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Original Article

An Empirical Investigation of the Determinants of Banking Crises in the WAEMU using the BMA Approach

Kodjo W. Baoula

Faculty of Economics and Management of the University of Lomé (TOGO)
Laboratory of Agricultural Economics and Applied Macroeconomics (LEAMA)

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Abstract *- The economic literature on methods for identifying the determinants of crisis risk in the banking sector presents important divergences; due to uncertainty regarding the choice of model and indicators. The objective of this paper is twofold: first, to identify the factors that expose the WAEMU banking sector to the risk of crises and second, to determine for these factors the critical threshold at which they become a source of triggering banking crises. To do this, we adopt an empirical approach based respectively on the Bayesian selection method (BMA) following Babecky et al. (2013) and a threshold effect model based on the Panel Threshold Regression (PTR) method of Hansen (1999), on a panel of seven WAEMU countries covering the period from 2000 to 2016. Our results show that the size of bank assets, foreign ownership, capital inflows and credit market regulation are factors that reduce the probability of a banking crisis; on the other hand, rates of private sector lending, public sector lending, delinquency and the level of corruption control are factors that contribute to the increased probability of banking crises in the WAEMU. Furthermore, our results reveal that among the eight indicators selected by the BMA method, three admit a critical threshold at which they become a source of triggering a banking crisis in WAEMU countries. These include the share of foreign capital, the rate of credit to the public sector and the corruption control index, for which we find a critical threshold of 80.83%, 6.27% and -0.96, respectively.*

Keywords *- Banking crises, Bayesian model, WAEMU.*

JEL classification *- G21 C11 O55.*

I. INTRODUCTION

Delicate and difficult simultaneously, the banking sector has always attracted the attention of researchers around the world (Beju and Ciupac-Ulici, 2012). Indeed, since the post-Bretton Woods era, systemic banking crises have become increasingly frequent, and the economic literature on methods of identifying the determinants of these banking sector crises presents important divergences. This leads to increased uncertainty regarding, on the one hand, the choice of model and, on the other hand, the choice of indicators of banking crisis risk.

Thus, there is extensive empirical literature on banking crises, most of which generally uses two econometric approaches (Gaytan and Johnson (2002); Demirgüc and Detragiache (2005)), namely the non-parametric signal approach and Logit/Probit models. From the end of the 1980s, new empirical methodologies were used to identify the determinants of banking crises, such as neural networks (Maillet, Olteanu and Rynkiewicz, 2004), the regime shift of Markov models (Brunetti, Mariano, Scotti and Tan, 2007; Duttagupta and Cashin, 2008) and recursive binary trees. Moreover, the indicators used in the literature differ from one study to another. According to Bell (2000), the choice of independent variables can be influenced by several factors, including the nature of the economies (developed, emerging, transition...) and their stage of financial development (structure of banking systems, characteristics of means of payment, size and nature of interbank relations, etc.).

In this context, the issue of model uncertainty, the choice of independent variables and the resulting estimates need to be taken into account. Thus, the research question is the following: Which variables are likely to play an important role in the risk of banking crises in WAEMU countries? To answer this question, the objective of this paper is twofold: first, to identify the factors that expose the WAEMU banking sector to the risk of crises, and second, to determine for the selected indicators the critical threshold at which they become a source of triggering a banking crisis. Indeed, we consider a wide range of bank-specific financial indicators, financial liberalization indicators, macroeconomic framework indicators, regulatory framework indicators and institutional framework indicators. To do so, we adopt an empirical approach based respectively on the Bayesian selection method (BMA) following the example of Babecky et al. (2013) and a threshold effect model based on the Panel Threshold Regression (PTR) method of Hansen (1999), on a panel of seven WAEMU countries covering the period from 2000 to 2016.

According to Goldstein (2013), banking crises refer to a situation marked by significant liquidity problems, deterioration in asset values and insolvency leading to failures in the banking system. Indeed, according to the study by Caprio and Klingebiel (2003), WAEMU countries were not spared by these crises, followed by severe recessions from 1988-to 1995. In recent decades, we note remarkably that the commercial banks of the union are evolving in a globalized environment characterized by remarkable financial innovations and technological advances.

However, the default risks associated with these developments expose them to banking crises, the socio-economic costs of which are very often high. Indeed, EU banks are subject to deteriorating financial soundness indicators resulting from increased macro-financial risks, notably sovereign risks and macroeconomic volatility. Gonzàlez-Hermosillo (1999) estimates that a banking system is difficult when the ratio of non-performing loans to total assets exceeds 6% to 8%. During periods of banking crises, Demirgüç-Kunt and Detragiache (1998) indicate that this ratio exceeds 10%. In the WAEMU, the gross portfolio degradation rate was 15.1% in 2014 against 15.6% in 2013 (2015 Report of the WAEMU Banking Commission). In addition, the average solvency ratio of banks stood at 12.6% against 12.8% in 2013, remaining above the minimum standard of 8%.

Because of these controversial developments, combined with the development of the financial system and the greater openness to the outside world, which do not protect commercial banks in WAEMU countries from episodes of financial turmoil, this article contributes through the methodology to the assessment and monitoring of the vulnerability of the banking system, in particular, that of WAEMU to perceive the occurrence of a crisis in a context of financial sector dynamism. To this end, our results show that eight variables among the twenty-three considered have a significant predictive power of the banking crises studied. These are the size of bank assets, foreign ownership, capital inflows and credit market regulation, which are factors that reduce the probability of a banking crisis; In contrast, the rates of credit to the private sector, the public sector, outstanding loans and the level of corruption control are factors that contribute, on the other hand, to the increase in the probability of banking crises in the WAEMU. Furthermore, our results reveal that among the eight indicators selected by the BMA method, three admit a critical threshold at which they become a source of triggering a banking crisis in WAEMU countries. These include the share of foreign capital, the rate of credit to the public sector and the corruption control index, for which we find a critical threshold of 80.83%, 6.27% and -0.96, respectively. In this respect, the structure of bank credits plays a key role in increasing the probability of banking crises in the union; this implies that the operationalization of the BIC (Credit Information Bureau) must be reinforced, which aims to reduce the asymmetry of information between lenders and borrowers on the credit market.

The remainder of the paper presents the review of the literature on the explanatory factors of banking crises (section 1); then, section 2 presents a description of the methodology to be used, including the construction of the dependent variable of the banking crisis, the econometric model to be applied; section 3 presents the empirical result and finally, the conclusion and policy implications.

II. LITERATURE REVIEW

Most existing studies highlight the key role of financial, macroeconomic, external and institutional indicators in the emergence of systemic banking crises over the last 20 years.

A. Banking situation and crisis risk

Bank solvency, changes in bank profitability, credit distribution policy, the quality of bank management, and the banking system's liquidity are factors that play a role in triggering and spreading banking crises. Indeed, Schwartz (1985) finds that the banking crisis is primarily a liquidity problem banks face. Demirguc-Kunt and Detragiache (2000) find that the origin of banking crises can be both solvency and liquidity problems. In addition, other studies (Saravalos and Frankel, 2010; Babecký et al., 2013) point to a significant positive correlation between banking sector problems and excessive credit expansion as measured by the change in the private sector and domestic credit growth as a percentage of GDP. According to these studies, pre-crisis periods are often characterized by rapid real growth of domestic credit relative to GDP, a strong increase in credit to the private sector, and, consequently, an increase in credit risk.

B. Macroeconomic Framework and Risk of Banking Crises

The theoretical and empirical literature establishes that macroeconomic factors such as economic conditions, worrying inflation rates, interest rate instability and the explosion of unhedged credit play a role in triggering and spreading banking crises. Indeed, according to Davis and Dilruba (2008), the following macroeconomic variables: real GDP growth rate, inflation, real exchange rates, growth in international reserves and the short-term real interest rate as the main determinants of banking crises. For them, these variables capture negative macroeconomic shocks, which can weaken the banking sector by, for example, increasing the share of non-performing loans. Similarly, Detragiache and Demirguç-Kunt (1998) conclude that an unfavourable macroeconomic environment, low GDP growth and high inflation can negatively affect the quality of bank portfolios. Furthermore, Quintyn and Taylor (2003) find that macroeconomic banking crises have their origins in external events; thus, even in the case of a sound banking system, an unstable macroeconomic environment can be at the origin of the outbreak of banking crises.

C. Financial Liberalization and the Risk of Banking Crises

The theoretical and empirical literature has established the relevance of external indicators such as the deterioration of the terms of trade, the increase in current account deficits, the fall in exports and the rise in imports, the increase in the M2 ratio on reserves and the massive flow of foreign capital, to increase the difficulties of the banking sector. Indeed, the work of Kaminsky and Reinhart (1999); Demirguc-Kunt and Detragiache (1998, 2005); Falcetti and Tudela (2008) empirically validate the relevance of certain indicators such as deterioration in terms of trade, increasing current account deficits, falling exports which increase the probability of financial crises.

Moreover, the exponential growth of external capital flows, the composition of external capital flows, credit booms, and exposure to competition are all factors of financial liberalization that trigger and spread banking crises. According to Dietz et al. (2008), a massive inflow of foreign capital can contribute to the weakening of the financial system and trigger a crisis by encouraging excess liquidity and increased bank lending. Also, Detragiache and Demirgüç-Kunt (1998), studying the relationship between banking crises and financial liberalization in 53 countries between 1980 and 1995, shows that liberalized financial systems are more likely to suffer from banking crises in countries where the institutional environment is weak.

D. Regulatory framework and banking crises

Several studies, both theoretical and empirical (Demirguc-Kunt and Detragiache (1998, 2005), Menkhoff Suwanaporn (2007); Laeven and Levine (2008, 2009)) have shown that better governance of banking institutions reduces the probability of occurrence (or severity) of a banking crisis by reducing the problem of moral hazard after financial liberalization. The authors establish that the growing problems in the banking sector may be due to inadequate prudential regulation and the absence of deposit guarantee schemes. Moreover, using the z-score as a measure of default risk, Delis and Staikouras (2011) find that capital requirements, even when reinforced with supervisory activities, are ineffective in reducing bank risk. Klomp and de Haan (2011) find that banking regulations reduce bank risk, but that this effect depends on the ownership structure and size of the Bank and is more pronounced the riskier the Bank.

E. Quality of banking institutions and banking crises

A great deal of work suggests that the quality of institutions is relevant in all economic fields. Indeed, Acclassato, Ali Aga, and Eggoh (2009) present a literature review on the relationship between corruption and bank credit by isolating three different axes. The first axis is La Porta et al. (1997, 1998, 1999), which shows the negative impact of corruption on bank lending through the relationship between the legal framework and corruption. The second axis highlights the collaboration between the lender and the borrower. The former may overestimate the project's profitability; while the latter may overestimate the project's profitability, corruption leads him or her to make little effort to achieve the project's best profitability. The third axis can be found in the work of Ahlin and Pan (2008), whose results show that low levels of corruption favour productive investment despite weak financial development.

III. METHODOLOGICAL APPROACH

In this section, first, we present variables and data sources. In the econometric approach, we indicate the econometric model used, the preliminary econometric tests and the estimation technique.

A. Presentation of variables and data sources

In this sub-section, we will present the set of variables in the model and the data sources we used to determine the coefficients of the model. The choice of indicators is guided by three considerations : (i) the theoretical foundations, (ii) the availability of quarterly data, and (iii) the results of previous studies. Indeed, our empirical analysis is based on annual observations for seven (7) WAEMU countries covering 2000 to 2016.

a) Dependent Variable: Indicator of Risk of the Banking Crisis

Several authors suggest that one of the key proxies of a banking crisis is its default risk index (z-score) to identify episodes of banking crises. This risk indicator will be the subject of several studies to understand better the possible relationship between bank failure and capital supervision measures. Thus, the measure of default risk as proposed by Roy (1952), Blair and Heggestad (1978), Boyd and Graham (1986), Goyeau and Tarazi (1992), Mercieca et al. (2007) is retained in our study as a dependent variable used in the Bayesian model. These authors define the failure of a bank as the probability that its losses exceed its capital. Thus, Laeven and Levine (2009), Houston et al. (2010), Beck et al. (2013); Jeon and Lim (2013); Kasman and Carvallo (2014), among others, have recently used the z-score as a proxy for bank insolvency risk in cross-country studies. It is estimated as follows:

$$Z_{it} = \frac{ROA_{it} + \left(\frac{EQ}{TA}\right)_{it}}{\sigma_{ROA}} \qquad [1]$$

Where ROA_{it} is the return on assets, $\left(\frac{EQ}{TA}\right)_{it}$ indicates the equity/assets ratio, and σ_{ROA} is the standard deviation of the return on assets.

The z-score is exclusively determined by variations in capital and profitability levels (Beck et al., 2013; Schaeck and Cihak, 2010). The z-score increases with profitability and creditworthiness and decreases as the standard deviation of return increases (Cihak et al., 2009). A higher z-score implies a lower probability of insolvency or bankruptcy, providing a more direct measure of strength than other risk measures. In other words, a higher z-score indicates that the Bank is more stable (Mirzaei et al., 2013). This is the most widely used indicator for

projecting the safety and soundness of financial institutions (Liu and Wilson, 2013). The main advantage of this indicator is that it is more widely accepted because it is inversely related to the probability of a bank's insolvency.

b) Explanatory Variables: Potential Indicators of the Risk of Banking Crises

In the framework of our study, we select a set of variables generally used in the literature that are likely to influence the risk of bank failure. To this end, we distinguish five (5) categories of indicators affecting the financial situation of banks. These are financial variables specific to banks, indicators of financial liberalization, macroeconomic framework; indicators, regulatory framework indicators, and institutional framework indicators.

1) Financial variables specific to banks

i) The degree of capitalization

To measure the degree of capitalization, and following the example of (Lanine and Vander Vennet (2006) and Pasiouras et al. (2006), we used the ratio of capital to total assets.

ii) The Size of Bank Assets

As measured by the imperial logarithm of total assets: As Beck et al. (2013) indicate, bank assets, as measured by the imperial logarithm of total assets, could influence funding decisions and default risk. Large banks may benefit from the implicit assurance that they are perceived as *too big to fail and* thus increase the risk of their assets (Mishkin, 1999). Recent empirical studies indicate that size induces higher risk (Fortin and Dinamona (2008); Lepetit et al. (2008)

iii) The Quality of the Assets

Following Lanine and Vander Vennet's (2006) example, we use the credit ratio to total assets to assess the quality of the Bank's assets. Indeed, this ratio is considered a measure of credit risk.

iv) Management Quality

In the literature, several measures are put forward as proxies to measure the management quality of the management team; in particular, the ratio of bank charges to total assets has been chosen in this study. This ratio is measured as the ratio of all costs or charges borne by banks except interest charges to total assets (Ioannidis et al., 2010).

v) Performance

Among the standard performance measures used, we have chosen the financial return on equity ratio. Indeed, banks with low profitability are encouraged to choose risky projects to defend their profitability and, at the same time, respect the restrictions imposed by the supervisory authorities.

vi) Liquidity

In the context of our study, we have chosen the ratio of liquid assets to total deposits as an indicator that assesses the level of the Bank's internal liquidity.

vii) Average Lending Rate

An increase in the lending rate that discourages the demand for credit can also result from inefficiency in banks and the financial system. This means that the Bank cannot effectively perform its function as an intermediary and transfer funds from savers to investors (Tan, 2012). On the other hand, Igan and Tamirisa (2009) and Adrian and Shin (2010)find a positive relationship between the measure of bank profitability and the growth of credit to the private sector, thereby enhancing its ability to increase leverage and take more risk.

The data relating to these variables are taken from the balance sheets and profit and loss accounts of WAEMU banks and financial institutions (annual data).

2) Indicators of financial liberalization

i) Capital Flows

A bank can increase its resources through bank deposits and the attraction of external debt. Hahm et al. (2013) explain that banks' liabilities to the foreign sector constitute the main component of these flows in most emerging and developing countries. For our study, we distinguish between foreign assets and foreign liabilities. Thus, two measures of assets and liabilities relative to GDP are noted: Total Liabilities to study the total effect of capital inflows and Total Assets to study the total effect of capital outflows. Calderón and Kubota (2013) and Reinhart and Rogoff (2008) find that an inflow of international capital will weaken the banking sector and thus expose it to the risk of failure. These different measures of financial liberalization used are related to GDP and are taken from the updated Lane and Milesi-Ferretti (2007) database.

ii) Banking Competition

Like many other studies by Berger et al. (2017), Berger (2009), Beck et al. (2013), and Anginer et al. (2014), we opt for the Lerner index to measure banking competition. Indeed, the economic literature presents the Lerner index (Angelini and Cetorelli (2003); Maudos and De Guevara (2007)) as a measure of competition in the banking sector. The higher the index value, the more market power the credit institution is supposed to have to impose its tariffs. This variable takes on values between 0 and 1 and is taken from the GFDD (*Global Financial Development Database*, 2018).

iii) Banking Concentration Rate

This rate represents the percentage of banking system assets held by the five largest banks in relation to the total assets held by all banks in the countries in question. This rate makes it possible to determine the influence of the large banks on the banking sector and, therefore, the margin of competition in this market. The effect of this variable is ambiguous. Some authors (Beck et al., 2006; Allen and Gale, 2004; Hellman et al., 2000) argue that a less competitive and more concentrated banking market, which is easier to monitor, increases banking market power and thus bank profits. On the other hand, Boyd and De Nicolo (2005) argue that the above argument does not consider the potential impact of banking market power on

corporate behaviour. Mishkin (1999) considers that the government is more concerned about bank failures and tries to offer higher subsidies if the banking system is more concentrated, which could intensify risk-taking, thus increasing the fragility of the banking system.

iv) Share of Foreign Capital

This variable represents the percentage of the Bank's capital held by foreigners. Indeed, according to Nguyen (2008), financial liberalization leads to the privatization of banks and reduces state intervention in the banking sector. Previous empirical studies indicate that foreign and private ownership are risk reduction factors (Iannotta et al. (2007); De Nicoló and Loukoianova (2007); Laeven and Levine (2009)). Data for this variable are taken from the balance sheets and income statements of WAEMU banks and financial institutions (annual data).

3) Regulatory Variables

Theoretically, there is evidence that better governance of banking institutions reduces the likelihood of occurrence (or severity) of a banking crisis by reducing the problem of moral hazard after financial liberalization. Indeed, the first theoretical formalizations to highlight the effects of capital regulation on bank risk were based on portfolio models (Koehn and Santomero (1980); Borio and Zhu (2012)).

i) Equity to Total Assets

In the context of our study, we use the ratio of equity to total assets to capture the regulatory measure of capital requirement. Thus, the higher this ratio is, the more solid the Bank should reduce its risk of default. The data relating to this variable are taken from the balance sheets and income statements of WAEMU banks and financial institutions (annual data).

ii) Average Risk Coverage Ratio by Country

Several studies have been carried out to study the impact of prudential regulation on banking fragility (Barth et al. (2008; 2013)). In our study, we have chosen the risk coverage ratio as a regulatory measure, equivalent to the Cooke ratio, also known as the capitalization ratio or solvency ratio, which is at the heart of the WAEMU's prudential framework. The data relating to this variable are taken from the various annual reports on banking conditions in the WAEMU.

iii) Credit Market Regulation

According to Frait et al. (2011), banking regulation is just a prerequisite for financial stability. Dell'Ariccia et al. (2012) find that credit booms often occur following certain financial reforms, a large inflow of international capital following capital account liberalization and during a period of strong economic growth. This regulation of the credit market helps avoid rapid expansion of the credit market. Data for this variable are taken from the EFW (Economic Freedom of the World, 2018) database.

iv) Overdue Credit Ratio

Measures the percentage of overdue loans as a percentage of total loans at the banking sector level. This ratio provides regulators with better visibility of the fragility of banking institutions. Data for this variable are taken from the various annual balance sheets of banks in the WAEMU.

4) Macroeconomic indicators

We select five macroeconomic variables to consider the state of the economy.

i) The Inflation Rate

Indeed, price stability is generally one of the objectives sought by many central banks, including that of the WAEMU. Although they are aware of the harmful effects of a high level of inflation, the effects of a moderate level of inflation are mixed (Cordeiro, 2003; Athanasoglou et al., 2008; Kamgna et al., 2009). Thus, the impact of the inflation rate on the risk of bank failure is a function of the level of inflation. The variable is extracted from the World Bank database (WDI).

ii) Gross Domestic Product Growth Rates

GDP growth measures the overall health of the economy, which in turn may reflect the level of demand for credit. Thus, an upward trend in GDP should contribute to improving the banking system's health because increased production increases incomes and thus the ability of economic agents to meet their commitments. Dell'Ariccia et al. (2012) explain that in periods of expansion, a good level of economic growth improves the solvency of borrowers. However, during periods of growth, banks may choose riskier assets and thus be exposed to higher default risk (Jokipii and Milne, 2008; Houston et al., 2010). Our measure of GDP growth is taken from the World Bank (WDI) database.

iii) Credit to the Private and Public Sector in Relation to GDP

An increase in credit to the private sector reflects an improvement in the level of development of banks and easier access to credit, Beck et al. (2000). Nevertheless, this variable can also measure the credit boom. In this case, an excessive increase in credit to the private sector in a period of financial instability may represent a risk that may lead to a higher probability of banking crises.

iv) Trade Openness

This measures the sum of imports and exports relative to GDP. The effect of trade openness on banking crises remains ambiguous to date. On the one hand, a highly integrated country in international markets is more exposed to external shocks. On the other hand, if export revenues are high, the country may face a "sudden stop" and withdrawal of international capital flows (Furceri et al., 2011).

5) Indicators of the Institutional Framework

Some authors are increasingly beginning to question the role of institutional arrangements in waves of financial instability. Thus, numerous works mention that the quality of institutions is a factor in all economic fields (Mehrez and Kaufmann (2000); Demirgüç-Kunt and Detragiache (1998); Kose et al. (2003) and Kose et al. (2007).

The institutional environment data are taken from the World Bank's *Worldwide Governance Indicators* (WGI) database developed by Kaufmann et al. (2011). Kaufmann et al. (2011) collect data on the institutional environment at the country level. Indeed, the World Bank's Worldwide Governance Indicators measure six components of good governance: freedom of speech and accountability, political stability and absence of violence, government effectiveness, regulatory quality, the rule of law, and control of corruption. The values of these indicators are expressed on a scale of [-2.5; +2.5]. A higher value corresponds to better institutional performance.

We focus on two dimensions of institutions: the rule of law and the control of corruption. The rule of law indicator variable reflects perceptions of the extent to which agents trust and respect the rules of society, in particular the quality of contract enforcement, property rights, police and courts, and the likelihood of crime and violence. The corruption control dummy variable reflects perceptions of the extent to which public power is exercised for private purposes, including minor and major forms of corruption and the 'capture' of public power by elites and vested interests.

B. The Econometric Approach

In this paragraph, we first present the Bayesian Model Averaging *(*BMA), following the example of Babecký et al. (2013) for linear regression, and then the threshold effect model based on the Panel Threshold Regression (PTR) method of Hansen (1999).

a) Bayesian Model Averaging (BMA) for Linear Regression

The Bayesian Model Averaging (Bayesian Model Averaging) method of robust regression model selection by combining specifications aims to isolate the indicators that influence a dependent variable among many candidates' explanatory variables. Indeed, in a linear regression with many explanatory variables, Babecký et al. (2012) point out at least two problems. First, an unsatisfactory approach is to combine all potential variables in a single regression. This tends to deteriorate the precision of the estimation and makes the true specification of the parameters uncertain (parameter uncertainty). Second, the traditional approach (based on a sequence of tests to obtain the "best" model) may produce irrelevant results. In other words, at each iteration, an error may be made, i.e. the relevant variables may be excluded by rejecting the correct model (model uncertainty).

The Bayesian selection method by combining models allows many variables to be considered in a single estimate. This approach considers all possible models by averaging their inclusion probabilities a posteriori. It puts in competition the possible combinations of regressors to obtain the most robust forecasting quality. It also provides precisely a priori information on the parameters to obtain the most efficient model for out-of-sample forecasting (Hoeting et al. ii., 1999).

Many studies use model averaging to address these issues (Bayale 2020; Nagou et al., 2020; Fragoso, Bertoli, and Louzada 2018; Sanso-Navarro and Vera-Cabello 2018; Okafor and Piesse 2017; Moral-Benito 2015; Babeckỳ et al., 2014; 2013; Moral-Benito, 2011; Feldkircher and Zeugner, 2009; Sala-i-Martin et al., 2004). Similarly, Babecky et al. (2014) apply the BMA method in the context of discrete models of financial crisis occurrence. The BMA has also been applied to resolve model uncertainty in the meta-analysis (Babecky and Havranek, 2014; Havranek and Rusnak, 2013; Raftery et al., 1997; Eicher et al., 2011).

Using a simple linear regression model to identify the factors of banking sector fragility in WAEMU countries with a large set of candidate explanatory variables, within the framework of the BMA, many different models are estimated based on the following structure:

$$y_{i,t} = \alpha_i^{\gamma} + X_{i,t}^{\gamma}\beta^{\gamma} + \varepsilon_{i,t}^{\gamma} \qquad [2]$$

$$\text{with } \varepsilon_{i,t}^{\gamma} \rightsquigarrow N(0, \sigma^2 I)$$

With $y_{i,t}$ is an indicator variable relating to the occurrence of a banking crisis of the following dimensions $(n \times 1)$, α_i^{γ} a column vector of constants, β^{γ} a vector of parameters to be estimated $(k \times 1)$, $X_{i,t}^{\gamma}$ represents the vector of k included explanatory variables of dimension $(n \times k)$ and $\varepsilon_{i,t}^{\gamma}$ is an error term.

In the Bayesian approach, a model is composed of a fraction of likelihood is a priori density. Therefore, if we assume that the specification of models depends on the inclusion or exclusion of each explanatory variable. Thus for the number k of potential explanatory variables, there are $\mathbf{2^k}$ possible combinations of models; $\boldsymbol{\gamma}$ is used to referring to a specific one of these models.
The coefficients in each model are then weighted by the probabilities of the models a posteriori :

$$P\left(M^{\gamma}\middle|y_{i,t}, X_{i,t}^{\gamma}\right) \propto P\left(y_{i,t}\middle|M^{\gamma}, X_{i,t}^{\gamma}\right)P(M^{\gamma}) \qquad [3]$$

Where $P\left(M^{\gamma}\middle|y_{i,t}, X_{i,t}^{\gamma}\right)$ is the posterior model probability, which is proportional to the marginal probability of the model $P\left(y_{i,t}\middle|M^{\gamma}, X_{i,t}^{\gamma}\right)$times the previous probability of the model $P(M^{\gamma})$. $\propto$ A sign of proportionality.

The robustness of an explanatory variable is assessed by its posterior inclusion probability (PIP). The latter is the conditional probability that a variable belongs to a model knowing the sample used. The posterior inclusion probability (PIP) is calculated as follows :

$$PIP = P\left(\beta^{\gamma} \neq 0\middle|y_{i,t}\right) = \sum_{\beta^{\gamma}\neq 0} P\left(M^{\gamma}\middle|y_{i,t}\right) \qquad [4]$$

Thus, a leading indicator of banking crises is that the more robust, the higher the probability of its inclusion a posteriori.

The BMA approach enables us to identify the most important leading indicators of bank failure. We collect data for more than twenty-three (23) potential indicators of bank failure. These indicators have all been suggested in the literature on early warning models for banking crises (Frankel and Rose (1996); Kaminsky et al. (1998)). Thus for the number of 23 potential explanatory variables, there are $2^{23} = 8\,388\,608$ possible combinations of models. We carry out 200 miles of iterations to obtain more precise parameters with sufficiently long Markov chains.

We choose the model which offers a better correlation between the model's posterior probability (PMP) and the one deduced from the Monte Carlo Markov Chain method. Here, this correlation is equal to 0.9942, suggesting that the algorithm seems to have converged reasonably well. Indeed, the correlation obtained between the number of iterations and the analytical probabilities of the posterior model exceeds 0.95, which we consider sufficient convergence. This measure indicates the quality of the approximation by showing to what extent the MCMC sampler has converged to a good approximation of the posterior model probabilities.

Raftery (1995) and Jeffreys (1998) suggest that variables with a posteriori inclusion probabilities greater than 0.5 should be retained. An a posteriori inclusion probability between 50% and 75% means that the variable gives a weak signal. Its influence is positive if the probability is between 75% and 95%. The signal becomes strong if the probability is between 95% and 99%. Finally, a variable plays a decisive role if its probability exceeds 99%.

b) Hansen's (1999) Non-Linear Threshold Effects Model

To determine the critical threshold for the indicators selected by the BMA method, we adopt the non-linear threshold effect approach of Hansen (1999). The starting point of Hansen's (1999) approach is the specification of the linear model as follows:

$$Y_{it} = \mu_i + \beta X_{it} + u_{it}, \qquad [5]$$

with Y_{it} the country-dependent variable i to the period t, μ_{it} country-specific fixed effects i and $X_{i,t}$ the exogenous variable of the country i to the period t. The terms of error $u_{it} \sim iid$ with a zero mean and a finite or constant variance.

If the hypothesis of a non-linear relationship is validated, we move on to the specification of the non-linear threshold effect model. Referring to Hansen's (1999) model, we can link our two variables by a non-linear model with a (01) threshold as follows :

$$Y_{it} = \mu_i + \beta_1 X_{it}(X_{it} \leq \gamma) + \beta_2 X_{it} I(q_{it} > \gamma) + u_{it} \qquad [6]$$

Where γ is the critical threshold of X_{it} which separates the regimes: in the first regime, $X_{it} \leq \gamma$ and the relationship are bound by the parameter β_1, in the second regime, $X_{it} > \gamma$ and the relationship is bound by the parameter β_2. γ, β_1 and β_2 are the parameters to be estimated from the model presented in equation [6]

IV. PRESENTATION AND DISCUSSION OF RESULTS

In this section, we first present and discuss respectively the results obtained from the Bayesian selection model as in Babecký et al. (2013) based on 23 financial, macroeconomic and institutional variables and those from the threshold effects model of Hansen (1999).

A. Presentation and Discussion of the Results of the BMA Model

The results of the Bayesian model are presented in the following tables. The PIP column corresponds to the probability of inclusion a posteriori for each variable in the analysis. We also report the posteriori mean, which is the mean value of the coefficient of a variable across all models, including models in which the variable was not contained (meaning that the coefficient is zero). The next column shows the a posteriori standard deviation. This corresponds to the average standard deviation of the coefficient of a variable in the models considered. The last column indicates the codes of the variables in the estimated database. Table 1 below presents the results of the BMA Model with level variables, and Table 2 below presents the results of the BMA Model with standard variables.

Concerning the work of Raftery (1995) and Jeffreys (1998), among the twenty-three (23) potential variables initially considered, we retain the eight (8) for which the probability of inclusion a posteriori is greater than half (0.5). These are Logarithm of Total Assets; Share of Foreign Capital; Public Sector Credit; Overdue Credit on Total Loans; Credit Market Regulation; Total Commitments; Private Sector Credit, and Corruption Control.

The results in Table 3.1 indicate that the variable "Logarithm of total assets" has a decisive effect and an a posteriori average of the coefficient of the positive sign on the z-score with an inclusion probability equal to 0.9984. This indicates that large banks are better able to survive during crises, as they are expected to diversify risks better than smaller banks. However, as Beck et al. (2013) indicate, the size of bank assets, measured by the imperial logarithm of total assets, could influence capitalization decisions and default risk. Large banks may benefit from the implicit assurance that they are perceived as "*too big to fail*" and thus increase the risk of their assets (Mishkin, 1999). Other empirical studies indicate that size induces higher risk (Fortin and Dinamona (2008); Lepetit et al. (2008)).

Also, the variable "Share of foreign capital" has a decisive effect and an a posteriori average of the coefficient of the positive sign on the z-score with a

probability of inclusion equal to 0.9970. This indicates that foreign and private shareholdings reduce the probability of bank failure. This result is consistent with those found by Iannotta et al. (2007), De Nicoló and Loukoianova (2007), and Laeven and Levine (2009), which indicate that foreign and private ownership are risk-reducing factors and public ownership is a risk factor.

On the other hand, we note that the variables "Credit to the private sector" and "Overdue credit on total loans" are positive and negatively related to the z-score with inclusion probabilities equal to 0.89878 and 0.82999, respectively. Similarly, the variable "Credit to the private sector" is low and negatively related to the z-score with an inclusion probability of 0.508885. These results show that an increase in the rate of credit to the private sector, to the public sector, especially for overdue credits, leads to an increase in the probability of bank failure. Indeed, the latest episodes of banking crises in the 1990s in WAEMU countries and other developing countries were marked by the rapid expansion of domestic credit to the public sector. Reinhart and Rogoff (2011) and Demirgüç-Kunt and Detragiache (1998) indicate that banking crises result from excessive growth of real domestic credit that makes banks fragile due to debt leverage.

Moreover, according to Frankel and Saravelos (2012), countries with strong credit growth suffered more than others during the banking crises. Reinhart and Rogoff (2008) find that most of these crises are triggered by a credit boom. Similarly, Mendoza & Terrones (2012) show that the credit cycle is a "boom" and "bust" cycle. A credit boom has triggered almost all crises. Such an effect depends on the size of the deviation of credit from its equilibrium value. Borio and Drehmann (2009) focus on private sector credit as determinants of the onset of banking crises. They find that the credit gap (defined as the deviation of private credit/GDP from its trend), calculated from the ratio of private credit to GDP, is the most reliable indicator of a banking crisis.

Our results indicate that the variable "Credit market regulation" has a small effect and an a posteriori average of the coefficient of the positive sign on the z-score with an inclusion probability equal to 0.6998. This indicates that an improvement in credit market regulation reduces the probability of bank failure. This result is consistent with those of Admati et al. (2010), which show that countries with a high level of supervision and thus a stricter level of prudential supervision experienced fewer bank failures.

Table 1. Result of the BMA Model with Level Variables

Decision	Variables	PIP	A posteriori average	A posteriori standard deviation	Variable code
Decisive	The logarithm of total assets	0,9984	3,1870	0,9010	3
	Share of foreign capital	0,9970	10,9666	2,8476	19
Positive	Credit to the public sector	0,9243	-0,7123	0,3277	16
	Overdue credit on total credits	0,8558	-28,3792	15,9476	18
	Credit to the private sector	0,7778	-0,2137	0,1538	17
Low	Regulation of the credit market	0,6998	0,6049	0,4856	1
	Total Commitments	0,6787	2,2188	1,8652	21
Very low	Corruption control	0,4436	-1,3812	1,8420	13
	Inflation	0,3323	0,0854	0,1469	10
	Degree of capitalization (capital on total assets)	0,3297	17,7351	30,8257	22
	Commercial opening	0,2803	1,4092	2,8537	11
	Liquid assets in relation to total deposits	0,2515	2,7515	6,0471	2
	Average risk coverage ratio by country	0,2113	-2,0131	5,0613	6
	Banking concentration	0,1600	0,6496	2,1609	8
	Rule of law	0,1538	-0,2299	0,8596	14
	Quality of regulation	0,1414	-0,2416	1,1668	7
	GDP growth rates	0,1380	-0,0152	0,0582	12
	Return on equity	0,1162	-0,1175	0,6453	15
	Lerner index	0,1038	-0,4057	2,3025	9
	Total Assets	0,1022	0,1542	1,3560	20
	Bank charges on total assets	0,1004	-0,4777	12,8056	23
	Shareholders' equity on total assets	0,0983	0,1811	3,0849	5
	Average credit rate	0,0917	0,0000	0,0729	4

Source: Author's estimate

As Lane and Milesi-Ferretti (2007) measured, the "Total Commitment" variable of de facto financial liberalization has a decisive and positive effect on the z-score with a probability of inclusion equal to 0.9769. This assumes that the more open the country is to capital transactions with the outside world, the lower the probability of a banking crisis. This result is consistent with Ranciere et al. (2008) and Levine (2001), who show that financial liberalization is negatively related to banking crises. Indeed, it promotes growth by increasing stock market liquidity and improving the functioning of the domestic banking system. Moreover, Shehzad and De Haan (2009) show that financial liberalization improves the development of the financial sector, which in turn contributes to economic growth. The authors conduct sensitivity tests and conclude that liberalization is a potential indicator for predicting banking crises.

This result also confirms the one obtained by Schmukler and Kaminsky (2003) on a panel of industrialized and emerging countries, which states that financial liberalization has a negative effect in the short term; this effect disappears in the long term when financial reforms are familiar with the new global finance. However, this result contrasts with other empirical studies, such as Ranciere et al. (2006) and Eichengreen and Arteta (2002), which have shown that financial liberalization is the common cause of the banking crises observed over the last two decades.

B. Presentation and discussion of the results of the threshold effects model

Table 2 presents Hansen's (1999) threshold effects model. The table shows the estimated threshold (γ), the statistic (F-stat) of the threshold significance test, the confidence interval and the coefficients β_1 and $\beta_2$when the estimated threshold is significant.

Among the eight (8) indicators previously selected by the BMA method, three (3) significantly admit a critical threshold at which they become a source of triggering a banking crisis in WAEMU countries. These include the share of foreign capital, the rate of credit to the public sector and the corruption control index.

Indeed, based on the approach of Hansen (1999), we find for the indicator "share of foreign capital" a critical threshold of 80.83% significant at 5% for a confidence interval of [80.02%; 83.87%]. This result thus reveals that the share of foreign capital increases the risk of the banking crisis in the WAEMU when it becomes higher than 80.83%. This result indicates that foreigners can hold no more than 80.83% of bank capital in the union. This would avoid the phenomenon of contagion based on the behaviour of foreign investors, who may re-evaluate the risks associated with investments in other markets through pure mimicry behaviour.

For the indicator of credit to the public sector in relation to GDP, we find that a critical threshold of 6.27% is significant at 1% for a confidence interval of [6.08%; 6.35%]. This result thus reveals that the ratio of public sector credit to GDP increases the risk of a banking crisis in the WAEMU when it exceeds 6.27%. This result indicates that to finance investments, the states of the union must reasonably resort to bank loans and avoid accumulating large public deficits that they will transfer to banking institutions. Also, avoid the mismanagement of projects financed by these bank credits.

For the corruption control index, we find a critical threshold of -0.96 significant at 10% for a confidence interval of [-0.97; -0.93]. This implies that the corruption control index significantly increases the risk of a banking crisis in the WAEMU when it is less than or equal to -0.96; since the higher the index, the less corruption there is. But above this threshold, the effect diminishes. Thus, the union's current very low level of corruption control exposes its banking sector to the risk of crisis. This result is consistent with La Porta (1997, 1998) and La Porta et al. (2000), which show the negative impact of corruption on bank lending.

Table 2. Results of Hansen's threshold effects model (1999)

Variables	Estimated threshold (γ)	F-stat (proba)	Confidence interval	Coefficients β_1 and β_2
Share of foreign capital	80,83%	20,89**(0,0233)	[80,02 ; 83,87]	$\beta_1 = 0{,}0349^{**}$ $\beta_2 = -0{,}0205$
Credit to the public sector	6,27%	17,92***(0,0067)	[6,08 ; 6,35]	$\beta_1 = 0{,}2672^{**}$ $\beta_2 = -0{,}1288^{**}$
Corruption control	-0,96	14,42* (0,1000)	[-0,97 ; -0,93]	$\beta_1 = -4{,}0376^{*}$ $\beta_2 = -1{,}8567^{***}$
Logarithm of total assets	12,86	17,42 (0,1333)	*seuil non significatif*	
Overdue credit on total credits	10,19%	7,23 (0,3967)	*seuil non significatif*	
Credit to the private sector	14,75%	7,19 (0,4500)	*seuil non significatif*	
Regulation of the credit market	6,65	3,31 (0,7000)	*seuil non significatif*	
Total Commitments	63,90%	6,17 (0,3833)	*seuil non significatif*	

Note: Values in parentheses represent probabilities. ***, **, and * indicates significance at the 1%, 5%, and 10% thresholds.
Source: Author's estimates

V. CONCLUSION

According to theoretical and empirical studies, the main leading indicators of impending banking crises are multiple and varied. To this end, the objective of this paper was, on the one hand, to identify the factors that expose the WAEMU banking sector to the risk of crises and, on the other hand, to determine for the selected indicators the critical threshold at which they become a source of triggering a banking crisis. To do this, we adopt an empirical approach based respectively on the Bayesian selection method (BMA) following the example of Babecky et al. (2013) and a threshold effect model based on the PTR (*Panel Threshold Regression)* method of Hansen (1999), on a panel of seven WAEMU countries covering the period from 2000 to 2016.

Our results show that eight variables among the twenty-three considered have a significant predictive power of the banking crises studied. These are the size of bank assets, foreign ownership, capital inflows and credit market regulation, which are factors that reduce the probability of banking crises; At the same time, the rates of private sector lending, public sector lending, delinquency and the level of corruption control contribute to the increased probability of banking crises in the WAEMU. Finally, our results reveal that among the eight indicators selected by the BMA method, three admit a critical threshold at which they become a source of triggering a banking crisis in WAEMU countries. These include the share of foreign capital, the rate of credit to the public sector and the corruption control index, for which we find a critical threshold of 80.83%, 6.27% and - 0.96, respectively.

From our findings, several economic policy implications can be drawn for the consolidation of the stability of the union's banking sector in a context of financial liberalization that is, in fact, more marked. Indeed, our results show that the structure of bank credit plays a key role in increasing the probability of banking crises in the union; this implies that the operationalization of the BIC (Bureau d'Information sur le Crédit), which aims at reducing the asymmetry of information between lenders and borrowers in the credit market, should be reinforced. Similarly, prudential policies must ensure that the banking system is stronger and resilient to an external shock.

REFERENCES

[1] Adrian T, Shin H.S, Financial Intermediaries ET Monetary Economics, In Handbook of Monetary Economics, Elsevier. (2010) 601–650.

[2] Ahlin C, Et Pang J, Are Financial Development and Corruption Control Substitutes in Promoting Growth, Journal of Development Economics. 86 (2008) 414-433.

[3] Allen F, & Gale D, Competition and Financial Stability, Journal of Money, Credit and Banking. (2004) 453-480.

[4] Babecky J, & Havranek T, Structural Reforms and Growth in Transition: A Meta Analysis, Economics of Transition. 22(1) (2014) 13-42.

[5] Bayale, Nimonka, Empirical Investigation into the Determinants of Foreign Aid in Sahel Countries: A Panel Bayesian Model Averaging Approach, Defence and Peace Economics. (2020) 1-21.

[6] Beck T, De Jonghe O, & Schepens G, Bank Competition and Stability: Cross-Country Heterogeneity, Journal of Financial Intermediation. 22(2) (2013) 218-244.

[7] Beck T, Demirgüç-Kunt A, & Levine R, Bank Concentration, Competition, and Crises: First Results, Journal of Banking & Finance. 30(5) (2006) 1581-1603.

[8] Beju, Daniela Georgeta, Et Maria-Lenuta Ciupac-Ulici. The Impact of Financial Liberalization on Banking System, Procedia Economics and Finance. 3 (2012) 792-799.

[9] Borio C, Zhu H, Capital Regulation, Risk-Taking Et Monetary Policy: A Missing Link in the Transmission Mechanism? Journal of Financial Stability. 8 (2012) 236–251.

[10] Boyd John H, Et Gianni De Nicolo, The Theory of Bank Risk Taking and Competition Revisited, The Journal of Finance. 60(3) (2005) 1329-1343.

[11] Calderón C, Kubota M, Sudden Stops: Are Global Et Local Investors Alike? Journal of International Economics. 89 (2013) 122–142.

[12] Čihák M, Maechler A. M, Schaeck K, & Stolz S. M, Who Disciplines Bank Managers? IMF Working Papers. 2009(272) (2009) 1-45.

[13] Davis, E. Philip, Et Dilruba Karim, Comparing Early Warning Systems for Banking Crises, Journal of Financial Stability. 4 (2) (2008) 89-120.

[14] De Nicolo G, & Loukoianova E, Bank Ownership, Market Structure and Risk, IMF Working Papers. (2007) 1-44.

[15] Delis M. D, & Staikouras P. K, Supervisory Effectiveness and Bank Risk, Review of Finance. 15(3) (2011) 511-543.

[16] Dell'Ariccia G, Igan D, & Laeven L. U, Credit Booms and Lending Standards: Evidence from the Subprime Mortgage Market, Journal of Money, Credit and Banking. 44 (2012) 367-384.

[17] Demirgüç-Kunt, Asli Et Harry H, Are Banks Too Big to Fail or Too Big to Save? International Evidence from Equity Prices and CDS Spreads, Journal of Banking & Finance. 37(3) (2013) 875-894.

[18] Diamond, Douglas W, Financial Intermediation and Delegated Monitoring, The Review of Economic Studies. 51(3) (1984) 393-414.

[19] Diamond, Douglas W, Et Philip H, Dybvig, Bank Runs, Deposit Insurance, and Liquidity, Journal of Political Economy. 91(3) (1983) 401-419.

[20] Eicher T. S, Papageorgiou C, & Raftery A. E, Default Priors and Predictive Performance in Bayesian Model Averaging with Application to Growth Determinants, Journal of Applied Econometrics. 26 (2011) 30-55

[21] Eicher T. S, Papageorgiou C, & Raftery A. E, Default Priors and Predictive Performance in Bayesian Model Averaging, With Application to Growth Determinants, Journal of Applied Econometrics. 26(1) (2011) 30-55.

[22] Falcetti E, & Tudela M, What Do Twins Share? A Joint Probit Estimation of Banking and Currency Crises, Economica. 75(298) (2008) 199-221.

[23] Fragoso M. T, W. Bertoli, and F. Louzada, Bayesian Model Averaging: A Systematic Review and Conceptual Classification, International Statistical Review. 86(1) (2018) 1–28.

[24] Frankel J.A, Rose A.K, Currency Crashes in Emerging Markets: An Empirical Treatment, Journal of International Economics. 41 (1996) 351–366.

[25] Frankel, Jeffrey, Et George Saravelos, Can Leading Indicators Assess Country Vulnerability? Evidence from the 2008-09 Global Financial Crisis, Journal of International Economics. 87(2) (2012) 216-231.

[26] González-Hermosillo, Brenda, Determinants of Ex-Ante Banking System Distress: A Macro-Micro Empirical Exploration of Some Recent Episodes, IMF Working Paper. 99(33) (1999).

[27] Goyeau D, & Tarazi A, Assessing the Risk of Bank Failure in Europe, Revue D'économie Politique. (2) (1992) 249-280.

[28] Goyeau, Daniel, and Amine Tarazi, Evaluation of the Risk of Bank Failure in Europe, Revue D'économie Politique. 102(2) (1992) 249-280.

[29] Hahm J, Shin H.S, Shin K, Noncore Bank Liabilities Et Financial Vulnerability, Journal of Money, Credit Et Banking. 45 (2013) 3–36.

[30] Hellmann T. F, Murdock K. C, & Stiglitz J. E, Liberalization, Moral Hazard in Banking, and Prudential Regulation: Are Capital Requirements Enough? American Economic Review. 90(1) (2000) 147-165.
[31] Houston J. F, Lin C, Lin P, & Ma Y, Creditor Rights, Information Sharing, and Bank Risk Taking, Journal of Financial Economics. 96(3) (2010) 485-512.
[32] Iannotta G, Nocera G, Sironi A, Ownership Structure, Risk Et Performance in the European Banking Industry, Journal of Banking & Finance. 31 (2007) 2127–2149.
[33] James R, Barth & Gerard Caprio & Ross Levine, Bank Regulation and Supervision in 180 Countries from 1999 to 2011, Journal of Financial Economic Policy, Emerald Group Publishing. 5(2) (2013) 111-219.
[34] Jeffreys, Harold, The theory of probability, OUP Oxford. (1998).
[35] Jeon J. Q, & Lim K. K, Bank Competition and Financial Stability: A Comparison of Commercial Banks and Mutual Savings Banks in Korea, Pacific-Basin Finance Journal. 25 (2013) 253-272.
[36] Jokipii T, & Milne A, The Cyclical Behaviour of European Bank Capital Buffers, Journal of Banking & Finance. 32(8) (2008) 1440-1451.
[37] Kamgna S. Y, Tinang N. J, & Tsombou K. C, Macro-Prudential Monitoring Indicators for CEMAC Banking System, MPRA Paper. 17095 (2009).
[38] Kaminsky, Graciela L, and Carmen M, Reinhart, On crises, Contagion, and Confusion. Journal of International Economics. 51(1) (2000) 145-168.
[39] Kaminsky, Graciela L., et Carmen M, Reinhart, The Twin Crises: The Causes of Banking and Balance-of-Payments Problems, American Economic Review. 89(3) (1999) 473-500.
[40] Kasman A, & Carvallo O, Financial Stability, Competition and Efficiency in Latin American and Caribbean Banking, Journal of Applied Economics. 17(2) (2014) 301-324.
[41] Klomp, Jeroen, et Jakob de Haan, Bank Regulation, The Quality of Institutions, and Banking Risk in Emerging and Developing Countries: An Empirical Analysis, Emerging Markets Finance and Trade. 50(6) (2014) 19-40.
[42] Kose M.A, Prasad E.S, Terrones M.E, Financial Integration Et Macroeconomic Volatility, IMF Staff Papers. 50 (2003) 119–142.
[43] La Porta R, Lopez–de-Silanes F, Shleifer A, et Vishny R, The Quality of Government, Journal of Law and Economic Organization. 15 (1999) 222-279.
[44] Laeven L, & Levine R, Complex Ownership Structures and Corporate Valuations, The Review of Financial Studies. 21(2) (2008) 579-604.
[45] Laeven L, & Levine R, Bank Governance, Regulation and Risk-Taking, Journal of Financial Economics. 93(2) (2009) 259-275.
[46] Laeven L, & Valencia F, Systemic Banking Crises Database, IMF Economic Review. 61(2) (2013) 225-270.
[47] Laeven Luc, and Fabian Valencia, Systemic Banking Crises Database, IMF Economic Review. 61(2) (2013) 225-270.
[48] Lanine G, & Vander Vennet R, Failure Prediction in the Russian Bank Sector with Logit and Trait Recognition Models, Expert Systems with Applications. 30(3) (2006) 463-478.
[49] Lepetit L, Nys E, Rous P, Tarazi A, Bank Income Structure Et Risk: An Empirical Analysis of European Banks, Journal of Banking & Finance. 32 (2008) 1452–1467.
[50] Levine, Ross, International Financial Liberalization and Economic Growth, Review of International Economics. 9(4) (2001) 688-702.
[51] Liu H, Molyneux P, & Wilson J.O, Competition and Stability in European Banking: A Regional Analysis, The Manchester School. 81(2) (2013) 176-201.
[52] Maillet B, Olteanu M, & Rynkiewicz J, Characterization of Financial Crises Using Hybrid Models (HMC-MLP), Revue D'économie Politique. 114(4) (2004) 489-506.
[53] Maudos J, De Guevara J.F, The Cost of Market Power in Banking: Social Welfare Loss vs Cost Inefficiency, Journal of Banking & Finance. 31 (2007) 2103–2125.
[54] Menkhoff L, & Suwanaporn C, 10 Years After the Crisis: Thailand's Financial System Reform, Journal of Asian Economics. 18(1) (2007) 4-20.
[55] Mercieca S, Schaeck K, & Wolfe S, Small European Banks: Benefits from Diversification? Journal of Banking & Finance. 31(7) (2007) 1975-1998.
[56] Mirzaei A, Bank Performance During the Financial Crisis 2007-2010, International Journal of Business and Economics. 12(1) (2013) 27.
[57] Mishkin F.S, Financial Consolidation: Dangers Et Opportunities, Journal of Banking & Finance. 23 (1999) 675–691.
[58] Moral-Benito E, Model Averaging in Economics: an Overview, Journal of Economic Surveys. 29(1) (2015) 46–75.
[59] Nagou M, N. Bayale, and B. K. Kouassi, On the Drivers of Public Debts in Africa: Fresh Evidence from Bayesian Model Averaging Approach, Journal of Sustainable Finance & Investment. (C) (2020) 1–24.
[60] Okafor G, and J. Piesse, Empirical Investigation into the Determinants of Terrorism: Evidence from Fragile States, Defence and Peace Economics. 12 (2017) 1–15.
[61] Raftery A, Hoeting J, Volinsky C, Painter I, & Yeung K. Y, BMA: Bayesian Model Averaging. 3(13) (2010).
[62] Raftery A.E, Bayesian Model Selection in Social Research, Sociological Methodology. 25 (1995) 111–164.
[63] Sanso-Navarro M, and M. Vera-Cabello, The Socio-economic Determinants of Terrorism: A Bayesian Model Averaging Approach, Defence and Peace Economics. 31(3) (2018) 269–288.