theta \times \text{Macro control variables}_{t-1} + \Theta \times \text{Market control variables}_{t-1} + \delta \times \text{Other control variables}_{t-1} + \varepsilon_{i, t}$  (Equation 2). So, in the right-hand side of the equation, we considered the credit risk as a dependent variable (Equation 1).

All explanatory variables are lagged one period in order to control the speed of adjustment of the credit risk indicators.  $\varepsilon_{ij,t}$  is an *iid* error term specific to bank  $i$  from country  $j$  in year  $t$ . There aren't correlations bigger than 0.5 between regressors and all variables used in our analysis are stationary. Estimated risk of bank credit is determined as a ratio between Revenues for loans granted / Total credits granted (English: allowance for loan losses) / Total loans) according to the explanatory variables and it has been obtained that the factors that determine the credit risk are capital adequacy ratio, GDP, unemployment rate, inflation rate, government debt and financial crisis.

Credit risk is determined as the ratio between Reserves for loans granted and Total loans granted (English: Loan reserves (allowance Total loans) (according to database reporting used in face research respectively Worldscope database), (Equation 2).

Based on the above-mentioned equation, four equation models were developed for each of the four main regressions that were analyzed in this empirical research (Equation 2a, Equation 2b, Equation 2c, Equation 2d), because it was desired to study the impact of each financial assistance measure or each major regressor on the bank credit risk, as risk determined as a ratio between the allowance for the Reserve loans granted and the Total loans granted. On the left side of the equation it was taken into account the four main regressors, namely financial assistance measures: 1) Recapitalisation, guarantees; 2) Granting credits; 3) Acquisition of toxic assets and 4) Nationalisation. Also on the left side of the equation control variables were taken into consideration (bank control variables, macroeconomic control variables, market control variables and other control variables).

The estimated base equation includes bank-specific variables (cumulative credit risk and capital adequacy indicator), macroeconomic variables (GDP, the unemployment rate, the inflation rate, government debt), bank specific variables (banking concentration) and other control variables (the financial crisis).

The accumulation of reserves for loans granted in the total credits granted compared to the previous period has a positive impact on the dependent variable. Therefore, loan decisions from the previous period define changes in the current level of bank loan portfolio quality. This indicator promotes stability and protects depositors of the bank. Thus, the hypothesis that higher levels of this indicator leads to a decrease in the likelihood of rising bank credit risk is confirmed (Berger and De Young, 1997) [3]. The results show that GDP growth has a negative impact on bank lending. Salas and Saurina (2002) [15] obtained the same results. The expansion phase of the economy is usually characterised by a low credit risk and then when the recession phase is established, the credit risk tends to increase. It is thus also confirmed the hypothesis that the unemployment rate has a positive impact on bank credit risk (Brookes, Dicks and Pradhan, 1994) [6].

An increase in the unemployed should have a negative effect on the cash flows of the population and companies. This can lead to a decrease in jobs and a fragile debt situation. The results show that the inflation rate has a positive impact on bank lending. Therefore, repayment of loans can be difficult when there is a high inflation rate, as the real income of borrowers decreases (when wages and salaries remain stable). Also, government debt has a positive impact on bank lending. As

investors' confidence in the country declines when public debt increases, interest rates tend to increase. This will positively affect credit risk (Castro, 2013) [7]. The obtained results highlight the positive link between bank concentration and credit risk (Jimenez G., et al., 2007) [13].

Banking concentration may lead to higher interest rates on loans, which may lead to increased credit risk, i.e. debtors will not pay off their debts. The obtained results highlight the positive relationship between the financial crisis dummy variable and the bank credit risk. Due to the deterioration of economic activity, borrowers face more difficulties in paying off debts to banks, thus lowering the quality of their credit portfolio and increasing credit risk.

**Table 1. Determinants of credit risk in the European banking system**

<b>Variables</b>	<b>Econometric model</b>
<b>Bank specific variables</b>	
<b>Balance sheet data (bank level)</b>	
Credit risk	0.287*** (0.150)
Capital adequacy	0.0123*** (0.00332)
<b>Macroeconomic variables</b>	
GDP	-0.00128*** (0.0117)
Unemployment rate	0.0205*** (0.00020)
Inflation rate	0.0247** (0.00915)
Government debt	0.001*** (0.02223)
<b>Market structure variables</b>	
Banking concentration	0.00353*** (0.000946)
<b>Others variables</b>	
Financial crisis	0.009** (0.0125)
Constant	-0.238*** (0.119)
Observations	1,296
R-squared	0.262

Source: own calculations.

Note: Explanatory variables are one quarter lagged. Robust standard error in brackets. \*, \*\* and \*\*\* denote significance levels of 10%, 5% and 1%.

## 5. Conclusions

Using a panel of 70 banks, it was possible to determine the factors that determine the level of credit risk. These include the capital adequacy ratio, GDP, the unemployment rate, the inflation rate, the government debt and the financial crisis. The main recurrences were included in this analysis: recapitalisations and guarantees offered, lending, toxic asset acquisition and nationalized financial-banking institutions. Based on a wide set of bank specific variables, macroeconomic variables, market variables, and other control variables, the OLS estimator was applied with robust standard errors and clustered standard errors grouped to correlate the heteroscedasticity and the correlation across each country.

The obtained results confirm the hypothesis that the financial assistance measures taken by European governments to recapitalise and re-launch bank lending determine the increase of the credit risk by increasing the level of the dependent variable used in the model. The assumptions obtained, following the run of the basic models, highlight that the recapitalisations of the banking institutions, the guarantees granted, the state loans and the nationalisations achieved have a positive impact on the credit risk.

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#### **Rezumat**

Criza financiară recentă a debutat în anul 2007 în SUA, principala cauză fiind creditele ipotecare securizate. Scopul cercetării empirice a fost studierea factorilor care determină riscul de creditare bancară, respectiv calitatea portofoliului de credite. Analiza s-a efectuat pe un eșantion unic de date specifice bancare format din 70 de instituții bancare din 13 țări europene (Austria, Belgia, Cipru, Germania, Grecia, Italia, Norvegia, Polonia, Portugalia, Spania, Suedia, Danemarca și Elveția.) cu venituri ridicate în perioada 2005q1-2011q4. Ca indicator al creditării bancare s-a utilizat raportul dintre rezervele pentru creditele acordate și totalul creditelor acordate. Principalele rezultate obținute, constau în faptul că, factorii care determină riscul de creditare sunt indicatorul de adecvare a capitalului, PIB-ul, rata șomajului, rata inflației, datoria guvernamentală și criza financiară. Ecuația de bază estimată cuprinde: variabile specifice instituțiilor bancare (riscul de credit acumulat și indicatorul de adecvare a capitalului), variabile macroeconomice (PIB-ul, rata șomajului, rata inflației, datoria guvernamentală), variabile specifice bancare (concentrarea bancară) și variabile de control (criza financiară). Acumularea rezervelor pentru creditele acordate în totalul creditelor acordate față de perioada precedentă a avut impact pozitiv asupra variabilei dependente. Deciziile de împrumut din perioada precedentă definesc modificări la nivelul actual al calității portofoliului de credite bancare.

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**Cuvinte-cheie:** risc de creditare, rezerve, factori, total credite, variabile, cauze

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#### **Аннотация**

Недавно начатый в 2007 году финансовый кризис в США имел как основную причину - обеспеченные ипотечные кредиты. Целью данного эмпирического исследования стало изучение определяющих факторов банковского кредитного риска и качества кредитного портфеля. Анализ проводился по выборке конкретной базы данных, состоящая из 70 банковских учреждений из 13 европейских стран с высокими доходами (Австрия, Бельгия, Кипр, Германия, Греция, Италия, Норвегия, Польша, Португалия, Испания, Швеция, Дания и Швейцария) в течение конкретного периода годов 2005q1-2011q4. В качестве показателя банковского кредитования проанализировано соотношение между резервами по предоставленным кредитам и общей суммой предоставленных кредитов. Выявлено, что факторами, определяющими кредитный риск, являются: показатель достаточности капитала, ВВП, уровень безработицы, уровень инфляции, государственный долг и финансовый кризис. Расчетное базовое уравнение включает в себя банковские институциональные переменные (совокупный кредитный риск и коэффициент достаточности капитала), макроэкономические переменные (ВВП, уровень безработицы, уровень инфляции, государственный долг), банковские переменные (банковская концентрация) и контрольные переменные (финансовый кризис). Выявлено, что накопление резервов по предоставленным кредитам в общей сумме предоставленных кредитов по сравнению с предыдущим периодом оказало положительное влияние на зависимую переменную. Заемные решения за предыдущий период предопределяют изменения текущего уровня качества банковского кредитного портфеля.

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**Ключевые слова:** кредитный риск, резервы, факторы, общая сумма кредитов, переменные, причины

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Received 17.09.2018

Accepted 29.11.2018

Published 28.12.2018