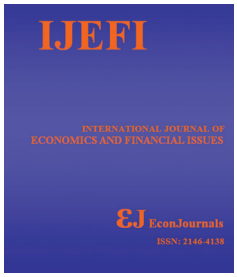

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The Determinants of the European Banking Crisis

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ABSTRACT

The fragility of the European banking system in recent years has motivated us to research on the main indicators that weigh on the soundness of its banking institutions and therefore deserves special attention from supervisors. Our study is based on 40 consolidated banking groups from 10 countries in Europe. We used binary logistic regression as an econometric model. We introduced accounting, macroeconomic, regulatory, legal and institutional variables. The results of our study confirm that doubtful credit is the main variable contributing to the birth of the European banking crisis.

Keywords: Banking Crisis, Binary Logit Model, Legal, Regulatory and Institutional Environment.
JEL Classifications: E58, C15, P48.

1. INTRODUCTION

According to Angora (2009), empirical studies on the determinants and prediction of banking crises do not provide a consensus on the definition of the crisis and the factors behind it. This is why the need to understand the formation of balances of banking crises has aroused within the community of researchers a wave of theoretical work on this issue.

In another way, several researchers have been interested in the concept of banking crisis. They want to understand the sequence of these crises and their origins from research and the development of new methods since these crises entail very high costs for banks and even for the economy.

Linicifort (2009) adds that the subprime crisis shows that bank failure has negative consequences on the economy. Even the failure of a single bank can cause a high cost to the economy. Indeed, these banking crises can cause bank panic, reduce economic activities, increase the budget deficit. So it can be said that since the 2008 subprime crisis, multiple reactions, questions and concerns in public opinion about the organization and soundness of national, European and global financial systems. Thus, since bank failure brings with it high costs to the economy, it is important to identify the factors that explain it, in order to prevent it. So the problem of all research lies in the consensus on the explanatory factors of the crises. In general, it can be said that among the most cited factors of banking crisis are: unfavorable macroeconomic conditions (recession, inappropriate inflationary policy), the credit boom, the exchange rate regime, destabilizing external factors, liberalization Inadequate prudential supervision, weak institutions and non-compliance with legality (Angora, 2009).

Thus, the statistical analysis of banking crises adds a very important additional element: all banking crises are not identical, as banks are institutions that vary from one country to another and are placed in different regulatory and prudential contexts (Boyer et al., 2004).

Boyer et al., (2004) add that the banks which are the first to be affected by a crisis are those whose paradoxically pre-crisis profitability was the highest because the level of risk of the loans, They agreed was very high, their equity was lower, and their profit was more derived from market activities. So a bank suffers a crisis

when its equity fails to cover its losses, such that its profitability is lower in relation to risk.

According to Leprêtre (2012) for more than 4 years, the European Union is facing an unprecedented economic and budgetary crisis, it is experiencing a critical moment in its history. This crisis takes place within a very broad international framework and has repercussions on all the continents.

In this study, we have chosen to treat the banking crisis in a defined way in the European Union in order to study the main determinants of the European banking crisis.

This paper is organized as follows: in section 2, a literature review is presented on the empirical studies that have studied the effect of several indicators on the occurrence of banking crises. Section 3 is devoted to the presentation of our sample, the variables and the methodology used. In section 4, we present the results of the regression. Section 5 concludes with the implications of our findings.

2. REVIEW OF LITERATURE

The work that has developed over the last decades has mainly focused on the origins of banking crises and the means to prevent them (Abdennour and Houhou (2009), Angora (2009), Werner (2012), Berjaoui, (2012))

Bernal et al. (2015) , Ambrosius (2017), Boucekkine et al. (2017) similarly argue that the causes of banking crises have become an important question for researchers.

Several researchers have attempted to show the factors that weigh more heavily on banking crises. For example, the studies by Mihaly (2010) ,Werner (2012), Wall (2013),Mayes (2013), Jing et al. (2015) García-Palacios et al. (2014). They have sought the relationship between banking crises and deregulation. We also find Calomiris and Gorton (1991), who have shown that banking panic represents the main factor of banking crisis (Salameh, 2013).

Caprio and Klingebiel (2003) show the extent of the banking crisis phenomenon and its universality in the almost exhaustive account of the most recent banking crises since 1970 (Angora, 2011). They list 117 so-called systemic banking crises. These crises hit 93 countries. In addition to these large-scale crises, shallow banking crises, which the authors refer to as "borderline and smaller" or "non-systemic," occurred in the same period, affecting 45 countries (Boyer et al., 2004).

Ma. K (2018), Jing.Z, Haan.J, Jacobs.J., Yang.H (2015), Gertler. MKiyotaki.N, Prestipino.A (2016) claim that banks experience a banking crisis when they face different losses, which reduce their different prudential ratios such as the accumulation of non-performing loans.

In parallel, Jones and Zeitz (2017) adds that in 1998, for example, in a sample of 50 developed and developing countries, the IMF estimated that there were 54 banking crises over the period 1975-1997.

Similarly, Chebbi adds that Caprio and Klingebiel (1996) showed that the terms of trade account for about 20 of the crises and that a weak supervisory and regulatory framework explains 26 banking crises on 29 cases between 1970- 1998. Miotti and Plihon (2001) presents the main studies that showed the relationship between banking crisis and financial liberalization. Permitted for this work is the study by Kaminski and Reinhart (1996) of 20 countries in Asia, Latin America, Europe, and the Middle East, from the 1970s to the mid-1990s. Their main findings confirm that, as a result of the general movement of financial liberalization in the world, the number of banking crises has increased sharply, and most banking crises are preceded by LF policies.

Similarly, Onyiriuba (2016) carried out a study of 53 countries during the years 1980-1995, which showed that liberalization increases the likelihood of a banking crisis.

Recent studies of banking crises include the study by Onyiriuba (2016), which shows in his analysis of problems related to the failure of banks in developing economies that the impact of risk management influences The ease with which banks slip into the crisis.

In addition, Gluzmann and Guzman (2017), Schliephake (2016), Onyiriuba.L. (2016), Schwert (2018), Rampini and Viswanathan, (2019) studied banking crises for the period 1973-2005 for emerging economies. They found that all control variables are important determinants of banking crises.

At the same time, Davis et al., (2016) showed that the rapid growth of private sector credit is a strong predictor of a banking crisis.

Thus, Teimouri and Dutta (2016) seek to study the dynamic adjustment of the investment-to-GDP ratio and the bank-to-GDP ratio after the bank crisis episodes; On the basis of a sample of 79 developed and emerging countries during the period (1973-2010). The results suggest that after the banking crises, the investment ratio decreases but quickly reverts to its pre-crisis level in two or three years. Bank credit declined significantly and stagnated even in the medium term.

Subsequently, on a small sample, Babecky et al., (2014) tried to identify early warning indicators of crises specific to developed economies. More consistent in the different specifications and horizons is that the significant growth of domestic private credit precedes bank crises.

3. METHODOLOGY

Our objective in this part of our research is to test the effectiveness of accounting, macroeconomic, institutional and legal factors in mitigating banking crises. As a result, we have chosen the European banking sector to do our research. To test this contribution, we progress in three steps. In a first step, we present the model to be tested. Thus, the definition and measurement of variables constitute an indispensable passage. Finally, the last step is reserved for the results obtained As well as their interpretations.

In this study, we propose an early warning model of banking difficulties. The purpose of these models is to rapidly identify

institutions whose financial situation appears to be of concern. Indeed, the examination of the difficulties of banks has the advantage over bankruptcies that it makes it possible to assess the fragility of the banking system before a crisis occurs (Hermosillo , (1999), Babecky et al. (2014), Chaudron and Haan (2014) Caballero (2015), Boyd et al. (2019).

The objective of these early warning models or systems is to translate the various performance and solvency indicators of the banks into an estimate of the bank's risk of default or to the allocation of a rating that will allow the regulator, Identify distressed establishments at the first warning signs (Abdennour et al. 2005), Broyer, 2013; Cole and White, 2017; Cosset and Lampron, 2013; Devereux and Dwyer, 2016; Dimitrios and Konstantinos, 2019).

We use an early warning system of banking difficulties including CAMEL-type financial variables, macroeconomic variables, institutional variables, and regulatory and legal variables for determining institutions in difficult financial situations.

The probit method determines the vulnerability of a banking institution. Indeed, according to Miotti and Plihon (2001) the probit method uses a binary variable to identify two different cases whose probability we want to determine. The main advantage of this method is to summarize all relevant information about an event and assign a probability measure.

In our case, the banks that have suffered bankruptcies are differentiated from those that have subsisted by assigning the value 1 to the first and the value 0 to the second.

According to these two authors A binomial logit model for forecasting bank capital degradation is adopted in order to test the contribution of institutional and regulatory factors in addition to the accounting indicators usually used in the literature.

The first specification corresponds to a binary logit where the explained variable takes only two values:

Yit { 1: pre-crisis two years before the crisi
Yit { 0: quiet

We will adopt the model advocated by Abdennour and Houhou (2009). Our approach is first to authenticate the contribution of the balance-sheet indicators to the forecasting of the deterioration of the solvency ratio of the banks and then to study the stability of the predictive power of such indicators with regard to the integration of the regulatory and institutional role at the level of European countries. We are interested in the predictability of deterioration in the capital ratio, which are identified in our study using the declines in the capital ratio.

In order to do so we construct a variable indicating the occurrence of the deterioration of the solvency ratio as well as a set of advanced quantitative indicators constructed on the basis of accounting data and a set of qualitative variables that reflect, on the one hand, the role Of the public entities and, on the other hand, the influence of rating agencies' ratings on the occurrence of a banking difficulty.

As far as the modeling of this relation is concerned, we retain a Logit specification commonly exploited in the existing literature and which allows to analyze a binary qualitative variable (value 0 or 1 to identify two distinct events). The choice of the Logit model is explained by the fact that this simple model gives results as satisfactory as the more complex models.

In this work, the probability of a bank being undercapitalized is estimated based on a binomial Logit model on panel data at a one-year time horizon.

Let Y_{it}: be a latent binary dependent variable. We do not model the Y_{it} variable itself but the probability P (Y_{it} =1) that this variable takes the value 1. To model this probability, we assume that the decision is based on the value taken by an unobservable underlying variable Y_{it} Determines in turn the value taken by the indicator variable Y_{it} according to the following process:

Y_{it}=1 if the bank is undercapitalized, if Y^*_{it}>0.

Y_{it}=0 if the bank is well-capitalized, if Y^*_{it}≤0.

Y^*_{it} depends linearly on a number of explanatory variables $X_{i,t}$ and fictitious qualitative variables that we denote by $Q_{i,t}$.

$$Y^*_{it} = \alpha X_{i,t} + \beta Q_{i,t} + \varepsilon_{i,t}$$

i = 1. 40 banks, t = 1. 5 years (2009-2013)

i_t represents Bank I at the date

Consequently, the probability of the event (Y_{it}=1) can be considered as the probability that the error $\varepsilon_{i,t}$ is less than $\alpha X_{i,t}$ and $Q_{i,t}$, and P (Y_{it} =1) = P (Y_{it} *>0) = F ($\alpha X_{i,t}$ 1+ exp$\alpha X_{i,t}$ + $\beta Q_{i,t}$)

Where F is the logistic distribution function.

P (Y = 1) represents the probability that a certain bank belongs to the group of vulnerable banks;

B is the set of parameters that we want to estimate; And X is the vector of indicators of the financial system that accounts for the probability to be estimated. B thus reflects the impact on the probability of a possible bankruptcy of the changes in vector X (Miotti and Plihon, 2001).

In order to ensure a better quality of the results, the first step was to select the most relevant indicators for the explanation of the deterioration of the bank capital ratio.

4. DATA AND PRELIMINARY RESULTS

Balance and profit-and-loss data for individual banks are collected from the bankscope. Data on macroeconomic, regulatory, legal and institutional variables are derived from the World Bank database (2013), the OECD and the Human Development Report (World Bank, 2013).

Our sample consists of 40 consolidated banking groups from 10 countries (Ireland, Italy, Portugal, Spain, Greece, Austria, the Netherlands, Germany and Cyprus). The period studied is 5 years (2009-2013). The choice of countries and period is explained by:

- The fact that these countries experienced banking difficulties during the period under review
- The availability of data from the selected banks.
- We introduce accounting ratios used to assess the financial health of a bank. These ratios are obtained by aggregating and weighting the accounting ratios by the size of the banks' balance sheets in each of the countries in our sample. These are individual banking data (bank by bank). In order to have the aggregate bank data for each country, we calculated weighted averages by the size of the balance sheets for each variable. We use the following variables:
- C (capital adequacy): Equity + provision/Total assets
- A (asset quality): Provision/total loan
- M (management): Short-term loan/fund and deposit
- E: ROA (earnings: revenues): Net income/total assets
- L (liquidity): Active loan/total assets
- Doubtful credits: Total doubtful/total assets
- The second category of variables includes macroeconomic indicators: GDP growth rate (GR), terms of trade (TT), inflation (INFL), real interest rate (RIR) and share of the credit granted to the private sector as a percentage of GDP (SCGPS).
- The third category of variables includes legal and regulatory indicators

Audit: =1 if the auditors are obliged by law to report to the supervisory authorities the bad conduct of the managers or managers of the bank (fraud, illegal activities, management abuse.

=0 if no
Sup =1 if supervision is exercised by the central bank;
=0 if supervision is exercised by an independent institution.
INS =1 if there is an explicit deposit insurance system;
=0 otherwise.
Resp =1 if it is possible to sue supervisors for their actions.
=0 otherwise
Or =1 if the legal system is of French origin
=0 if of English or German origin
EFF: Measures the efficiency of the legal system between 0 and 10
10 is the best quality.

Guarantee: Index of the strength of the legal guarantees (0= low and 12= solid)

We recall that the aim of this study is to identify the factors of the European banking crisis. In particular, to test the contribution of banking, macroeconomic, regulatory and institutional variables in the explanation of this crisis using a binomial logit model.

To better distinguish healthy banks from the most fragile banks, our dependent variable Y will take two values:
Y = 1 if the ratio (doubtful/total assets)> (equity/total assets); the bank is supposed to be in difficulty.
Y = 0 if the ratio (bad debts/total assets) < (equity/total assets); the bank is assumed to be sound

Table 1: Distribution by country of the individual banking variables of Spain

Spain	Minimum	Maximum	Mean	Standard deviation
CA	0,06	0,11	0,0860	0,01949
AQ	0,02	0,12	0,0460	0,04336
M	1,27	1,85	1,5840	0,25677
ROA	−0,08	0,45	0,2600	0,19962
L	0,52	0,84	0,6880	0,16100
DC	4,10	9,40	6,3400	2,15244
GR	−4,00	−1,00	−2,4000	1,51658
TT	88,00	97,00	92,0000	4,58258
INF	−0,30	3,20	1,2800	1,57702
RIR	3,97	5,85	4,7580	0,85713
SCGPS	172,00	206,00	195,0800	14,97304
AUDIT	1,00	1,00	1,0000	0,00000
SUP	1,00	1,00	1,0000	0,00000
INS	1,00	1,00	1,0000	0,00000
RESP	1,00	1,00	1,0000	0,00000
ORI	1,00	1,00	1,0000	0,00000
GUARANTEE	5,00	6,00	5,8000	0,44721
EFFIC	7,50	7,86	7,6440	0,19718

Table 2: Distribution by country of the individual banking variables of Ireland

Ireland	Minimum	Maximum	Mean	Standard deviation
CA	0,06	0,11	0,0860	0,01949
AQ	0,02	0,12	0,0460	0,04336
M	1,27	1,85	1,5840	0,25677
ROA	−0,08	0,45	0,2600	0,19962
L	0,52	0,84	0,6880	0,16100
DC	4,10	9,40	6,3400	2,15244
GR	−4,00	−1,00	−2,4000	1,51658
TT	88,00	97,00	92,0000	4,58258
INF	−0,30	3,20	1,2800	1,57702
RIR	3,97	5,85	4,7580	0,85713
SCGPS	172,00	206,00	195,0800	14,97304
AUDIT	1,00	1,00	1,0000	0,00000
SUP	1,00	1,00	1,0000	0,00000
INS	1,00	1,00	1,0000	0,00000
RESP	1,00	1,00	1,0000	0,00000
ORI	1,00	1,00	1,0000	0,00000
GUARANTEE	5,00	6,00	5,8000	0,44721
EFFIC	7,50	7,86	7,6440	0,19718

4.1. Descriptive Statistics

The Tables 1-10 present descriptive statistics of the individual banking variables of each country in the union.

Our study covers the period from 2009 to 2013 and covers a group of 10 EU countries (Spain, Ireland, Italy, Portugal and Belgium, Greece, Austria, the Netherlands, Germany and Cyprus). Our study includes 40 consolidated banking groups. For Spain 7 consolidated banks, Ireland 4 consolidated banks, Portugal 2 consolidated banks, Italy 4 consolidated banks, Greece 3 consolidated banks, Belgium 4 consolidated banks, Austria 3 consolidated banks, Netherlands 5 consolidated banks and Germany 5 consolidated banks and finally For Cyprus 3 consolidated banks.

It should be noted that the descriptive tables show that the values taken by the five ratios retained in the 5 years are dispersed. They

Table 3: Distribution by country of the individual banking variables of Portugal

Portugal	Minimum	Maximum	Mean	Standard deviation
CA	0,03	0,05	0,0440	0,00894
AQ	0,01	0,01	0,0100	0,00000
M	1,09	1,30	1,1720	0,08497
ROA	−0,20	0,40	0,1600	0,23822
L	0,38	0,51	0,4780	0,05541
DC	4,80	10,60	7,5800	2,61954
GR	−3,00	−1,00	−2,4000	0,89443
TT	91,00	94,00	92,6000	1,51658
INF	−4,50	2,60	−0,8400	3,42316
RIR	4,21	10,55	7,1000	3,12740
SCGPS	168,00	224,00	196,4400	26,34546
AUDIT	1,00	1,00	1,0000	0,00000
SUP	1,00	1,00	1,0000	0,00000
INS	0,00	0,00	0,0000	0,00000
RESP	1,00	1,00	1,0000	0,00000
ORI	0,00	0,00	0,0000	0,00000
GUARANTEE	2,00	3,00	2,8000	0,44721
EFFIC	6,43	7,50	6,8580	0,58606

Table 4: Distribution by country of the individual banking variables of Italy

Italy	Minimum	Maximum	Mean	Standard deviation
CA	0,03	0,11	0,0840	0,03209
AQ	0,01	0,16	0,0400	0,06708
M	1,17	2,62	1,7220	0,65481
ROA	−0,20	0,08	−0,0060	0,11480
L	0,38	0,55	0,4800	0,07583
DC	1,00	16,50	9,6200	5,97553
GR	−5,00	−2,00	−3,2000	1,64317
TT	91,00	102,00	97,6000	4,72229
INF	0,80	3,00	1,6800	1,04499
RIR	2,74	10,24	4,6500	3,16681
SCGPS	107,20	189,90	128,2800	34,92817
AUDIT	1,00	1,00	1,0000	0,00000
SUP	1,00	1,00	1,0000	0,00000
INS	,00	1,00	0,8000	0,44721
RESP	1,00	1,00	1,0000	0,00000
ORI	0,00	1,00	0,8000	0,44721
GUARANTEE	2,00	3,00	2,8000	0,44721
EFFIC	6,43	6,79	6,5740	0,19718

Table 5: Distribution by country of the individual banking variables of Greece

Greece	Minimum	Maximum	Mean	Standard deviation
CA	0,04	0,30	0,1160	0,10502
AQ	0,02	0,47	0,1960	0,21007
M	0,26	3,02	1,1020	1,12580
ROA	0,00	0,01	0,0040	0,00548
L	0,05	0,75	0,4300	0,30092
DC	7,00	31,90	16,6000	10,62309
GR	−7,00	1,00	−3,4000	2,88097
TT	88,00	95,00	90,2000	2,86356
INF	−0,90	2,70	1,1400	1,29730
RIR	3,08	22,50	9,1940	7,86684
SCGPS	91,80	122,60	108,9600	15,74192
AUDIT	1,00	1,00	1,0000	0,00000
SUP	1,00	1,00	1,0000	0,00000
INS	0,00	1,00	0,2000	0,44721
RESP	1,00	1,00	1,0000	0,00000
ORI	0,00	1,00	0,2000	0,44721
GUARANTEE	3,00	4,00	3,6000	0,54772
EFFIC	5,71	6,43	6,1420	0,39436

Table 6: Distribution by country of the individual banking variables of Belgium

Belgium	Minimum	Maximum	Mean	Standard deviation
CA	0,10	0,34	0,2740	0,09889
AQ	0,23	0,44	0,3600	0,08689
M	0,79	1,11	0,9060	0,12934
ROA	0,00	0,07	0,0200	0,02828
L	0,00	0,72	0,5140	0,29938
DC	2,80	14,40	5,6800	4,90989
GR	−9,00	2,00	−2,6000	4,15933
TT	9,00	99,00	79,0000	39,21097
INF	−0,10	3,30	1,4000	1,59374
RIR	1,74	15,75	9,1400	5,15671
SCGPS	89,10	122,30	98,1600	13,79793
AUDIT	0,00	1,00	0,2000	0,44721
SUP	0,00	1,00	0,2000	0,44721
INS	0,00	1,00	0,8000	0,44721
RESP	0,00	1,00	0,2000	0,44721
ORI	0,00	0,00	0,0000	0,00000
GUARANTEE	4,00	5,00	4,6000	0,54772
EFFIC	5,71	8,21	7,7100	1,11803

differ greatly from one bank to another. Therefore, it should be pointed out that this diversity may explain the phenomenon of the crisis. In other words, the diversity of these ratios can classify banks into well capitalized banks and undercapitalized banks.

4.2. Model Estimation

This work is reserved to test the significance of the variables in the prediction of banking crisis with a logistic regression binary by panel data. In Model I, only CAMEL variables are used as explanatory variables C: (capital adequacy), A: (asset quality, M: (management).

E: ROA (earnings: revenues), L liquidity, Doubtful credits). In model II we add to the first variables, other macroeconomic variables. Finally, in the third model, five regulatory variables (Audit, INS, Sup, Resp and Guarantee) and two variables describing the legal and institutional environment (OR and Eff) are added to the first variables.

We present the statistical tests leading to the validation of the model. Tests of the likelihood ratio (1) (for model validation) and Wald (2) (for the validation of each covariate).

5.EMPIRICAL RESULTS

Based on the results of the three model estimates (model 1: includes only accounting variables, model 2: including accounting

1 The likelihood ratio test is a hypothesis test that compares the fit of two models to determine which fit offers the best fit.

2 The statistic of Wald tests the null hypothesis of non-significance of the set of coefficients associated with the explanatory variables (out of constant). This statistic follows a law of x^2 with k

Table 7: Distribution by country of the individual banking variables of Austria

Austria	Minimum	Maximum	Mean	Standard deviation
CA	0,09	0,29	0,1320	0,08843
AQ	0,02	0,34	0,0920	0,13882
M	0,81	1,84	1,1660	0,39221
ROA	0,00	0,02	0,0080	0,00837
L	0,56	0,78	0,7140	0,09154
DC	2,30	3,30	2,8200	0,35637
GR	−4,00	3,00	−0,8000	3,11448
TT	87,00	95,00	91,4000	4,03733
INF	0,50	3,50	1,8000	1,30384
RIR	2,01	10,54	4,5600	3,45788
SCGPS	90,10	121,60	112,0000	12,94894
AUDIT	0,00	1,00	0,8000	0,44721
SUP	0,00	0,00	0,0000	0,00000
INS	0,00	1,00	0,2000	0,44721
RESP	0,00	1,00	0,8000	0,44721
ORI	0,00	0,00	0,0000	0,00000
GUARANTEE	5,00	7,00	6,6000	0,89443
EFFIC	7,86	8,21	8,0700	0,19170

Table 8: Distribution by country of the individual banking variables of the Netherlands Germany and Cyprus

The Netherlands	Minimum	Maximum	Mean	Standard deviation
CA	0,05	0,05	0,0500	0,00000
AQ	0,00	0,01	0,0080	0,00447
M	0,84	1,01	0,9380	0,07791
ROA	0,00	0,00	0,0000	0,00000
L	0,69	0,74	0,7200	0,02121
DC	2,80	3,20	3,0600	0,16733
GR	−3,00	2,00	−1,4000	2,07364
TT	92,00	95,00	93,8000	1,30384
INF	1,20	2,50	1,9400	0,68044
RIR	0,37	1,86	1,1620	0,66289
SCGPS	178,00	198,80	189,6400	9,03233
AUDIT	0,00	1,00	0,2000	0,44721
SUP	1,00	1,00	1,0000	0,00000
INS	1,00	1,00	1,0000	0,00000
RESP	0,00	1,00	0,2000	0,44721
ORI	0,00	0,00	0,0000	0,00000
GUARANTEE	3,00	6,00	5,4000	1,34164
EFFIC	8,93	8,93	8,9300	0,00000

Table 9: Distribution by country of the individual banking variables of Germany

Germany	Minimum	Maximum	Mean	Standard deviation
CA	0,04	0,08	0,0600	0,01871
AQ	0,00	0,02	0,0060	0,00894
M	0,92	1,09	1,0260	0,07335
ROA	0,00	0,09	0,0180	0,04025
L	0,36	0,60	0,5040	0,09127
DC	2,70	3,30	3,0200	0,23875
GR	−6,00	4,00	−1,6000	4,33590
TT	94,00	100,00	97,0000	2,82843
INF	0,30	2,10	1,2400	0,88769
RIR	1,50	3,22	2,4240	0,84925
SCGPS	93,10	109,60	102,1400	7,30055
AUDIT	0,00	1,00	0,8000	0,44721
SUP	0,00	0,00	0,0000	0,00000
INS	1,00	1,00	1,0000	0,00000
RESP	1,00	1,00	1,0000	0,00000
ORI	0,00	0,00	0,0000	0,00000
GUARANTEE	6,00	7,00	6,8000	0,44721
EFFIC	7,86	8,21	8,0700	0,19170

Table 10: Distribution by country of the individual banking variables Cyprus

Cyprus	Minimum	Maximum	Mean	Standard deviation
CA	0,07	0,07	0,0700	0,00000
AQ	0,01	0,04	0,0240	0,01140
M	0,70	1,15	0,9260	0,17300
ROA	0,00	0,01	0,0040	0,00548
L	0,57	0,72	0,6320	0,06181
DC	4,50	38,00	15,3400	13,78289
GR	−5,00	0,30	−2,1400	1,88361
TT	9,00	98,00	78,6000	38,97820
INF	−0,40	3,30	1,2200	1,55628
RIR	−0,67	1,26	0,2320	0,97523
SCGPS	2,81	317,90	186,5044	167,78353
AUDIT	0,00	0,00	0,0000	0,00000
SUP	1,00	1,00	1,0000	0,00000
INS	0,00	0,00	0,0000	0,00000
RESP	0,00	0,00	0,0000	0,00000
ORI	0,00	0,00	0,0000	0,00000
GUARANTEE	7,00	9,00	8,6000	0,89443
EFFIC	6,43	6,43	6,4300	0,00000

variables plus macroeconomic variables) and (model 3: includes accounting variables plus regulatory, legal and institutional variables) to distinguish the difference in significance between the variables and between the models. We note that this test of significance differs according to each model (Table 11).

We use binary logistic regression by panel data, from the period (2009 to 2013). First, we introduce only 6 financial ratios, the result of the estimate shows only one significant ratio and keep a positive sign (doubtful credit). For this variable it means that bad loans are more important than the equity of each bank. So this positive sign shows the high probability of banks entering a period of crisis. Indeed, the heavy weight of uncollectible credits can cause a bank to fail and the possibility of entering a period of crisis.

In the second model we add macroeconomic data to the first accounting data. We note that only the variable DC remains significant and keeps a positive sign.

The third model also introduces the accounting data for legal and institutional data. Note that no variables are significant.

For validation of the model, the likelihood ratio test is used to measure the overall adjustment level of the model. Indeed, one chooses alone which offers the best value of P value.
H0: $\beta i = 0$.
H1: $\beta i \neq 0$.

In our case we reject the hypothesis H0 such that we note that almost all values of P value are different from zero. But we note that it is the first model that is the best since it has the greatest value.

Table 11: Result of estimating binary logistic regression

Variables	Model 1		Model 2		Model 3	
	Coefficients	Signif	Coefficients	Signif	Coeff icient	Signif
Constante	−0.9541772		−3.763947	0,324	−4.358605	0,453
CA	3.825573	0,668	10.26169	1,326	7.453413	1,024
AQ	−5.246929	0,928	−11.37195	1,227	−13.59742	1,140
M	1.035035	1,032	0.747416q8	0,619	0.3500156	0,161
ROA	1.000021	0,417	1.963446	0,558	0.4593375	0,125
L	−4.182269	1,628	−6.470419	1,611	−5.079	1,375
DC	0.3817475	2,843*	0.4030138	2,045*	0.6637431	1,821
GR			−0.1350978	0,519		
TT			0.0046233	0,036		
INF			0.7518599	1,695		
RIR			0.1326194	0,490		
SCGPS			0.0145556	1,4		
AUDIT					1.797832	0,701
SUP					−0.9974302	0,394
INS					−0.2341077	0,131
RESP					−3.31201	1,015
ORI					2.122121	0,667
GUARANTEE					−0.2722413	0,644
EFFIC					0.8488113	0,772
Number of observations	40 groupes bancaires					
Stat Wald	25,60	0,003	61,69	0,000	28,95	0,0067
Likelihood ratio test	0,81	0,184	1,96	0,081	1,81	0,089

So we use the Wald test (for the validation of each covariate).

H_0: the non-significance of the set of coefficients associated with the explanatory variables.
H_1: There is at least one variable with a significant coefficient.

A P value is compared to a specified alpha level, our willingness to accept a Type I error, which is typically set to 0.05.

If the value of test P < 0.05%, the result is significant. Therefore, in our case we reject the hypothesis H_0.

Indeed, with the individual significance of the coefficients, the results of the Wald test at the 5% threshold make it possible to reject the null hypothesis of the overall non-significance of the banking variables in the first two models only. This suggests that there is at least one variable that plays a non-negligible role in the process of weakening the banking system.

Finally, we conclude that among the accounting, macroeconomic, regulatory and institutional factors in explaining the banking difficulties of some European countries. Only doubtful loans are the most likely to generate a banking crisis. This suggests that this variable plays a non-negligible role in the process of weakening the banking system and that contribute to the birth of the crisis. Thus, the variable of unperformant credits remains the most important indicator causing this crisis. As a result, European banks must take this into account. They must know how to properly manage their loans by requesting sufficient guarantees or by limiting the loans granted. In other words, institutions need to think about a new organization and procedures for assessing and monitoring credit risks.

This first set of indicators reveals mainly the importance of doubtful loans at the onset of the crisis for each type of model in general.

6. CONCLUSION

In the context of banks in European countries, the main problem is the heavy burden of credit and the size of loans granted. Thus, this phenomenon encourages banks to take the necessary measures to reduce credit risk. Indeed, credit risk is the most important risk of the bank whose core businesses are lending and financing.

Indeed, according to Schliephake (2016), Kim and Sohn (2017), Lambert et al. (1997), Leprêtre, L. (2012), Linicifort (2009), Occhino (2016) given the scale of these risks, banks must put in place adequate measures to ensure the security of the banking system and avoid the consequences of their occurrence. The author adds that these measures are essentially aimed at ensuring a satisfactory liquidity and solvency position for the bank. Therefore, taking this indicator into account (doubtful credit) improves the explanatory and discriminatory power of our early warning model of banking difficulties.

An early warning system of difficulties or bank fragility is preferable to a system that predicts banking bankruptcy because in the latter case it will be a little late to carry out rescue actions of the bank in question. On the other hand, in our model supervisors have the time necessary to take the disciplinary measures and consequently avoid the total bankruptcy of the bank which can exert a contagious effect on all the system degrees of freedom where k corresponds to the number of coefficients associated with the variables.

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