



Early Warning Indicators for Systemic Banking Crises

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Abstract

In this study we use the BMA model to study the determinants of systemic banking crises for a set of emerging and developed in a context of uncertainty. To this end, we selected a set of macroeconomic, financial, accounting and external variables, annual frequencies for period January 1970 - January 2012. The estimation results show the important role of accounting variables in the occurrence of banking crises and the need for the BMA model in determining the probability of each explanatory variable in the occurrence of these crises.

Keywords: Systemic banking crises, Bayesian model averaging.

JEL Classification: G01-C11

1. Introduction

Research on banking crises was largely inspired by the experiences of the 19th century and early 20th century. But from the 1990s, the study of banking crises has given new materials for research, and a growing literature has studied the causes and consequences of bank fragility in several countries, including developed economies, developing countries, and economies in transition. To this end, IMF (1998) defines a banking crisis as a situation in which bank runs induce banks to suspend convertibility of their liabilities or, forcing governments to intervene in the banking system on a large scale.

According to Demirguc-Kunt and Detragiache (1998), a crisis episode takes place when at least one of the following conditions is met: The ratio of NPA (non-performing assets relative

to total assets) exceeds 10% in the banking system, banking sector problems cause nationalization of banks on a large scale and cost of the rescue operation is at least 2% of GDP.

Similarly, Leaven and Valencia (2008, 2010) consider a systemic banking crisis occurs if two conditions are met: Significant signs of financial distress in the banking system and intervention measures of the bank's policy. As a result, non-performing loans increase sharply and all or most of the global banking system capital is exhausted. Thus, this may be accompanied by significant increases in interest rates and slowdown in capital flows.

Frankel and Saravelos (2012) stipulate that a bank liquidity reserve has a key indicator that relates to banking crises. Indeed, low liquidity reflects a higher risk. The lack of transparency is itself associated with an increased risk to a banking panic indicating a relative lack of alternative and diversified to respond to shocks options risk. In addition, the authors show that with the collapse of trade credit, countries that rely heavily on exports of goods were the most vulnerable to banking crises.

There is an abundant empirical literature on banking crises¹. Most of these studies generally use two econometric approaches, namely the non-parametric signals approach and limited dependent variable Logit / Probit² models. From the late eighties ten new empirical methodologies described as "revolutionary" have been used to identify the determinants of banking crises, such as the neural networks³, the regime switching Markov⁴ models and recursive binary trees. However, none of these approaches consider a well-defined selection criterion to clearly identify the robustness of early warning signals.

This paper examines the systemic banking crisis, explicitly taking into account the uncertainty of the model using Bayesian statistical techniques, particularly the Bayesian model averaging (BMA) that provides a methodology for calculating the average values of the parameters of all alternative models, using the posterior probabilities of each model as respective weights to assess the relative importance of different variables.

Indeed, this approach has the attractive feature that directly addresses issues central to the interests of researchers, such as "What is the probability that the model is correct"? And "What is the probability that an explanatory variable has an effect on the dependent variable"?

¹ Abiad (2003), Hawkins (2000), Collins (2003), Frankel and Saravelos (2012).

² Demirgüç and Detragiache (2005).

³ Olteanu and Rynkiewicz (2004).

⁴ Cerra and Saxena (2001).

The contribution of this research is the methodology which we adopt throughout this work in order to answer the following question: What are the determinants of systemic banking crises in a context of uncertainty?

The paper is structured as follows. In section 2, we provide a brief theoretical background of the determinants of systemic banking crises. Then, section 3 presents a description of the methodology which will be used including the construction of the dependent variable of banking crisis, econometric model to be applied, the database and its properties. Section 4 provides the empirical result. Section 5 concludes.

2. Determinants of Banking Crises

After the first studies proposed by Kaminsky and Reinhart (1999) and Demirguc Kunt and Detragiache (1998), a long documentation focused on the determinants of bank fragility, proceeded on several fronts:

2.1. Macroeconomic shocks: External and Domestic

Regarding the first group of factors, Honohan (2000) finds that banking crises are often preceded by high rates of growth of real bank credit. On the domestic front, growth and inflation are often very volatile. The assessment of credit risk becomes more difficult when growth and inflation rates vary widely. Caprio and Klingebiel (1996b) argue that banking crises are more likely to occur in countries with greater volatility of output growth and inflation.

In addition, the authors⁵ find a sharp deterioration in terms of trade of a country leads to banking crises. Indeed, they show that the deterioration of this variable has to be one of the stylized facts of banking crises in emerging markets. In addition, they believe that the standard deviation of the change in terms of trade in Latin American emerging markets is about 2 times higher than in industrialized countries over the last 20 years. Volatility in terms of trade is particularly pronounced for countries with high export concentration.

Rising international interest rates and the induced effect on private capital flows is another important external factor (G Morris (1996)). Not only changes in interest rates affect the cost of borrowing in emerging markets, but they also alter the relative attractiveness of investing in these markets.

⁵ Kaminsky -Reinhart (1995) and Hausmann-Gavin (1996).

Goldstein, Kaminsky and Reinhart (2000) argue that the exchange rate is the third member of the trio of external volatility. Indeed, the actual volatility of the exchange rate can lead to difficulties for banks, either directly (when there is "maturity mismatch" between the assets and liabilities of the bank), or indirectly (when volatility rate creates large losses for the bank's borrowers). The authors state that large fluctuations in the real exchange rate tend to precede banking crises. These results suggest that the problems in the banking sector may be due to loss of international competitiveness of domestic industries.

2.2.Financial liberalization

The view that financial liberalization can lead to greater financial fragility has often been criticized. Demirguc -Kunt and Detragiache (1998) shows that financial liberalization leads to bank fragility since it gives banks more to take the risk. The authors find that banking crises are more likely to occur in countries that have liberalized their financial systems. This effect is however mitigated by a strong institutional environment, in particular respect for the rule of law, low corruption and good execution of contracts. These results are consistent with the idea that if liberalization is not accompanied by adequate prudential regulation and guarantee institutions to ensure effective control, it is likely to lead to excessive risk-taking and subsequent crisis. Similarly, empirical studies by Kuafmann (1999) and G. Htchison (2001) showed that financial liberalization can significantly increase bank fragility.

As Rossi (1999), he developed a long list of institutional and regulatory variables by limiting its sample of 15 developing countries. However, his conclusions on the impact of domestic financial liberalization (represented by the level of domestic interest rates) are in contradiction with those of Demirguc Kunt and Detragiache (1998). Indeed, he shows that liberalization reduces the risk of a banking crisis.

2.3. Weaknesses in accounting and disclosure

Although there are significant differences between economies, most analysts consider existing accounting systems, disclosure practices and legal framework, as an obstacle to the operation of market discipline and the exercise of supervision effective Banking Supervision.

Either private investors or banking supervisors will be able to monitor and discipline banks without accurate information about the creditworthiness of their customers. In many countries, the accounting classifications of bank assets as impaired or non-performing are not sufficient to

prevent the banks to make bad loans look good in paying more money for troubled borrowers "evergreening".

Distinguish whether the bank is healthy or unhealthy is often hampered by the lack of financial statements of the consolidated banks' exposure, the lack of uniform reporting requirements for banks in the same country, the lack of financial data on individual banks and by the scarcity of private credit ratings for banks in major economies (G Morris (1996)).

2.4. Institutional factors

The role of institutional factors affecting the banking fragility has been studied in depth. To this end, Demirguc-Kunt and Detragiache (1998) identify institutional development through the "Proxy GDP per capita" and show that the weaker institutional environments are linked to a greater likelihood of banking crises. About Mehrez and Kaufmann (1999), they investigated the effect of transparency on banking crises in financial markets liberalized and they found that countries with low transparency are more likely to experience banking crises following financial liberalization.

Another important feature of the institutional environment is the presence of an explicit deposit insurance scheme. While the explicit deposit insurance should reduce bank fragility by eliminating self panic director, she is also well known that this can create incentives for risk taking. Indeed, they find that deposit insurance is associated with a higher probability of banking crises in a large sample of countries, particularly if the bank interest rates are deregulated and the institutional environment is weak. In addition, the impact of deposit insurance on bank fragility varies depending on the system design, that is to say, it is possible to reduce the moral hazard with a better design.

2.5. Political systems

Political considerations can play a very important role in government decisions to deal with insolvent institutions. Indeed, Krozner (1997) shows that the dissemination of information on the costs of inefficient government policy ensures competition between interest groups, thereby increasing the transparency of government decisions allowing the entry of foreign banks, thereby reduce the cost of crises. Keefer (1999) finds that the determinants of banking crises are significantly different in countries with high levels of checks and balances compared to countries with lower levels. Jo (2006) argues that the type of political regime affects the timing of the financial crisis, and to control for this effect, the author includes a number of variables that

capture different aspects of the country's political system. Thus, institutions in countries with a long democratic history have more political capital to implement adjustment policies to restore financial stability.

Second, political instability increases uncertainty on the economic and financial policies of the government and can increase uncertainty in financial markets. Therefore, Demirguc-Kunt and Detragiache (1997) recommend that countries that do not have a sound legal system and good governance could have problems in the financial system due to corruption or ineffective enforcement.

However, most studies deal with the determinants of banking crisis as a homogeneous cause. This implicitly means that there are significant (in a model "Pooled") must be meaningful to all individual crises. According to Kaminsky and Reinhart (1999), most banking crises follow a common pattern of causes and consequences. For this purpose, banking crises are initiated by deregulation measures that lead to the rapid expansion of credit: it increases asset prices, bubbles burst and there is a disruption in asset markets (especially for real estate). This is accompanied by an increase in non-performing loans, credit losses and severe liquidity problems in the banking system. Finally, governments should bail out the weak banking system recapitalization operations and large-scale nationalization.

Klomp (2010) shows that there is significant heterogeneity in the causes of banking crises, as the impact of different determinants between systemic non-systemic crises and the level of economic development. In general, he finds that the credit growth rate of GDP growth and real interest rates are the most important causes of a banking crisis. In addition, he shows evidence that the increase in the ratio M2 / exchange reserves is a factor of a banking crisis.

3. Methodology

3.1. The banking crisis variable

The aim of our research is to investigate the determinants of banking crises for a set of emerging and developed countries from 1970 until 2012. To this end, we adopted the list of Leaven and Valencia because it contains information relating to the global banking crisis of 2008.

Table 1 in Appendix I presents our sample of countries with the dates of banking crises identified by the studies of Laeven and Valencia.

Several studies have determined the occurrence of a banking crisis: Caprio and Klingebiel (2003), Detragiache and Spilimbergo (2001), Kaminsky (2006), Kaminsky and Reinhart (1999), Laeven and Valencia (2008,2010,2012), Levy Yeyati and Panizza (2011), Reinhart and Rogoff (2008,2011). Indeed, these documents do not constitute a universal definition of the banking crisis for various reasons. First, while some studies identify episodes of crises using a variable and variable threshold (Kaminsky and Reinhart (1999), Kaminsky (2006)), other studies (Caprio and Klingebiel (2003), Laeven and Valencia (2008)) using the literature (see Table 2). Second, some studies do not cover all countries because of their specific orientation also due to various limitations of data.

Finally, there is considerable divergence when a particular crisis is over (it is generally easier to find information on the exact time of onset of a crisis) since all indicators are gradually returning to normal levels.

Thus, let Y_{it} the dummy variable of banking crisis that takes a unit value when a banking crisis is identified in country i at time t and zero otherwise.

$$Y_{it} = \begin{cases} = 1 & \text{If } \textit{crise} \\ = 0 & \text{Otherwise} \end{cases} \quad (1)$$

The dependent variable takes the value of the unit in the first year of the crisis and zero otherwise. Since episodes of banking crises occur over a long period (on average four years), Demirguc-Kunt and Detragiache (1998a) suggested retaining only the first year of the banking crisis.

3.2.econometric specification

Econometric research on systemic banking crises has grown rapidly in recent years and a large literature has developed theories to motivate early warning signals of banking crises. In this article, it is to identify the most useful early warning indicators by the Bayesian model (BMA) which is characterized by uncertainty by considering different combinations of models and therefore, it has the advantage of minimizing subjective judgment of the investor in determining the optimal set of early warning indicators.

To this end, we apply this model to a set of 15 macroeconomic, financial, accounting and external variables selected on the basis of literature review and data availability. We consider the linear regression model as follows:

$$y = \alpha_y + X_y\beta_y + \varepsilon \text{ And } \varepsilon \sim (0, \sigma^2 I) \quad (2)$$

Where:

y : is a binary variable indicating the starting date of the crisis

α_y : Is a constant

X_y : Denotes the subset of relevant independent variables

β_y : is a vector of coefficients

ε : a white noise error term

The K number of potential independent variables gives 2^k potential models. The index is used to refer to a specific model among the 2^k models. An average is then calculated from information from the model using the posterior probabilities of the model implemented by Bayes' theorem:

$$P(M_y|y, X) \propto P(y|M_y, X) * P(M_y) \quad (3)$$

Where $P(M_y|y, X)$ is the posterior probability of the model that is proportional to the marginal likelihood of the model $P(M_y|y, X)$ times the model priori probability $P(M_y)$.

The relevance of an exogenous variable in explaining the endogenous variable is given by the posterior inclusion probability (PIP). The PIP designates the likelihood that a given variable is included in the regression. It is calculated as follows:

$$PIP = P(\beta_y \neq 0) = \sum_{\beta_y \neq 0} P(M_y|y) \quad (4)$$

The variables with a high PIP (0.5 or greater) is considered as robust determinants of the dependent variable.

3.3. Data and properties

Our sample consists of 29 countries, including 15 developed and 14 emerging (see Table 1, Appendix). We use panel data with annual frequency for the period 1970-2012. According to this criterion, 516 annual observations are identified.

The data used in our estimation include 15 macroeconomic, financial, accounting and external independent variables. The first category includes variables macroeconomic indicators: gross domestic product (CPIB), the rate of change in real exchange rate (VTCR) and the rate of change of consumer prices (inflation).

The second category comprises financial indicators, which includes the growth of credit to private sector (créditpriv), credit to the public sector as a percentage of GDP (créditgov) and the ratio of bank loans / deposits (credit deposit ratio).

The third category is derived from the accounting ratios used to evaluate the financial health of a bank. Thus, we consider the ratio of capital over total assets (ratiocapital), the ratio of income relative to total assets (roa), the ratio of nonperforming loans to total gross loans (ratiopnp) and the cost ratio to income ratio (ratio of cost income).

Finally, the last category of external variables include: the M2 money as defined in relation to reserves (M2tores), the terms of trade relative to GDP (openness), the rate of growth of exports as% of GDP (export) foreign direct investment (fdi) and the flow of foreign private capital as% of GDP (detteexter).

The main sources of data underlying indicators are extracted from the World Development Indicators of the World Bank, IMF and Bankscope. Table 2 of the Annex summarizes the independent variables, the data source and the theoretical expected sign between the dependent variable and each independent variable.

The analysis of descriptive statistics (see Table 4, Appendix) shows that the number of observations of the independent variables varies from one variable to another due to data availability. In addition, we found that some variables have very large fluctuations relative to other variables during the study period.

At the end of overcoming the problems of co linearity, we conducted a selection process to exclude variables whose correlation with another independent variable is greater than or equal to 0.5. To this end, we performed the Pearson correlation test to test the null hypothesis of no correlation. This test is intended to exclude from the econometric regression, variables that capture the same information and have, on the one hand, the correlation coefficients that are statistically significant, and on the other hand, are more involved in the problems of co linearity (see table 5, Appendix).

Thus, since there is a strong significant correlation between capital ratio and creditpriv (0.5733), non-performing ratio and roa (0.59) & cost / income ratio and roa (0.5623), then it is best to remember that the following variables : CPIB, VTCR, inflation, créditgov, ratio credit / deposit M2tores open, export and fdi.

4. Empirical results

We recall that the aim of this study is to identify the determinants of banking crises for the sample of countries studied based on the logit model to assist supervisors in establishing an early warning system early.

We begin by presenting the adjustment variables in the logit model (see Table 6, Appendix). Model 1 of Table 6 shows that a decrease in the growth rate of GDP (CPIB) and a higher rate of change in real exchange rate (VTCR) are associated with a high probability of occurrence of banking crises. Thus, this result implies that these macroeconomic variables are probably related to the weakening of the banking system.

When regressing the dependent variable Y_{it} on all macroeconomic and financial variables (model 2), the coefficient of the variables growth rate (CPIB) and the rate of change in real exchange rate (VTCR) retain their robustness with financial variables that are private credit growth and the public as a percentage of GDP (with a positive and significant coefficient). This indicates that an increase in the share of these coefficients is associated with a high occurrence probability of banking crises.

By adding external variables next macroeconomic and financial variables in the third model, we note that, on the one hand, macroeconomic and financial variables retain their robustness in terms of early warning indicators of banking crises, and Moreover, external variables such as external debt as a percentage of GDP and the currency under M2 relative to reserves (M2tores) increases the predictive power of crises. This indicates an increase in external debt to GDP ratio is a factor associated with an outbreak of banking crisis (Similarly for M2tores).

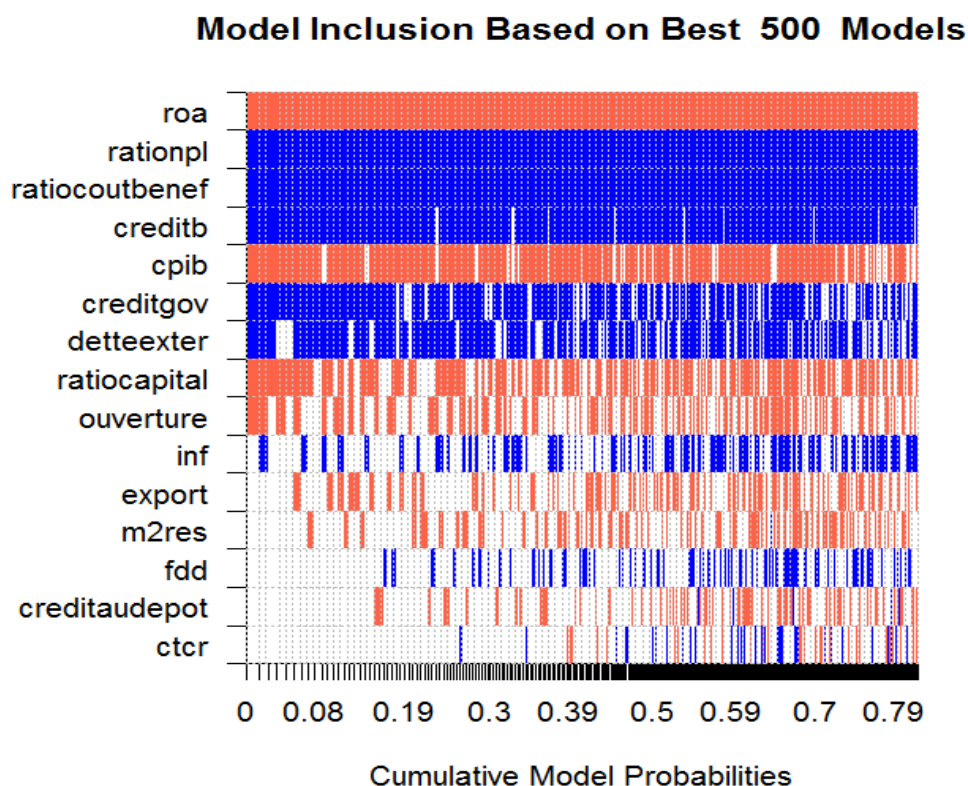
As for model 4, it has a better predictive power than the model 3 (see Table 6, Appendix). Indeed, it emits more early warning than the model 3 (72.58% against 48.74%). Similarly, Model 4 also has the lowest ratio noise / signal is 0.36 against 0.77.

In light of these econometric tests, it appears that the accounting variables allow bank supervisors to scrutinize the characteristics of the banking crisis that is likely to trigger, and have a more relevant factor in explaining banking crises. These results confirm the findings of previous studies (Mannasoo and Mayes (2005)).

To identify the most effective indicators of banking crises while taking explicitly into account the uncertainty of the model, Bayesian model BMA specificity to be the most suitable, since it combines the indicators and in choose the best combination.

To this end, the results of the estimation of the BMA model are illustrated in Figure 1. Posterior inclusion probability (PIP) and the mean and the posterior variance of the parameters are given in Table 7 of Annex.

Figure 1 Estimation results of the first regression BMA:



Note: Rows = potential determinants of systemic banking crises, Columns = best models according to marginal likelihood, Full cell = variable included in model, blue = positive sign, red = negative sign.

The regression results indicate that banking crises in these countries studied are characterized by a growth ratio results by asset ratio (roa), strong growth in the ratio of non-performing loans over total loans (rationpnp) and an increase cost / income ratio.

Again, the main results of this combination highlight the important role of accounting variables in the occurrence of banking crises. On macroeconomic variables, only the variable gross domestic product (CPIB) has a PIP greater than 0.5, or (PIP = 0.77) with a negative coefficient, which proves that this is a key factor triggering banking crises.

Nevertheless, this result is not consistent with the work of Valencia and Laeven (2012), which support the hypothesis that no significant loss of production were recorded in the case of systemic banking crises.

Among the financial variables in this study, only variables private and public credit as a percentage of GDP have PIP over 0.5, respectively equal to (PIP = 0.9566) and (PIP = 0.7088) with positive coefficients. These results are consistent with the theoretical and empirical literature on the determinants of banking crises, including work and Artera Eichengreen (2002), Borio and Lowe (2002), Alessi and Detken (2011) which show that high credit growth domestic and public are factors that increase the likelihood of crises.

According Demirgüç-Kunt and Detragiache (1998-2005), excessive domestic credit growth is a determinant of occurrence of a banking crisis, as it encourages risk taking by banks. This reflects deterioration in loan quality and the high proportion of non-performing loans which increases the probability of a systemic banking crisis.

As for external variables, the variable external debt relative to GDP has more than 0.5 PIP or (PIP = 0.6546) with a positive coefficient, which shows that this variable is an important determinant of banking crisis. In fact, this result was proved by Carmen Reinhart and S.Rogoff (2011) has shown that this variable is a history of banking crisis.

In conclusion and through these two econometric specifications, we have shown that accounting variables play a fundamental role in explaining the onset of banking crises.

5. Conclusion

The objective of this study is to highlight the symptoms and determinants of systemic banking crises for a set of emerging and developed countries over the period 1970-2012. To do this, we relied on four independent variables: macroeconomic, financial, accounting and external.

The main results of this study highlight the important role of accounting variables in the occurrence of banking crises. Indeed, it appears that lower income compared to total assets (roa), a low ratio of non-performing loans (ratio_{npn}) and a lower / cost ratio Revenue (cost income ratio) are associated with high probability of crisis because they have the lowest noise signal ratio and the highest percentage of crises correctly predicted.

Certainly, the use of BMA model was used to determine the probability of each explanatory variable in determining banking crises because it considers different combinations of models and

minimizes the subjective judgment of investors in determining the optimal set of early warning indicators.

However, the results of this paper can be developed and improved in several directions: first, our article requires the use of sub-annual data frequency (monthly or quarterly) to have a large number of observations. And secondly, it would be useful to study from models of Markov regime switching.

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Appendix

Table 1: List of countries with the respective dates of banking crises:

No.		Country	Date of crisis	EU	OCDE
1		Germany	2008-2011	EU	OCDE
2		Austria	2008-2011	EU	OCDE
3		Belgium	2008-2011	EU	OCDE
4		Denmark	2008-2011	EU	OCDE
5		USA	1988*; 2007-2011		OCDE
6		Finland	1991-1995	EU	OCDE
7		Greece	2008-2011	EU	OCDE
8	Developed countries	Ireland	2008-2011	EU	OCDE
9		Italy	2008-2011	EU	OCDE
10		Japan	1997-2001		OCDE
11		Netherlands	2008-2011	EU	OCDE
12		Rayaume Kingdom	2007-2011	EU	OCDE
13		Spain	1977-1981; 2008-2011	EU	OCDE
14		Sweden	1991-1995; 2008-2011*	EU	OCDE
15		Korea	1997-1998		OCDE
16		Argentina	1980-1982; 1989-1991; 1995*; 2001-2003		
17		Brazil	1990-1994*; 1994-1998		
18		Chile	1976; 1981-1985		OCDE
19		Colombia	1982; 1998-2000		
20		Indonesia	1997-2001		
21		Malaysia	1997-1999		
22	Emerging countries	Mexico	1981-1985; 1994-1996		OCDE
23		Peru	1983		
24		Philippines	1983-1986; 1997-2001*		
25		Sri Lanka	1989-1991		
26		Thailand	1983; 1997-2000		
27		Turkey	1982-1984; 2000-2001		OCDE
28		Uruguay	1981-1985; 2002-2005		
29		Venezuela	1994-1998		

Notes : * non-systemic banking crisis

Source : Laven & Valencia (2012, P. 24-26)

Table 2. Sources and data description:

	Categories	Indicators	Descriptions	Sources	expected signs
1	Variable banking crisis	ICB_t	Binary variable constructed from the work of Laeven and Valencia (2008, 2010, 2012).		
			Independent variables		
2	Macroeconomic variables	cpib	Growth of gross domestic product.	IFS	-
3		vtr	Percentage change in real exchange rate	IFS	+
4		inflation	Rate of change of consumer prices	IFS	+
5	Financial variables	créditpriv	Growth of private sector credit	WDI	+
6		Créditgov	Credit to the public sector as a percentage of GDP	IFS	+
7		credit deposit ratio	Ratio of bank loans / bank deposits	IFS	+
8	Accountants variables	ratiocapital	Ratio of capital to total assets	Bankscope	-
9		roa	Ratio returns on assets	Bankscope	-
10		ratiopnp	Ratio of non-performing loans / total gross loans	Bankscope	+
11		ratiocoutrevenu	Ratio cost to income	Bankscope	+

12	External variables	M2tores	M2/Reserves	IFS	+
13		Ouverture	Terms of trade to GDP	WDI	-
14		Export	Growth rate of exports as% of GDP	WDI	-
15		Fdi	Foreign direct investment portfolio as% of GDP	WDI	+
16		detteexter	Foreign Private Capital Holdings% of GDP	WDI	+

Table 3. Definition of banking crises:

NO.	Source	Definitions
1	Demirguç-Kunt (1998-2005)	Banking crises are defined when at least one of the following conditions is met: (1) the ratio of NPA (non-performing assets relative to total assets) exceeds 10% in the banking system, (2) problems in the banking sector lead nationalization of banks on a large scale and (3) the cost of the rescue operation is at least 2% of GDP.
2	Kaminsky and Reinhart (1999)	Banking crises are defined by two types of events: (1) bank runs that lead to the closure, merger or takeover by the public in one or more financial institutions sector, and (2) if there is no panic, closing, merging and government large-scale acquisition of a major financial institution (or group of institutions) marks the beginning of a series of similar results for other financial institutions. The dataset Panel (1970-1995) includes 26 episodes of banking crises in 20 countries.
3	Caprio and Klingebiel (2003)	A systemic banking crisis is defined as "The total or a huge part of bank capital has been exhausted." The annual data set (1970-2002) contains information on 117 episodes of systemic banking crises in 93 countries and non-systemic banking crises in 45 countries.

4	Laeven and Valencia (2008-2010-2012)	<p>A banking crisis is considered systemic if two following conditions are met: (1) significant signs of financial distress in the banking system (losses in the banking system, bank liquidations ...) and (2) meaningful measures of intervention banking policy in response to significant losses in the banking system.</p> <p>The first year that both criteria are met is considered as the starting year of the banking crisis, and political interventions in the banking sector is considered significant if at least three of these measures were used: (1) a broad support liquidity, (2) the restructuring of the bank, (3) a significant bank nationalization, (4) significant safeguards in place, (5) major asset purchases.</p> <p>The annual data set (1970-2011) covers the importance of systemic banking crises (147 episodes) in over 100 countries around the world and provides information on strategies for crisis management.</p>
5	Reinhart and Rogoff (2008-2011)	The definition of the banking crisis is the same as Kaminsky and Reinhart (1999).

Table 4. Descriptive analysis:

Variable	Obs	Mean	Std. Dev.	Min	Max
fbindice	1247	0.0344828	0.1825388	0	1
cpib	1209	3.412988	3.744656	-13.1267	18.2866
Inf	1110	31.52707	257.3562	-4.47994	7481.66
Vtcr	1067	0.2391458	14.50662	-49.7118	182.158
creditpriv	1240	82.58818	58.40786	8.19606	346.21
creditgov	916	14.83116	13.67186	0.043	74.203
creditaudepot	1128	104.3205	39.63363	30.9429	313.3344
ratiocapital	376	7.952128	2.999172	2	16
roa	402	0.5746269	2.105841	-22	6
ratiopnp	380	5.505263	6.434773	0	49
ratiocoutrevenu	427	62.65088	21.7511	12.00397	290.5985
detteexter	1183	60.38377	62.06115	3	498
export	1189	6.979653	22.26972	-31.805	721.891
ouverture	1239	61.00609	37.10006	9.1023	220.407
m2res	1240	15.8829	38.43987	0.42765	656.961
fdd	1161	1.96284	3.371922	-6.71487	36.4308

Note: Moy, Std. Dev. et Max, Min, denote the mean, standard deviation, maximum and minimum.

Table 5. Correlation matrix:

	Cpib	inf	ctcr	créditpri v	créditgov	créditdépo t	ratiocapita l
Cpib	1						
inf	-0.1557*	1					
ctcr	-0.3022*	-0.0349	1				
créditpriv	-0.2288*	-0.0725*	0.0055	1			
créditgov	-0.1346*	-0.0238	0.0066	0.4837*	1		
créditdépot	-0.037	-0.0291	0.0316	0.2230*	-0.1760*	1	
ratiocapital	0.2340*	0.2141*	-0.0609	-0.5733*	-0.2126*	-0.3776*	1

Suite :

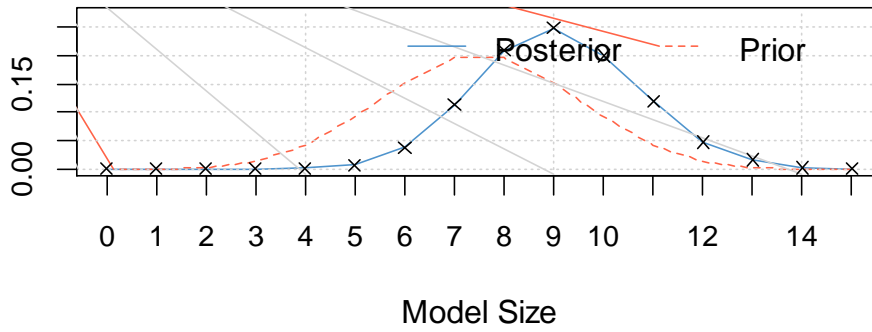
	roa	ratio pnp	ratio coutre	dette exte	export	ouverture	M2res	fdi
roa	1							
ratio pnp	-0.5901*	1						
ratio coutre	-0.5623*	0.4722*	1					
dette exte	-0.1489*	0.2456*	0.0926	1				
export	-0.023	-0.0033	-0.0046	0.1685*	1			
ouverture	-0.0823	0.0609	-0.2382*	-0.0817*	-0.0253	1		
M2res	-0.045	-0.1095*	-0.1735*	-0.0523	-0.0014	0.1592*	1	
fdi	0.0019	-0.1925*	-0.1480*	-0.0222	-0.0127	0.4578*	0.3114*	1

Note : * coefficients significant correlations at 5%.

Table 6. Estimation results of logit models of banking crises:

Predictive ability of the model of banking crises in the sample: (Cut-off=0.20)					
	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
% of correct predictions	87.78	86.62	86.15	88.74	89.55
% of crises correctly predicted	28.17	43.55	48.74	72.58	78.33
% false alarms	38.46	36.47	37.63	26.23	24.19
% conditional probability of crisis alert	61.54	63.53	62.37	73.77	75.81
% probabilité de crise conditionnelle a une absence d'alerte	10.47	10.45	10.17	7.33	6.31
Ratio noise/signal	1.36	0.83	0.77	0.36	0.31
Total observations	1039	755	693	293	268

Posterior Model Size Distribution
Mean: 9.0718



Posterior Model Probabilities
(Corr: 0.7206)

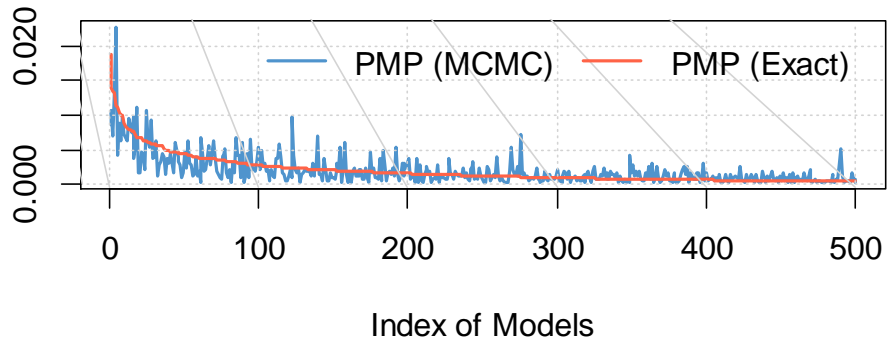


Table 7. BMA model results:**Total sample**

Dependant variable : ICB_t				
	PIP	Post Mean	Post SD	Cond.Pos.Sign
roa	1	-0.301163443	0.045858406	0
rationpl	1	0.502210658	0.093946636	1
rationcoubenef	1	0.020374456	0.005534813	1
creditb	0.9566	0.018158086	0.007351135	1
cpib	0.7714	-0.009104412	0.006683544	0
creditgov	0.7088	0.038011261	0.032315884	1
detteexter	0.6546	0.006323814	0.00591054	1
rationcapital	0.6114	-0.211188683	0.221534917	0
inf	0.49	0.022596214	0.034216814	0.99387755
export	0.4162	-0.013958933	0.024047559	0
ouverture	0.4026	-0.028134558	0.04455332	0
m2res	0.3738	-0.001189718	0.002490393	0.02461209
creditaudepot	0.2532	-0.009068397	0.042214235	0.20695103
fdd	0.251	0.002559655	0.007484288	1
ctcr	0.1822	-0.000200366	0.008151619	0.47530187