Regulation and Banking Stability: A Survey of Empirical Studies

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Abstract

This paper brings together and adds structure to the empirical literature on the link between banking regulation and banking system stability. In addition to clarifying the theoretical underpinnings for studying banking regulation, it points to several directions for future empirical research, necessary to fill the gaps in our understanding of the link between banking regulation and stability. The paper starts with a review of the literature on the design of banking regulation and its link with stability, followed by an assessment of the most common methodologies used in this literature.The paper then reviews the empirical literature of various banking regulations. This is followed by a proposal on the new directions for research of the link between banking regulation and banking system stability.

Keywords: Banking Stability, Banking Regulation.

JEL Codes: G21, G28.

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1 Introduction

Banking is one of the most regulated and monitored industries in the world. In fact, there exist no less than eight types of banking regulation.[1] Two main reasons have been pointed out to explain why this is the case. Firstly, is the perception of banks as fragile institutions that need the help of government to evolve in a sound and safe environment; and secondly, banking instability is costly to the entire economy as a result of the key role banks play in financial intermediation by providing liquidity insurance, monitoring services, and providing economic and financial information.

Generally, governments delegate their regulatory power to Central Banks, which organize the regulatory system given their role of the lender of last resort. However, this has not always been the case (see, e.g., Allen and Herring (2001)). In fact, Central Banks were initially founded for different purposes. It is only in the nineteenth century that the focus of Central Banks shifted towards financial stability and their role increasingly came to be to eliminate crises. Moreover, the experience of bank panics during the Great Depression had a profound effect on bank regulation in the US. and in almost all countries in the world. As a result banks became heavily regulated in every country. Furthermore, in some countries the government intervened directly in the financial system to allocate resources. Interest rates were strictly controlled and systemic risk was avoided. Financial stabilization became the objective of banking regulation.

The costs of banking crises were perceived to be so high that they had to be avoided at all costs. Even though intensive regulations were able to eliminate systemic risk associated with banks in the post war period, over time it became increasingly less obvious that heavily regulated banking were optimal. This led to a worldwide wave of financial liberalization. Unfortunately, it also led to the return of financial crises. More importantly, it induced a new generation of regulations.

Since the re-introduction of financial liberalization in the 1980s, new types of regulation have emerged, the most important being the Basel Accords with its capital adequacy requirement and its supervision practices. We also noticed the decline of the level of the reserve requirement, the adoption or the redesign of deposits insurance, and the emergence of banking examination and supervision in a great number of economies. This new regulatory framework has been praised for the international convergence of banks' risk management standards and for the improvement of these standards in many economies. Their design and implementation have been blamed for increasing several market failures in the banking

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[1]see, e.g., Mishkin (2000), Barth, Caprio, and Levine (2004), and Allen and Herring (2001)

industry. For example Brimmer (1992) argued that:

"*Contrary to expectations,(...) the banking bill which became law in December 1991, will most likely undermine the stability and the efficiency of the banking system in coming years. In the mistaken belief that it was helping to enhance the "safety and soundness" of individual banks—and simultaneously protecting Federal insurance funds—Congress actually established an inflexible regulatory regime which will cut back on the scope of the financial activities in which banks can engage, increase the level and costs of capital requirements, make the money market less efficient, and involve regulators much more extensively in the internal affairs of banking institutions.*"

Existing banking regulations can be grouped into three broad categories: regulatory measures affecting the bank's balance sheet (capital adequacy requirements, reserve requirements, and asset holding restrictions), regulatory measures affecting the structure of the banking system (separation of the banking and other financial industries like securities, insurance, or real estate (e.g., the Glass-Steagall act of 1933); restrictions on competition), and regulatory measures for banks' owners' and managers' behavior (risk-based deposit insurance premiums, disclosure requirements, bank chartering, and bank examination).

Despite the recent progress in the research on banking fragility, there is still no consensus on how best to design and implement banking regulation in this new context of free banking. According to Santos (2001), this is the result of our lack of understanding of the mechanisms between banking regulation and market failure, and also the interaction of these regulations among them. It is also a consequence of our limited understanding of the implications of those regulations in a general equilibrium framework.

Notwithstanding of these limitations, the research already undertaken has produced some important results, specifically on the link between the type of banking regulation and banking system stability. This paper contributes to this literature by bringing together and adding structure to the contemporary theoretical and empirical literature.

The remainder of the paper is organized as follows. Section 2 presents a brief theoretical review of the link between regulation and banking stability. Section 3 reviews the design of banking regulations. Section 4 assesses the existing methodologies used in the literature. Section 5 reviews the empirical literature of various types of banking regulation. Section 6 presents a proposal for new directions of research on the link between banking regulation and banking system stability, and concludes.

Before proceeding, we should mention several important topics closely related to banking regulation that our article does not deal with, as well as some of the references to these topics. Specifically, our study does not deal with the link between regulation, banking

profitability, and/or financial development (see, e.g., Bath, Caprio, and Levine (2004)). It also does not deal with the link between regulation and bank governance (see, e.g., Beck, Demirguç-Kunt, and Levine (2006b)). The last preliminary point is on the selection of countries that we talk about. Most of the available empirical evidence comes from the United States and the group of ten member countries of the Basel committee. One reason for this is the fact that data are generally more easily available for these economies than for others, and another is that a great number of economic researchers is located in these countries.

2 Reviewing the Link Between Regulations and Banks' Stability

In the introduction we argued that one of the key rationales for banking regulation is the prevention of banking crises. Hence, we start our paper with a brief review of the sources of banking instability, and the channels through which regulations can prevent it.

There are two main reasons for banks' failure. A bank can fail because the assets it owns or the credit it has made, have realized an unexpected low return such that the bank no longer has the resources to pay back depositors. A bank can also fail if a sudden rush of withdrawals forces it to sell off assets at a very low price. Let us start with the latter.

A financial crisis can be initiated by a sudden rush of withdrawals; hereafter, a run on a bank. This sudden rush is generally a result of a coordination failure among the bank's depositors. In fact, banks are characterized by balance sheets where banks' liabilities (deposits) are generally short-term, while their assets are long-term and illiquid. A run on a bank occurs when the bank's demand for withdrawals by depositors exceeds the short-term value of its assets.

Many reasons have been given in the literature as the trigger of bank runs. The most important is an arbitrary shift in expectations generally called sunspot; see, e.g., Diamond and Dybvig (1983). Another trigger is a shift in expectations due to the release of "bad news" (see, e.g., Morris and Shin (1998, 2000), Goldstein and Pauzner (2000), Chari and Jagannathan (1988)). Finally a productivity shock can trigger a bank run (e.g., Diamond and Rajan (2001a, 2001b), and Chen (1999) and Dasgupta (2000)).

But even if coordination failure can cause the failure of a bank, we need a linkage between banks in the form of information spillovers or credit exposures to turn a bank run into a systemic banking crisis, see e.g., Allen and Gale (2000a); Freixas, Parigi, and Rochet (2000).

The coordination failure problem in banking is a type of market failure, which can be

solved by a proper identification of unnecessary withdrawals, suspension of withdrawals, and/or the institution of deposit guarantee, which can give incentive to depositors not to join the rush even if others are rushing.

The information spillovers market failure can be mitigated by markets' transparency, which helps to reduce information asymmetry and gives confidence to the other banks' depositors not to join the run occurring in the neighbour bank. Moreover, efficient lender-of-last-resort operations by the Central Bank can provide liquidity into the banking system and mitigate the negative effect of credit exposure and reduce the risk of contagion, see, e.g., Allen and Gale (2000).

A banking crisis can also be initiated by a high level of unexpected non-performing loans in a bank. When this information is known by the depositors, they rush to the bank to get back their deposits before the other depositors. If markets for liquidity are inefficient because of market power or information asymmetries, liquidity problems at healthy banks can turn into solvency problems. In fact, in this case the bank is forced to sell its long-term assets below their fair value, see, e.g., Allen and Gale (1998), Bernanke and Gertler (1989, 1990), Donaldson (1992), and Kiyotaki and Moore (1997).

In order to mitigate the risk due to non-performing loans, banks can choose to hold an important proportion of their portfolio in safe assets. Regulators can help them to do so by increasing the required capital ratio. Another channel which can be used to mitigate this type of risk is the increase of competition among banks so as to reduce their market power and provide them with an incentive to organize efficiently the interbank lending market.[2]

3   Review of the Design of Banking Regulation

According to Allen and Herring (2001), there are 16 types of banking regulation.There are broadly four goals for these regulations, namely: preventing systemic risk, providing protection for investors, enhancing efficiency, and improving the social welfare. None of the regulations can achieve all of these objectives. Given our interest in banking stability we focus only on regulations put in place to prevent systemic risk. According to this paper there are eight types of regulation which help to achieve stability. These regulations are: (i) the asset restrictions; (ii) the capital adequacy requirement; (iii) the deposit insurance, (iv) the fit and proper entry tests; (v) the interest rate ceilings on deposits, (vi) the liquidity requirement; (vii) the reserve requirements; (viii) the restrictions on services and product lines.

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[2]For a detailed review of the theoretical literature on banking instability see Lai (2002).

Other studies have also focused on the design of the banking system regulation around the world. Barth, Caprio, and Levine (2001) provide an extensive assessment of the existing regulation and supervision.[3] Mishkin (2000) provides a list of eight types of regulation.[4] Although these studies do not report the same regulations, they do report many in common.

For a structured presentation of the design of banking regulation let us organize the presentation around the three groups that we presented above.

3.1 Regulations Affecting Bank's Balance Sheet

Among the regulatory measures presented by the above three studies, three measures are aimed at affecting the bank's balance sheet: restrictions on asset holdings, capital adequacy requirements, and reserve and/or liquidity requirements.

a) Restrictions on asset holdings aim at reducing the proportion of some type of risky assets in the portfolios of banks. It is then a constraint on the asset side of the bank's balance sheet. Its theoretical justification is based on the presence of information asymmetries between depositors and the bank manager, which can lead the manager to take too much risk without being disciplined by the withdrawal of deposits. It is a regulation, which has been adopted by many countries around the world. However, findings of Barth, Caprio, and Levine (2004) show that the level of restriction is higher in lower-income countries than in higher-income countries.

b) Capital adequacy requirements ask bank managers and/or owners to keep, in the form of equities, a given proportion of the amount of the risky loans that they have made. It has a direct effect on the composition of the liability size of a bank's balance sheet. More importantly, it aims at providing incentives for banks to hold less risky portfolios. In fact, this regulation can reduce their incentive to provide too many risky loans since in the case of a failure they may lose all their equities, and if their amount of equity is important, it means that they will lose a lot.

There are many types of capital adequacy requirement; their design has also evolved over time. According to Mishkin (2000) bank capital requirements typically take three forms: (i) the first type is based on the so-called leverage ratio, which is the amount of capital

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[3]From Barth, Caprio, and Levine (1998) there are 12 basic types of banking regulation: (i) entry into banking, (ii) ownership, (iii) capital, (iv) activities, (v) external auditing requirements, (vi) internal managements/organizational requirements, (vii) liquidity and diversification requirements, (viii) the deposit requirements, (ix) the accounting /information disclosure requirements, (x) the discipline/problem institutions/exit, and (xi) supervision.

[4]The eight basic regulatory measures pointed out by Mishkin (2000) are: (i) restrictions on asset holdings and activities, (ii) separation of the banking and other financial industries like securities, insurance, or real estate, (iii) restrictions on competition, (iv) capital requirements, (v) risk-based deposit insurance premiums, (vi) disclosure requirements, (vii) bank chartering, and (viii) bank examination.

divided by the bank's total assets; (ii) the Basel I Accord type where assets and off-balance sheet activities are allocated into four categories, each with a different weight to reflect the degree of credit risk; (iii) the third type is the capital requirement based on the level of market risk taken by banks.

Given the importance of the capital adequacy requirement in the regulatory framework of almost every country in the world today, we found useful to present some insight about the design of the capital adequacy requirement as stated by the Basel II Accord. The risk-weighted capital adequacy requirement is based on the concept of the capital ratio where the numerator represents the amount of capital a bank has available and the denominator is a measure of the risks faced by the bank and is referred to as risk-weighted assets. The resulting capital ratio may be no less than eight percent. The assessment of the risk-weighted assets taken by a bank depends heavily on the technique used to measure it. The Basel II accord specifies the technique that should be used to assess each type of risk. Let us recall that the Basel committee identified three types of risk in the banking industry: credit risk, market risk, and operational risk.

To measure the credit risk the bank can use three approaches: the standardized approach, the foundation internal ratings based (IRB) approach, and the advanced IRB approach: (i) the standardized approach uses only a predetermined risk weight for different types of loans; (ii) the model underlying the internal ratings based approach is the one-factor Gaussian copula model of time to default.[5]

To assess the market risk, Basel II accord proposed the VaR. The market risk capital requirement for banks when they use the internal model-based approach is calculated at any given time as $k * VaR + SRC$, where k is a multiplicative factor and SRC is a specific risk charge. The value at risk, VaR, is the greater of the previous day's value at risk and the average value at risk over the last 60 days. The minimum value of k is 3.

In addition to improving the way banks calculate credit risk capital, Basel II required banks to keep capital for operational risk. The regulators offered three approaches to measure this: the basic indicator approach, the standardized approach, and the advanced measurement approach. The basic indicator approach sets the operational risk capital equal to the bank's average annual gross income over the last three years multiplied by 0.15.

Barth, Caprio, and Levine (2004) found that the stringency of capital requirements

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[5]More precisely, consider a large portfolio of N loans. Let us denote: $WCDR$: the worst-case default rate during the next year that we are 99.9% certain will not be exceeded, PD: the probability of default for each loan in one year, EAD: the exposure at default on each loan (in dollars), LGD: the loss given default, i.e., the proportion of the exposure that is lost in the event of a default. Suppose that the copula correlation between each pair of obligors is ρ. We have $WCDR = N[((N^{-1}(PD) + \sqrt{\rho}N^{-1}(0.999))/(\sqrt{(1-\rho)}))]$. It follows that there is a 99.9% chance that the loss on the portfolio will be less than N times $EAD \times LGD \times WCDR$.

is lower for lower-income countries than for higher-income countries. The overall capital stringency is lower in developing countries than in developed countries.

c) Reserve and/or liquidity requirements are a form of regulation which forces banks to maintain, in the form of a reserve, a given proportion of their deposits in an account of the Central Bank, and/or to maintain, in the form of liquidity, a given proportion of deposits in their account. This type of regulation affects the composition of the asset size of the bank's balance sheet. This regulation can mitigate the incentive of a bank's owner and manager to get involved in too risky activities. Besides, the reserve requirement is probably one of the most ancient types of banking regulation. It has been viewed as a form of taxation on banks by governments, since generally these required reserves do not bear interest. Many US economists have argued that a reserve requirement was needed in the US because of the existence of a deposit insurance run by the government. But this is no longer the view of a lot of Central Bank economists in developed economies. In fact, in the 1990s some countries like Australia, Canada and New Zealand have abandoned the use of this required reserve and even countries which have not removed it, have reduced it substantially and more frequently. Meanwhile, in developing countries the reserve and/or liquidity requirement is still used. Some countries have significantly reduced their reserve requirement and increased the liquidity requirement. More than four-fifth of the countries still maintain a reserve requirement and about one-eighth of the countries has a liquidity requirement.

3.2 Regulations Affecting the Banking Sector Structure

Some regulations have an important impact on the structure of the banking system in a given country. From the previous example of regulations the following can have a significant influence on bank structure: regulations separating banking and non-banking business, and restrictions on entry in the banking industry.

a) Regulations separating banking and non-banking business: some governments restrict banks from involvment in commercial activities, which are considered to be outside the core banking business and, therefore, may be more risky. In the United States there was an even more restrictive policy, which was under application during the period 1933-2003: the Glass-Steagall Act of 1933.[6] We observed from the Barth, Caprio, and Levine (2004) survey that almost every country (except New-Zealand) has at least a restriction on banks' involvement in activities such as: securities, insurance, real estate, and a bank owning non-

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[6]The Glass-Steagall Act of 1933 forces banks to be separated from other financial industries such as securities, insurance or real estate.

financial firms. They also found that restrictions imposed on bank activities are greater for lower-income countries than higher-income countries; and that government ownership of banks increases in countries, on average, as one moves from the higher-income level to the lower-income level.

b) Regulation on entry into the banking industry: there are many types of restrictions to the entry into the industry. It ranges from the minimum amount of capital that the owner should provide to the regulatory agencies, to the restriction of foreigners to own or invest in banks. If the goal of the minimum amount of capital needed to enter into the banking sector is mainly to limit competition, the goal of restricting foreign funds is three-fold: to limit competition, to reduce the exposure to capital flight, and to reduce the exchange-rate risk. From Barth, Caprio, and Levine (2004) almost every country has a minimum amount of capital to obtain a licence or a charter for banking activities. Although the entry of foreign funds was prohibited for acquisition, subsidiary, and creation of a branch during the 1980s, according to Barth, Caprio, and Levine (2004) almost no banking system is now restricting foreign funds to invest in banking. Meanwhile, they found that the percentage of entry applications denied is greater for low-income countries than for high-income countries; and that developing countries place more limitations on foreign bank ownership of domestic banks and foreign bank entry through branching than developed countries.

3.3 Regulations Affecting the Managers' and/or Owners' Behavior

Since the theoretical literature has pointed out many market failures which can lead managers to take too much risk or to take improper actions without being disciplined by a free well-functioning financial market, many regulations have been designed to deal with this issue: the risk-based deposit insurance, disclosure requirements, bank chartering, and bank examination.

a) Deposit insurance was first introduced in the US after the Great Depression and has since been adopted by many countries. In their survey of 2001 Barth, Caprio, and Levine observed that at least 77 countries were applying it while Demirgüç-Kunt, Kane, and Laeven (2006) found that 87 countries were applying it by the end of 2003. Its aim is to reduce the likelihood of bank runs and panics in the banking system. However, complete insurance is likely to introduce moral hazard into the banking system and therefore increase its fragility. That is why a new type of deposit insurance has emerged, namely risk-based deposit insurance premiums. If the deposit insurance premium, provided by the government, is priced appropriately to reflect the amount of risk taken by a bank, it will solve the moral

hazard issue.[7] Barth, Caprio, and Levine (2004) found that developing countries are almost three times as likely as developed countries not to have an explicit deposit insurance scheme.

b) Disclosure requirements aim at mitigating the asymmetry of information available in the banking industry. Generally, regulators require that banks adhere to certain standard accounting principles and disclose a wide range of information that helps the market assess the quality of a bank's portfolio and the degree of the bank's exposure to risk. This type of regulation is widely used by high-income countries and less by developing countries. For example, Barth, Caprio, and Levine (2004) point out that the percentage of banks rated by international credit rating agencies is seven times greater for high-income countries as compared to low-income countries.

c) Bank chartering aims at preventing dishonest people and overly ambitious entrepreneurs from engaging in highly speculative activities. In fact, chartering proposal for new banks are screened to prevent dishonest and speculative people from controlling banks. Almost every country has this type of regulation.

d) Bank examination, or supervision, or monitoring helps to limit moral hazard incentives for excessive risk taking. Since it is not enough to have regulations which encourage less risk taking, banks must be monitored to see if they are complying with these regulations. This type of regulation improves the quality of the financial information given to the public by bank owners and managers and can also serve to enforce the existing regulations. Barth, Caprio, and Levine (2004) found that the degree of private monitoring increases as one compares lower-income countries to higher-income countries and that the tenure of supervisors is less in developing countries than in developed countries.

4   Review of Empirical Methodologies

The empirical analysis of the link between regulation and stability of the banking system had so far taken two main directions. The first direction is to compute, using a measure of risk assessment, the risk taken by the banks during a period under which a given type of regulation was under implementation and to see if the dynamic of the risk is associated with the given regulation. We will refer to this method as the implicit-risk method. This method is generally applied on bank-level data in a given economy or on bank-level data of a group of economies.

The second direction is to talk about banking fragility in a given economy. The risk measure here takes the form of a dummy variable which takes the value 1 if a banking

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[7]Risk-based deposit insurance premiums are theoretically appealing but in practice they have not worked very well mainly because it is hard to accurately determine the amount of risk a bank is actually taking

system is assumed to be in a systemic banking crisis situation during a given year, and 0 if not. Under this method cross-country data and discrete regression model are widely employed.

4.1 Implicit Risk Method

A least three classes of econometric models use the implicit measure of risk to assess the impact of regulation on banking stability. These classes are: the simultaneous equation model, which is generally used to study the impact of capital adequacy requirement on bank's risk, the discrete regression model which is mainly used in studies using the rate recorded by credit rating agencies, and the survival and hazard models used to model the probability of a bank's failure.

4.1.1 Simultaneous Equation Model

The simultaneous equation model was introduced by Shrieves and Dahl (1992) to analyze adjustments in capital ratio and risk following the imposition of capital adequacy requirement in the US banking system.[8] The key ingredient of this model is that observed changes in bank capital ratios and portfolio risk levels can be decomposed into two components, a discretionary adjustment, and a change caused by an exogenously determined random shock, such that

$$
\begin{cases}
\Delta CAP_{jt} &= \Delta^d CAP_{jt} + E_{jt} \\
\Delta RISK_{jt} &= \Delta^d RISK_{jt} + U_{jt}
\end{cases}
$$

where ΔCAP_{jt} and $\Delta RISK_{jt}$ are observed changes in capital ratios and risk levels for bank j in period t, $\Delta^d CAP$ and $\Delta^d RISK$ represent discretionary adjustments in capital ratios and risk levels, and E and U are exogenous shocks. Recognizing that banks may not be able to adjust their desired capital ratios and risk levels instantaneously, the discretionary changes in capital and risk are modeled using a partial adjustment framework.

$$
\begin{cases}
\Delta CAP_{jt} &= \mu(CAP_{jt}^* - CAP_{j,t-1}) + E_{jt} \\
\Delta RISK_{jt} &= \beta(RISK_{jt}^* - RISK_{j,t-1}) + U_{jt}
\end{cases}
$$

Thus, observed changes in bank capital ratios and portfolio risk in period t are functions of the target capital ratio CAP_{jt}^* and target risk level $RISK_{jt}^*$, the lagged capital ratio CAP_{t-1} and risk levels $RISK_{t-1}$ and any random shocks.

The target capital ratio level is not observable, but is assumed to depend upon some set of observable variables, including the changes in portfolio risk ($\Delta RISK_{jt}$), while the exogenous shock that could affect bank capital ratios is the regulatory pressure. Also, the

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[8]It has since then been used by a great number of authors e.g., Jacques and Nigro (1997), Rime (2000), and Nachane et al. (2000).

target risk level is not observable, but is assumed to depend on a set of observable variables including the changes in portfolio risk (ΔCAP_{jt}), while the exogenous shock that could affect bank capital ratios is the regulatory pressure. This assumption helps to recognize the possible simultaneous relationship between capital and risk.[9]

To complete the empirical estimation of the simultaneous equation system one must provide a measure of the bank capital and a measure of the portfolio risk of banks. In the literature, portfolio risk is measured in two ways: using the ratio of total risk weighted assets to total assets, and using the gross non-performing loans as percentage of total assets (see, e.g., Avery and Berger (1991), Berger (1995), and Shrieves and Dahl (1992)). The literature also uses two definitions of a bank's capital ratio: the ratio of capital to total assets (see, e.g. Shrieves and Dahl (1992), and the ratio of capital to risk-weighted assets (see, e.g. Jacques and Nigro (1997), Aggarwal and Jacques (1998) and Ediz et al. (1998)).

In this literature also, the regulatory pressure is a cornerstone of the hypotheses involving minimum capital standards; hence, it should be captured. Generally, the regulation pressure (REG) is a binary variable.

Let us denote by $OTHERS$ the other variables affecting the banking capital and the bank's risk. The model can be broadly set as

$$\left\{ \begin{array}{rcl} \Delta CAP_{jt} & = & \mu_0 + \mu_1 REG_{jt} + \mu_2 OTHERS_{jt} + \mu_3 \Delta RISK_{jt} + \mu 4 CAP_{jt-1} + u_{jt} \\ \Delta RISK_{jt} & = & \beta_0 + \beta_1 REG_{jt} + \beta_2 OTHERS_{jt} + \beta_3 \Delta CAP_{jt} + \beta 4 RISK_{jt-1} + v_{jt} \end{array} \right.$$

where u_{jt} and v_{jt} are error terms. This model is generally estimated using a two or a three-stage least-square procedure. Authors using the three-stage method argue that it allows them to take into account the simultaneity of banks' adjustments in capital and risk and to get estimates that are asymptotically more efficient than under the two-stage technique.

4.1.2 Methodology with the Credit Rating

Some authors working on bank level data use the rate of commercial banks provided by the international rating risk agencies as their measure of risk. Typically these agencies rate banks' financial strength on a $N-point$ scale, ranging from E to $A+$. Since these rates form a limited dependent variable, the appropriate econometric model used to assess the impact of regulation on the banking system stability here is an ordered probit or logit. Specifically, the regression equation estimated is:

$$RAT_{ij} = \beta_0 + \beta_1 REG_j + \beta_2 BKC_{ij} + \beta_3 INS_j + \beta_4 MEV_j + u_{ij}$$

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[9] Shrieves and Dahl (1992) argued that a positive relationship between changes in capital and risk may signify, among other possibilities, the unintended impact of minimum regulatory capital requirements or even managerial risk aversion. Jacques and Nigro (1997) argued that a negative relationship may result because of methodological flaws in the capital standards.

where the subscript i denotes the country and the subscript j denotes the bank; with RAT for rating, REG for regulation, BKC for banking characteristics, INS for institutions, MEV for macroeconomic variables.[10]

4.1.3   Survival Model

Some authors use the probability of bank failure as their measure of risk or fragility. They then study the impact of regulation on this probability of failure. In the literature survival econometric model of Kaplan-Meier is generally used.[11]

4.2   Explicit-Instability Method

So far in the literature, we have reported two econometric methodologies used to study the link between banking regulation and banking instability when the dependent variable is the explicit dummy variable of banking crisis. The most frequent one is the Demirguç-Kunt and Detragiache (1998), hereafter DKD98 method, which consists of using a discrete regression model in the context of panel data. More precisely, DKD98 built a model similar to this:

Let P_{it}^* denotes an unobservable variable representing the probability that the banking system of country i suffers a systemic crisis at time t, and P_{it} - a dummy variable which takes the value 1 when country i suffers a systemic banking crisis at time t and 0 otherwise. The probability of a systemic banking crisis is modelled as follows:

$$\begin{cases} P_{it} = 1 & if \quad P_{it}^* > C \\ P_{it} = 0 & if \quad P_{it}^* \leq C \end{cases}$$

With

$$P_{it}^* = \beta' X_{it} + \varepsilon_{it}$$

and where X_{it} represents the matrix of all exogenous variables; i the country index; t the time index, and C a threshold value of the banking crisis probability.

The impact of each regulation on the banking system stability can be assessed by augmenting the above benchmark model of banking crises with variables capturing some characteristics of the banking regulation. Let us denote by L_{it} the matrix of variables representing the regulatory measures in country i at time t. The reduced form equation can be given by

$$P_{it}^* = \beta' X_{it} + \theta' L_{it} + \varepsilon_{it}.$$

If θ is significant and negative, then regulation reduces the probability of the banking system being in a systemic crisis.

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[10] See Demirgüç-Kunt, Detragiache, and Tressel (2006) for more details.
[11] See, e.g., Erlend and Baumann (2006), and Sheldon (2006) for more details

This model is estimated using the logit regression model in the context of panel data. The sign of the estimated coefficients for each exogenous variable shows how an increase of that explanatory variable increases or decreases the probability of a crisis. However, as is well known for a binary model, the estimated coefficients cannot represent the magnitude of the effect of a marginal change in the exogenous variable on the likelihood of a banking crisis. Each coefficient instead reflects the effect of a change in a given explanatory variable on $ln(P_{it}/(1 - P_{it}))$, so that the magnitude of the effect on the probability of a crisis depends on the slope of the cumulative distribution function at $\beta'X_{it} + \theta'L_{it}$: it follows that the magnitude of the change in the probability of a banking crisis depends on the initial values of all the exogenous variables and their coefficients. Hence, after the estimation of the logit model, the following step is to compute the marginal coefficient estimates which are evaluated at the sample mean. These estimates represent the magnitude of the link between each exogenous variable and the probability of a systemic banking crisis evaluated at the sample mean.

The literature tends to use the logit instead of the panel-logit to estimate this model because the former is always convergent and the latter may not be.

The second method consists of using the discrete regression model but in the context of cross-section data. More precisely, Barth, Caprio, and Levine (2004) use the cross-section data over a five-year period time. Their dependent variable, which is the dummy variable for a crisis, is defined as follows: if a country has suffered a systemic banking crisis during the five-year period, the dummy variable takes on the value 1; if not it is 0. The regulatory variables are taken from a survey, and the macroeconomic control variables are the average of this variable over the five-year period. They then use a simple logit model to assess the impact of each regulatory measure on the banking instability.

5 Review of Empirical Studies

We will carry out our empirical review with respect to the above groups. Let us first start with the implicit-method.

5.1 Empirical Studies Using the Implicit-Risk Method

A great number of theoretical and empirical studies have been carried out on the impact of the capital adequacy requirement on the banking stability or the risk-taking behavior of bank managers in developed economies over the last decade. A lot of research has been done on the US banking system. Generally, these works use individual bank-level data and

compute a measure of risk taken by each bank. Let us first present the work already done for the US banking system before presenting the work for other economies.

5.1.1 Capital Standard and Stability in the US Banking System

The capital standard was first introduced in the US banking system in 1981.[12] Even before the introduction of the Basel I accord on capital requirement, many theoretical studies have been carried out on this regulation regarding the risk-taking behavior of bank owners and managers. The most important studies were Koehn and Santomero (1980) and Kim and Santomero (1988). The message of this theoretical work was that capital standard may not be effective under various sets of conditions. Since then a lot of economists have carried out empirical studies on the US banking system to test this theoretical conclusion.

The first empirical work for the US banking system is the paper of Furlong (1988). He used the data of 98 large US bank holding companies from 1975 to 1986. He defined the risk taken by banks as the volatility of underlying asset values. He computed this by inverting the call option pricing formula, and found that asset risk measured in this way doubled during the period 1981-86 in the part of his sample in which banks were under capital requirements, compared with the earlier period. However, banks which were well-capitalized in 1981 before the introduction of capital requirement experienced the same rise in volatility as those which were not. He then argued that these findings do not support the view that an increase in capital adequacy requirement leads banks to increase their risky-assets.

As noted by Jackson et al. (1999), his interpretation is true only if one assumes that the level of bank capital in 1981 was representing the desired or the equilibrium capital level. In this case Furlong's findings would be inconsistent with the Kim and Santomero's theoretical findings since well-capitalised banks would not have been subjected to any additional constraint.[13] But, it is possible that, through the effects of capital requirements on market discipline, the introduction of fixed capital standards led to an increase in target capital rates for both highly capitalised and weakly capitalised banks. In this event, Furlong's findings might be seen as consistent with Kim and Santomero's findings.

This work has been criticized for not controlling for many variables which could have affected risk-taking behavior during that sample period. Also, it hasn't taken into account

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[12]This was even before the introduction of the Basel I accord which was adopted by the G10 countries in 1988.

[13]i.e., although capital requirements with differentiated weights will probably give banks an incentive to shift towards lowly-weighted asset categories, for any category of assets which bear the same proportional capital charge, banks will shift towards the more risky assets in the category, which will end up increasing risk-taking behaviour in the banking system.

the endogeneity of capital ratio and risk. This has motivated the emergence of a new set of studies. Shrieves and Dahl (1992) built a simultaneous equation model to take into account the fact that changes in both capital and risk have endogenous as well as exogenous components, and to focus on the determination of discretionary changes in risk which are induced by either endogenous or exogenous changes in capital. They then investigated the relationship between changes in risk and capital in a large sample of US banks over the period 1983-1987, and found a positive association between changes in risk and capital.[14] In fact, their results established that risk exposure and capital levels are simultaneously related, and that the majority of banks mitigate the effects of increases in capital levels by increasing asset risk posture, and vice versa. They argued that the fact that these relationships were present even in banks which were in excess of the minimum regulatory requirements for capital adequacy, supports the conclusion that a positive association between risk and capital in such banks is not strictly the result of regulatory influence, but rather reflects the view that risk-taking behavior tends to be constrained by bank owners' and/or managers' private incentives. Their findings suggest then that capital standard tends to increase the risk in the US banking system.

A partial conclusion at this stage is that taking into account the endogenous part of an increase in capital and risk can make a huge difference to the results. But this conclusion will not be entirely fair, since the sample period and banks are slightly different and the measures used to assess risks in banks are also different. Besides, when Jacques and Nigro used the same empirical methodology on a different sample period, they obtained a different result. In fact, Jacques and Nigro (1997) studied the impact of risk-based capital standards on capital ratio and risk is the US banks under the period 1990-91 and found that changes in the capital ratio and risk are negatively related, i.e., an increase in the level of capital reduces the risk taken by US banks.[15]

The implicit-risk method failed then to close the debate about the effectivity of capital standard for banking stability in the US banking system. To end this subsection, let us review the Dahl and Spivey (1995) paper which provides an indirect way of assessing the importance of capital standard on banking stability. They used US bank data over the period 1980-88 to assess the likelihood and timing of bank recovery from undercapitalization.

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[14]Where risk is measured using the gross non-performing loans as percentage of total assets, and bank's capital ratio is the ratio of capital to total assets.

[15]The conflicting empirical findings on the effect of capital standard on banking stability is confirmed by the study of Haubrich and Watchel (1993) which found that the implementation of the Basle risk standards caused poorly-capitalised banks to reconfigure their portfolios away from high-risk and towards low-risk assets, and which runs contrary to that of Hancock and Wilcox (1992) who found out that, banks that had less capital than required by the risk-based standards, shifted their portfolios towards high-risk assets.

They noted that there appears to be only a limited capacity for banks to change positions of undercapitalisation by growth limitations or dividend restrictions, and that the impact of profitability on recovery is greater the longer a bank remains undercapitalised. Hence, the design of the capital requirement has important implications not only for optimal capital levels, but also for the level of risk and the safety and soundness of the banking system as a whole.

5.1.2 Capital Standard and Stability in Other Countries' Banking Systems

Outside of the US, studies on the impact of capital adequacy requirement on banking stability using the implicit-risk method are scarce. So far, we have found two studies on the Switzerland banking system (Rime (2000), and Sheldon (2001)), a study on the group of ten member countries of the Basel committee (Sheldon (1996)) and a study on the Indian banking system (Nachane et al. (2000)).

Using a modified version of the Shrieves and Dahl (1992), Rime (2001) built a simultaneous equations model to analyze adjustments in capital and risk in Swiss banks and found that regulatory pressure to implement capital adequacy requirement induced banks to increase their capital ratio but did not affect the level of risk. In his study, risk is measured by the ratio of risk-weighted earnings to total assets. He argued that his findings indicate that for Swiss banks, an increase in available capital through retained earnings or equity issues is less costly than a downward adjustment in the risk of the portfolio, and that a rationale for this can be the absence of a developed market for asset-backed securities in Switzerland. However, this runs contrary to the result found by Sheldon (2001) on banks that operated in Switzerland during the period 1987-99. He estimated the impact of the capital standard on the probability of banks' failure and found that over this period the capital adequacy requirement succeeded in increasing the banks' safety, although it decreased the profitability of banks, and finally that the level of adequacy requirement was too high from a welfare point of view. As in the case of the US banking system the difference in results can be due to sample periods and the methodology used.

Nachane et al. (2000) provided an empirical assessment of the impact of capital adequacy requirement on the risk-taking behavior of India's commercial banks. Their study examined 27 Indian public sector banks using year-end data for 1998. Their measures of risk were: the ratio of risk-weighted assets to total assets and the ratio of gross non-performing loans to total assets. They found that banks adjusted their capital ratios significantly, but their risk positions adjusted relatively slowly to the respective target levels. They argued that this suggests that changes in capital and risk are negatively related.

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Sheldon (1996) performed an analysis of the equity and asset volatilities of 219 banks from the group of ten member countries of the Basel committee over the period 1987 to 1994. He found that bank asset volatility in the US banks rose and that this was the case both for banks which increased their capital ratios and for those which did not. In Japan, asset volatility fell, although most banks raised their capital ratios. He concluded that he found little evidence that the implementation of the Basel guidelines had a risk-increasing impact on bank portfolios.

5.1.3   Other Regulations and Banking Stability

In the literature of implicit-risk there are few studies about the impact of other types of regulation on banking stability. There is a study of Horiuchi (1999) about the safety-net in the Japanese banking system, two other studies on safety-net in cross-section analysis, and two studies using a broad notion of regulation.

We have found one study of the Japanese government safety-net and its links with stability. It is the paper of Horiuchi (1999) which examines how the Japanese government safety-net mechanism generated fragility in the banking system during the 1990s. He found that even though the Japanese safety net protected depositors from losses associated with bank failures, it did not implement prudential regulations to prevent moral hazard associated with it. The later translated into the systemic banking crisis that Japan experienced during that period. This study therefore associated deposit insurance with banking crises in Japan.

Cull, Senbet and Sorge (2005) found a similar result using the volatility of credit to the private sector as the proxy for risk in a cross-country analysis. More precisely, they found that the decision to introduce deposit insurance increases the volatility of credit to the private sector in countries with weak institutions. Demirgüç-Kunt and Huizinga (2004) also found a similar result about the association of deposit insurance with banking fragility. They used bank-level data to study the effect of deposit insurance on market discipline of banks. They focused on the disciplinary role of interest rates and deposit growth and found that market discipline is stronger in countries with better institutions, but that the presence of generously designed deposit insurance is able to reduce its effect significantly, leading to banking system fragility. Nier and Baumann (2006) found the same result using bank-based data that *"government safety nets result in lower capital buffers and that stronger market discipline resulting from uninsured liabilities and disclosure results in larger capital buffers, all else equal,"*. In other words, the deposit insurance is less important for banking stability

than market-discipline.[16]

Some studies used a broad notion of regulation. These defined an index of banking regulation as a weighted average of many types of regulation. For example, Gonzalez (2005) provided a channel through which banking regulation affects banking stability: charter value. The study used a panel database of 251 banks in 36 countries to analyze the impact of bank regulations on bank charter value and risk-taking. He found, after controlling for the presence of deposit insurance and for the quality of a country's contracting environment, that regulatory restrictions increase banks' risk-taking incentives by reducing their charter value. More precisely, banks in countries with stricter regulation have a lower charter value, which increases their incentives to follow risky policies. In other words, there is a negative relationship between regulatory restrictions and the stability of banking systems. He also found that the deposit insurance can have a positive effect on stability if it is exogenous, but if it is endogenous, it is not relevant for stabilization purposes. Gonzalez used non-performing loans to total loans and bank stock price volatility as the measure of risk in banks.

Also, viewing bank concentration as a symptom of regulatory restriction, Evrensel (2007) applied non-parametric and parametric methods of survival analysis to study the impact of bank concentration on banking crises. The empirical results suggest that concentration in the banking sector increases the survival time. In other words, it reduces the probability of bank failure. Another result is that the $G10$ and $non - G10$ countries constitute two distinct groups of countries, where the $non - G10$ countries have a higher incidence of bank crises.[17] The parametric survival time regressions confirmed the possibility that the effects of the covariates on bank crises may have different dynamics in the $G10$ and $non - G10$ countries. The study states that the different dynamics associated with banking crises in developed and developing countries seem to be related to the absence of competitive forces in the economic and political environment.

Demirgüç-Kunt, Detragiache, and Tressel (2006) studied whether compliance with the Basel Core Principles for effective banking supervision (BCP) improves bank soundness. They argued that BCP compliance assessments provide a unique source of information about the quality of bank supervision and regulation around the world. They found a

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[16]This result about a positive association of deposit insurance and banking instability was found as a byproduct of their research on market discipline. Nier and Baumann (2006) found, using a cross-country panel data set consisting of observations on 729 individual banks from 32 countries over the years 1993 to 2003, that competition leads to greater risk.

[17]The G10 refers to the group of eleven countries member of the Basel Committee on Banking Supervision. More precisely, Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, the United Kingdom and the United States.

significant and positive relationship between bank soundness (measured with Moody's financial strength ratings) and compliance with principles related to information provision. Specifically, they found that countries, which require banks to report their financial data regularly and accurately to regulators and market participants, have sounder banks. They found similar results when the soundness was measured through $z - scores$ yields. They interpreted their findings as evidence that transparency makes supervisory processes effective, strengthening market discipline, and that it is the most important element of the core principles.

The general result found in the implicit-risk literature about the relationship between capital standard and stability is that the previous implementation of capital requirement before the Basel II Accord had not shown convincingly that it has any effect in fighting risk-taking in the banking sector. This had motivated regulators to introduce the Basel II capital standard. So far no empirical assessment of the impact of the Basel II Accord on risk-taking in banking have been found in the literature. It will take some time to be able to carry out a good study on this new accord. This time may even be longer than usual, since the introduction of Basel II in the US has been coupled with a banking crisis.[18] A key issue one should take into account should be the endogenous part of the level of the capital ratio.

Apart from the capital standard, other types of regulation have not been scrutinized by many authors. Their findings however show that regulation directly affecting the bank manager's and/or owner's behavior (excluding full deposit insurance) seems effective for stabilization purpose. However, one cannot conclude strongly whether the empirical findings presented in this section are robust, since we have only a few studies. Therefore, these regulations need additional empirical scrutiny.

However, the implicit-risk method will always bring controversy as some would argue that the measure of the risk which is taken into account is not the one which matters for stability.

5.2   Explicit-Risk Method

A recent and growing literature of the empirical studies on banking regulation and stability using an explicit measure of banking instability departs from the work of $DKD98$. These studies use cross-country data on banking regulation and banking crises to assess, using a discrete variable regression model such as the logit or the probit model, if a given regulatory

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[18]This crisis caused by the subprime loans for housing cannot be accounted for as a consequence of Basel II; more reasonably, it can be viewed as an evidence of the weakness of the Basel I Accord on capital standard.

measure has successfully contained or reduced the probability of the occurrence of a banking crisis in a given set of economies. Some studies use all countries with available data, while others focus on a group of countries such as developing countries, developed countries, etc.

Generally, these studies are motivated by the conflicting theoretical results of the effect of regulation on the banking system stability. However, the most important reason for the increase in empirical research on regulation and stability seems to be the availability of data. Since 1998, a group of researchers at the World Bank : Barth, Caprio, Levine, and others have developed a comprehensive survey of the banking regulation practices around the world. From the first survey in 1998-1999 to the third survey in 2007, the number of countries covered has increased significantly from 100 to almost every country in the world. The number of questions and types of regulation practices covered by these surveys have also increased over this period. They have also assembled a database on banking crises.

Many studies have used these datasets to answer different types of questions, ranging from the effect of entry restriction on banking stability, to the effect of deposit insurance, capital adequacy requirement, and a broad range of criteria in banking regulation.

5.2.1 Banking Entry Restriction

A key question which has earned empirical scrutiny is whether {a lower level of} entry restriction into the banking system is likely to increase the stability of the banking sector. Beck, Demirguc-Kunt, and Levine (2006) provided an empirical answer to this question. They used data for 69 countries from 1980 to 1997, and applied the $DKD98$ discrete regression model. They found that crises are less likely in economies with more concentrated banking systems. Moreover, the data showed that regulations that thwart competition are linked with greater banking system fragility. Furthermore, Barth, Caprio, and Levine (2004) found that the likelihood of systemic banking crisis is positively associated with greater limitations on foreign bank entry; and they found no evidence of positive association between domestic entry restrictions and banking stability.

But before all this research Demirguc-Kunt and Detragiache (1998) have provided the first empirical assessment of the link between lower entry restriction in banking and financial fragility using a dummy variable of banking crises. Their study used a panel of data of 53 countries over the period 1980-1995. They found that banking crises were more likely to occur in countries with more liberalized financial systems. They pointed out that the financial liberalization's impact on a fragile banking sector is weaker in countries with strong institutions–especially where there is respect for the rule of law, a low level of corruption, and good contract enforcement. They also found that even in the presence of macroeconomic

stabilization, less entry restriction is likely to be linked with the occurrence of banking crises in countries where institutions to ensure legal behaviour, contract enforcement, and effective prudential regulation and supervision are not fully developed.

Conversely, Noy (2004) found a different result when studying the effect of liberalization on banking stability. He examined the hypothesis that insufficient prudential supervision of the banking sector after the removal of entry restriction results in excessive risk-taking by financial intermediaries and a subsequent crisis. The paper evaluated the empirical validity of this hypothesis using a panel-probit model of the occurrence of banking crises controlling for macro-economic, institutional and political variables. It concluded that such a development is, at worst, only a medium run threat to the health of the banking sector. He found that a more direct danger is the loss of monopoly power that liberalization typically entails.

5.2.2 Capital Standard

So far we have found in the literature only one study of the impact of capital standard on banking stability using the explicit-risk method. Barth, Caprio, and Levine (2004) found a significant negative relationship between higher ratio of capital requirement and non-performing loans. However, when they used the explicit dummy variable for banking crises, they found some specifications in which capital requirement entered with a negative and significant coefficient. They interpreted this result as evidence that the relationship between capital adequacy requirement and banking stability is not very robust.

5.2.3 Deposit Insurance

Before the important empirical research of Demirguc-Kunt and Detragiache (2002), here-after $DKD02$, there was a large body of theoretical literature on deposit insurance and its association to fragility. However, there was a large divergence in the results of these studies too. $DKD02$ used cross-country panel data on 61 countries over the period 1980-1997 and found that explicit deposit insurance tends to increase the likelihood of banking crises, the more so where bank interest rates are deregulated and the institutional environment is weak. They also found that the negative effect of deposit insurance on banks' stability is stronger the more extensive is the coverage offered to depositors, where the scheme is funded, and where it is run by the government. Barth, Caprio, and Levine (2004) found a positive association between the generosity of the deposit insurance scheme and the bank fragility. Their relationship was robust to alterations in the control variables. This was consistent with the view that deposit insurance not only substantially aggravates moral

hazard but also produces deleterious effects on banking stability.

However this result has not been found to be robust by Arteta and Eichengreen (2006). In fact, they assessed the link between banking fragility and deposit insurance using a sample of 75 emerging market economies over the period 1975-1997 and found no significant effect of deposit insurance on the probability of the banking system being in a systemic crisis. They argued that what led to this difference was that they had more data on deposit insurance on emerging market than $DKD02$.

5.2.4 Overall Banking Regulation

Using the above databases some studies such as: Barth, Caprio, and Levine (2000, 2004, 2006), and Barth, Gan, and Nolle (2006) have assessed the stabilization effect of existing banking regulations.

In a book entitled "Rethinking Banking Regulation: Till Angels Govern" based on the World Bank survey, Barth, Caprio, and Levine (2006) assessed the importance of each type of regulatory policy on the stabilization of the banking system. They provided empirical results for a range of regulations. They found that regulation is not effective for stability, and for a long range of criteria. They argued for paying closer attention to the foundations of the financial sector, and that without good information and adequate incentives, market participants will not be able to effectively monitor banks. These findings are the summary of findings already done in one of their previous works: Barth, Caprio, and Levine (2004). In this work they used their database on bank regulation and supervision covering 107 countries to assess the relationship between specific regulatory and supervisory practices and banking-sector development, efficiency, and fragility. More precisely, they examined the effect on banking stability of regulations such as: restrictions on bank activities; entry restriction; capital adequacy requirement; deposit insurance system design features; supervisory power, independence, and resources; loan classification stringency, provisioning standards, and diversification guidelines; regulations fostering information disclosure and private-sector monitoring of banks; and government ownership. They found that regulatory measures that rely excessively on direct government restriction on bank activities is not good for stability and can even create fragility. More precisely, they found that the relationship between capital adequacy requirement and banking stability is not robust. They also found that regulatory policies that rely on guidelines that force accurate information disclosure, empower private-sector corporate control of banks, and foster incentives for private agents to exert corporate control, worked best to promote stability.

They argued that their findings do not mean that regulations which have not been proven

effective have no role in strengthening the banking sector. Rather, their interpretation is that it suggested a supporting role for regulation, one in which the regulators' job is to verify that the information being disclosed by banks is accurate, and to penalize banks that disclose false, misleading or inadequate information.

Furthermore, Shimpalee and Breuer (2006) found, using cross-section data on twin banking crises and controlling for institutional factors, mixed evidence that deposit insurance, the removal of capital controls, a lack of central bank independence, and financial liberalization increase the chance of banking crises.[19] Using cross-country data on bank ownership, regulation and supervision, Barth, Caprio, and Levine (2000) investigated the link between bank ownership and regulation on banking fragility. They found that the tighter the restrictions placed on this activity (a bank is not permitted to do securities, insurance and real estate activities), on average, the more inefficient are banks and the greater the likelihood of a banking crisis. The likelihood of a banking crisis is also greater, on average, the tighter the restrictions placed on bank ownership of non-financial firms. They also found that restricting the mixing of banking and commerce is associated with greater financial fragility. Whereas restricting non-financial firms from owning commercial banks is not associated with financial fragility, restricting banks from owning non-financial firms is positively associated with bank instability. Finally, countries that restrict banks from owning non-financial firms have a robustly higher probability of suffering a major banking crisis.

It follows from the empirical studies, using explicit measures of banking crises, that regulations affecting a bank's balance sheet or the banking sector structure are generally at least not effective for stabilization purposes, and can even increase the fragility of the banking system. Conversely, regulation affecting a bank managers' and/or owners' behavior is effective. The importance of taking the institutional factors into account has emerged as these factors are often linked with instability.

6   Summary and Conclusion

The empirical literature on banking regulation has so far tried to solve the theoretically conflicting results on banking regulatios and banking stability. It has taken two main directions in respect of the stability measure which is used in the study. The so called implicit-stability method uses an implicit measure of risk such as: the ratio of non-performing loan on the total asset, bank stock price volatility, and the ratio of risk-weighted assets to total assets; while the explicit-stability method uses the occurrence of a systemic banking crisis in a

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[19]Their dataset consists of over 30 countries covering 13 institutional factors for the period 1984-2002.

given economy as the measure of instability.

These two methods differ also in terms of econometric techniques that they use for their estimations. The implicit-stability method relies mainly on a simultaneous equation model, and on a survival and/or hazard model; while the explicit-stability method relies on a discrete regression model such as logit or probit in the context of panel data.

So far, many studies have been done on the US banking system but only few on other banking systems. Most importantly, many works focus on a given type of regulation, generally on the capital adequacy requirement, deposit insurance, entry restriction, and supervision practices in the banking sector. So far, also these studies have failed to provide a convincing result about the impact of many types of regulation on banking stability. No regulation assessed so far had been found by all the empirical studies done on it to present the same result about its effect on stability. Hence, instead of providing a solution of the conflicting theoretical findings, empirical studies add confusion to them.

These conflicting results are mostly due to the methodologies used. In fact, even for studies using the implicit-instability technique, the results on banking regulation and instability vary from studies using simultaneous equation models to those using hazard or survival models. They vary also in the function of the control variable used to account for the characteristics of the banking system, and finally on the sample periods or sample countries. The difference between the simultaneous equations model and the others may be that the former takes into account the endogeneity effect of some types of regulation.

For studies using a cross-section dummy variable of systemic banking crises as the measure of the banking stability, the result is generally not robust, showing that regulations such as entry restriction and capital requirement have no significant effect on stability. These studies suffer mainly from selection bias, which comes from the method used to build the banking crisis variable. In fact, as pointed out by von-Hagen and Ho (2007), all datasets on the banking crises variable identify a crisis year using a combination of market events such as closures, merges, runs on financial institutions, and government emergency measures such as a freeze. Hence, they identify crises only when they are severe enough to trigger market events. In contrast, crises successfully contained by corrective policies are neglected.

There is a need to find a good measure of banking stability in order to assess the importance of regulation on stability. The measure of banking instability can be constructed using banking system indicators which are positively correlated to banking crises, such as the growth of credit to the private sector, and the growth of banks' deposits.[20] Thereafter, one can use methods such as the Markov-switching model, suitable for modelling changes

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[20]See, e.g., Demirgüç-Kunt, Detragiache, and Gupta (2007)

in the state of a variable, to detect banking crises episodes.

References

[1] Allen, Franklin, and Douglass Gale 1998. "Optimal Financial Crises." Journal of Finance 53 (4): 1245-84

[2] Allen, Franklin, and Douglass Gale. 2000a. "Financial Contagion." Journal of Political Economy, 108: 1-33.

[3] Allen, Franklin, and Douglass Gale. 2000b. "Bubbles and Crises." Economic Journal, 110: 236-55.

[4] Allen, Franklin, and Richard Herring. 2001. "Banking Regulation versus Securities Market Regulation," Center for Financial Institutions Working Papers 01-29, Wharton School Center for Financial Institutions, University of Pennsylvania.

[5] Arteta, Carlos O., and Barry J. Eichengreen. 2006. "Banking Crises in Emerging Markets: Presumptions and Evidence" Center for International and development Economic Research Working Paper Series No.1007.

[6] Barth, James R., Gerard Caprio, and Ross Levine. 1998. "Financial Liberalization and Financial Fragility", World Bank Policy Research Working Paper, 1917.

[7] Barth, James R., Gerard Caprio, and Ross Levine. 2000. "Banking Systems Around the Globe: Do Regulation and Ownership Affect Performance and Stability?"

[8] Barth, James R., Gerard Caprio, and Ross Levine. 2004. "Bank Supervision and Regulation: What Works Best?", Journal of Financial Intermediation 13:205-248.

[9] Barth, James R., Gerard Caprio, and Ross Levine. 2006. "Rethinking Bank Regulation: Till Angels Govern." Cambridge University Press, Cambridge.

[10] Beck, Thorsten, Asli Demirguç-Kunt, and Ross Levine. 2006a. "Bank Concentration, Competition, and Crises: First Results," Journal of Banking & Finance, 30: 1581–1603.

[11] Beck, Thorsten, Asli Demirguç-Kunt, and Ross Levine. 2006b. "Bank Supervision and Corruption in Lending" Journal of Monetary Economy, 23:2131-2163.

[12] Bernanke, Ben S., and Mark Gertler. 1989. "Agency Costs, Net Worth and Business Fluctuations." American Economic Review 79 (1): 14-31.

[13] Bernanke, Ben S., and Mark Gertler. 1990. "Financial Fragility and Economic Performance." Quarterly Journal of Economics: 87-114.

[14] Blum, Jurg .1999. " Do Capital Adequacy Requirements Reduce Risks in Banking?" Journal of Banking and Finance, 23:755-771.

[15] Brimmer, Andrew F. 1992. "Financial Regulation and the Fragility of Banking System," Eastern Economic Journal, 18:4:375-386.

[16] Chari, Varadarajan V., and Ravi Jagannathan. 1988. "Banking Panics, Information and Rational Expectations Equilibrium." Journal of Finance 43 (3): 749-63.

[17] Chen, Yehning. 1999. "Banking Panics: The Role of the First-Come, First-Serve Rule and Information Externalities." Journal of Political Economy, 107,5: 946-968.

[18] Cull, Robert, Lemma W. Senbet, and Marco Sorge. 2005. "Deposit insurance and Financial Development", Journal of Money, Credit and Banking, 37,1:43-82.

[19] Dahl, Drew, and M.F.Spivey. 1995. "Prompt Corrective Action and Bank Efforts to Recover from Undercapitalisation," Journal of Banking and Finance, 19: 228-243.

[20] Demirgüç-Kunt, Asli, and Enrica Detragiache . 1998. "Financial Liberalization and Financial Fragility" The World Bank Policy Research Working Paper Series, 1917.

[21] Demirgüç-Kunt, Asli, and Enrica Detragiache .2002. "Does Deposit Insurance Increase Banking System Stability? An Empirical Investigation" Journal of Monetary Economics, 49:1373–1406.

[22] Demirgüç-Kunt, Asli, Enrica Detragiache, and Poonam Gupta. 2006. "Inside the crisis: An empirical analysis of Banking Systems in Distress", Journal of International Money and Finance, 25: 702-718.

[23] Demirgüç-Kunt, Asli, Enrica Detragiache, and Thierry Tressel. 2006. "Banking on the Principles: Compliance with Basel Core Principles and Bank Soundness." World Bank Policy Research Working Paper, 3954.

[24] Demirgüç-Kunt, Asli, and Harry Huizinga. 2004. "Market Discipline and Deposit Insurance", Journal of Monetary Economics, 51:375-399.

[25] Dewatripont, Matthias, and Jean Tirole. 1993. "Efficient Governance Structure: Implications for Banking Regulation." Pp. 12-35 in Capital Markets and Financial Intermediation, eds.C. Mayer and X. Vives, Cambridge: Cambridge University Press.

[26] Dewatripont, Matthias, and Jean Tirole .1994. "The Prudential Regulation of Banks." MIT Press.

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

[28] Diamond, Douglas W. and Raghuram G. Rajan. 2001a. "Liquidity Risk, Liquidity Creation and Financial Fragility: A Theory of Banking." Journal of Political Economy, 109 (2): 287-327.

[29] Diamond, Douglas W., and Raghuram G. Rajan. 2001b. "Banks, Short Term Debt and Financial Crises: Theory, Policy Implications and Applications." Carnegie-Rochester Conference Series on Public Policy, 54 (1): 37-71.

[30] Donaldson, Glen R. 1992. "Costly Liquidation, Interbank Trade, Bank Runs and Panics." Journal of Financial Intermediation, 2: 59-82.

[31] Evrensel, Ayşe Y. 2007. "Banking Crisis and Financial Structure: A Survival-Time Analysis. International Review of Economics and Finance", doi:10.1016/j.iref.2007.07.002.

[32] Freixas, Xavier, Bruno Parigi, and Jean-Charles Rochet. 2000. "Systemic Risk, Interbank Relations, and Liquidity Provision by the Central Bank." Journal of Money, Credit and Banking, 32,3: 611-38.

[33] Furlong, Frederick T. 1988. "Changes in Bank Risk-Taking," Federal Reserve Bank of San Francisco Economic Review, Spring 1988,2:45-56.

[34] Goldstein, Itay, and Ady Pauzner. 2005. "Demand Deposit Contracts and the Probability of Bank Runs." The Journal of Finance, 60,3:1293-1327.

[35] González, Francisco. 2005. "Bank Regulation and Risk-Taking Incentives: An International Comparison of Bank Risk," Journal of Banking and Finance, 29: 1153–1184.

[36] Jackson, Patricia, et al. 1999. "Capital Requirements and Bank Behavior: The Impact of the Basle Accord," Basle Committee on Banking Supervision working papers No.1. Bank for International Settlements: ISSN 1561-8854 (www.bis.org).

[37] Hancock, D, and J.Wilcox .1992. "The Effects on Bank Assets of Business Conditions and Capital Shortfalls, in Credit Markets in Transition, " Federal Reserve Bank of Chicago, May, 502-520.

[38] Haubrich, J.G. and P.Watchel .1993. "Capital requirements and Shifts in Commercial Banks Portfolios," Federal Reserve Bank of Cleveland, 29, 2-15.

[39] Horiuchi, A .1999. "Financial Fragility and Recent Developments in the Japanese Safety Net" Social Science Japan Journal, 2:23-43.

[40] Jacques, Kevin, and Peter Nigro. 1997. "Risk-Based Capital, Portfolio Risk and Bank Capital: A Simultaneous Equations Approach," Journal of Economics and Business, 49: 533-547.

[41] Kim, Daesik, and Anthony M. Santomero .1988. "Risk in Banking and Capital Regulation," Journal of Finance, 43, 1219-1233.

[42] Koehn, M and A.M. Santomero (1980) Regulation of Bank Capital and Portfolio Risk, Journal of Finance, 35, 1235-1244.

[43] Kiyotaki, N. and J. Moore. 1997. "Credit Cycles." Journal of Political Economy, 105 (2): 211-48.

[44] Lai, Alexandra. 2002. "Modelling Financial Instability: A Survey of the Literature" , Bank of Canada Working Paper, 2002-12.

[45] Mishkin, Frederic S. 2000. "Prudential Supervision: Why is it Important and What are the Issues? ", NBER Working Paper, 7926.

[46] Morris, Stephen and Hyun Song Shin. 1998. "Unique Equilibrium in a Model of Self-Fulfilling Currency Attacks." American Economic Review, 88 (3): 587-97.

[47] Morris, Stephen and Hyun Song Shin. 2000. "Rethinking Multiple Equilibria in Macroeconomic Modelling." 2000 NBER Macroeconomics Annual.

[48] Nachane, D.M., Aditya Narain, Saibal Ghosh, and Satyananda Sahoo. 2000. "Capital Adequacy Requirements and the Behaviour of Commercial Banks in India: An Analytical and Empirical Study," Department of Economic Analysis and Policy Reserve Bank of India, Development Research Group Study No.22.

[49] Nier, Erlend, and Ursel Baumann. 2006. "Market Discipline, Disclosure and Moral Hazard in Banking," Journal of Financial Intermediation, 15: 332–361.

[50] Noy, Ilan. 2004. "Financial Liberalization, Prudential Supervision, and the Onset of Banking Crises », Emerging Markets Review, 5:341–359.

[51] Rime, Bertrand. 2001. "Capital Requirements and Bank Behaviour: Empirical Evidence for Switzerland," Journal of Banking and Finance, 25: 789-805.

[52] Santos, Joao A. C. 2001. "Bank Capital Regulation in Comtemporary Banking Theory: A Review of the Literature ", Financial Markets, Institutions and Instruments, 10,2:41-84

[53] Shimpalee, Pattama L., Janice Boucher Breuer. 2006. "Currency Crises and Institutions," Journal of International Money and Finance, 25: 125-145.

[54] Shrieves, Ronald E., Drew Dahl. 1992. "The Relationship Between Risk and Capital in Commercial Banks." Journal of Banking and Finance, 16: 439-457.

[55] Von Hagen, Jürgen, and Tai-kuang Ho. 2007. "Money Market Pressure and the Determinants of Banking Crises," Journal of Money, Credit and Banking, 39,5:1037-1066.