

Banking Crises, Bank Regulation and Intervention

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This cross-country analysis examines whether specific regulatory and supervisory practices and intervention policies are associated with the possibility of the recent banking crisis in countries. In general, countries significantly increase restrictions on bank regulatory capital requirement after global financial crisis but banking crisis countries do not significantly change their regulatory and supervisory structure to better prevent the next crisis. The empirical results show that (a) greater restrictiveness on bank activities and supervisory practices that strengthen the rights of private sector monitors of banks regulations decrease the likelihood of banking crisis, (b) capital regulatory stringency is positively correlated with higher likelihood of banking crisis; and (c) capital regulatory stringency is positively correlated with lower likelihood of systemic banking crisis; and both private monitoring and official supervisor power are positively associated with higher likelihood of systemic banking crisis when the authors only consider systemic banking crisis countries.

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1. Introduction

Many policy recommendations, regulatory proposals, and global financial stability reports emphasize the importance of financial reforms in the banking system. In response, some countries have employed a broad range of intervention policies to restore the banking system to health in the aftermath of the crisis. As these reforms made in response to the financial crisis are implemented and with many countries in the process of implementing Basel III with its increased liquidity and capital requirements, it is not clear these reforms will prevent future banking crises.

Given the role that banks have played in crises over time and in countries worldwide, researchers continue exploring several aspects of banking crises. It is interesting to examine the evolution of regulations during global financial crisis since the causes of earlier banking crises may differ from the causes of more recent banking crises mostly experienced in advanced economies. Regulatory policymakers around the world may be asking the same questions. This cross-country analysis provides information of whether specific regulatory and supervisory practices were associated with lower likelihood of the crisis in countries and thereby enhanced bank stability. Specific questions to be answered in this research are as follows. Did the bank regulatory/supervisory environment in some countries function better than in others to mitigate the likelihood of the crisis? Were the interventions that took place during the crisis associated with some regulatory/supervisory environment? Finally, have the

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policy responses in countries that suffered the most been toward regulations and supervisory practices that were more effective in reducing the severity, if not completely avoiding, the crisis? All of these are important questions that merit answers. Such information should be valuable to policy makers in countries everywhere as they consider and implement reforms.

The empirical results indicate that (a) greater restrictiveness on bank activities and supervisory practices that strengthen the rights of private sector monitors of banks regulations decrease the likelihood of banking crisis, (b) capital regulatory stringency is positively correlated with higher likelihood of banking crisis; and (c) capital regulatory stringency is positively correlated with lower likelihood of systemic banking crisis; and both private monitoring and official supervisor power are positively associated with higher likelihood of systemic banking crisis when the authors only consider systemic banking crisis countries. Further, countries with fewer bank activity restrictions were more likely to intervene during the crisis by introducing a guarantee on bank liabilities, acquiring assets from banking institutions, taking over the systemically important financial institutions or injecting a majority stake of capital in such institutions over the period of 2007–2011. Finally, the authors find evidence that lower levels of bank competition, higher bank stability, and lower levels of interest margins are positively associated with the likelihood of banking crisis.

This paper will help better understand whether regulation and supervision in some countries made a difference in terms of bank stability. In general, the results suggest that increasing capital requirements, as many countries did following the crisis, will do little to enhance bank stability in the event of a similar crisis. In addition, the countries experiencing a banking crisis did not significantly change their regulatory and supervisory structure to better prevent the next crisis.

The paper proceeds as follows. In Section 2, the authors review literature on banking crises, research related different regulatory and supervisory database, and regulatory interventions. Section 3 describes and discusses the data and methodology used and provides summary statistics for the variables used in the empirical analysis. Section 4 provides and discusses the results. Section 5 provides conclusions.

2. Literature Review

A broad body of research has been conducted to provide potential answers on causes, consequences, and resolution of financial crises. (Caprio & Daniela 1996; Kaminsky & Reinhart 1999; Caprio, Klingebiel, Laeven & Noguera 2005; Claessens, Klingebiel & Laeven 2005; Claessens, Pazarbasioglu, Laeven, Dobler, Valencia, Nedelescu & Seal 2011; Schularick & Taylor 2012). Indeed, banking crises are a worldwide phenomenon and systemic banking crises are especially contagious and costly. In this regard, Kroszner, Laeven & Klingebiel (2007) support for the existence of a credit channel operating through the banking system and provide evidence of larger output losses experienced in advanced economies are to some extent driven by deeper banking systems that rely heavily on external sources of finance [1]. Recently, Laeven and Valencia (2008, 2010, 2012, and 2013a) provide a new comprehensive database on systemic banking crises and information on policy responses to resolve them. In particular, they point out that recent crises display some important differences with earlier crises, and have been concentrated in advanced economies with large and

integrated financial systems and these economies tend to increases in public debt and experience larger output losses [2].

There are relatively few studies of bank regulations and banking crises due to the fact of the data constraints on several aspects of bank regulations in time series across countries. With one exception of regulations about deposit insurance, there is strong evidence of explicit deposit insurance increase the likelihood of banking crises and the problem of moral hazard appears in banking sector (Demirgüç–Kunt & Detragiache 2002; Demirgüç–Kunt & Huizinga 2004; Anginer, Demirgüç–Kunt & Zhu 2012a) [3]. Also, Cihak & Tieman (2008) examine quality of regulation and supervision by using data from IMF-World Bank assessments of countries' compliance with international standards and codes. Abiad, Detragiache & Tressel (2008) provide Financial Reform Database to cover seven aspects of financial sector policy. Kaufmann, Kraay & Mastruzzi. (2009 and 2010) introduce Worldwide Governance Indicators to cover six dimensions of governance structure such as regulatory quality and government effectiveness.

Most importantly, Barth, Caprio, & Levine (2001) provide the first comprehensive database to cover a wide range of characteristics associated with bank regulation and supervision worldwide based upon a survey of 117 national bank regulatory and supervisory authorities. Bart, Caprio & Levine (2004, 2006, and 2008) find that some regulations and supervisory practices enable countries to lower the likelihood of a country suffered a banking crisis during the 1990s. Their findings show that generous deposit insurance schemes, barriers to foreign-bank entry, restricting bank activities, and restrictions on making loans abroad are positively associated with bank fragility. However, it is not clear whether specific regulation and supervisory continue affecting the likelihood of a banking crisis during 2007–2009. It is interesting to examine whether the relationships have changed in response to the recent global financial crisis. Although the relationship between bank stability and bank regulations has been examined in Barth, Caprio & Levine (2004 and 2006), this paper identifies not just which regulatory variables are associated with a crisis during the global financial crisis, but also associated with different types of regulatory intervention.

Recently, there is a growing literature to explore the role of bank regulations during global financial crisis. Lee and Lu (2015) use multivariate difference-in-difference model to investigate the changes of bank outcomes and regulations. Their results support Basel II's first and third pillars: capital requirements and private monitoring. Caprio, D'Apice, Ferri & Puopolo (2014) find evidence that countries with a higher level of restrictions to bank activities and private monitoring and with a more concentrated and traditional banking system in terms of higher level of net interest margin and lower credit-to-deposit ratio had a lower probability of suffering the crisis in 2008. Laeven (2011) provides a review of the literature on banking crises and suggests that financial stability can be enhanced by making banking regulation more macro-prudential and improving market discipline. Furthermore, Masciandaro, Pansini, & Quintyn (2011) examine the relationship between supervisory systems economic resilience and find that governance and quality of regulation played an important role of economic growth [4]. Cubillas, Fonseca & Gonzale (2012) examine the effect of banking crises on market discipline and find that market discipline weakens after a banking crisis. Anginer, Demirgüç–Kunt & Zhu (2012b) investigate the relationships between bank competition and systemic stability and find evidences that entry barriers, activity restrictions, supervisory power and private monitoring are associated with lower systemic fragility. Cihak, Demirgüç -Kunt, & Johnston (2013) examine

the role of regulation and supervision during the crisis and argue that weaker regulatory and supervisory frameworks leading to the crisis can be improved by private monitoring incentives.

Throughout the world, intervention policy responses to the recent financial crisis in attempt to reduce to cost of banking crises have taken place in many countries [5]. Cecchetti, King & Yetman (2011) examine the relationship between cross-country variation and a country's macroeconomic performance over 2007–2009 and find that the result of pre-crisis policy decisions reduced the severity of the crisis, but also suggest that good luck too played a part. Laeven and Valencia (2013b) collect comprehensive cross-country data on resolution policies and find evidence that bank recapitalization policies have a significant and disproportionate effect on the growth of financially dependent firms in 50 countries during the recent financial crisis, while other intervention policies such as guarantees, asset purchases, and liquidity support do not [6]. Cabral (2013) assesses the recent policy response to the crisis such as Dodd-Frank Act and the Basel III Capital and Liquidity Accord and argues that the increase in large banks' financial leverage- possible cause of the financial crisis was due to misguided changes in the regulatory framework implemented in the 1990s. Lu and Whidbee (2016) examine the characteristics of U.S. banks that were the target of intervention in the form of bailout during the recent financial crisis.

The authors extend this literature in two ways: first, the authors investigate whether specific bank regulations and supervisory practices that reduced the likelihood of a country suffering a crisis during global financial crisis; second, the authors examine the role of bank regulatory and supervisory approaches on policy interventions.

3. Data, Methodology, and Explanatory Variables

3.1 Data

The main bank regulatory and supervisory data used in this study is from the work of Barth, Capiro & Levine. Those unique indexes have been widely used in banking research (see Barth, Capiro & Levine, 2001, 2006, 2008 and 2013 for a detailed analysis and a detailed description of the construction of the indexes). The authors focus on six major indexes, introduced in the next session (Table 1) [7]. The data for banking crises and government interventions is from Laeven and Valencia (2008, 2010, 2012, 2013a, and 2013b), and the data on financial indicators is from the World Bank Global Financial Development Database [8]. Table 2 shows a list of country the authors used in this paper and their participation of four surveys, banking crisis status (systemic cases or borderline cases), and government policy interventions during the global financial crisis.

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Table 1: Bank regulatory and supervisory indexes

| | | Capital Regulatory Index | Private Monitoring Index | Official Supervisory Power | Entry into Banking Requirements | Restrictions on bank activities | Government -Owned Banks |
|--|--|--------------------------------|--------------------------------|----------------------------------|---------------------------------------|---------------------------------------|-------------------------------|
| All surveys | All countries participating in surveys | 6.255 | 7.779 | 10.944 | 7.663 | 10.161 | 16.904 |
| | Countries included in this paper | 6.17 | 8.253 | 10.835 | 7.465 | 9.234 | 15.842 |
| All countries in this paper | Survey I | 5.725 | 7.824 | 10.61 | 7.261 | 8.827 | 21.737 |
| | Survey II | 6.147 | 8.377 | 10.793 | 7.261 | 9.093 | 13.564 |
| | Survey III | 5.854 | 8.423 | 11.025 | 7.596 | 10 | 13.128 |
| | Survey IV | 6.943 | 8.378 | 10.915 | 7.759 | 9.02 | 15.391 |
| Banking crisis countries | Survey I | 6.087 | 7.348 | 10.426 | 7.542 | 7.783 | 16.37 |
| | Survey II | 6.338 | 7.958 | 10.641 | 7.411 | 8.458 | 8.996 |
| | Survey III | 6.365 | 8.273 | 10.574 | 7.792 | 8.727 | 8.053 |
| | Survey IV | 6.682 | 8.286 | 10.806 | 7.826 | 7.81 | 15.341 |
| Non- banking crisis countries | Survey I | 5.429 | 8.214 | 10.745 | 7.056 | 9.655 | 25.659 |
| | Survey II | 6 | 8.724 | 10.903 | 7.152 | 9.6 | 17.429 |
| | Survey III | 5.474 | 8.533 | 11.353 | 7.455 | 10.933 | 16.629 |
| | Survey IV | 7.129 | 8.441 | 10.993 | 7.71 | 9.867 | 15.433 |

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Table 2: Government interventions during the global financial crisis

| Country | Banking crises | | Government intervention policies | | | | |
|---------------------|----------------|------------------|----------------------------------|------------------|----------------|------------------|----------------|
| | Systemic cases | Borderline cases | Systemic cases | Borderline cases | Systemic cases | Borderline cases | Systemic cases |
| Argentina | | | | | | | |
| Australia | | | X | X | | | |
| Austria | X | | X | X | X | X | X |
| Belgium | X | | X | X | X | X | X |
| Brazil | | | X | X | | X | |
| Canada | | | X | | | X | |
| Chile | | | | | | | |
| China | | | | | | | |
| Colombia | | | X | | | | |
| Croatia | | | X | | | | |
| Czech Republic | | | X | | | | |
| Denmark | X | | X | X | X | X | X |
| Finland | | | X | X | X | | |
| France | | X | X | X | X | | |
| Germany | X | | X | X | X | X | X |
| Greece | X | | X | X | X | X | |
| Hong Kong, China | | | | X | | | |
| Hungary | | X | X | X | X | X | |
| Iceland | X | | X | X | X | | X |
| India | | | X | | | | |
| Indonesia | | | X | | | | |
| Ireland | X | | X | X | X | X | X |
| Israel | | | | X | X | | |
| Italy | X | | X | X | X | | |
| Jamaica | | | | | | | |
| Japan | | | X | X | X | X | |
| Kazakhstan | | X | X | | X | | X |
| Kenya | | | X | | | | |
| Korea | | | X | X | X | X | |
| Latvia | X | | X | X | X | X | X |
| Lithuania | | | | | | | |
| Luxembourg | X | | X | X | X | | X |
| Malaysia | | | | X | X | | |
| Mexico | | | X | | | | |
| Morocco | | | X | | | | |
| Netherlands | X | | X | X | X | X | X |
| New Zealand | | | X | X | | | |
| Nigeria | X | | X | X | X | X | X |
| Norway | | | X | | X | X | |
| Pakistan | | | X | | | | |
| Peru | | | X | | | | |
| Philippines | | | X | | | | |
| Poland | | | X | X | | | |
| Portugal | | X | X | X | X | | |
| Russia | | X | X | X | X | X | |
| Singapore | | | X | X | | | |
| Slovenia | | X | X | X | | X | |
| South Africa | | | X | | | | |
| Spain | X | | X | X | X | X | |
| Sri Lanka | | | X | | | | |
| Sweden | | X | X | X | X | | |
| Switzerland | | X | X | X | X | X | |
| Taiwan | | | X | X | | | |
| Thailand | | | | X | | | |
| Turkey | | | X | | | | |
| Ukraine | X | | X | | X | | X |
| United Kingdom | X | | X | X | X | X | X |
| United States | X | | X | X | X | X | X |
| Number of countries | 16 | 8 | 49 | 35 | 29 | 21 | 14 |

3.2 Methodology

To this point, the existing research suggests a potential relationship between a country's regulation and supervision and the likelihood of a country suffering a crisis. The primary interest is in how regulation and supervision impact the likelihood of banking crises and intervention policies. The authors further examine the two most recent surveys, completed in 2007 and 2011, to investigate the changes in bank regulations in countries that have taken place and investigate whether they differ between those countries that suffered a major banking crisis and those that did not. Furthermore, the authors are interested in whether specific regulatory and supervisory practices reduced the likelihood of banking crisis and what types of government intervention policies associated with specific bank regulatory and supervisory structures.

Specifically, this paper investigates whether capital regulations, restrictions on bank activities, official supervisory power, government ownership of banks, private monitoring of banks, and entry into banking requirements affect the likelihood of a country suffering a major banking crisis since 2006 and the likelihood of specific intervention policies put in place during the period of 2007–2011. Specifically, the authors use a series of logit regressions to examine the relation between bank regulations in pre-crisis situation (Survey III) and banking-system stability and policy interventions during the global financial crisis over the period of 2007–2011. In banking crises model, the dependent variable equals to one if a country suffered a banking crisis during 2007–2011. In intervention model, the dependent variable equals to one if a country put in place an intervention policy such as liquidity support, guarantees on liabilities, restructuring, asset purchases, or nationalizations.

3.3 Variable Definitions

3.3.1 Outcome Variables for Logit Regressions

1. *Crisis*, an indicator where a country suffered a systemic banking crisis over the period of 2007–2011. Laeven and Valencia (2008, 2010, 2012, and 2013a) consider a systemic banking crisis to be that both country's banking system experienced significant signs of financial distress (measures as either (i) more than 20 percent of nonperforming loans or at least 20 percent of banking system assets closed or (ii) fiscal restructuring costs of the banking sector exceed 5 percent of GDP) and at least three significant policy interventions took place in response to significant losses (including extensive liquidity support, at least 5 percent of deposits and liabilities to nonresidents; deposit freezes and /or bank holidays; significant bank nationalizations; gross bank restructuring costs, at least 3 percent of GDP; significant guarantees on bank liabilities; and significant asset purchases, at least 5 percent of GDP). The authors consider banking crisis countries in both systemic cases and borderline cases that almost met as a systemic crisis but not met intervention policy criteria.
2. *Liquidity*, an indicator where a country used emergency liquidity support over the period of 2007–2011. Liquidity support includes central bank claims on deposit money banks and liquidity support from the Treasury to demand deposits, other deposits, and liabilities to nonresidents.

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3. *Guarantees*, an indicator where the government introduced a guarantee on bank liabilities (either a full protection of liabilities or on non-deposit liabilities) in a country over the period of 2007–2011.
4. *Restructuring*, an indicator where restructuring costs directed to the financial sector, excluding liquidity support and asset purchase, such as recapitalization, in a country over the period of 2007–2011.
5. *Asset purchase*, an indicator where a special entity or the central bank acquired assets from banking institutions over the period of 2007–2011.
6. *Nationalizations*, an indicator where the government in a country took over the systemically important financial institutions or injected a majority stake of capital of such institutions over the period of 2007–2011.

3.3.2 Regulation and Supervision Variables

1. *Capital regulation*, an index of regulatory oversight of bank capital. It measures the extent of regulatory requirements regarding the amount and the source of capital and whether the authorities verify the source of capital (Range: 0~10, with higher values indicating greater stringency).
2. *Private monitoring*, an index that measures the degree to whether there are incentives and ability for the private sector to monitor banks (Range: 0~12, with higher values indicating greater private monitoring).
3. *Official supervisory power*, an index of the power of the official supervisory authorities. It measures the extent to which the authorities have the power to take specific actions to prevent and correct problems (Range: 0~14, with higher values indicating greater power).
4. *Entry into banking requirements*, an index of regulatory entry barriers. It measures the strictness of specific legal requirements for obtaining a license to operate as a bank (Range: 0~8, with higher values indicating greater stringency).
5. *Restrictions on bank activities*, an index of regulatory restrictions of bank activities. It measures the limitations in the ability of banks to engage in securities, insurance, and real estate activities, and to own and control nonfinancial firms (Range: 4~16, with higher values indicating greater restrictiveness).
6. *Government-owned banks*, a percent of the banking system's assets government owned.

4. Empirical Results

The goal of this paper is to understand how countries have changed their bank regulations and supervisory practices in a way that promotes a more safe and sound banking system. As a first step in the role of regulation structure in banking crises, the authors employ univariate analysis of mean differences for major categories of bank regulatory and supervisory practices, the six bank indexes the authors use in this paper [9]. Table 3 provides nonparametric tests for

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differences in the average regulatory and supervisory indexes by Survey III (before global financial crisis) and Survey IV (after global financial crisis) for all countries, the banking crisis countries and non-banking crisis countries [10].

Table 3: Nonparametric tests for differences in the average regulatory and supervisory indexes

Panel A: All countries by survey III and IV

| | Survey III | Survey IV | Kruskal-Wallis test |
|---------------------------------|------------|-----------|---------------------|
| Capital regulation | 5.854 | 6.943 | 7.96*** |
| Private monitoring | 8.423 | 8.378 | -0.05 |
| Official supervisory power | 11.025 | 10.915 | 0.0 |
| Entry into banking requirements | 7.596 | 7.759 | 0.23 |
| Restrictions on bank activities | 10.0 | 9.02 | -3.39* |
| Government -owned Banks | 13.128 | 15.391 | 1.19 |

Panel B: Survey III and IV by banking crisis countries and non-banking crisis countries by survey

| | Survey III | | | Survey IV | | |
|---------------------------------|----------------|--------------------|---------------------|----------------|--------------------|---------------------|
| | Banking crises | Non-banking crises | Kruskal-Wallis test | Banking crises | Non-banking crises | Kruskal-Wallis test |
| Capital regulation | 6.365 | 5.474 | -2.72* | 6.682 | 7.129 | 0.83 |
| Private monitoring | 8.273 | 8.533 | 0.5 | 8.286 | 8.441 | 0.76 |
| Official supervisory power | 10.574 | 11.353 | 1.9 | 10.806 | 10.993 | 0.13 |
| Entry into banking requirements | 7.792 | 7.455 | -1.05 | 7.826 | 7.71 | -0.26 |
| Restrictions on bank activities | 8.727 | 10.933 | 9.23*** | 7.81 | 9.867 | 7.98*** |
| Government -owned banks | 8.053 | 16.629 | 0.86 | 15.341 | 15.433 | 0.47 |

Panel C: For banking crisis countries and non-banking crisis countries by survey III and IV

| | Banking crises | | | Non-banking crises | | |
|---------------------------------|----------------|-----------|---------------------|--------------------|-----------|---------------------|
| | Survey III | Survey IV | Kruskal-Wallis test | Survey III | Survey IV | Kruskal-Wallis test |
| Capital regulation | 6.365 | 6.682 | 0.40 | 5.474 | 7.129 | 9.34*** |
| Private monitoring | 8.273 | 8.286 | 0.00 | 8.533 | 8.441 | -0.04 |
| Official supervisory power | 10.574 | 10.806 | 0.28 | 11.353 | 10.993 | -0.19 |
| Entry into banking requirements | 7.792 | 7.826 | 0.00 | 7.455 | 7.71 | 0.35 |
| Restrictions on bank activities | 8.727 | 7.81 | -1.99 | 10.933 | 9.867 | -2.63 |
| Government -owned banks | 8.053 | 15.341 | 3.57* | 16.629 | 15.433 | -0.00 |

Panel A of Table 3 indicates there is a significant increase in regulatory restrictions on capital requirements regarding the amount and the source but there is a significant decrease in restrictions on bank activities after global financial crisis. Panel B in Table 3 show that bank regulatory and supervisory practices were relatively less strict on capital adequacy requirements, greater private monitoring, greater official supervisory power, fewer requirements on enter into banking sector, greater restrictions on bank activities, and higher percent of government-owned banking systems in non-banking crisis countries than in banking crisis countries before global financial crisis. These regulation comparisons remain the same, with one exception that non-banking crisis countries increase restrictions on bank capital such

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as minimum capital requirement or regulatory approach to assessing and verifying the degree of capital and have greater stringency on capital regulations than non-banking crisis countries after global financial crisis (shown in Panel C of Table 3).

Not surprisingly, a significant increase in government-owned banks in banking crisis countries is probably due to the fact that significant intervention policies such as asset purchases or nationalizations put in place during and after global financial crisis. However, banking crisis countries do not change their regulatory and supervisory structure to improve bank stability, performance and development. Overall, significant differences for capital regulation and restrictions on bank activities between banking crisis countries and non-banking crisis countries suggests that these bank indexes may have had different impact on their likelihoods of banking crisis.

To this point, the univariate analysis suggests a relationship between a bank regulation structure and the likelihood of bank stability. The authors estimate logit regressions in an effort to identify the likelihood of banking crises and interventions and to assess the role of the bank regulatory and supervisory practices identified to this point. Table 4 shows logit regression results for the banking crisis and intervention policy models. The dependent variables are either banking crisis (Models 1-2) or government intervention policy (Models 3-7), which is indicated in the first row [11]. Unlike the research of Barth, Caprio & Levine (2004 and 2006) [12], the authors control for the level of banking efficiency (Interest margin) [13] and bank competitiveness of a banking system [14], measured by the ratio of the five largest banks' assets to total banking system assets (Bank concentration). The authors also include Z score [15], the inverse of the probability of insolvency, with a higher value indicating more stable, to take into account of banking stability.

Consistent with the findings of Anginer, Demirgüç–Kunt & Zhu (2012b) and Cihak, Demirgüç - Kunt, and Johnston (2013), supervisory practices that strengthen the rights of private sector monitors of banks and greater levels of restrictions on bank activities are associated with lower likelihood of banking crises including both systemic cases and borderline cases [16]. However, when the authors restrict banking crisis to only systemic cases (Model 2), both private monitoring and official supervisor power together enter jointly significant in banking crisis model. The findings show that both private monitoring and official supervisor power are positively associated with the likelihood of systemic banking crisis when the authors only consider systemic banking crisis countries. This is probably due to the market discipline weakened during systemic banking crisis or private monitoring may particularly harmful to bank stability in countries with powerful supervisors in advanced economies with large and integrated financial system where most systemic banking crises experienced.

Table 4: Logit regression analysis: Banking crises and intervention policies

| | Banking crises | | Intervention policies | | | | |
|---------------------------------|---|---|-----------------------|-------------------|-------------------|--------------------|-------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | Crisis, including borderline cases | Crisis, excluding borderline cases | Liquidity | Guarantees | Restructuring | Asset purchases | Nationalization |
| Capital regulation | 0.96** (0.04) | -16.21** (0.05) | 0.31 (0.27) | 0.03 (0.89) | 0.84** (0.02) | 0.50* (0.06) | -0.19 (0.53) |
| Private monitoring | -1.52* (0.09) | 32.78** (0.05) | -0.70 (0.29) | 0.21 (0.74) | -0.52 (0.25) | 0.01 (0.98) | 0.37 (0.36) |
| Official supervisory power | 0.24 (0.44) | 10.06** (0.05) | 0.06 (0.86) | 0.59* (0.09) | -0.30 (0.29) | 0.14 (0.59) | 0.07 (0.81) |
| Entry into banking requirements | 0.34 (0.70) | 15.14 (0.15) | 1.12 (0.26) | 2.28 (0.13) | -0.09 (0.9) | 1.80 (0.14) | -1.37 (0.10) |
| Restrictions on bank activities | -0.79* (0.08) | -25.71** (0.05) | -0.64 (0.12) | -1.12** (0.02) | -0.17 (0.58) | -1.02*** (0.00) | -0.86** (0.04) |
| Government-owned banks | -0.10 (0.12) | -0.13 (0.61) | 0.01 (0.77) | 0.01 (0.82) | -0.09* (0.09) | 0.03 (0.42) | -0.11* (0.07) |
| Bank concentration | -0.14** (0.03) | -6.33** (0.05) | -0.01 (0.74) | -0.10* (0.09) | -0.06 (0.13) | -0.01 (0.78) | -0.11** (0.03) |
| Bank Z score | -0.26* (0.10) | -1.28* (0.06) | 0.04 (0.59) | -0.04 (0.46) | -0.05 (0.29) | -0.03 (0.49) | -0.09 (0.13) |
| Interest margin | -1.71** (0.05) | -62.8** (0.04) | 0.05 (0.91) | -1.48** (0.04) | -1.28** (0.02) | -0.14 (0.71) | -0.30 (0.50) |
| Intercept | 30.15* (0.06) | 448.37* (0.06) | 3.99 (0.65) | -0.92 (0.93) | 15.07* (0.10) | -7.99 (0.46) | 25.95** (0.04) |
| Number of countries | 43 | 43 | 43 | 43 | 43 | 43 | 43 |

In addition, the logit analysis shows that capital regulatory stringency is associated with bank stability measured by systemic banking crisis (Model 2). In other words, capital stringency is positively correlated with lower likelihood of systemic banking crisis, suggesting strict capital adequacy regulations may be especially important in countries with systemic banking crisis experienced. However, when the authors include borderline cases, the counter-intuitive result shows that stringent capital requirements increase the probability of banking crisis. It is probably due to that higher capital is associated with more risk taking and thus the importance of capital in lowering risk taking by banks may not work in some specific circumstances such as non-systemic banking crisis measured by borderlines cases. In this regard, Laeven and Levine (2009) points out that the same regulations had different effects on bank risk depending on bank's ownership structure.

The findings of regulations and interventions show that a country with more powerful supervisors had a higher likelihood for the government to introduce a guarantee on bank liabilities during the global financial crisis. However, a country with fewer restrictions on bank activities had a higher likelihood to use intervention policies: guarantees, asset purchases, and nationalization. Specially, those counties with higher levels of bank activity restrictions had lower chance to introduce a guarantee on bank liabilities, acquired assets from banking institutions, took over the systemically important financial institutions or injected a majority stake of capital of such institutions over the period of 2007–2011. Also, the results suggest that a country where restructuring costs directed to the financial sector such as recapitalization had more stringent capital regulations and lower levels of government ownership in banking sector.

In addition, the analysis shows that lower levels of bank competition (Bank concentration), higher probability of insolvency or bank stability (Bank Z score), and lower levels of interest margins are positively associated with the likelihood of banking crisis. Consistent with Beck, Demirgüç-Kunt & Levine (2006) and Schaeck, Cihak & Wolfe (2009), the findings support that more concentrated banking systems reduce the likelihood of a country suffering a banking crisis. Consistent with Caprio, D'Apice, Ferri & Puopolo (2014), net interest margin play a role in banking crisis. Less bank concentration is significantly associated with the likelihood of a country introduces interventions such as guarantees or nationalization. Countries with higher levels of interest margins or bank efficiency are less likely to use crisis resolution policies such as guarantees and recapitalizations. However, there is not strong relationship between bank stability and the likelihood of intervention policies. The authors do not find evidence of the findings that less government support is associated with bank stability in Marques, Correa & Sapriza (2013) [17].

5. Conclusions

Although this study has limitations such as small observations because of data limitations on bank regulation surveys and banking crisis, the authors hope the empirical results help better understand whether bank regulation in countries associated with the likelihood of the recent banking crisis and intervention policies. In general, countries significantly increase restrictions on bank regulatory capital requirement after global financial crisis but banking crisis countries do not significantly change their regulatory and supervisory structure to better prevent the

next crisis. The empirical results show that supervisory practices that strengthen the rights of private sector monitors of banks regulations improve bank stability, consistent with the findings of Anginer, Demirgüç–Kunt & Zhu (2012b) and Cihak, Demirgüç -Kunt, & Johnston (2013). Furthermore, greater restrictiveness on bank activities is associated with higher levels of bank stability, consistent with the findings of Caprio, D’Apice, Ferri & Puopolo (2014).

However, the result that capital stringency is positively correlated with lower likelihood of systemic banking crisis suggests that strict capital adequacy regulations may be especially important in countries with systemic banking crisis experienced. Similarly, Lee and Lu (2015) find evidence that stronger capital regulatory requirements reduce bank fragility, as measured by lower levels of non-performing loans. Overall, the findings support Basel II’s third pillar of market based disciplinary. The paper contributes to the ongoing debate regarding appropriate regulatory reform in the banking industry to promote global financial stability by shedding light on the extent to which the regulatory and supervisory frameworks have an impact on banking crises and intervention policies.

Endnotes

1. Dell’Ariccia, Detragiache & Rajan (2008) find similar evidence that firms with more dependent on external finance perform relatively worse during banking crises.
2. Berkmen, Gelos, Rennhack & Walsh (2009) investigate the differences in the crisis impacts across developing countries and emerging markets and find that a small set of variables explain a large share of the variation in economic growth. However, they do not take regulation into account.
3. See Demirgüç–Kunt, Karacaovali & Laeven (2005) for a comprehensive database on deposit insurance.
4. They propose the Financial Supervision Herfindahl Hirschman Index and Central Bank Supervisory Share Index to measure the level of consolidation of the supervisory powers and the level of central bank involvement in supervision.
5. However, Claessens, Klingebiel & Laeven (2005) do not find a negative relationship between policies to support the banking system and output cost of banking crises.
6. In an earlier study, Honohan and Klingebiel (2003) provide evidence that accommodating policies such as repeated partial recapitalizations, blanket deposit guarantees, and open-ended liquidity support tend to add significantly to fiscal costs. They fail to evidence that countries that employed these accommodating policies experienced a faster subsequent economic recovery.
7. Barth, Caprio, and Levine construct 52 indexes. Notice that the authors use all average scaled indexes which are calculated as an average of the available questions responses to construct each index. Following Barth, Caprio, and Levine, the authors fill in missing values, if there are responses to a question in at least two surveys (Survey I, II, or III) and these responses are the same, while the missing values for Survey IV are never filled because of potential regulatory changes after the global financial crisis. All fifty two index values for four surveys are available from the author upon request. The authors add the index, Restrictions on bank activities, the summation of the two index values, Activity Restrictions and Bank Owning Nonfinancial Firms.
8. See Beck, Demirgüç–Kunt & Levine (2009) for a brief introduction of the Financial Development and Structure Database and recent trends in financial development across countries. Cihak, Demirgüç–Kunt, Feyen & Levine (2012) introduce the Global Financial Development Database and provide a comprehensive database for 205 economies.
9. See Cihak, Demirgüç–Kunt, Soledad, Peria & Mohseni-Cheraghlo (2012) for more details from a broad aspect of regulation and supervision between crisis and non-crisis countries.
10. This table reports the results for means and Kruskal-Wallis test statistics for differences in samples (chi square approximation). The superscripts ***, **, and * indicate that means are significantly different from different sample at the 1%, 5%, and 10% levels, respectively. The minus sign indicates that the mean of the second category is greater than the mean of the first category. Survey III characterized the regulatory situation in 2006, before the global financial crisis, while Survey IV represented regulatory environment in

2011, after global financial crisis. Banking crisis countries include both systemic cases and borderline cases. Systemic banking crises are the cases where a country's banking system experienced significant signs of financial distress and at least three significant policy interventions took place in response to significant losses, whereas borderline cases are those that almost met as a systemic crisis but not met intervention policy criteria.

11. This table reports the results for the logistic regression models. Each column provides information with complete logit results. The dependent variables are either systemic banking crisis (models 1-2) or government intervention policy (models 3-7), which is indicated in the first row. Regulatory and supervisory variables are from Survey III, characterized the regulatory situation before the global financial crisis. Bank concentration, bank Z score, and interest margin are measured in 2007. The p-values are in parentheses under the estimated coefficients. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.
12. Their banking crisis regressions control for the level of inflation.
13. Net interest margins have shown to decrease over the recent years through 2007 in high-income countries. Beck, Demirgüç-Kunt & Levine (2009) point out that the recent trends of low interest margins and declining stability are unique in high-income countries, not in low and middle income countries. They argue that low and declining interest margins forced banks to look for alternative income sources and the trends of declining interest margin and stability, and rising profitability in financial sector match the boom period leading up to the global financial crisis and eventually resulted in the financial crisis of 2007 (Cihak, Demirgüç-Kunt, Feyen & Levine, 2012).
14. Beck, Demirgüç-Kunt & Levine (2006) find evidence of countries with more concentrated banking systems are less likely to experience a systemic crisis. Also, Schaeck, Cihak & Wolfe (2009) find no evidence of more competitive banking systems are more prone to experience a systemic crisis.
15. The z-score is the ratio of return on assets plus capital-asset-ratio to the standard deviation of return on assets and measures the distance from insolvency (Roy, 1952).
16. However, the findings are inconsistent with Beck, Demirgüç-Kunt & Levine (2007). They find evidence of fewer regulatory restrictions on banks reduce bank stability measured by banking crises over the period 1980–1997.
17. They examine the relationship between government support measured by Moody's and Fitch ratings and risk taking measured by Z-score.

References

- Abiad, A, Detragiache, E & Tressel, T 2008, *A new database of financial reforms*, International Monetary Fund Working Paper no. 08/266, viewed 7 June 2017, <<http://www.imf.org/en/Publications/WP/Issues/2016/12/31/A-New-Database-of-Financial-Reforms-22485>>.
- Anginer, D, Demirgüç-Kunt, A & Zhu, M 2012, *How does deposit insurance affect bank risk?*, World Bank Policy Research Working Paper no. 6289, viewed 7 June 2017, <<https://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-6289>>.
- Anginer, D, Demirgüç-Kunt, A & Zhu, M 2012b, *How does bank competition affect systemic stability?*, World Bank Policy Research Working Paper no 5981, viewed 7 June 2017, <<http://documents.worldbank.org/curated/en/943621468167965155/pdf/WPS5981.pdf>>.
- Barth, JR, Caprio G & Levine, R 2008, 'Bank regulations are changing: for better or worse?', *Comparative Economic Studies*, vol. 50, pp. 537–563.
- Barth, JR, Caprio G & Levine, R 2004, 'Bank regulation and supervision: what works best?' *Journal of Financial Intermediation*, vol. 13, pp. 205–248.
- Barth, JR, Caprio G & Levine, R 2006, *Rethinking bank regulations: till angels govern*, Cambridge University Press, New York.
- Barth, JR, Caprio, G & Levine, R 2013, 'Bank regulation and supervision in 180 countries from 1999 to 2011', *Journal of Financial Economic Policy*, vol. 5, pp. 111–219.

Lu

- Barth, JR, Caprio, G & Levine, R 2001, 'The regulation and supervision of banks around the world: a new database', in R Litan & R Herring (eds.), *Brookings-Wharton Papers on Financial Services*, Brookings Institution Press, Washington, DC, pp. 183–240.
- Beck, T, Demirgüç-Kunt, A & Levine, R 2006, 'Bank concentration, competition, and crises: first results', *Journal of Banking & Finance*, vol. 30, pp. 1581–1603.
- Beck, T, Demirgüç-Kunt, A & Levine, R 2007, 'Bank concentration and fragility: impact and mechanics', in M Carey & RM Stulz (eds.), *The risks of financial institutions*, University of Chicago Press, pp. 193–234.
- Beck, T, Demirgüç-Kunt, A & Levine, R 2009, *Financial institutions and markets across countries and over time*, World Bank Policy Research Working Paper no. 4943, viewed 7 June 2017, <<http://documents.worldbank.org/curated/en/909081468176992559/pdf/WPS4943.pdf>>
- Berkmen, P, Gelos, G, Rennhack, R & Walsh, JP 2009, *The global financial crisis: explaining cross-country differences in the output impact*, International Monetary Fund Working Paper no. 09/280, viewed 7 June 2017, <<https://www.imf.org/external/pubs/ft/wp/2009/wp09280.pdf>>.
- Cabral, R 2013, 'A perspective on the symptoms and causes of the financial crisis', *Journal of Banking & Finance*, vol. 37, pp. 103–117.
- Caprio, G & Daniela K 1996, 'Bank insolvencies: bad luck, bad policy, or bad banking?', in M. Bruno & B. Pleskovic (eds), *Annual World Bank conference on development Economics 1996*, World Bank, Washington, DC, pp. 79–114.
- Caprio, G, Klingebiel, D, Laeven, L & Noguera G 2005, 'Appendix: banking crisis database', in P. Honohan & L Laeven (eds), *Systemic financial crises: containment and resolution*, Cambridge University Press, Cambridge, UK, pp. 307–340.
- Caprio, G, D'Apice, V, Ferri, G & Puopolo, G 2014, 'Macro financial determinants of the great financial crisis: implications for financial regulation', *Journal of Banking & Finance*, vol. 44, pp. 114–129.
- Cecchetti, SG, King, MR & Yetman, J 2011, *Weathering the financial crisis: good policy or good luck?*, Bank for International Settlements Working Papers no. 351, viewed 7 June 2017, <<http://www.bis.org/publ/work351.pdf>>.
- Cihak, M, Demirgüç-Kunt, A, Soledad, M, Peria, M & Mohseni-Cheraghloo, A 2012, *Bank regulation and supervision around the world: a crisis Update*, World Bank Policy Research Working Paper no. 6286, viewed 7 June 2017, <<http://documents.worldbank.org/curated/en/279091468168248726/pdf/wps6286.pdf>>.
- Cihak, M & Tieman, A 2008, *Quality of financial sector regulation and supervision around the world*, International Monetary Fund Working Paper no. 08/190, viewed 7 June 2017, <<https://www.imf.org/external/pubs/ft/wp/2008/wp08190.pdf>>.
- Cihak, M, Demirgüç-Kunt, A, Feyen, E & Levine, R 2012, *Benchmarking financial systems around the world*, World Bank Policy Research Working Paper no. 6175, viewed 7 June 2017, <<http://documents.worldbank.org/curated/en/868131468326381955/pdf/wps6175.pdf>>.

- Cihak, M, Demirgüç -Kunt, A, & Johnston, RB 2013, *Incentive audits: A new approach to financial regulation*, World Bank Policy Research Working Paper no. 6308, viewed 7 June 2017, <<http://documents.worldbank.org/curated/en/242601468338394908/pdf/wps6308.pdf>>.
- Claessens, S, Klingebiel D & Laeven, L 2005, 'Crisis resolution, policies, and institutions: empirical evidence', in P. Honohan & L Laeven (eds), *Systemic financial distress: containment and resolution*, Cambridge University Press, Cambridge, UK, pp. 169–196.
- Claessens, S, Pazarbasioglu, C, Laeven, L, Dobler, M, Valencia, F, Nedelescu, O & Seal, K 2011, *Crisis management and resolution: early lessons from the financial crisis*, International Monetary Fund Staff Discussion Note no. 11/05, viewed 7 June 2017, <<https://www.imf.org/external/pubs/ft/sdn/2011/sdn1105.pdf>>.
- Cubillas, E, Fonseca, A & Gonzale, F 2012, 'Banking crises and market discipline: international evidence', *Journal of Banking and Finance*, vol. 36, pp. 2285–2298.
- Dell'Ariccia, G, Detragiache, E, Rajan, RG 2008, 'The real effect of banking crises', *Journal of Financial Intermediation*, vol. 17, pp. 89–112.
- Demirgüç–Kunt, A, & Detragiache, E 2002, 'Does deposit insurance increase banking system stability? An empirical investigation', *Journal of Monetary Economics*, vol. 49, pp. 1373–1406.
- Demirgüç–Kunt, A, & Huizinga, H 2004, 'Market discipline and deposit insurance', *Journal of monetary Economics*, vol. 51, pp. 375–399.
- Demirgüç–Kunt, A, Karacaovali, B & Laeven, L 2005, *Deposit insurance around the world: a comprehensive database*, World Bank Policy Research Working Paper no. 3628, viewed 7 June 2017, <http://siteresources.worldbank.org/INTRES/Resources/469232-1107449512766/DepositInsuranceDatabasePaper_DKL.pdf>.
- Honohan, P & Klingebiel, D 2003, 'The fiscal cost implications of an accommodating approach to banking crises', *Journal of Banking & Finance*, vol. 27, pp. 1539–60.
- Kaminsky, GL & Reinhart, CM 1999, 'The twin crises: the causes of banking and balance-of-payments problems', *American Economic Review*, vol. 89, no. 3, pp. 473–500.
- Kaufmann, D, Kraay, A & Mastruzzi, M 2009, *Governance matters VIII: aggregate and individual governance indicators 1996–2008*, Work Bank Policy Research Working Paper no. 4978, viewed 7 June 2017, <<http://documents.worldbank.org/curated/en/598851468149673121/pdf/WPS4978.pdf>>.
- Kaufmann, D, Kraay, A & Mastruzzi, M 2010, *The worldwide governance indicators: methodology and analytical issues*, Work Bank Policy Research Working Paper no. 5430, viewed 7 June 2017, <<http://info.worldbank.org/governance/wgi/pdf/wgi.pdf>>.
- Kroszner, RS, Laeven, L & Klingebiel, D 2007, 'Banking crises, financial dependence, and growth', *Journal of Financial Economics*, vol. 84, no. 1, pp. 187–228.
- Laeven, L 2011, 'Banking crises: a review', *Annual Review of Financial Economics*, vol. 3, pp. 17–40.
- Laeven, L & Levine, R 2009, 'Bank governance, regulation and risk taking', *Journal of Financial Economics*, vol. 93, pp. 259–275.
- Laeven, L & Valencia, F 2008, *Systemic banking crises: a new database*, International Monetary Fund Working Paper no. 08/224, viewed 7 June 2017, <<https://www.imf.org/external/pubs/ft/wp/2008/wp08224.pdf>>.

Lu

- Laeven, L & Valencia, F 2010, *Resolution of banking crises: the good, the bad, and the ugly*, International Monetary Fund Work Paper no 10/146, viewed 7 June 2017, <<https://www.imf.org/external/pubs/ft/wp/2010/wp10146.pdf>>.
- Laeven, L & Valencia, F 2012, *Systemic banking crises database: an update*, International Monetary Fund Working Paper no. 12/163, viewed 7 June 2017, <<https://www.imf.org/external/pubs/ft/wp/2012/wp12163.pdf>>.
- Laeven, L & Valencia, F 2013a, 'Systemic banking crises database', *International Monetary Fund Economic Review*, vol. 61, no. 2, pp. 225–270.
- Laeven, L & Valencia, F 2013b, 'The real effects of financial sector interventions during crises', *Journal of Money, Credit and Banking*, vol. 45, no. 1, pp. 147–177.
- Lee, K & Lu, W 2015, 'Do bank regulation and supervision matter? International evidence from the recent financial crisis', *Journal of Financial Economic Policy*, vol. 7, pp. 275–288.
- Lu, W & Whidbee, DA 2016, 'US bank failure and bailout during the financial crisis: Examining the determinants of regulatory intervention decisions', *Journal of Financial Economic Policy*, vol. 8, pp. 316–347.
- Marques, BL, Correa, R & Sapriza, H 2013, *International evidence on government support and risk taking in the banking sector*, International Monetary Fund Working Paper no. 13/94, viewed 7 June 2017, <<https://www.imf.org/external/pubs/ft/wp/2013/wp1394.pdf>>.
- Masciandaro, D, Pansini, R & Quintyn, M 2011, *The economic crisis: did financial supervision matter?*, International Monetary Fund Working Paper no. 11/261, viewed 7 June 2017, <<https://www.imf.org/external/pubs/ft/wp/2011/wp11261.pdf>>.
- Roy, AD 1952, 'Safety first and the holding of assets', *Econometrica*, vol. 20, pp. 431–449.
- Schaeck, K, Cihak, M & Wolfe, S 2009, 'Are competitive banking systems more stable?' *Journal of Money, Credit, and Banking*, vol. 41, pp. 711–734.
- Schularick, M & Taylor, A 2012, 'Credit booms gone bust: monetary policy, leverage cycles, and financial crises, 1870-2008', *American Economic Review*, vol. 102, no. 2, pp. 1029–1061.