Does bank supervision impact nonperforming loans : cross-country determinants using agregate data ?

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Abstract

The paper empirically analyses the cross-countries determinants of nonperforming loans and the potential impact of regulatory factors on credit risk exposure. We employ aggregate banking, financial, economic and legal environment data for a panel of 59 countries over the period 2002-2006. Empirical results indicate that higher capital adequacy ratio and prudent provisionning policy seem to reduce the level of problem loans. We also report a desirable impact of private ownership, foreign participation and bank concentration. Our findings do not support the view that market discipline leads to better economic outcomes and to reduce the level of problem loans. In contrast, all regulatory devices either exert a counterproductive impact on bad loans or do not significantly enhance credit risk exposure for countries with weak institutions, corrupt business environment and little democracy.Our results are interesting for regulators, bankers and investors as well. To reduce credit risk exposure, the effective way to do it is through enhancing the legal system, strengthening institutions and increasing transparency and democracy, rather than focusing only on regulatory and supervisory issues.

Key words: *Banks, Nonperforming loans, Financial system stability, Banking regulation*
JEL classification: *G21, G28*

1 Introduction

Despite ongoing efforts to control bank lending activities, non performing loans (NPL) are still a major concern for both international and local regulators. In this context, the aggregate rate of nonperforming loans is commonly used by international regulatory and supervisory bodies (IMF, World Bank and BIS) to assess the strength of the banking industry in each country.According to the Global Financial System Report (IMF, 2007), the aggregate rate of nonperforming loans varies considerably amongst countries with values ranging between 0.2% for Australia to 26.5% for Egypt, over the period 2002-2006.

In scholar studies, problem loans are often used as an exogenous variable to explain other banking outcomes such as bank performance, failures, and bank crises. However, a limited number of studies investigates problem loans as an endogenous variable (Sinkey and Greenwalt,1991; Kwan and Eisenbeis, 1997 and Salas and Saurina, 2002). In these studies NPL is explained either by bank specific or by macroeconomic factors. Recently, the interest on the determinants of nonperforming loans has been reconsidered by various authors, as data on problem loans became available. For instance, Breuer (2006), using Bankscope data, analyses the impact of legal, political, sociological, economic, and banking institutions on problem bank loans. Nevertheless, her study suffers from a representativeness bias due to the fact that Bankscope data on NPL are only available for a very limited number of countries and for a few numbers of banks. Babihuga (2007) explores the relationship between several macroeconomic variables and financial soundness indicators (capital adequacy, profitability and asset quality) based on country aggregate data. The limit addressed to this study is mainly methodological. Using various econometric approaches, results are not conclusive as the choice of the econometric method depends on the data structure. Finally, a new growing stream of literature, pioneered by Barth et al. (2004), investigates the impact of banking regulation and supervision factors on various banking outcomes, such as nonperforming loans. They do not however control for non regulatory determinants of banking outcomes.

The seminal works of Barth et al. (2004, 2006) highlighted the superiority of the private interest view over the public interest view in governing banking systems. According to the authors, market imperfections are preferred to political imperfections in regard to economic and financial outcomes. The debate over which of the two points of view is preferred is yet uresolved. Some continue to argue that empowering government regulation is the unique mean to overcome undesirable market imperfections. Others, stress out that a powerful government and control agencies are associated with inefficient economic outcomes.

The aim of this study is first to investigate the impact of bank industry factors on the aggregate rate of nonperforming loans. Based on an extensive literature review, we propose a model relating nonperforming loans to banking industry features. The baseline model is then used to examine the impact of the regulatory environment on reducing problem loans and hence banking sector fragility.

Our study contributes to the literature on problem loans in two ways. First, it examines aggregated data which best reflect the level of NPL of the banks in a country as opposed to individual data included in databases that suffer from the problem of representativeness. Second, to the best of our knowledge, no research has examined the impact of regulatory variables after controlling for bank industry factors that alter primarily problem loans (as in Barth et al., 2004).

We use aggregate NPLs data drawn from the Global Financial Stability Report (IMF, 2007) over the period (2002-2006). The final sample consists on a panel of 59 countries for which bank industry and regulatory data are available. The empirical results show that a high level of capitalization, a prudent provisioning policy, the concentration of the banking industry and the presence of foreign capital are the main factors that reduce the level of NPL. However, the presence of state participation in banks appears to be increasing problem loans. Furthermore, the results indicate that bank regulatory and supervisory variables, introduced one by one in the basic model, do not affect the level of NPL. These variables work properly only in a healthy legal and democracy environment.

The remainder of this paper is organized as follows. Section 2 reviews the existing literature on bank industry and regulatory determinants of nonperforming loans. Section 3 describes the data and the methodology. Section 4 and Section 5 respectively present and discuss the empirical results. Finally, section 6 concludes the paper.

2 Bank industry factors, supervision and nonperforming loans: literature review

2.1 Bank industry factors of nonperforming loans

Theoretically, the *capital adequacy ratio* might serve as a tool to control excessive risk taking by banks and to prevent them from being insolvent through recapitalization (Basel accord)**.** Banks with capital adequacy ratio (CAR) less than the regulatory minimum are forced to adjust their balance sheet to comply with the regulatory requirement either by raising more capital (holding assets constant) or reducing risk-weighted assets (holding capital constant). In fact, raising the level of capital relative to risky assets by either means could have a beneficial impact on the bank performance and soundness (Fries et al., 2002). Empirically, There is no consensus on the relation between capital adequacy and non performing loans. On one hand, Sinkey and Greenawalt (1991) show that banks with adequate capital ratio during the three years preceding the year of study experience lower rates of NPLs. On the other hand**,** banks with high levels of CARs might be encouraged to embark in riskier activities leading to riskier credit portfolios. Rime (2001) corroborates this argument. He puts forward that Swiss banks tend to increase their capital adequacy ratio, as it approaches the minimum regulatory level.

Loan loss provisions are regarded as a controlling mechanism over expected loan losses. Under backward-looking provisioning practice, where provisions are triggered by default incidents on loans, higher levels of nonperforming loans are associated with high rates of provisioning (Hasan and Wall, 2004). Banks anticipating high levels of capital losses might create higher provisions to decrease earnings volatility and to reinforce medium term bank solvency. Managers can also use loan loss provisions to signal the financial strength of their banks as the willingness of a bank to provision for loan losses is regarded as a strong belief in the future performance of the bank (Ahmad et al. 1999). The overall rate of provisioning reflects the general attitude of the banking system toward risk control.

Bank profitability may also determine the risk taking behavior of managers. Banks with high profitability are less pressured to revenue creation and thus less constrained to engage in risky credit offerings. At the same time, inefficient banks are more likely to experience high levels of problem loans. Poor management can imply weak monitoring for both operating costs and credit quality of customers, which will induce high levels of capital losses. Under this "bad management" hypothesis advanced by Berger and DeYoung (1997), managers lack competencies to effectively assess and control risks incurred when lending to new customers. Godlewski (2004) using the adjusted ROA as a proxy for performance, shows that banks profitability negatively impacts the level of non performing loans ratio. However, using a panel of 129 Spain banks during 1993-2000, Garciya-Marco and Robles-Fernandez (2007) find that higher levels of return on equity are followed by greater risk in the next period. They argue that profit-maximising policies will be accompanied by higher levels of risk.

State ownership seems to explain the behavior of risk taking of bankers and consequently the level of NPLs. Salas and Saurina (2002) argue that to enhance the economic development of the country, state-owned banks have more incentives to fund riskier projects and to allocate more favorable credits for small and medium firms. This inadequate risk taking behavior (compared to the return profile) will lead to a higher level of NPLs. Micco et al. (2004) report that state-owned banks tend to have higher levels of NPLs, due to their weak credit recovery capacity compared to privately owned banks. Others suggest that the interaction between private and state shareholding in the same bank could determine the risk level taken by banks. Hu et al. (2004) argue that unjustified risky behavior is lower when the two groups check and balance each other. In the opposite, when private and state shareholders collude (especially in societies with little civil disciplines), problem loans will be higher due to risky credit offering. Tian (2000) suggests that under conditions of market imperfection, due to a balancing mechanism between management incentives and bureaucracy forces, a mixed enterprise (joint shareholding of private and state owners) will maximize social surplus. Novaes and Werlang (1995) report lower performance for state controlled banks in Brazil and Argentina due to high proportion of problem loans given to government. Micco et al. (2004), examining 50000 financial institutions with different ownership types covering 119 countries, conclude that NPLs tend to be higher for banks with state ownership than for other groups. This is explained by the development mandate given to state-owned banks in developing economies. Hu et al. (2004) examining a panel of Taiwanese banks find a positive correlation between capital share owned by the state and the level of NPLs. Garciýa-Marco and Robles-Fernàndez (2007) examine the relationship between risk taking and ownership structure. They find that commercial banks (mainly private owned) are more exposed to risk than deposit banks (mainly state owned).

Foreign ownership is known to have a positive impact on banks' soundness. Levine (1996) suggests that foreign shareholding improves the supply and the quality of financial services, enhance the overall supervisory environment and ease the access to international financial markets. Brealey and Kaplanis (1996) report that the presence of foreign banks may enhance foreign direct investment in nonfinancial sector. Lensink and Hermes (2004) find that foreign ownership leads to improve human capital through foreign manager which brings better skills and technologies, in particular in developing countries. This international expertise will also lead to improve local competencies

through training and knowledge transfer. Empirically, Barth et al. (2002) find a negative effect of foreign ownership on nonperforming loans on a cross countries analysis. They highlight that foreign banks raise loan quality in a country and may lead to improve domestic banks credit quality. Micco et al. (2004), examining a panel of emerging countries, find that foreign controlled banks are more performant than domestic ones. At the same time, Boubakri et al. (2005) show that foreign participation reduces the level of risk taking amongst banks on a sample of 81 banks from 22 developing countries.

Finally, the banking *industry concentration* can also affect the credit risk taking among banks (Fernandez de Lis et al., 2000). In monopolistic banking markets, lending institutions are willing to charge higher interest rates in the future to recover the losses incurred today. In this situation, lower quality firms will obtain loans from banks which leads to an increase in the NPLs in the future. This will not happen in competitive markets where lower quality firms do not accept to be charged with interest rates above the market rates once their difficulties overcome. Petersen and Rajan (1995) find that in concentrated banking systems, younger firms (supposed to be of lower quality) are financed by banks in comparison to more competitive markets, where firms use other instruments, leading thus to a higher level of problem loans. At the same time, Breuer (2006) finds a small but a significant positive association between banking industry concentration and nonperforming loans.

2.2   Bank supervision and nonperforming loans

By its nature, the banking sector should be regulated and supervised to ensure the financial stability of the whole system. During the recent decades, the banking sector has experienced sharp changes. Several reforms regarding the banking regulatory and supervisory have been initiated since 1988 (Basel I) and reviewed in 2004 (Basel II). The question of what and how regulation influences the banking stability and soundness remains a great source of debate. In previous studies, there is no consensus on what type of regulations and supervisory practices promote bank development, enhance financial stability, and facilitate efficient corporate finance (Barth et al., 2004; Beck et al., 2006; Shaffer, 2008). In the remainder of this section, we examine the impact of the regulatory framework on problem loans. We use four variables related to the level of capital requirement, the official supervisory power, the market discipline, and the independence of supervisory authority.

Regulatory and supervisory bodies emphasize the positive role of capital stringency as a buffer against losses and hence failures (Dewatripont and Tirole, 1994). Empirical evidence suggests that this is not always the case. Barth et al. (2004) study the relationship between specific regulatory and supervisory practices and banking-sector development, efficiency and fragility. They find that stringent capital requirements are associated with fewer nonperforming loans but are not robustly linked with other banking outcomes. Pasiouras (2008) reports a positive association between technical efficiency and capital requirements, albeit not statistically significant in all cases. Other studies indicate that capital requirements increase, on the contrary, risk-taking behavior (e.g. Besanko and Kanatas, 1996; Blum, 1999). Godlewski (2004), reports that capital regulation in the banking industry is positively related to excess risk taking. The increased credit risk leads to an increase in the ratio of nonperforming loans. He explains that stringent constraints on capital imply additional pressure on assets returns, which could be done through higher risk taking. Pasiouras et al. (2006) find a negative relationship between capital requirements and banks' soundness as measured by Fitch ratings. Delis et al. (2008) examining a panel of transition countries, argue that capital requirements does not appear to have a statistically significant impact on productivity.

Granting broad powers to supervisors remain a subject of controversial debates. From a theoretical point of view, increased official supervisory power is beneficial for the development and the stability of the financial system. Barth et al. (2004) argue that, due to market imperfections, official supervision may constitute a better substitute to market failure and contribute to further stabilize the financial system. However, under specific circumstances, such as corrupt environment or lack of democracy and civil discipline, powerful supervision will hinder the performance and the efficiency of the financial system (Shleifer and Vishny, 1998; Levine, 2003). Barth et al. (2004) show that broader supervisory power is associated with higher problem loans and hampers bank development, especially inside closed political systems. Pasiouras et al. (2006) also find evidence for the negative impact of supervisory power and credit ratings.

Market discipline function has not received sufficient interest from researchers, although it is one of the pillar of the Basel II accord. Private monitoring promotion is considered to lead to more efficient banking sector, owing to accurate information disclosure (Hay and Shleifer, 1998) and less corruption of bank officials (Beck et al., 2006). Empirically, Barth et al. (2004) report no evidence of a relationship between enhanced information disclosure and other regulatory incentives and banking fragility. Recently, Barth et al. (2006) revisiting the

market discipline function, indicate that the positive impact of private monitoring on bank lending relies on the quality and the development of the legal system and the governmental institutions effectiveness. Demirguc-Kunt et al. (2008) find that sounder banks are located in countries where financial data on banks have to be reported regularly and accurately to regulators and market participants.

Finally, the independence of supervisory authorities is deemed to have an impact on problem loans. Theoretically, the independence of supervisory authorities is supposed to lead to healthier financial system, as political interference in monetary policies is shown to have various undesirable consequences. Barth et al. (2006) suggest that the extant to which bank supervisors are politically and economically pressured or influenced, may condition disciplinary actions enforcement on banks. However, many policy makers are still opposed to such independency. They fear that this will lead to create states into states, particularly in developing economies. Hüpkes et al. (2006) advocate the need to draw up accountability on supervision agencies to promote their performance and enhance their legitimacy. Abrams and Taylor (2001), among others, stress the need to entrust bank supervision to central banks, which are considered to be more independent than banks supervision bodies, especially in emerging countries. Empirically, Donzé (2006) finds supervision independence to be positively associated to sounder banking systems. Klomp and Haan (2008) considering data for 70 countries, report a negative relationship between central bank independence and financial instability.

3 Data and methodology

3.1 Data

This study considers aggregated data on nonperforming loans. This choice is motivated by the fact that data on nonperforming loans for individual banks are available only for a very limited number of countries. As noted by Hasan and Wall (2004), only US banks provide full information on their financial outcomes and particularily on problem loans. They emphasize the challenges that face researchers examining nonperforming loans data on other countries. For instance, the Bankscope database, which provides the widest coverage of countries and banking organizations[1], suffer from representativeness bias. Breuer (2006) albeit considering only countries providing NPL data for at least four banks, information used don't represent the aggregate level of bad loans as published by the IMF. To our knowledge, except the study by Babihuga (2007), this paper pioneers the research work investigating the determinants of nonperforming loans at the aggregate level.

We use aggregate Financial Soundness Indicators (FSI) data drawn from the IMF Global Financial Stability Report (2007)[2], which provides a unique information set for 95 countries[3] during the period 2002-2006. We started our sample selection by considering all the countries available in the IMF Global Financial Stability Report 2007. We then excluded 19 countries for which informations on nonperforming loans, capital adequacy ratio, return on asset and provisions are missing. We further excluded 4 countries for which data on financial development, are missing in the financial development report. Finally, we excluded 12 countries not included in the World Bank (WB) database on regulations and supervision (Barth et al., 2001, 2006) or for which regulatory variables were not available. Table (1) illustrates these different treatments. The final data set includes 59 countries[4] for which data are available for all variables. This resulted in a data set of 295 country-year observations.

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[1] Full data on NPL are available only for the USA.
[2] Some missing data are collected from Central Banks reports of countries and individual reports of the IMF (FASP).
[3] Brazil was excluded from the full sample because it is characterized by high level of inflation even compared to others similars countries (Arestis et al., 2006).
[4] Australia, Belgium, Bolivia, Bulgaria, Canada, Colombia, CostaRica, Croatia, Czech Republic, Denmark, Egypt, El Salvador, Estonia, Finland, France, Germany, Ghana, Greece, Hungary, Iceland, India, Indonesia, Israel, Italy, Japan, Jordan, Kazakhstan, Kenya, Korea, Kuwait, Latvia, Lithuania, Malaysia, Mexico, Morocco, Nigeria, Norway, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Russia, Saudi Arabia, Slovak Republic, South Africa, Spain, Sweden, Switzerland, Thailand, Tunisia, Turkey, Uganda, United Kingdom, USA, Venezuela.

Table 1
Data construction

Missing Variables	Countries
Nonperforming loans	Albania, Montenegro, Romania, Austria, Malta, Lesotho, Rwanda, Sierra Leone
Capital adequacy ratio	Argentine, Albania, Montenegro, Ireland, China, Lesotho, Rwanda, Sierra Leone
Return on asset	Montenegro, Netherlands, China, Gabon, Lesotho, Rwanda, Senegal, Sierra Leone
Loan loss reserves to total loans	Guatemala, Albania, Bosnia and Herzegovina, Macedonia, Serbia, Malta, Netherlands, Ireland, Luxembourg.
Financial development[5]	Belarus, Dominican, Lebanon, Mozambique,
Regulatory and Supervisory variables	Namibia, Ukraine, UAE, Swaziland, Chile, Ecuador, Uruguay, Bangladesh, Hong Kong, Singapore Armenia, Georgia

3.2   Variables definition

We employ a sample of 59 countries over the period 2002-2006 to investigate bank industry determinants of nonperforming loans and the role of the supervisory framework. The bank industry factors include the one year lagged bank regulatory capital to risk-weighted assets minus the required minimum capital ($Difcar_{t-1}$). This measure is more appropriate than using the absolute level of the regulatory capital because it controls the differences in the regulatory minimum solvency ratio between countries. This category is composed also of the one year lagged loan loss reserves to total loans ratio ($Prov_{t-1}$), the one year lagged return on assets ratio (ROA_{t-1}), the percentage of state-owned banks ($State$), the percentage of foreign ownership ($Forg$) and the percentage of assets held by the five largest banks ($Conc$) as a measure for the bank concentration. Finally, we introduce two control variables : the lagged real GDP growth ($GDPgr_{t-1}$) and the level of financial development (Fin_Dev). Appendix 1 provides further details on variables calculations and sources of information.

To study the supervisory and regulatory environment, we use an assortment of indicators from the Barth, Caprio, and Levine (2001, 2004) database developed on 3 versions [6]. Since this database is available at only three points in time, we used information from Version 2 for the period 2002-2004, and from Version 3 for the period 2005-2006. A growing number of papers use the information contained in this data set to examine the impact of bank supervision and regulatory policies on bank performance, stability, and corporate finance (e.g., Beck et al., 2003; Demirguc-Kunt et al., 2003).

To test the effect of the regulatory and supervisory factors on problem loans, we include four variables. First, to account for both initial and overall capital stringency, we introduce the Capital regulatory index (Car_index), which is supposed to capture both the overall stringency (amount of capital) and the initial capital stringency (verifiable sources of capital) with higher values indicating higher capital stringency. The second variable is the supervisory power (Pow_sup), which indicates the ability of supervisors to exercise their power and get involved in banking decisions. Then, to capture the impact of private monitoring on problem loans, we use the ($Priv\_mon$), which indicates the degree of information that is released to officials and the public, auditing related requirements and whether credit ratings are required. A higher values indicating more private oversight. This first three variables may be seen as reflecting the three pillars of Basel II accord. Finally, the impact of the independence of supervision authority on nonperforming loans is captured through the variable ($Indep$), which indicates the level of independence of supervisory authority. Higher values signify greater independence.

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[5]   This variable is introduced as a control variable in the model. it measures "*the factors, policies, and institutions that lead to effective financial intermediation and markets, and deep and broad access to capital and financial services*" (Financial Development Report, 2008).

[6]   Survey 1, 2 and 3 established in 1999, 2001 and 2006, respectively.

3.3 Descriptive statistics

Summary descriptive statistics for the variables used in the empirical analysis are presented in Table (2)[7]. We note particularly that NPL rate presents a higher disparity between countries with a minimum of 0.2% and maximum of 26.5%. A similar pattern is observed for the provision variable ranging between 18.6 % and 276.9%. Furthermore, we remark that some countries have a negative GDP growth rate and/or negative banking performance with minimum values of -8.86% and -8.9% respectively. With regard to the ownership structure, foreign bank participation seems to be higher than state property with respectively mean values of 33% and 14%. Finally, banking systems tend to be strongly concentrated with an average of 66%.

Table 2
Descriptive statistics for nonperforming loans and bank industry variables

Variables	Mean	Median	Min	Max	SD
NPL	6.52	3.7	0.2	26.5	6.77
$Difcar_{t-1}$	5.33	4.70	-3.50	21.50	3.44
$Prov_{t-1}$	82.63	70.40	18.60	276.90	43.33
Roa_{t-1}	1.38	1.10	-6.10	8.70	1.27
State	0.14	0.04	0	0.92	0.21
Forg	0.33	0.21	0	0.99	0.30
Conc	0.66	0.67	0.14	1	0.19
$GDPgr_{t-1}$	4.08	3.91	-8.86	21.18	3.17

Where NPL is the aggregate rate of nonperforming loans, Difcar is the difference between the capital adequacy ratio and the minimum required, Prov is the bank provisions to nonperforming loans, ROA is Bank Return on assets, State is Government owned bank assets divided by total bank asset, Forg is Foreign-owned bank assets divided by total bank, Conc is Percentage of assets held by the five largest banks, GDPgr is the annual real growth rate of GDP.

The correlation matrix of the bank industry variables (appendix 3) shows statistically significant correlations between NPLs and all of the explanatory variables except for the one year lagged ROA and Foreign ownership. The coefficients indicate no significant correlations between the independent variables included. Descriptive statistics for regulatory variables are presented in table (4)[8] .

Table 3
Descriptive statistics for regulatory and supervisory variables

Variables	Mean	Median	Min	Max	SD
Pow_sup	11.24	11.5	5	15.5	2.55
Priv_mon	8.27	8	4	11	1.34
Indep	1.68	2	0	3	0.93
Car_index	5.52	6	2	9	1.72

Where Pow_sup is the official supervisory power, Priv_mon is the private monitoring index, Indep is the Independence of supervisory authority, and Car_index is the capital regulatory index.

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[7] Descriptive statistics by country are presented in appendix 2.
[8] Fore more details, see appendix 4 for summary statistics of regulatory and supervisory variables by country.

3.4   Methodology

To investigate the bank industry determinants of the aggregate nonperforming loans and the impact of supervisory environment, we use two specifications. The baseline model regresses the bank industry variables on nonperforming loans. Lagged GDP growth rate and financial development are use as control variables. The second specification examines the impact of bank regulation factors by reestimating the baseline model including each of the four regulatory variables. The baseline model is expressed as follows,

$$
\begin{aligned}
NPL_{it} \quad = \quad & \alpha_0 + \alpha_1 Difcar_{it-1} + \alpha_2 \Pr ov_{it-1} + \alpha_3 ROA_{it-1} + \alpha_4 State_{it} \\
& + \alpha_5 Forg_{it} + \alpha_6 Conc_{it} + \alpha_7 GDPgr_{it-1} + \alpha_8 Fin\_Dev_{it} + \varepsilon
\end{aligned}
\tag{1}
$$

Where NPL is the aggregated nonperforming loans to total loans ratio, $(Difcar_{t-1})$, is the one year lagged bank regulatory capital to risk-weighted assets minus the required minimum capital, $(Prov_{t-1})$ is the one year lagged loan loss reserves to total loans ratio, (ROA_{t-1}) is the one year lagged return on assets ratio , $(State)$ is the percentage of state-owned banks, $(Forg)$ is the percentage of foreign ownership, $(Conc)$ is the percentage of assets held by the five largest banks, $(GDPgr_{t-1})$ is the one year lagged real GDP growth rate, and (Fin_Dev) is a measure of the level of country financial development.

We use a pooled regression approach. Panel data combines both time series and cross-section data. First, it has the advantage to increase the number of observations, degrees of freedom and reduce collinearity among explanatory variables especially when the number of years is low. Second, pooling enables controlling for exogenous shocks common to all banks (time effects) and reducing the omitted variable bias (unit effects). However, simple pooled regression may not be well designed to capture relationships between dependant variable and explanatory variables[9]. This is due to the fact that pooled regression assumes homogenous behavior of endogenous variable for all individuals in the sample (same intercept and same slopes). This is not obviously the case for the variable NPL, as it varies considerably between countries and years. Several alternative estimation methods are more suitable for panel data (fixed and random effects). Using the Hausman test, the fixed effect specification is preferred. However, the use of fixed effects specification raises, two concerns. First, as noted by Haas and Lelyveld (2006), unit dummies are known to eliminate too much cross-sectional variance. Second, the inclusion of units dummies eliminate de facto time invariant exogenous variables and does not properly capture the impact of quasi time invariant variables (Beck, 2005). With regard to error structure, the fixed effects specification assumes that the error terms have a constant variance over time and are serially uncorrelated. Another possible solution would have been to include country-specific dummies to capture the fixed effects. This would have considerably reduced the degrees of freedom (Haas and Lelyveld, 2006). Moreover, the country-specific effect is captured through the inclusion of macroeconomic and structural variables related to the financial sector. To further control for possible differences between countries, we introduced a dummy variable for the level of financial development. Also, we are rather interested in making inferences with respect to population characteristics than in estimating the country-specific effect.

We also turned to test the heteroskedasticity and the autocorrelation problems. Contemporaneous correlation (i.e. the errors across cross-sectional units are correlated due to common shocks in a given time period), panel heteroskedasticity (i.e., the error variance differs across cross-sectional units due to characteristics unique to the units), and serial correlation (i.e., the errors within units are temporally correlated) characterize our data structure. Feasible generalized last squares$(FGLS)$ specification can be used after controlling for the heteroskedasticity and the autocorrelation problems. However, Beck and Katz (1995, 1996), advocate the use of the Panel Corrected Standard Errors $(PCSE)$ method to improve inferences by taking into account the complexity of the error process. Based on Monte Carlo studies, Beck and Katz (1995, 1996) demonstrate that $PCSE$ produces more reliable standard errors than $FGLS$ method.

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[9]   Hsiao test rejects the homogeneity of data structure.

4 Empirical results

Table (4) shows the empirical results of the basic model. Model 1 presents results for the baseline model. Model 2 to model 5 exhibit results for the regulatory factors. The estimated coefficients on the banking industry variables appears to be robust to the specification used. The regressions show evidence of a negative impact of the variable ($DifCar$) on the credit risk control suggesting that the capital adequacy ratio might be used as a regulatory device to mitigate banks excessive risk taking. In fact, it seems that the regulatory capital serves as an indicator of the financial risk exposure of the whole banking system. We find also a significant and negative relationship between nonperforming loans and lagged loan loss provisions rate ($Prov$). Countries with higher rates of problem loans exhibit lower level of provisions rates and *vice versa.* This contradicts the theoretical assertion, which predicts the use of provisions as a risk control tool and therefore to be positively related to problem loans. It appears that countries with low rates of nonperforming loans adopt a better provisioning policy (higher loan loss provisions). This may reflect the general attitude toward risk in the banking industry of each country. In countries where risk control is more effective and considered as an essential component of the bank strategy, loan loss provisions are used, among other means, to hedge future exposures to credit risk.

However, we do not find any evidence of the relationship between NPL and ROA. We give the following explanations to this surprising result. First, it is possible that the relation between performance and risk taking do not hold at the aggregate level, while it holds at the bank firm level. In fact, the overall performance of the banking system may hide severe variation in the individual performance of banks, while the aggregate level of nonperforming loans exhibit lesser variation. Second, the absence of any relation between performance and NPLs could be due to the inclusion in the sample of countries with different level of performance. In fact, while in developing economies, revenue creations pressures play a central role in shaping lending activities of banks, banks experiencing such pressures in developed countries do not necessarily embark in riskier lending offerings (in an aggregate level), as they may turn to other non credit revenues to respond to the revenue creation pressure.

The estimate coefficients on state property ($State$) are positive and significant. It appears that state-ownership rises the level of problem loans. This could be explained either by the development mandate given to state-owned banks, especially in developing countries, or by their weaker credit recovery capacities. These combined effects lead to higher credit risk taking and to increased defaults. This result corroborates that of Micco et al. (2004) who conclude that NPLs tend to be higher for state-owned banks on a panel of emerging countries.

Foreign participation ($Forg$) is found to have a positive effect on reducing the degree of bank problem loans. It appears that foreign ownership appears to contribute to the reduction of nonperforming loans This result corroborates the findings of Levine (1996) and Barth et al. (2002) who highlights the positive impact of foreign shareholding on financial outcomes. Another plausible explanation for this result is that banks with foreign participation are subject to more stringent control due to a more restrictive regulatory framework (from their home regulatory authorities) than domestic banks, which are supposed to have weaker institutions. Furthermore, as noted by Lensink and Hermes (2004), foreign ownership contributes to improve human capital and management efficiency as it brings better skill, technologies, and risk management practices, in particular in developing countries.

Finally, we find a negative relationship between bank concentration and the NPL. This result suggests, that in a concentrated banking market, risky borrowers cannot easily access to credit from large banks that monopolize the banking sector (Fernandez de Lis et al., 2000). On the other hand, in a non concentrated market, as competition among lenders increases it leads banks to relax the credit constraints and rises loans defaults occurrence.

We now turn to the investigation of the impact of the regulatory environment on problem loans. For all the specifications used, the main relations remain the same for all variables of the basic model, indicating the robustness of our previous results. However, all regulatory variables introduced are not significant. It seems that the regulatory channel is not the optimal device to reduce risk taking and hence problem loans. The ineffectiveness of all the statutory powers examined in our study corroborates the growing literature on the absence of any relationship between regulation and banking outcomes. However, as noted by several authors, the inefficacy of regulatory devices may be due to the fact that the measures used for regulatory variables used, as noted by Barth et al. (2006), "relate to statutory powers". Second, the efficacy of regulatory reforms depends mainly on the quality and the effectiveness of political and social institutions. The next section seeks to expose and to explain the different aspects related to this issue.

5 Discussion : explaining the ineffectiveness of regulatory devices

Hafeez (2003) stresses out that political institutions, corruption, rule of law and protection of property rights play a central role in the efficacy of regulatory reforms. As noted by Barth et al. (2006), strengthening official supervision will enhance the overall financial development. The previous studies dealing with banking regulation do not, however, consider whether the effective implementation of those regulations play any role in the efficacy of such policies. To further investigate the impact of regulatory and supervisory framework on problem loans, we introduced three interactions to account for possible effect of the political and legal environment on the effectiveness of regulation. We hence consider three factors : the level of corruption, the degree of democracy and the rule of law.

Barth et al. (2006) highlight that conventional official regulation and supervision do not improve banking outcomes, especially in countries with weak political institutions. They emphasize that empowering official supervision and regulation will lead to an increase in corrupt bank lending. Anderson (2004) supports this view. He finds that conventional government regulation is more likely to be counterproductive as regulators are less competent than bankers and are exposed to corruption and to political pressure. They end up by serving the interest of the banking industry and pressure groups either than serving the public interest. Corruption could also be present in privately owned banks especially in societies with little democratic traditions and civil discipline (Finkel et al., 2000; Johnson and Wilson, 2000). In such societies, decision makers are exposed to informal connections and other pressures from groups seeking for unjustified or illegal economic rents. The level of corruption is accounted for by the corruption perception index (CPI) which ranges from ten (squeaky clean) to zero (highly corrupt). To introduce the interactions terms, we constructed a dummy variable taking 1 for countries with CPI value less than 5 and 0 otherwise.

Table 4
Panel data regression of nonperforming loans

Indep variables	Model 1		Model 2		Model 3		Model 4		Model 5	
	Coef.	P.Val	Coef	P.Val	Coef	P.Val	Coef.	P.Val	Coef	P.Val
$Difcar_{t-1}$	-0.162	0.051*	-0.169	0.053*	-0.151	0.066*	-0.164	0.055*	-0.172	0.044
$Prov_{t-1}$	-0.043	0.000***	-0.043	0.000***	-0.040	0.000***	-0.045	0.000***	-0.043	0.000
Roa_{t-1}	0.197	0.306	0.197	0.311	0.216	0.285	0.213	0.281	0.206	0.283
State	4.688	0.024**	5.047	0.030**	4.194	0.027**	4.824	0.026**	4.837	0.029
Forg	-5.371	0.000***	-5.197	0.000***	-5.459	0.000***	-4.836	0.000***	-5.119	0.000
Conc	-7.137	0.008***	-7.227	0.005***	-7.936	0.031**	-6.223	0.009	-7.830	0.006
$GDPgr_{t-1}$	-0.078	0.154	-0.072	0.190	-0.082	0.136	-0.074	0.171	-0.076	0.166
Dev_fin	-7.275	0.000***	-6.947	0.000***	-6.950	0.000***	-7.372	0.000	-6.806	0.000
Car_index			0.060	0.252						
Pow_sup					0.085	0.421				
Priv_mon							0.133	0.138		
Indep									-0.163	0.161
Intercept	20.871	0.000***	20.536	0.000***	20.239	0.000***	19.116	0.000***	21.491	0.000***
R^2	0.5966		0.5888		0.5960		0.5932		0.5911	
Nb.Groups(Obs.)	59 (295)		59 (295)		59 (295)		59 (295)		59 (295)	

Where Difcar is the difference between the capital adequacy ratio and the minimum required, Prov is the bank provisions to nonperforming loans, ROA is Bank Return on assets, State is Government-owned bank assets divided by total bank asset, Forg is Foreign-owned bank assets divided by total bank asset, Conc is Percentage of assets held by the five largest banks, GDPgr is the annual real growth rate of GDP, Dev_fin is a dummy variable that takes 1 for financial developed countries and 0 otherwise, Pow_sup is the official supervisory power, Priv_mon is the private monitoring index, Indep is the Independence of supervisory authority and car_index is the capital regulatory index, ***, **and * indicate significance at 1%, 5%, and 10% levels, Method estimation is panel corrected standard errors.

On the other hand, Barth et al (2004) stress out that official supervision may be harmful to the development of the banking sector in countries with less political openness. According to Sobel (2003), the level of democracy which depends on the extant of political and civil freedom, will shape regulatory vulnerability to political and other groups pressures. In fact, democratic governments through countervailing forces and institutions will be constrained to pursue public interest (Tsebelis, 1995 and Eichengreen, 1998). The extant to which democracy and political participation shape economic outcomes is somewhat controversial. Wittman (1995), Pastor and Sung (1995) and Leblang (1997) argument that enhanced democracy precludes economic growth. Helliwell (1994) and Alesina and Rodrik (1994) suggest that democracy is negatively linked to economic outcomes. Finally, Keech (1995) and Clague et al. (1996) find mixed results. Barth et al. (2006) suggest taking into account the level of democracy in the country when evaluating the impact of supervisory independence on banking sector outcomes. The level of democracy is accounted for by the democracy index which ranges between 0 (authoritarian regime) and 10 (full democracy). Then, we constructed a dummy variable taking 1 for countries with democracy index value superior to 6 (democratic countries) and 0 otherwise (the Economist intelligence Unit's Index of Democracy, 2008).

Finally, the extant to which contracts and laws are enforced in the country may impact the efficacy of the implementation of both existing and newly implemented regulations. This is particularly true as the global economy is moving toward market based systems. On the other hand, Carothers (1998) notes that the rule of law is central to both economic development and democracy. Besides, international institutions are devoting considerable resources to strengthen legal institutions in several countries. To account for the level of law enforcement, we use the rule of law index developed by Kaufmann et al. (2008). It ranges between -2.5 (worst execution of laws) to 2.5 (best enforcement). We introduce a dummy variable that takes 1 for countries with values of rule of law index superior to median and 0 otherwise.

In contrast with Barth et al. (2006), who consider only the impact of these variables to examine their impact on bank crisis and other financial outcomes, we investigate this channel through the inclusion of interaction terms between the three political and business environment variables and each of the regulatory and supervision variables.

Results for the full model including each of the supervisory and regulatory variables together with the interaction terms are reported in table (5) through , (7). The main relations remain the same for all variables of the basic model (bank industry variables), indicating the robustness of our previous results.

Table (5) presents regression results after controlling for the level of corruption. It appears that in countries with little corruption, only the level of independence of the supervision authority seems to reduce the level of non-performing loans. The other three regulatory devices considered in our study have no significant impact on the level of problem loans. In this regard, we consider our results contradictory to those of Barth et al (2004 and 2006). In fact, they conclude for the superiority of the self-regulated systems (private interest view) based on the significance of the relationship between banking outcomes and the market discipline after controlling for the degree of corruption. Our results add inconsistency to this point of view which is, yet, confirmed by the 2008 crisis.

At the opposite, in corrupt systems the strength and the empowerment of regulation and official supervision seem to be counterproductive. All the interaction terms are significantly positive. It seems that in corrupt banking markets, where civil discipline is low and institutions are weak, the regulatory channel is not the optimal device to reduce risk taking and hence problem loans.

Table (6) exhibits the results of regressions after taking into account the level of democracy of a country. First, we find that the stringency of regulatory capital, official supervisory power and the independence of supervisory authority positively impact lending activities and hence reduces the level of problem loans in politically opened countries. In contrast, there is no support for the view that private monitoring boost financial stability. We consider our findings as an evidence (albeit not strong) against the view for the superiority of private interest view over the public interest view. Second, for countries with little democratic roots, the results show no significant impact of regulatory traits on the level of problem loans.

Table (7) reports the results for the regression using the interaction between regulatory variables and the rule of law. The results show clearly that in countries where laws are better enforced, regulatory devices seem to have a positive impact on the quality of loans. In contrast, in countries with weak rule of law, the stringency of regulatory capital and private monitoring have an adverse impact on problem loans and lending activities. There is however no support for any impact of the other two regulatory traits.

The empirical results are broadly corroborating the growing number of studies which suggest that there is no consensus as to what constitutes good regulation and supervision, or how specific regulations influence the performance and stability of the banking sector (see e.g. Barth et al., 2004; Beck et al., 2006; Demirguc-Kunt et al., 2008; Shaffer, 2008). Our results stress further the inefficacy of regulations

based on market discipline and indirect monitoring, especially in immature markets. Our results confirm that prior to regulation reforms, international institutions have to focus on enhancing market transparency, law enforcement, promoting healthy political institutions and increasing transparency and accountability.

Table 5
Panel data regression of nonperforming Loans (Interaction CPI)

Indep variables	Model 1		Model 2		Model 3		Model 4	
	Coef	P.Val	Coef	P.Val	Coef .	P.Val	Coef	P-Val
$Difcar_{t-1}$	-0.171	0.045**	-0.164	0.055*	-0.188	0.026**	-0.178	0.033**
$Prov_{t-1}$	-0.043	0.000***	-0.038	0.001***	-0.041	0.000***	-0.041	0.000***
Roa_{t-1}	0.231	0.271	0.263	0.227	0.270	0.230	0.254	0.222
State	4.075	0.046**	3.647	0.068*	3.331	0.102	4.114	0.041**
Forg	-5.325	0.000***	-5.193	0.000***	-5.193	0.001***	-4.816	0.000***
Conc	-5.130	0.010***	-6.250	0.019**	-6.929	0.008***	-5.954	0.001***
$GDPgr_{t-1}$	-0.095	0.124	-0.098	0.101	-0.098	0.089*	-0.096	0.126
Dev_fin	-6.196	0.001***	-6.181	0.000***	-5.712	0.002***	-6.395	0.000***
Car_index	-0.138	0.125						
Car_index * CPI	0.300	0.006***						
Pow_sup			-0.092	0.411				
Pow_sup*CPI			0.162	0.018**				
Priv_mon					-0.131	0.227		
Priv_mon *CPI					0.255	0.012**		
Indep							-0.600	0.001***
Indep*CPI							0.739	0.087*
Intercept	18.869	0.000***	19.261	0.000***	19.887	0.000***	19.455	0.000***
R^2	0.5810		0.5896		0.5836		0.5825	
Nb.Groups(Obs.)	59 (295)		59 (295)		59 (295)		59 (295)	

Where Difcar is the difference between the capital adequacy ratio and the minimum required, Prov is the bank provisions to non-performing loans, ROA is Bank Return on assets, State is Government-owned bank assets divided by total bank asset, Forg is Foreign -owned bank assets divided by total bank asset, Conc is Percentage of assets held by the five largest banks, GDPgr is the annual real growth rate of GDP, Dev_fin is a dummy variable that takes 1 for financial developed countries and 0 otherwise, CPI is a dummy variable taking 1 for countries with score corruption value inferior to 5 and 0 otherwise Pow_sup is the official supervisory power, Priv_mon is the private monitoring index, Indep is the Independence of supervisory authority and car_index is the capital regulatory index, ***, **and * indicate significance at 1%, 5%, and 10% levels respectively, Method estimation is panel corrected standard errors.

Table 6
Panel data regression of nonperforming Loans (Intraction Democracy)

Indep variables	Model 1		Model 2		Model 3		Model 4	
	Coef.	P.Val	Coef.	P.Val	Coef.	P.Val	Coef.	P.Val
Difcar_{t-1}	-0.124	0.139	-0.132	0.123	-0.144	0.073*	-0.135	0.100*
Prov_{t-1}	-0.043	0.000***	-0.042	0.000***	-0.045	0.000***	-0.043	0.000***
Roa_{t-1}	0.186	0.405	0.202	0.372	0.223	0.303	0.233	0.293
State	4.758	0.034**	4.639	0.035**	4.403	0.044**	4.002	0.035**
Forg	-3.675	0.000***	-3.449	0.001***	-3.531	0.002***	-3.365	0.001***
Conc	-5.269	0.045**	-6.489	0.040**	-5.803	0.024**	-6.142	0.003***
GDPgr_{t-1}	-0.071	0.222	-0.076	0.154	-0.072	0.186	-0.083	0.157
Dev_fin	-5.787	0.000***	-5.957	0.000***	-6.131	0.000***	-6.027	0.000***
Car_index	0.320	0.009***						
Car_index*Democ	-0.369	0.018**						
Pow_sup			0.094	0.329				
Pow_sup*Democ			-0.193	0.040**				
Priv_mon					0.269	0.079*		
Priv_mon*Democ					-0.216	0.070*		
Indep							0.647	0.135
Indep*Democ							-1.125	0.027**
Intercept	17.471	0.000***	19.152	0.000***	17.756	0.000***	18.846	0.000***
R^2	0.5863		0.5910		0.5858		0.5751	
Nb.Groups(Obs.)	59 (295)		59 (295)		59 (295)		59 (295)	

Where Difcar is the difference between the capital adequacy ratio and the minimum required, Prov is the bank provisions to nonperforming loans, ROA is Bank Return on assets, State is Government-owned bank assets divided by total bank asset, Forg is Foreign-owned bank assets divided by total bank asset, Conc is Percentage of assets held by the five largest banks, GDPgr is the annual real growth rate of GDP, Dev_fin is a dummy variable that takes 1 for financial developed countries and 0 otherwise, Democ is a dummy variable that takes 1 for democratic countries and 0 otherwise, Pow_sup is the official supervisory power, Priv_mon is the private monitoring index, Indep is the Independence of supervisory authority and car_index is the capital regulatory index, ***, **and * indicate significance at 1%, 5%, and 10% levels, method estimation is panel corrected standard errors.

Table 7
Panel data regression of nonperforming Loans (Interaction Rule of law)

Indep variables	Model 1		Model 2		Model 3		Model 4	
	Coef.	P.Val	Coef.	P.Val	Coef.	P.Val	Coef.	P.Val
$Difcar_{t-1}$	-0.151	0.068*	-0.154	0.088*	-0.182	0.042**	-0.162	0.050**
$Prov_{t-1}$	-0.041	0.000***	-0.040	0.000***	-0.040	0.001***	-0.039	0.000***
Roa_{t-1}	0.251	0.250	0.284	0.204	0.294	0.195	0.271	0.219
State	4.555	0.041**	3.907	0.053*	4.539	0.058*	4.315	0.058*
Forg	-4.945	0.001***	-4.196	0.002***	-4.606	0.001***	-3.514	0.000***
Conc	-4.424	0.015**	-5.323	0.030**	-6.410	0.003***	-4.673	0.000***
$GDPgr_{t-1}$	-0.079	0.177	-0.077	0.165	-0.077	0.164	-0.084	0.130
Dev_fin	-5.586	0.002***	-5.030	0.000***	-5.331	0.001***	-5.135	0.001***
Car_index	0.280	0.008***						
Car_index*RLaw	-0.429	0.006***						
Pow_sup			0.048	0.613				
Pow_sup*RLaw			-0.253	0.003***				
Priv_mon					0.287	0.063*		
Priv_mon*RLaw					-0.259	0.024**		
Indep							0.449	0.148
Indep*RLaw							-1.479	0.001***
Intercept	17.259	0.000***	18.512	0.000***	17.645	0.000***	17.082	0.000***
R^2	0.5908		0.5904		0.5994		0.6299	
Nb.Groups(Obs.)	59 (295)		59 (295)		59 (295)		59 (295)	

Where Difcar is the difference between the capital adequacy ratio and the minimum required, Prov is the bank provisions to nonperforming loans, ROA is Bank Return on assets, State is Government-owned bank assets divided by total bank asset, Forg is Foreign-owned bank assets divided by total bank, Conc is Percentage of assets held by the five largest banks, GDPgr is the annual real growth rate of GDP, Dev_fin is a dummy variable that takes 1 for financial developed countries and 0 otherwise, Rlaw is the rule of law index, Pow_sup is the official supervisory power, Priv_mon is the private monitoring index, Indep is the Independence of supervisory authority and car_index is the capital regulatory index, ***, **,and * indicate significance at 1%, 5%, and 10% levels, Method estimation is panel corrected standard errors.

6 Conclusion

In this paper, we proposed an empirical framework to investigate the bank industry factors and supervisory determinants of nonperforming loans on a cross-country basis. We propose a baseline model expressing problem loans in terms of bank industry specific variables. These variables capture many of the factors suggested by the theory and highlighted by case studies. Besides, to investigate the role of the regulatory framework on credit risk outcomes, we introduce variables on banks regulation and supervision. Finally, to assess the impact of the effective implementation of those regulations, we experiment interactions of three institutional variables (corruption, democracy and rule of law) with each of the supervision proxies.

Using aggregate data on a panel of 59 countries over the period 2002-2006 and robust econometric techniques, we find strong evidence on the association between NPLs and bank specific variables. Particularly, higher capital adequacy ratios and higher provision seem to reduce the level of problem loans. We also report a desirable impact of private ownership, foreign participation and bank concentration on the stability of the bank sector. Amongst the control variables, only financial development appears to explain the level of nonperforming loans. Economic conditions do not significantly impact bank credit outcomes.

Finally, we examine the extant to which regulatory and supervisory framework has a positive impact on credit risk exposure. Our primarily results indicate no support for any relation between official supervision and problem loans. This adds to the growing evidence against the effectiveness of such devices. However, our results suffer from the fact that the measures we used are, as noted by Barth et al. (2006), statutory variables. Thus, they do not address the issue of the effective implementation of supervisory reforms. To investigate this channel, we introduce three interaction using the level of corruption, the degree of political openness and the rule of law. All of these variables are supposed to have an impact on the efficacy of regulation.

Our findings do not support the view that market discipline will lead to better economic outcomes and to reduce the level of problem loans. In contrast, all regulatory devices either exert a counterproductive impact on problem loans or do not significantly enhance credit risk exposure for countries with weak institutions, corrupt business environment and little democracy.

Overall, our empirical analysis show that nonperforming loans are mainly driven by bank specific factors. Differences in capital adequacy ratios, provisions, bank ownership and the level of financial development could explain the way problem loans are accumulated in the countries of our sample. It appears also that to reduce credit risk exposure in countries with weak institutions, the effective way to do is through enhancing the legal system, strengthening institutions and increasing transparency and democracy.

Appendix 1 : Variables definition

	Definition	Source
NPL	Non performing loans to total loans	IMF Global Financial Stability Report 2007
Difcar	Bank Regulatory Capital to risk-Weighted Assets - required minimum capital	IMF Global Financial Stability Report 2007
Prov	Bank provisions to non performing loans	IMF Global Financial Stability Report 2007
ROA	Bank Return on assets	IMF Global Financial Stability Report 2007
State	Government-owned bank assets divided by total bank	Barth, Caprio and Levine Survey II (2002) and survey III (2006)
Forg	Foreign-owned bank assets divided by total bank assets	Barth, Caprio and Levine Survey II (2002) and survey III (2006)
Conc	Percentage of assets held by the five largest banks	Barth, Caprio and Levine Survey II (2002) and survey III (2006)
GDPgr	Annual real growth rate of GDP	World Bank dataset (2006)
Dev_fin	is a dummy variable taking 1 for countries with financial develomemnt index superior to median and 0 otherwise	Financial development report (2008) Values ranges between 1 and 7
Car_index	The sum of overall capital stringency and initial capital stringency.	Barth, Caprio and Levine Survey II (2002) and survey III (2006)
Pow_sup	indicates the ability of supervisors to exercise their power and get involved in banking decisions.	Barth, Caprio and Levine Survey II (2002) and survey III (2006)
Indep	The independence of supervisory authorities is the degree to which bank supervisors should be subject to political and economic policy pressure and influence.	Barth, Caprio and Levine Survey II (2002) and survey III (2006)
Priv_mon	Measures the degree to which the regulatory authorities require reliable information disclosure	Barth, Caprio and Levine Survey II (2002) and survey III (2006)
CPI	is a dummy variable that takes 1 for countries with score value inferior to 5 and 0 otherwise	The Transparency International Corruption Perceptions Index : The scores range from ten (squeaky clean) to zero (highly corrupt) (2008)
Democ	is a dummy variable that takes 1 for countries with values superior to 6 (democratic countries) and 0 otherwise	The Economist Intelligence Unit's Index of Democracy (2008), Value ranges between 0 and 10.
Rlaw	is a dummy variable that takes 1 for countries with value of rule of law index superior to median and 0 otherwise	Aggregate and Individual Governance Indicators Values range between -2.5 (worst governance) and 2.5 (Best governance) D. Kaufmann, A. Kraay, and M. Mastruzzi (2008).

Appendix 2 : Descriptive statistics by country

Country	NPL	$Difcar_{t-1}$	$Prov_{t-1}$	ROA_{t-1}	State	Forg	Conc	$GDPgr_{t-1}$
Australia	0.26	2.18	145.98	1.46	0.00	16.3	75.08	3.31
Belgium	2.34	4.68	53.48	0.54	0.00	21.0	89.32	2.02
Bolivia	13.68	5.12	73.40	0.12	2.68	35.0	71.10	3.61
Bulgaria	2.44	9.96	55.38	2.32	10.68	73.9	55.51	5.74
Canada	0.88	4.04	45.12	0.66	0.00	5.8	82.96	2.74
Colombia	4.92	4.02	115.08	1.84	17.10	20.1	45.40	4.43
Costa Rica	1.98	6.28	127.46	2.02	59.17	23.2	77.31	5.66
Croatia	7.6	6.72	65.32	1.56	4.35	90.1	69.68	4.85
Czech	5.1	5.74	69.42	1.16	3.28	87.8	67.60	4.54
Denmark	0.64	5.22	67.64	0.86	0.00	8.4	86.80	1.90
Egypt	24.06	2.28	60.60	0.58	65.50	16.7	61.64	4.36
Estonia	0.38	3.86	193.60	1.98	0.00	99.3	98.00	8.97
Finland	0.4	7.44	75.16	0.74	0.00	26.6	99.38	2.97
France	3.68	3.68	58.84	0.50	0.12	15.5	61.96	1.66
Germany	4.7	4.70	85.70	0.12	41.32	5.2	20.00	0.89
Ghana	15.6	5.86	60.16	6.42	15.66	51.5	81.14	5.52
Greece	5.4	4.20	50.68	0.66	22.80	10.8	70.58	4.31
Hungary	2.64	4.54	52.30	1.72	5.40	91.7	62.86	4.27
Iceland	1.82	4.30	76.98	1.46	0	0.0	100	4.42
India	7.02	3.36	51.14	0.86	74.76	7.1	42.04	7.63
Indonesia	17.1	11.86	122.28	2.14	38.48	39.7	50.79	5.10
Israel	2.34	1.22	56.07	0.68	27.66	1.2	91.16	3.46
Italy	6.26	3.04	56.05	0.58	9.72	7.9	53.80	0.87
Japan	4.52	3.20	29.10	0.00	0.00	5.5	47.84	1.76
Jordan	10.76	5.06	56.22	1.02	0.00	64.3	57.98	6.84
Kazakhstan	6.52	4.42	123.89	1.84	0.37	12.7	71.75	9.82
Kenya	11.38	5.56	89.10	1.64	0.66	39.0	57.82	3.93
Korea	1.78	3.96	98.94	0.76	31.50	40.0	69.74	4.83
Kuwait	5.62	7.74	77.08	2.26	0.00	0.0	87.98	9.74
Latvia	1.12	2.96	94.44	1.64	3.64	60.2	66.64	6.52
Lithuania	2.3	4.10	25.73	0.88	7.30	83.6	85.26	8.03
Malaysia	11.9	5.60	40.22	1.28	0.00	20.0	55.86	5.78
Mexico	2.52	6.68	172.58	1.52	0.00	81.6	80.51	2.81

Appendix 2: Descriptive statistics by country (continued)

Country	NPL	Difcar$_{t-1}$	Prov$_{t-1}$	ROA$_{t-1}$	State	Forg	Conc	GDPgr$_{t-1}$
Morocco	16.26	3.16	57.80	0.46	32.60	21.1	71.73	5.00
Nigeria	21.32	7.38	80.79	2.58	4.40	3.4	41.22	10.74
Norway	1.14	4.26	34.26	0.74	0.00	20.7	88.80	2.33
Oman	11.44	5.20	70.38	1.30	0.00	0.0	86.90	4.54
Pakistan	13.28	-1.92	64.48	1.48	19.80	47.9	54.00	6.01
Panama	2.22	10.00	138.63	1.60	12.00	56.3	24.80	5.96
Paraguay	12.2	9.18	50.70	1.48	91.50	83.5	56.73	3.02
Peru	4.16	4.00	69.66	1.14	4.97	42.8	84.42	5.69
Philippines	23.12	7.00	32.42	0.86	11.54	14.3	44.35	5.22
Poland	15.52	6.52	56.22	1.10	22.22	69.2	53.88	4.10
Portugal	1.9	2.20	73.00	0.78	23.68	17.0	82.56	0.74
Russia	4.04	7.80	126.88	2.74	36.70	8.6	43.20	6.60
Salvador	6.84	1.34	121.56	1.06	4.10	24.8	87.42	2.75
Saudi Arabia	4.18	11.32	139.08	2.60	20.76	20.7	70.60	4.68
Slovak	4.58	11.40	84.46	1.16	3.04	89.3	66.86	5.97
South Africa	1.94	2.62	52.44	0.88	0.00	16.4	80.88	4.41
Spain	0.86	4.50	214.88	0.92	0.00	9.2	53.20	3.31
Sweden	0.82	-0.20	74.78	0.82	0.00	0.0	75.76	3.17
Switzerland	0.96	4.36	95.04	0.70	13.10	9.9	73.24	1.69
Thailand	11.06	4.68	70.82	1.38	24.18	5.8	63.48	5.69
Tunisia	21.86	2.74	45.32	0.68	42.70	15.7	64.80	4.56
Turkey	4.74	16.98	75.92	0.28	31.82	3.5	55.64	7.22
USA	0.96	4.96	143.92	1.30	0.00	14.8	34.40	2.74
Uganda	3.5	7.90	85.92	3.90	0.00	75.7	71.21	5.67
United Kingdom	1.78	4.96	66.72	0.60	0.00	49.3	23.00	2.57
Venezuela	4.4	8.26	124.10	4.78	6.86	43.2	64.32	4.47

Where NPL is the aggregate rate of nonperforming loans, Difcar is the difference between the capital adequacy ratio and the minimum required, Prov is the bank provisions to nonperforming loans, ROA is Bank Return on assets, State is Government-owned bank assets divided by total bank asset, Forg is Foreign-owned bank assets divided by total bank Conc is Percentage of assets held by the five largest banks, and GDPgr is the annual real growth rate of GDP.

Appendix 3 : Correlation matrix for variables used

	NPL	Difcar$_{t-1}$	Prov	Roa$_{t-1}$	State	Forg	Conc	GDPgr$_{t-1}$	Pow_sup	Priv_mon	Indep	car_index
NPL	1											
Difcar$_{t-1}$	0.04	1										
Prov$_{t-1}$	-0.32***	0.13**	1									
Roa$_{t-1}$	0.03	0.27***	0.27***	1								
State	0.33***	0.10*	-0.10*	-0.05	1							
Forg	-0.05	0.21***	0.07	0.23***	-0.07	1						
Conc	-0.24***	-0.20***	-0.03	0.05	-0.25***	0.01	1					
GDPgr$_{t-1}$	0.09	0.09	0.15***	0.34***	-0.02	0.12**	0.04	1				
Pow_sup	0.25***	0.26***	0.15***	0.23***	0.25***	0.25***	-0.24***	0.22***	1			
Priv_mon	-0.17***	0.02	0.08	-0.25***	-0.14**	-0.12**	-0.16***	-0.14***	-0.12**	1		
Indep	-0.02	-0.08	-0.13**	0.04	-0.04	0.28***	-0.03	0.12**	0.31***	-0.05	1	
Car_index	0.03	0.03	0.07	0.09	-0.03	-0.09	-0.07	0.12**	0.11*	0.00	0.18***	1

Where NPL is the aggregate rate of banks nonperforming loans, Difcar is the difference between the capital adequacy ratio and the minimum required, Prov is the bank provisions to nonperforming loans, ROA is Bank Return on assets, State is Government-owned bank assets divided by total, bank asset, Forg is Foreign-owned bank assets divided by total bank, Conc is Percentage of assets held by the five largest banks, GDPgr is the annual real growth rate of GDP, Pow_sup is the official supervisory power, Priv_mon is the private monitoring index, Indep is the Independence of supervisory authority and car_index is the capital regulatory index.

Appendix 4 : Descriptive statistics for regulatory variables by country

Country	Car index (CarIndex)	Supervisory power (PowSup)	Independence (Indep)	Private Monitoring (PrivMon)
Australia	5.8	11.8	2.6	8.4
Belgium	4.2	10.4	2	7.6
Bolivia	4	10.8	2	7.6
Bulgaria	7	11	3	7.6
Canada	3	11	2.4	8.8
Colombia	4.2	13.6	0	9
Costa Rica	5.6	13	0.4	7.6
Croatia	4	11.2	2.4	8.2
Czech	5.2	8.8	2.6	7.6
Denmark	5.8	9.4	0.8	8.8
Egypt	4	14	2.6	8.4
Estonia	5	13	2	7
Finland	4.6	6	2	9.6
France	5.4	7.6	1	7.4
Germany	5.4	8	1	9
Ghana	6	12.4	1.4	5.2
Greece	5.2	11.2	1.6	8.4
Hungary	6	14.2	3	9.6
Iceland	6.8	5	0	8
India	7	10	2	8
Indonesia	7	15	2	10
Israel	5.6	7	1	8.8
Italy	4	7	0.8	8.6
Japan	5	11.4	1.4	9.2
Jordan	6.6	14	2.2	8
Kazakhstan	7	12	1	7.4
Kenya	6.6	13.3	2	9.2
Korea	3.4	12	1.6	9
Kuwait	7.4	9.6	2	10
Latvia	5.6	13	3	8.4
Lithuania	3.6	11	2	8.2
Malaysia	4.2	11	2.4	8.8
Mexico	6	8	0.4	10
Morocco	5.2	12.7	1	8.6
Nigeria	6.6	12.4	2.6	7.2
Norway	7.2	8.6	2.4	8
Oman	6	12	0	7
Pakistan	9	14	3	9
Panama	4.6	11.4	1	7.4
Paraguay	4	14	2	7
Peru	3.8	12	1.6	7.6
Philippines	5.8	11.8	1	8.2
Poland	3.6	8.4	0.8	8.6
Portugal	7.4	14	3	7

Appendix 4 : Descriptive statistics for regulatory variables by country (continued)

Country	Car index (CarIndex)	Supervisory power (PowSup)	Independence (Indep)	Private Monitoring (PrivMon)
Russia	6.8	11.5	2	7.2
Salvador	3.6	10.4	1	9.2
Saudi Arabia	4.4	13.6	1.4	9.4
Slovak	5.4	13.6	1.6	6.8
South Africa	7.2	6	1.6	9.4
Spain	9	10	1.4	8.4
Sweden	2.8	6.8	2	8
Switzerland	6.4	14	2.2	8.2
Thailand	4.8	9.4	0	9.4
Tunisia	7	13	2	5
Turkey	6	15.5	1	9
USA	5.4	13.6	2.4	11
Uganda	8	15	3	7
United Kingdom	6.4	11	1.8	10.6
Venezuela	3.2	11.8	1	6.6

Where Pow_sup is the official supervisory power, Priv_mon is the private monitoring index, Indep is the Independence of supervisory authority, and Car_index is the capital regulatory index.

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