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Puspa Amri

Claremont Graduate University


Apanard P. Angkinand

Milken Institute

Clas Wihlborg

Chapman University, wihlborg@chapman.edu

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Recommended Citation

Amri, Puspa, Apanard P. Angkinand, and Clas Wihlborg. "International comparisons of bank regulation, liberalization, and banking crises." *Journal of Financial Economic Policy* 3.4 (2011): 322-339.

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International Comparisons of Bank Regulation, Liberalization, and Banking Crises*

Puspa Amri
Claremont Graduate University
puspa.amri@cgu.edu

Apanard P. Angkinand
Milken Institute
pangkinand@milkeninstitute.org

Clas Wihlborg
Argyros School of Business and Economics
Chapman University
wihlborg@chapman.edu

July 31, 2011

Abstract:

Purpose: The recurrence of banking crises throughout the 1980s and 1990s, and in the more recent 2008-09 global financial crisis, has led to an expanding empirical literature on crisis explanation and prediction. This paper provides an analytical review of proxies for and important determinants of banking crises –credit growth, financial liberalization, bank regulation and supervision.

Design/methodology/approach: The study surveys the banking crisis literature by comparing proxies for and measures of banking crises and policy-related variables in the literature. Advantages and disadvantages of different proxies are discussed.

Findings: Disagreements about determinants of banking crises are in part explained by the difference in the chosen proxies used in empirical models. The usefulness of different proxies depend partly on constraints in terms of time and country coverage but also on what particular policy question is asked.

Originality: The study offers a comprehensive analysis of measurements of banking crises, credit growth, financial liberalization and banking regulations and concludes with an assessment of existing proxies and databases. Since the review points to the choice of proxies that best fit specific research objectives, it should serve as a reference point for empirical researchers in the banking crisis area.

Keywords: Banking crisis definition, domestic and external financial liberalization, credit growth, measures of bank regulation

Paper type: General Review

* We are grateful for comments on earlier drafts from James Barth, Alice Ouyang, Tom Willett, and participants at the 86th Western Economic Association International Annual Conference, July 2, 2011.

1. Introduction

The recurrence of financial crises in both advanced and emerging markets throughout the 1980s and 1990s, the recent severe global financial crisis and the Eurozone debt crisis have led to an expanding literature on the determinants of financial crises. The literature has grown to encompass a diversity of crisis types such as: Balance of Payments-, Currency-, Banking-, Debt-, Inflation-, Stock market- and Real Estate crises. More often than not, they represent different aspects of the same crisis episodes. Financial crises are of particular concern because they often have real repercussions on economic growth and employment.

In this paper we focus entirely on banking crises, which are particularly interesting for two reasons. First, in most countries banks play a dominant role in the financial system, compared to equity and debt markets. Second, the special characteristics of banks as providers of liquidity with longer term assets make them vulnerable to bank runs and contagion effects from interbank positions. In times of financial distress, even a solvent bank may fail to meet its obligations given the illiquid and opaque nature of its assets. Depositors and other creditors are often unable to distinguish between solvent and insolvent banks (Diamond and Dybvig 1983).

While it has been argued that “blind” bank runs can be mitigated by developing deposit insurance systems, explicit and implicit deposit guarantees can increase the likelihood of crisis because they tend to increase banks’ incentives to shift risk to deposit insurance authorities and taxpayers while reducing the incentives of holders of bank liabilities to monitor the riskiness of banks’ lending activities. This moral hazard problem can lead to excessive risk-taking on the part of bankers. Excess risk-taking as a result of explicit and implicit guarantees of depositors and other creditors seems to have been a central feature in most financial crises in modern times according to many observers (see, for example, Reinhart and Rogoff 2009).

Empirical work on banking crises generally focus on one of two aspects: early warning signals or factors explaining banking crisis. The signals are typically indicators of macroeconomic activity such as credit expansion, which often interact with indicators of “financial fragility”. High fragility implies that the banking system is crisis prone in response to relatively mild economic downturns or external shocks (see, for example, Kaminsky and Reinhart, 1999). Meanwhile, studies on the determinants of banking crises have identified a number of policy-related contributing factors such as government-created safety net features for the banking system (e.g. deposit insurance) and institutional arrangements (e.g. financial liberalization, financial regulatory structures, quality of supervision, legal systems, and exchange rate regimes).¹

The literature has so far been unable to produce a general consensus on the key causal factors leading to banking crises. For example, Barth et al., (2006) find that official supervisory power and stricter capital requirements have no significant effect on banking crisis probabilities, while Noy (2004), Amri and Kocher (forthcoming) argue the opposite. Angkinand et al., (2010), and Shehzad and de Haan (2009) find evidence that the direction of the effect of liberalization on banking crises depends on the strength of capital regulation and supervision. The relationship among credit growth, financial liberalization and banking crises are similarly subject to disagreements. We return to these issues in Sections 3 and 4.

Given that these existing studies use different ways of operationalizing both the dependent and independent variables, one question that naturally arises is to what extent are the contradictory results driven by differences in chosen proxies? Differences in country samples and time-period coverage explain some differences in results but the choices of proxies for crisis,

¹ See, for example, Angkinand, et al., (2010) on the effect of financial liberalization and bank regulation on banking crises and Angkinand and Willett (2011) on the impact of exchange rate regimes.

liberalization, strength of supervision and credit growth seem to help explain contradictory results as well.² This contention was confirmed empirically in a longer working paper version of this study.³ There, we report on tests of robustness for determinants of banking crises by changing proxies one by one in estimations for a specific group of countries over a certain period and a fixed set of macroeconomic controls. For example, strength of capital regulation and supervision (CRS) as defined by Abiad et al., (2008) has a significant negative effect while an index constructed by Barth et al., (2006) is not a significant explanatory factor. Similarly, the choices of proxies for financial liberalization and credit growth affect results. We return to these findings below.

Motivated by disagreements in the empirical literature, this study surveys existing proxies and measurements of banking crises and the key crisis determinants. Section 2 focuses on the definitions and proxies of banking crises. In Sections 3-5, we survey proxies for each of three important explanatory variables—credit expansion, financial liberalization, and bank capital regulation and supervision, respectively. Each section also provides a brief literature review as well as discussion of existing proxies. Section 6 concludes by assessing how the usefulness of different proxies depends on the objective of the analysis.

2. Definitions and proxies for banking crises

Banking crises can be studied on the country level as well as the bank level. A banking crisis on the country level refers to a situation when there are bank failures on a large scale in the financial system. A crisis of an individual bank can be defined more unambiguously but for

² In cross-country analyses, the difference in empirical findings on the early warnings and determinants of banking crises could also be driven by the difference in methodologies used. See, for example, Demirgüç-Kunt and Detragiache (2005) and Davis and Karim (2008) for the review of different methodologies used in the banking crisis literature.

³ Available at: <http://www.cgu.edu/pages/1380.asp>.

policy purposes the country level is obviously more interesting from the point of view of repercussions on the real economy. On the country level, likelihood of a banking crisis, banking system instability, lack of banking system soundness and fragility are often used more or less interchangeably. Banking instability generally has a broader definition than banking crisis. Instability may refer to disruption in the payment system or volatility of asset prices that potentially could lead to crises (see, for example, Mishkin 1996).

2.1 Banking crisis on the country level

To identify episodes of banking crises caused by bank runs, data on bank deposits could in principle be used. Crises originating on the asset side of banks' balance sheets through the deterioration of asset values could be identified by studying, for example, non-performing loans (NPLs). The data for these variables are not available for a long time span and they do not necessarily reflect or capture widespread bank failures in the banking system. Another reason why so few studies use NPL data is because the reliability and comparability of the NPL data can be questioned in a cross country analysis. Most countries have been reluctant to reveal the existence of severe banking problems in official statistics, and the definition of NPL varies from country to country although some convergence is ongoing.

Most studies of banking crises on the country level proceed by identifying dates of crises from explicit events. Generally, crisis episodes are identified based on a combination of objective data and interviews with experts. In some cases, quantitative data such as decline in deposit, NPLs and liquidity support are used with subjective judgment to identify the timing of a crisis event. As summarized in Table 1, the banking crisis data sets using this event-based approach have been provided in a small number of studies and cover a large number countries as well as decades. The data usually provide the beginning and ending dates of each crisis episode in each country.

The very first, comprehensive data set using this event-based approach was compiled by Lindgren, Garcia, and Saal, LGS, (1996) and Caprio and Klingebiel, CK, (1996, 2002, and updated by Caprio et al., 2005). Databases are also compiled by Demirgüç-Kunt and Detragiache, DD, (1998, and updated in 2005) and Reinhart and Rogoff, RR, (2009). The most recent studies that provide banking crisis dates including the recent global financial crisis are Laeven and Valencia's (LV) studies (2008 and 2010). Dates of banking crisis episodes from these studies are fairly highly correlated as they are compiled in a similar way and partly represent refinements of earlier studies. However, there are clearly great scope for judgmental differences with respect to the beginning and end of crises (see also Barrell et al., 2010). For example, the dating of the U.S. savings and loan crisis in LGS and DD is from 1980 through 1992, while RR date the same crisis from 1986 through 1993 and CK from 1988 through 1991. LV identify the crisis as a one year crisis which started and ended in 1988.⁴

[Table 1 here]

Dziobek and Pazarbasiogly (1997) limit the data set to “systemic crises,” wherein problem banks together hold at least 20 percent of total deposits in a country. Only 24 crises worldwide are covered in the study. Kaminsky and Reinhart (1999) identify crises based on existing studies and on the financial press. They include 20 countries from 1970 to mid-1995 in the study. To avoid dating too early or too late, they identify the peak period when there is the heaviest government intervention and/or bank closures. The objective of their paper is to examine the value of a number of macroeconomics variables as signals or leading indicators of banking crises.⁵

⁴ Additional statistical comparisons of the number of banking crisis episodes identified by these five studies can be found in the working paper version of this paper (see footnote 3).

⁵ There are few other studies using the event-based approach to identify banking crisis episodes. Their data have been less frequently used in the literature. For the additional review, see Kibritcioglu (2002).

Existing empirical studies on banking crises employ the banking crisis indicator from the sources mentioned in Table 1 by assigning a 0/1 dummy for non-crisis and crisis periods. There are studies pointing out limitations and disadvantages of such data sets. Boyd et al., (2009), for example, argue that this crisis dating scheme in fact reflects government responses to perceived crises rather than the onset or duration of adverse shocks to the banking industry. Serwa (2010) points out that these data sets fail to measure the extent of a crisis. Governments also have great scope to employ, for example, forbearance to prevent a crisis from erupting.

2.2 Indicators of banking sector fragility and distress of individual banks

A second group of studies in the banking crisis literature uses a continuous scale for banking crisis based on variables from banks' balance sheet and market data. The variables commonly used are NPLs, provision for loan losses, and equity capital in the banking systems. These variables are more suitable as proxies for risk-taking or fragility in a banking system or an individual bank since there are no clear trigger points for these variables to indicate a crisis that is associated with a sudden increase in fiscal and more general economic costs.⁶

There are a number of proxies for “financial stability”, indices for “financial soundness” and “financial stress” based on various components of balance sheet and market data for the banking sector. For example, Corsetti et al., (2001) use NPL as an indicator of financial instability, but only if there is a presence of a “lending boom.” Das et al., (2004) construct an index of financial system soundness from the average of the capital ratio and the (inverted) ratio of NPL to assets. This index is weighted by the credit-to-GDP ratio in order to capture the extent of financial intermediation in a country.

⁶ There are also more theory based proxies for risk-taking on the bank level intended to measure “distance to default.” The Z-score based on accounting data used in Boyd and Graham (1986) or market data used in Hovakimian et al., (2000) incorporates the capital asset ratio, the return on assets and the standard deviation of this return.

Kibritcioglu (2002) constructs a “financial fragility index” using proxies for liquidity risk (bank deposits), credit risk (bank credits to the domestic private sector) and exchange rate risk (foreign liabilities to banks). Illing and Liu (2006) and Hakkio and Keeton (2009) create an “index of financial stress” using the market data such as the bond spreads for various bond types. An extreme value of the index is used to identify periods of financial crises. The IMF performs country studies on the health of the banking system under the Financial Sector Assessment Program (FSAP) instituted by the IMF and World Bank (see IMF, 2003). Indicators of the health of the banking system in each country are presented in these occasional studies. Indicators included in the financial stress index are falling asset prices, exchange rate depreciation and/or losses of official foreign reserves, insolvency of market participants, defaults of debtors, rising interest rates, and increasing volatility of financial market returns. These indicators of financial stress are used as leading indicators of weaknesses and disruptions of the financial system.

Some of the indicators of financial fragility and stress discussed above build on balance sheet and market data for individual banks. Thus, proxies for and indicators of bank specific crises or distress can be constructed from variables like NPL and capital to asset ratios. The z-score as a measure of “distance to default” (see footnote 6) belongs to the bank-specific category. Market prices on securities issued by individual banks can also be used to extract implicit probabilities of default. Angkinand et al., (forthcoming) review the timeliness of equity prices, subordinated debt yields and credit default spreads as indicators of distress of individual banks.

Interest in measures of the contribution of individual bank risk to the likelihood of a systemic crisis has increased as a result of the recent financial crisis. Fear of contagion from banks that are “too big to fail” has led to attempts to identify “systematically important financial institutions” (SIFIs) and their contribution to the likelihood of a crisis.

There is no clear consensus on how a bank's contribution to the systemic risk should be measured. Drehmann and Tarashev (2011) use variables such as bank size and interbank lending and borrowing as measures of a bank's systemic importance. A group of researchers at New York University have developed an early warning measure geared towards providing a signal for the contribution of individual banks to systemic risk. This measure, the Marginal Expected Shortfall (MES), is an equity market-based signal and it depends on the volatility of a bank's equity price, the correlation with the market return, and the co-movement of the tails of the distributions. Thus, it is designed to capture special characteristics of the tails of distributions associated with systemic shocks. The MES is described in Brownlee and Engle (2010).⁷

3. Measures of Credit Growth

The role of private credit growth has been a source of disagreement within the banking crisis literature. There are theoretical as well as empirical grounds for the diverging views on credit booms. Proponents of the predominant view point to the boom-bust credit cycle explanation, along with distorted incentives to allocate credit away from market-determined criteria during periods of credit expansion. The story is straightforward: over-optimism about future earnings (i.e. the boom) boosts asset valuations and the net worth of the firms, "artificially" inflating their ability to borrow,⁸ but when profit expectations are unmet (i.e. the bust), the process is reversed, and banks face serious balance sheet problems. Others (see e.g. Gourinchas et al., 2001), however, view expansion of credit as a normal phase of financial development. Far from being a transitory development, Gourinchas et al. argue that credit booms can be symptomatic of improvements in investing opportunities.

⁷ Available at: <http://vlab.stern.nyu.edu/analysis/RISK.USFIN-MR.MES>.

⁸ This is formally demonstrated by Bernanke et al. (1998) through the financial accelerator model.

The relationship between rapid credit growth and banking crises remains controversial although most of the studies listed in Table 2 reveal a link between credit growth and subsequent crises. One reason is that results vary in multivariate regressions when other, possibly correlated variables, are included. For example, the significance of credit growth in the empirical model of Joyce (2010) did not hold when a proxy for financial liberalization was included. This observation is consistent with Mendoza and Terrones (2008). They show that credit booms were preceded by financial liberalization in 20 percent of cases. Amri et al. (2011) find that the interaction between credit growth and financial liberalization is significant in predicting banking crisis probability but credit growth alone is not.

The main variable used in these studies to construct a credit boom indicator is the ratio of bank credit to the private sector relative to GDP⁹ but there are variations in how to operationalize the “credit boom” variable. One way is to employ a continuous measure of private credit growth, another to define a dichotomous measure of credit boom episodes. Within the latter group, credit boom is coded as 1 when there occurs “usually large” credit growth. However, there has been much debate about what is “unusually large” vis-à-vis “normal” credit growth – whether it can be captured by the deviation in the growth of credit from its trend, above a certain “normal” threshold, or the pace of credit growth, as compared with the growth of GDP itself. the deviation from GDP growth¹⁰ – as well as the appropriate statistical filters to employ.

The continuous measure of credit growth has been used in most multivariate logit/probit banking crisis models with the purpose of estimating the marginal effect of private credit growth

⁹ Studies generally obtain the data for domestic bank credit to the private sector from two sources: 1) World Development Indicators and 2) International Financial Statistics (line 22d and 42d). In some studies such as Mendoza and Terrones (2008), this variable is transformed into “real credit per capita,” by adjusting to consumer price inflation and the total population, while some others (see Table 2) employ “net domestic credit” which includes bank credit to both the government and the public sector.

¹⁰ This measurement issue is similarly experienced in defining “sudden stops” as discussed in Sula et al., also in this special issue.

on the probability of a banking crisis. The dichotomous measure has been used in frequency analysis and event studies relating episodes of credit booms and banking crises (Mendoza and Terrones 2008). Gourinchas et al., (2001) compare probabilities of banking crises before and after credit boom episodes.

[Table 2 here]

4. Data Sets for Financial Liberalization

Many countries relaxed internal and external restrictions on their financial sectors during the 1980s and the 1990s. Many argue that financial liberalization lowers the cost of capital and encourages banks to engage in more risky projects. It has also been argued that increased competition can make banks become more vulnerable.

Most early studies of the impact of financial liberalization on banking crises focused on the elimination of interest rate controls (e.g. Demirgüç-Kunt and Detragiache, 2001 and Weller, 2001). A 0/1 dummy was used to distinguish between periods before and after liberalization. The literature has later expanded along with databases including liberalization of controls on credit allocation, external capital flows, equity markets and entry. Eichengreen and Arteta (2002), Noy (2004), Ranciere et al., (2006) emphasized the difference between the effects of domestic and external liberalization including relaxation of current and capital account restrictions.¹¹

The disadvantage of a dummy variable for liberalization is that it does not capture the extent or speed of liberalization. Continuous measures of degrees of financial liberalization require assumptions about the impact of liberalization on a variable affected by liberalization.

¹¹ Measures of external liberalization, i.e. the degree of capital controls, are discussed in the paper in this special issue on “International Aspects of Currency Policies” and Potchamanawong et al., (2008).

For example, Eichengreen and Arteta (2002) use the ratio of capital flows to GDP as a proxy for the degree of external liberalization. Bekaert et al., (2005) use market capitalization to capture the intensity of equity market liberalization. These continuous measures are obviously affected by a number of factors besides liberalization.

With an increased interest on the study of financial liberalization, scholars have developed the dichotomous measures of financial liberalization from simple dummies to incorporate intensity of liberalization. Two recent available databases are constructed by Kaminsky and Schmukler (2008) and Abiad et al., (2008). The former includes three-level financial liberalization indices for capital account controls, interest rate controls, and equity market restrictions in 28 countries from 1973 through 1999.

The *Financial Reforms Database* in Abiad et al. (2008) categorizes financial reforms into seven dimensions each year from 1973-2005.¹² Six of them refer to liberalization in the form of elimination of credit allocation controls, interest rate controls, capital account controls, equity market controls, entry barriers and privatization while the seventh dimension captures strength of bank capital regulation and supervision (CRS). The intensity of each reform category is captured on a four-point scale from fully repressed to fully liberalized for the six dimensions of liberalization. The CRS-dimension will be discussed in the next section. The data are available for 98 countries.

The more comprehensive databases have allowed analyses of effects of different types of liberalization. However, as pointed out by Abiad and Mody (2005) and Angkinand et al., (2010), all dimensions of financial liberalization are highly correlated since one type of liberalization is often accompanied or followed by other types of liberalization. Therefore, identification of effects of specific types of liberalization can be uncertain. Abiad and Mody

¹² The data are available to the public at <http://www.imf.org/external/pubs/cat/longres.aspx?sk=22485.0> (accessed 31 July 2011).

(2005) use only an aggregate index based on all available categories of financial reforms in their empirical study. Angkinand et al., (2010) use an aggregate index as well as three types of liberalization which are grouped based on six financial liberalization variables. They find that the most important type of liberalizations in associating with an increased likelihood of a banking crisis is the relaxation of restrictions on banks' actions and behavior (i.e. relaxation of interest and credit controls), but this relationship can be clearly distinguished from the effects of other types of liberalization only when it is conditioned on the strength of capital regulation and supervision (CRS) in the domestic banking system.

Finally we note that recent studies by Angkinand et al., (2010) and Shehzad and de Haan (2011) do not confirm the conventional wisdom that financial liberalization always increases the likelihood of banking crises. The former study finds that the likelihood of crises is at a maximum with partial liberalization while the latter finds that after some reform additional reforms lead to more stable financial systems. In the next section we will see how these results from these two studies are modified by interaction between liberalization and CRS.

5. Data sets for Bank Regulation and Supervision

Several studies investigate the effects of bank regulation and supervision on banking crises. These effects can be direct or captured by interaction between regulation or supervision and other variables like deposit insurance coverage or financial liberalization.

The variables directly measuring bank regulation and supervision are available only from few data sources. There are related proxies for the quality of countries legal systems and bureaucracy. These proxies have greater coverage of countries and periods and they are likely to be highly correlated with effectiveness of regulation and supervision of banking systems. The databases commonly used in the literature are the following:

- i. *The World Bank's Regulation and Supervision of Banks around the World: a New Database*, compiled by Barth, Caprio, Levine (2006) (*the World Bank survey*)
- ii. *Financial Reforms database* from Abiad, Detragiache and Tressel (2008), International Monetary Fund (the variable called Enhancement of capital regulations and prudential supervision of the banking sector)
- iii. *International Country Risk Guide, ICRG* (the variables include law and order, corruption, bureaucratic quality)¹³

The first database is the most commonly used as it is available for more than 140 countries, but the data availability is currently limited to three survey years; 1999, 2003 and 2005. One advantage of the *World Bank survey* database is that it comprises of a large number of survey questions on how bank are regulated and supervised. Different aspects of regulation and supervision can be studied. The database includes questions on restrictions on bank activities, formal supervisory powers, ownership, organization, accounting and disclosure. The different dimensions can be objectively defined. Studies using this database generally create a composite index from a certain number of related survey questions to capture the extent of banking regulation to serve the purpose of their studies.

The *Financial Reforms Database* provides data for the six types of financial liberalization discussed above as well as for “Enhancement of capital regulations and prudential supervision of the banking sector” (CRS). The scale of this variable goes from 0-3 where 0 = unregulated and unsupervised and 3 = strongly regulated and supervised. This data set is available annually from 1973-2005 for 91 countries. However, this database provides more limited aspects of banking regulation and supervision than the first database. It has only one dimension and is based on

¹³ The *World Bank survey* data are available to the public at: <http://go.worldbank.org/SNUSW978P0>. The data from *ICRG*, available at <http://www.prsgroup.com/ICRG.aspx>, require subscriptions. See also footnote 12.

assessment of available information from different countries. Thus, it has a judgmental component.¹⁴

We compare the data for CRS variables from the two mentioned sources by country group in Table 3. The data refers to 2005, the latest *World Bank survey* year. We construct an index from the three *World Bank survey* questions that are comparable to the components of CRS in the *Financial Reforms database*.

Table 3 shows that on average the *Financial Reforms database* assigns a higher value of CRS to developed countries, a lower value for emerging market economies, and the lowest value for other less-developed countries. The *World Bank survey*, on the other hand, ranks the group of other less-developed countries above emerging markets in terms of having better bank regulation and supervision. The correlation between the two variables is as low as 0.4.

[Table 3 here]

Turning to the proxies for legal system and institutional quality, the most widely used variables in the banking crisis literature include Law and Order, Corruption, Bureaucratic Quality from *the International Country Risk Guide* (ICRG). The data are available for more than 150 countries and from 1984, and have been continuously updated. Other variables and sources, which have been less frequently used, in part due to the limited number of country and/or period coverage, are the *Fraser Institute's Economic Freedom index*, the *Heritage Foundation's Index of Economic Freedom*, the *Worldwide Governance Indicators* by Kaufmann, Kraay, Mastruzzi (2009). The real GDP per capita is also used in some studies as proxy the general quality of domestic institutions. All these proxies reflect only general aspects of quality of institutions, and they may not directly measure bank regulation and supervision in the specific way researchers

¹⁴ For other sources of bank regulation data sets, Neyapti and Dincer (2005) develop an index of Legal Quality of Bank Regulation and Supervision. They identify a total of 98 criteria related to the quality of banking regulation and code them using information retrieved from actual banking laws. However, we do not find that their data sets have been used in existing studies.

desire. However, the advantage of using the proxies from ICRG and GDP per capita is that they allow time series analysis. The general trend of institutional quality over time is positive although there are periods of reversals in some countries. The trend for CRS in the *Financial Reform database* is positive as well.

Given the relatively low correlation in cross-section between the two data sets for CRS it is not surprising that researchers come to different conclusions regarding the relationship between banking crisis and strength of regulation and supervision. For example, Barth et al., (2006) find that the probability of banking crises is reduced in countries with a high quality of law and order but not in countries with relatively strong CRS as measured by the *World Bank survey*. However, Angkinand et al., (2010) find that CRS from the *Financial Reforms Database* reduces the likelihood of banking crises in a cross-section time-series analysis. Barrell et al., (2010) also conclude that bank regulation and supervision reduce banking crisis probabilities for the sample of 14 OECD countries from 1980-2007. Their conclusion is based on continuous variables for the capital adequacy and liquidity ratios in banking systems. They do not observe significant effects for OECD countries of other proxies from Kaufmann, Kraay, Mastruzzi (governance variable), the Heritage Foundation (banking- and economic freedom index), and the World Bank survey database (selected banking regulatory variables). Klomp (2010) does not find any evidence that a credit market regulations index from *the Fraser Institute* has a significant impact on the stability of the banking sector.

Turning finally to the interaction between strength of regulation and supervision, and financial liberalization Shehzad and De Haan (2009) find that a positive impact on financial stability is conditional on adequate supervision. Similarly, Angkinand et al., (2010) find that the decline in likelihood of banking crisis associated with increased liberalization occurs only in

countries with strong capital regulation and supervision. In countries with weak regulation and supervision the effect of liberalization is the opposite.

6. Assessment of usefulness of existing proxies and conclusions

The analytical review and comparisons of various proxies for banking crises, as well as important banking crisis determinants—credit expansion, financial liberalization, and bank regulation and supervision—show that differences between proxies explain some contradictory results in the literature, as well as differences in sensitivity of the likelihood of banking crises to changes in explanatory factors. Understanding of the construction of different proxies can help the researcher choose the relevant proxy for the research objective in cross-country and time-series analyses. Thus, the usefulness of a particular proxy depends on the research objective. We emphasize the following observations with respect to different variables:

- *Banking crises*: Data for crisis dates, which are available in few studies, are compiled in a similar way and sometimes draw upon one another. Banking crisis episodes from the available data sources are highly correlated but there are differences as a result of differences in judgment about what defines a crisis. The researcher concerned primarily with very costly systemic crisis should choose the most restrictive crisis proxy. Differences in beginning and end dates of crises matter less as long as one crisis is considered one observation whether it lasts one or three years. It is obviously necessary to consider country and time coverage; statistical significance may have to be traded off against appropriateness of proxy.

A fruitful area of research is the analysis of the relation between market-based measures of probability of distress and other proxies for distress of individual banks as well as for systemic crises.

- *Credit expansion*: A continuous measure captures simply the growth of private bank credit while dichotomous measures place emphasis on identification of lending boom episodes. The former measure seems most appropriate for studies using continuous proxies for probability of crisis rather than 0/1 crisis dummies, and for tests of theoretical hypotheses with respect to determinants and effects of credit growth. The dichotomous measures are associated with much debate about the identification of “excess” credit growth relative to the growth endogenously associated with the economy’s performance. There is scope for theoretical as well as empirical research on this issue.

- *Financial liberalization*: Attempts to measure financial liberalization have progressed from simple dichotomous measures to indices capturing a number of dimensions and degree of liberalization over time. Although the recently constructed comprehensive data sets, e.g. the IMF *Financial Reforms database* in Abiad et al., (2008) allow researchers to study the effects of different types of liberalization, the different types are highly correlated since most countries have moved towards greater liberalization. Moving away from simple dichotomous measures has led to results contradicting the conventional wisdom that liberalization contributes to the likelihood of banking crises. One remaining challenge is to be able to identify effects of different types of liberalization in order to produce meaningful policy implications with respect to effects of financial liberalization policies.

- *Bank regulation and supervision*: there are tradeoffs in the choice between available proxies for strength of regulation and supervision. The data from the *World Bank survey* of bank regulation and supervision by Barth et al., (2006) consist of objective measures of many dimensions of regulation and supervision. Thus, they seem to be appropriate for studies of effects of specific reforms. The *Financial Reform Database* covers fewer dimensions but include informal judgment about effectiveness of regulation and supervision. Another trade-off exists

because the *World Bank Survey* data exist only for three years so far. The literature commonly assumes that bank regulations rarely change over time, but the proxies for bank regulation and institutional quality from other data sources show otherwise.

Finally we note that results with respect to the effects of financial liberalization and strength of regulation and supervision on banking crises are strongly affected by interaction between these variables. We suspect that banking crises are influenced by interaction between these variables and credit growth as well.

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Table 1. Main Data Sources for Banking Crises at the Country Level

Study	Criteria for episode of banking system problem	Country coverage and banking problem episodes	Period coverage
Lindgren, Garcia and Saal (1996)	There are runs or otherwise substantial portfolio shifts, collapses of financial firms and/or massive government intervention. Two general classes are identified: “significant” or “crisis”.	133 out of 181 IMF members experienced a banking sector problem. 106 episodes were considered “significant”, and 41 episodes in 36 countries were classified as “crisis”.	1980-1996
Caprio et al., (2005) updates Caprio and Klingebiel’s 1996, 2002 studies	The dataset is based on data for loan losses and the erosion of bank capital, interviews with experts, and judgment whether an episode constitutes a crisis. A banking crisis episode is identified as: “systemic” or “non-systemic”. In a systemic crisis, much or all of bank capital is exhausted. In a non-systemic or borderline crisis, a subset of banks indicates a banking problem such as a large-scale of government intervention.	160 banking crisis episodes in all countries. 46 episodes are classified as systemic crises.	1970s-2003
Demirgüç-Kunt and Detragiache (2005) updates their 1998 study	Identifies, dates and updates episodes using above studies and others. One of the following conditions must be satisfied for a crisis to be identified: (i) the ratio of non-performing loans to total assets in the banking system exceeds 10 percent, (ii) the costs of rescue operation exceeds 2 percent of GDP, (iii) there was large scale nationalization of banks, or (iv) there were extensive runs or emergency measures to prevent runs were taken (deposit freezes, prolonged bank holidays, or blanket guarantees of deposits).	62 countries experiencing 83 crises	1980-2003
Reinhart and Rogoff (2009)	Banking crisis episodes are identified based on (i) bank runs that lead to the closure, merging or take over by the public sector of one or more of the financial institutions, or (ii) when no bank runs occur, but there is a closure, merging, take-over or large-scale government assistance of an important financial institutions followed by similar outcomes for other financial institutions.	66 countries experiencing 108 episodes	1800-2009 (but only data from 1970 are used)
Laeven and Valencia (2008, 2010)	Banking crisis episodes are identified based on (i) deposit runs, (ii) introduction of deposit freeze/blanket guarantee, (iii) extensive liquidity support, (iv) bank interventions/bank takeovers, or (v) high proportion of non-performing loans (NPL) which translates into loss of most of the capital in the system.	123 countries experiencing 145 episodes	1973-2008

Table 2. Measures of Credit Growth in the Banking Crisis Literature

Measures of credit	Data source	Authors	Binary or continuous	Findings
1. <u>Real credit per capita</u> : Real credit is the average of two contiguous end-of-year values, deflated by the end-of-year consumer price index.	International Financial Statistics (IFS)	Mendoza & Terrones (2008)	binary variable, set using standard Hondrik-Prescott (HP) Filter	Credit booms coincide with or precede banking crises in both advanced and emerging markets.
2. <u>Real domestic credit to the private sector credit to GDP ratio</u> : credit is financial resources provided to the private sector, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivables.	World Development Indicators (WDI)	Gourinchas et al (2001)	Binary variable, set using expanding HP Filter	The link is tenuous. Most banking crises are preceded by lending booms, <i>but</i> most lending booms are not followed by a banking crisis.
	WDI	Borio and Drehman (2009)	Binary variable, set using rolling HP filter	In 18 industrial countries (1980-2008), sharp increases in both credit and asset prices precede banking crises.
	WDI	Joyce (2010), Demirguc-Kunt & Detragiache (1998).	Continuous variable: one year growth of private credit to GDP ratio.	Using panel logit/probit models, an increase in credit growth significantly leads to an increase in the probability of a banking crisis.
3. <u>Real domestic private credit growth/real GDP growth</u> , three years prior to a banking crisis.	WDI	Caprio and Klingebiel (1996)	Dummy variable =1 if the variable is between 0-2.5%.	Positive link between rapid credit growth and crises applies to Latin America, but not when considering a larger set of countries.
3. <u>Net domestic credit</u> : the sum of net credit to the nonfinancial public sector, credit to the private sector, and other accounts.	WDI	Eichengreen and Arteta (2002)	Continuous variable, not weighted by GDP.	In 75 emerging markets (1975-97), credit growth is positive and significantly related to banking crisis probabilities.

Source: Authors' compilation based on studies cited in text, WDI and IFS.

Table 3. Comparison of Bank Regulation Data

	<i>The World Bank survey</i> (Barth, Caprio and Levine)	<i>Financial Reforms Database</i> (Abiad, Detragiache and Tressel)
Developed economies	0.82	0.89
Emerging market economies	0.74	0.65
Other less developed countries	0.78	0.55
<i>All countries</i>	<i>0.78</i>	<i>0.68</i>

Note: the data in the table are average values of the capital regulation and supervision (CRS) variable in 2005 by country group. The CRS variable in the third column is from the *Financial Reforms database* by Abiad et al., (2008). The CRS variable in the second column is constructed based on the comparable survey questions from the *World Bank survey* by Barth et al., (2006). See the working version of this paper for detail explanations.