

Public Credit Registries as a Tool for Bank Regulation and Supervision

Matías Gutiérrez Girault & Jane Hwang¹

Abstract

This paper is about the importance of the information in Public Credit Registries (PCRs) for supporting and improving banking sector regulation and supervision, particularly in the light of the new approach embodied in Basel III. Against the backdrop of the financial crisis and the existence of information data gaps, the importance of complete, accurate and timely credit information in the financial system is evident. Both in normal times and during crises, authorities need a device that allows them to look at the universe of credits in a detailed and readily way. And more importantly, they need to develop tools that exploit as much as possible the information therein contained. PCR databases contain individual credit information on borrowers and their credits which makes it possible to implement advanced techniques that measure banks' credit risk exposure. It allows optimizing the prudential regulation ensuring that provisioning and capital requirements are properly calibrated to cover expected and unexpected losses respectively. It also permits validating banks' internal rating systems, performing stress tests and informing macroprudential surveillance. In this respect, it is envisioned that the existence of a PCR will be a key factor to enhance the supervision and regulation of the financial system. Furthermore, the extent, accuracy and availability of the information collected by the authorities will determine the usefulness of the PCR as part of their toolkit to monitor the potential vulnerabilities not only on a microprudential level, but also on a macroprudential one.

¹ Banco Central de la República Argentina and World Bank, respectively. We wish to thank the insightful comments and suggestions received from Ramón Santillán and Jesús Saurina (Banco de España), Christian Castro (Bank of England), Jaime Coronado, Javier Guzmán, and Raúl Morales (CEMLA), Massimo Cirasino, Lily Chu and Cornelio Pimentel (World Bank). Any remaining error is our sole responsibility.

“Yes, the only place on earth where all places are, seen from every angle, each standing clear, without any confusion or blending”

The full knowledge of a fact sometimes enables you to see all at once many supporting but previously unsuspected things.

Jorge Luis Borges, *El Aleph* (1945)

I. Introduction

The recent subprime crisis demonstrated that banking supervision and regulation are necessary to promote stable financial markets and support economic growth. The business of banking entails a wide array of risks, thus the purpose of supervision and regulations is that banks be prudently operated amid the associated risks involved.

Banks are by definition highly leveraged in that they operate with a high share of borrowed funds. Their ability to function on fractional reserves and the fact that they typically transform short-term funding into longer-term credits with greater risk amplify their vulnerability. The essence of leveraging borrowed funds to create potential high returns on investment creates an element of moral hazard in which the ultimate consequence of a negative outcome may not only be borne by the bank (limited to its equity at risk) but by its depositors as well. Besides, banks can also fall prey to systemic risks as a result of: i) debt inter-linkages with problem banks; ii) generalized bank runs triggered by investor panic; and iii) an asset implosion, causing a substantial drop in prices of stocks and/or real estate, as has recently been vividly illustrated in the US housing market.

This inherent frailty within the operational function of banks, the fact that they provide valuable “public goods” (access to the payment systems, savings intermediation, asset transformation, etc.), and the potentially large social costs derived from bank failures and spillover effects (into other banks and the real sector as well) motivate their regulation and supervision. Such financial distress and crises can come at a sizable cost to the economy with substantial losses that can run into double digit percentages of GDP.²

The vexing events that followed the subprime crisis triggered a profound and comprehensive revision of the conventional approach to regulate and supervise financial systems. Championed by the Financial Stability Board and in response to the G20 Leaders’ call,³ international financial institutions, standards setters, surveillance bodies, national regulators, and supervisors are elaborating and analyzing proposals to fix the features which have seemingly led to (or at least failed to prevent) the recent crisis.

² Hoggarth, Reis and Saporta (2001) find that the cumulative output losses incurred during banking crisis periods are large, roughly between 15% and 20%, on average, of annual GDP. BCBS (2010a) surveys a wide array of approaches to measuring output costs from financial crises and finds that the median estimate of cumulative discounted costs is near 60%. Regarding the current crisis, Haldane (2010) estimates that the present value of output losses for the world economy can range between 90% and 350% of 2009 GDP, depending on what fraction of the 2009 loss is permanent.

³ As set forth in its *Washington Action Plan* (see Group of Twenty, 2008) and its *Declaration on Strengthening the Financial System* (see Group of Twenty, 2009).

Different working groups underway are addressing a multiplicity of weaknesses and loopholes in the conventional paradigm, and fleshing out proposals that will likely be introduced in the near term.⁴ Amid this effort, the Basel Committee on Banking Supervision (BCBS) has developed an array of reforms – some minor, others more radical – that will completely overhaul banking sector regulation and supervision. Some of these include: introducing a global liquidity standard; imposing larger capital requirements on systemically important banks; shifting to forward looking provisioning practices; introducing a countercyclical capital framework (i.e. a conservation buffer and a countercyclical buffer), and complementing the regulatory minimum capital requirements with a leverage ratio that curtails banks' risk appetite during expansions. These amendments, which build on the Revised International Capital Framework (Basel II), are being referred to as Basel III.

Necessary as these revisions are, this crisis is rooted in the fact that the basic principles of credit risk management were compromised on various levels. As a result of accelerated financial innovation, the banks offered new, but opaque, vehicles for investment. This made it difficult to assess risk levels and the true extent of credit leverage. Thus, as financial institutions began to develop and issue more convoluted instruments, credit risk management became more imprecise and at times erroneous. Without proper regulatory oversight and amid highly liquid credit markets (particularly, facing an infinitely elastic demand of asset backed securities - ABSs - and collateralized debt obligations - CDOs - of ABSs), it further enabled banks to loosen their lending policies and thus continue taking riskier positions. This set the stage for a preminent collapse as lenient, and at times deceptive, lending practices were combined with extreme household exposure (especially to an upside in interest rates). And to make matters even worse, bank supervisors and regulators often times lacked the appropriate information to readily monitor the developments unfolding in the market place.

Credit reporting systems (CRSs) are important institutions in credit markets in that they provide a complete picture of an individual or firm's creditworthiness. Besides being important for credit risk management, the availability of high quality and timely information on borrowers' behavior is important for other reasons as well, such as developing a "credit culture." A credit culture facilitates access to credit as it addresses the fundamental problem of credit markets: asymmetric information between borrowers and lenders, which leads to adverse selection and moral hazard. This problem is reduced as credit reporting systems capture current and historical lending and payment information. The more accurate, complete and timely information that is available in the credit system, the better the lenders are able to use credit data to grant credits and monitor their portfolios. One of the most important institutional elements supporting a well-functioning credit market is credit reporting firms. They are able to provide rapid access to accurate, reliable, and standardized information on potential borrowers and are of critical importance in determining risk exposure.⁵

⁴ The guidelines that sound financial regulation should observe have been assembled in Brunnermeier *et al* (2009).

⁵ The benefits of the sharing of positive and negative information and thus of complete credit reporting systems are supported by profuse empirical evidence: see Jappelli and Pagano (1999), Barron and Staten (2003) and Majnoni *et al* (2004). For theoretical developments see Pagano and Padilla (1993) and Brown and Zehnder (2005).

In many countries, central banks or bank superintendences operate public credit registries (PCRs). PCRs are databases with detailed information of the credits granted by financial intermediaries⁶ created to support bank regulation and supervision. On occasions they also participate actively in the credit information market by providing data to creditors (namely banks) and credit bureaus.⁷ The degree of interaction and involvement with other CRS⁸ players (e.g. financial institutions, other credit providers and credit bureaus) varies from country to country. It heavily depends on the institutional and legal arrangements that support their operation and on the idiosyncrasy of the local credit markets.

Besides its role in improving creditors' risk assessment and in facilitating access to finance, credit information is also an important tool for bank supervisors and regulators as watchdogs of financial stability. One of the many lessons this crisis has painstakingly taught is the paramount importance that supervisors regularly and thoroughly monitor banks' risk exposure (i.e. at least on a quarterly basis). Being able to evaluate the credit risk of borrowers in the financial system gives important information to monitor the quality of banks' portfolios and to shape the prudential regulation.

This paper is about the importance of the information in PCRs for supporting and improving banking sector regulation and supervision. Bank on-site examinations and off-site monitoring can be more efficient and effective when supervisory authorities have direct access to credit data, and hence can avoid relying exclusively on bank internal databases and regulatory reports. The fact that PCR databases contain individual credit information on borrowers makes it possible to implement advanced techniques that measure banks' credit risk exposure. It also allows optimizing the prudential regulation ensuring that provisioning and capital requirements are properly calibrated to cover expected and unexpected losses respectively.

PCRs will play a role in the adoption of the new International Regulatory Framework for Banks (Basel III). The foundations laid down in Basel II remain – to a large extent – unchanged.⁹ In regards to minimum capital requirements, Basel II introduces model based approaches for credit risk¹⁰ (Pillar 1) and requires a thorough assessment of

⁶ In some countries, financial institutions outside the scope of the central bank or bank superintendency regulation report their data to the public credit registries as well. For example, in Argentina many credit cards issued by retail stores are reported to the public credit registry operated by the Central Bank of Argentina.

⁷ It is not the purpose of this paper to analyze the role of PCRs in the credit information market or its implications for the dynamics of the (private) credit bureau industry. While the former has been much analyzed in the literature on credit information sharing, the latter is to a large extent an unexplored field (perhaps with the exception of Negrin (2001), who presents an analysis on the complementarities between credit bureaus and public credit registries).

⁸ Credit and loan reporting systems are "...the broader institutional framework for credit reporting in an economy including existing public and private credit registries, collateral registries, judicial records, etc., and the legal and regulatory framework for credit reporting, privacy and consumer protection" (WHCRI (2005)). Credit reporting, in turn, refers to the sharing of positive and negative information of individuals and firms relevant for making credit decisions.

⁹ In July 2009 the BCBS introduced a series of amendments to Basel II, which in particular strengthened the treatment of securitizations, both in the banking and in the trading book. See BCBS (2009a) and BCBS (2009b).

¹⁰ As well as for operational risk, which is outside the scope of this document.

banks' risk profile by the banks themselves and by their supervisors (Pillar 2). But Basel III also brings new duties into the authorities' agenda, which include identifying systemically important financial institutions (SIFIs) – which among other criteria are large and highly interconnected – and deciding on the countercyclical capital buffer – based on the ratio of credit (bank and non-bank) to GDP. As a result of this, it will be highly demanding in information gathering.¹¹ Despite the fact that only internationally active banks of Basel Committee member countries¹² will have to implement Basel III, in many other non-BCBS countries supervisors will also adopt it, as has been the case with Basel II. For those that do not, international banking groups operating in their jurisdictions will likely be implementing the most sophisticated approaches on a global basis; hence detailed data will be needed to support the home supervisor.

The paper is organized as follows. Section II explores how PCR data can be used to design the prudential regulation for credit risk. Section III describes the role of PCRs in bank supervision. Making use of the supervisory responses to the World Bank's survey on credit reporting systems, it exemplifies how supervisors around the globe are taking advantage of PCR data to enhance their supervisory process. In Section IV, the paper describes how PCRs can support the implementation and supervision of Basel III, while Section V explains their importance in steering a broader macro prudential surveillance. Having determined the usefulness of PCR data for central banks and bank supervisors, Section VI characterizes the desirable features that public credit registries should have. Finally, Section VII contains some concluding remarks.

II. The role of PCRs in bank regulation

Until Basel III becomes globally widespread and authorities admit the use of banks' internal rating systems, regulatory frameworks for credit risk may not be completely aligned to the underlying risk of banks portfolios. However, loan loss provisions should be commensurate with expected or average losses, while capital is to cover unexpected losses. Bank capital acts as a buffer against unexpected bank risk therefore reducing the risk of bank failure and helps to control for moral hazard, mitigating the incentives to take excessive risk.

As long as PCRs contain sufficiently long historical data for the largest possible share of borrowers in the banking sector, the analysis performed with the information therein contained can assist in reshaping the prudential regulation for credit risk. By means of diverse data mining and econometric techniques, such as transition matrices and credit scoring models, and by deriving loss distributions from credit portfolio models, local authorities can better calibrate provisioning ratios and capital requirements to more closely reflect expected and unexpected losses for credit risk.

While banks may use their own internal rating systems to manage credit risk,¹³ in many

¹¹ For an analysis of the usefulness of credit bureau data in relation to Basel II see, for example, Trucharte Artigas (2004).

¹² As of early 2009 the BCBS membership was expanded to include 27 countries: Argentina, Australia, Belgium, Brazil, Canada, China, France, Germany, Hong Kong SAR, India, Indonesia, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, Russia, Saudi Arabia, Singapore, South Africa, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

¹³ For a review of the range of practice regarding internal rating systems of financial institutions from G10 countries, see Basel Committee on Banking Supervision (2000).

jurisdictions they must also rate their borrowers with a mandatory system prescribed by the regulator and based only on a few criteria, such as type of credit, days past due and projected cash flow.¹⁴ These “prudential ratings” have typically been introduced as a means to homogenize the criteria to compute regulatory loan loss provisions and to assess the credit quality of different bank portfolios with the same metric, particularly in jurisdictions where banks’ rating systems were yet not widespread.¹⁵ Although these “prudential rating systems” are not aimed at replacing or competing with banks’ rating systems,¹⁶ they can play a subsidiary role. For example, smaller banks may be limited in their capacity to develop their own rating systems because of insufficient data, experience or resources; in such cases, the prudential ratings could supplement better risk analysis. Well constructed regulatory/supervisory rating systems may contribute to leveling the playing field in bank risk management practices and at the same time it would familiarize less advanced banks with modern credit risk management tools.¹⁷ Statistical evidence for Argentina in Majnoni *et al* (2004a) shows that a rating system built with PCR data benefits smaller banks with a larger reduction in their loan portfolio credit risk, as compared to that observed in bigger banks.

In jurisdictions where mandatory rating systems are in place, transition matrices coupled with assumptions regarding recovery rates can indicate to what extent provisioning ratios are aligned with average risk. Computing credit portfolio models with PCR data can also assist in optimizing the design and calibration of the regulatory framework, since they typically yield loss distributions that depict banks’ risk profile.¹⁸ The output of credit portfolio models can be used to verify that credit loss provisions, obtained from applying the supervisory ratios, globally match the estimated expected loss and that regulatory capital covers most unexpected losses. Academic attempts to perform such comparisons can be found in Balzarotti *et al* (2002) - with Central Bank of Argentina PCR data -, in Cronemberger Parente *et al* (2004) - with data from the Central Bank of Brazil PCR -, and in Jiménez and Mencía (2009) - with data from the PCR operated by the Bank of Spain.

III. The role of PCRs in bank supervision

Bank supervisors around the world typically adopt risk-based approaches to bank supervision. Supervision focuses on assessing banks particular vulnerabilities and the

¹⁴ Examples of countries using this approach are Argentina, Brazil, Costa Rica and Panama.

¹⁵ However, in response to the increasingly widespread development and use of rating systems by banks, regulators are recognizing those internal ratings to compute loan loss provisions. Hence, when banks report their information to the public credit registry they include the internal rating assigned to their obligors.

¹⁶ For example, banks’ rating systems must be very granular (i.e. have many rating grades). This is necessary to display discriminatory rating power. In turn, to construct such a granular rating system a wide array of information is required, both of the credit operations and of the borrowers themselves as well. This is particularly important when building rating systems for corporate obligors, who for example use information on liquidity and leverage ratios as inputs. This typically exceeds the range of information registered at public credit registries, which only collect information on the credits and associated collaterals.

¹⁷ Colombia and Mexico pioneered the development of these supervisory rating systems.

¹⁸ In particular, they provide useful information of a loan portfolio loss distribution such as its median, its mean (average loss rate, to be covered with total provisions) and different quantiles from the tail of the distribution, usually referred to as Value at Risk (VaR). Most importantly, the difference between the VaR, typically at the 99.9% confidence level, and the expected loss should be covered with capital.

likelihood of failing, while at the same time taking into consideration their systemic importance when budgeting the time and resources devoted to their monitoring. The information contained in PCRs can be used to enhance those risk-based supervisory practices. When bank supervisors have detailed data of bank loans, they can depict a more accurate risk profile of bank loan portfolios and perform more efficiently and effectively the two dimensions of the supervisory framework: the regular off-site monitoring and the less frequent on-site inspections.¹⁹

According to survey data collected by the World Bank between 1999 and 2001,²⁰ of the 34 central banks or bank superintendencies that had a PCR (of near 60 surveyed), 33 indicated that PCR data information is used for bank supervision, mainly to determine the total indebtedness of borrowers across the system. The PCR data also helped supervisors to revise, and when necessary rectify, the classification that financial institutions assign to their borrowers. PCR data also help to evaluate the sufficiency of provisions for problem loans, to identify lending trends and to flag banks that had significantly increased their exposure to riskier credits. Also, 31 authorities indicated that PCR data were reviewed on a periodic basis as a complement to off-site monitoring and prior to on-site inspections. When asked how important PCR data were for strengthening supervision, 23 central banks/superintendencies indicated they were very important and 10 stated they were somewhat important.

On-site inspections

The on-site supervision is a time-tested tool to monitor and assess banks solvency and resilience. The results of on-site supervisions are usually translated into a rating. For example, initiated by the US supervisors and now also used in other countries,²¹ the CAMELS rating system yields a composite rating of an institution's overall condition and performance by assessing six components: capital adequacy, asset quality, management quality, earnings, liquidity, and sensitivity to market risk. Asset evaluation is of paramount importance: it measures to what extent the financial institutions are exposed to credit risk, usually the most important driver of bank losses which is present in the trading book (e.g. in OTC credit derivatives) but most prominently in the loan portfolio (broadly defined, including off-balance sheet exposures). These examinations can be streamlined using the information in PCRs.

The assessment of bank loan portfolio quality is usually based on samples of borrowers. It is not feasible that supervisors conduct a one-by-one review of every credit, particularly when dealing with large banks. Although samples of credits can be obtained from the banks themselves, they can also be produced with PCR data. By knowing beforehand the number and amount of credits that each bank has granted by type of borrower, type of credit and risk rating at the minimum, samples can be customized and supervisory efforts better allocated. Samples may be stratified to ensure representativeness of the banks' activity in the geographic regions, business

¹⁹ On-site inspections and off-site monitoring are closely interrelated components of bank supervision. However, for exposition purposes we will here refer to them in separate sub-sections.

²⁰ World Bank Survey on Public Credit Registry for Central Banks.

²¹ Argentina, Bangladesh, Chile, Colombia, Honduras, Hong Kong, India and Kenya are a few examples of countries that have adopted the CAMEL rating system - or similar approaches - as an element of their supervisory toolkit. For a review of the models used by G10 countries, see Sahajwala and Van den Bergh (2000).

sectors and type of product in which they are active, or tailored to those segments that merit closer scrutiny during the visit. For example, for borrowers whose credit quality has deteriorated, banks' largest obligors and connected borrowers could merit a more thorough review. When PCRs register individualized credit operations, they can produce samples to evaluate how new credit policies or financial products are impacting the bank's risk profile, and if this is consistent with their credit strategy.

For prudential purposes, in many countries regulatory frameworks set a criteria or mandatory rating system that banks must use to risk classify their borrowers and to compute loan loss provisions. Increasingly, though, they are allowing banks to use their own rating systems for those purposes. At times they require these particular banks to map their grades into a single and homogeneous scale that allows performance comparisons across banks. In either case, during on-site inspections bank supervisors examine the reliability and robustness of banks' risk rating processes and systems and, in particular, whether they are underestimating default risk. Banks' portfolio samples obtained from PCRs should look for inconsistencies or abnormalities in rating systems or rogue credit policies.²² For example, they should flag and track refinanced/restructured credits to monitor their payment behavior. It is also helpful that samples cross check risk ratings assigned by different banks to the same borrower: significant and systematic differences should be deemed abnormal and should trigger the necessity for further revisions.

Off-site monitoring

Bank on-site examinations can be highly demanding in time and resources for both the supervisor and the inspected institution, and consequently are conducted at periodically timed intervals. Off-site monitoring procedures are thus an efficient aid for an effective ongoing supervision, allowing supervisors to monitor banks and observe how their risk profile evolves between inspections, with the possibility to promptly identify changes in their financial condition.

Besides its usefulness for conducting on-site supervision, PCR data can support continuous off-site bank monitoring. PCRs databases can be programmed to produce regular, timely supervisory reports (for internal use) containing key risk indicators that summarize banks' exposure to credit risk. At the minimum, they should characterize the overall quality of a bank's portfolio and of its various segments, depicting with particular detail the risk profile of the largest borrowers. These reports can also measure bank exposure to concentration risk by type of borrower, region, business sector, credit type, etc. It is important that they indicate the extent of connected lending and verify banks' compliance with prudential regulation for borrower risk classification. This can be accomplished by comparing the rating for the same borrower in different banks or computing transition matrices to benchmark the deterioration of a bank's portfolio relative to other banks.

In recent years, bank supervisors have been modernizing their toolboxes for assessing banks' financial performance and risk profile, adapting diverse credit risk management methods that had been introduced or developed by the banking industry. This has

²² When revising a bank rating system, the supervisor may wish to perform some tests of discriminatory power and calibration with PCR data to assess the reliability of that model. For further details see section below on Basel III.

allowed them to instill a quantitative approach to their off-site monitoring, with techniques that can summarize large amounts of data into a few quantitative assessments. Although the reliance on databases is not a perfect substitution for on-site supervision, the process for off-site monitoring has particularly been facilitated by those jurisdictions that utilize the PCR to produce more reliable and useful estimations of bank risk; for example, those that use PCRs in techniques, such as risk assessment and early warning systems, credit portfolio models and stress tests, and need detailed data on banks credits.

- **Supervisory risk assessment and early warning systems.** Based to a large extent on the experience with credit scoring models and rating systems by the banking industry, supervisors developed their own systems to quantify and rank banks' performance in general, and to measure their loan portfolio quality in particular. In a review of the supervisory approaches for bank monitoring in G10 countries, Sahajwala and Van den Bergh (2000) grouped the diverse systems into four categories: supervisory bank rating systems, financial ratio and peer group analysis systems, comprehensive bank risk assessment systems and statistical models.²³ To the extent that credit risk is the major driver of bank losses, the ability to count with detailed PCR data enhances the quality of these systems and the reliability of their assessments. For example, the off-site rating system used at the Bank of Italy (the PATROL rating system)²⁴ measures credit quality and loan concentration with PCR data.
- **Bank portfolio credit risk.** When monitoring banks and assessing their capacity to withstand losses for credit risk, the adequacy of their provisions and capital levels can be evaluated by means of transition matrices and portfolio credit risk models (CreditRisk+²⁵, Internal Ratings Based approach - IRB -, etc.) that incorporate PCR data. Transition matrices are useful devices to analyze the dynamics of portfolio credit risk - they show how borrowers risk grading has evolved in the past, what their average default rate has been and how far it has deviated from that average (its volatility). Portfolio models also exploit historical credit data, but are more efficient in that they better depict loan portfolio loss distributions. Either way, these techniques can provide insight as to banks' ability to withstand expected and unexpected losses. They are of particular importance in those jurisdictions that have yet to adopt risk based capital and provisioning requirements for credit risk.
- **Stress tests.** Although banks (in particular, large and/or internationally active ones) perform stress tests as part of their credit risk management policies, central banks and bank supervisors are increasingly performing their own stress testing exercises.²⁶ These supervisory stress tests are designed to gauge the

²³ These comprise models for ratings or rating downgrades, survival prediction and expected loss models, and others for obtaining early warning signals.

²⁴ Marullo Reedtz and Trapanese (2000) find empirical evidence for the importance of the information in the PCR of the Bank of Italy in building off-site early warning techniques of bank frailty.

²⁵ CreditRisk+ is a credit portfolio model developed in Credit Suisse First Boston (1997).

²⁶ When reviewing banks stress tests, supervisors should at the minimum be wary of their results: "A few years ago, ahead of the present crisis, the Bank of England and the FSA commenced a series of seminars with financial firms, exploring their stress-testing practices. The first meeting of that group sticks in my mind. We had asked firms to tell us the sorts of stress which they routinely used for their stress-tests. A quick survey suggested these were very modest stresses. We asked why. Perhaps

capacity of banks to undergo an extreme, but plausible, financial stress event. With respects to credit risk, in general banks losses are modeled as a function of bank specific (types of credit, loan portfolio quality and concentration, etc.) and macroeconomic variables (GDP growth, unemployment, etc.) behaving in accordance with the agreed scenario, which may be deterministic (historical or subjective) or stochastic (typically, derived by Monte Carlo). Regardless of how the scenarios are assembled, the effect on banks' loan portfolio quality can be obtained with a top-down analysis, directing the impact of the shock to the bank portfolio as a whole, or bottom-up, assessing the effect on each market segment or business line and aggregating the results across the bank. The latter type of analysis is much more precise and detailed, and therefore requires a rich set of data. Much of this necessary information is normally collected by PCRs as part of their normal operational business procedure. Detailed PCR data can also allow supervisors to perform a precise analysis tracing the impact on banks largest borrowers, who typically account for a large share of their assets and thus may have systemic relevance. In all these cases, detailed loan data will allow bank supervisors to better model the impact on banks portfolios of the shock as well as banks' capacity to remain solvent.

These and other off-site techniques require detailed credit information of banks' loan portfolio to evaluate their underlying risk. Although some of these data may be obtained from the bank themselves by means of regulatory reports or from the latest on-site report, PCRs usually contain updated data of practically all borrowers in the loan portfolio and consequently outperform other sources of information.

IV. PCRs and the implementation of Basel III

Published in 1988, the former Basel I Accord became obsolete as the banking industry developed new financial products to circumvent its capital requirements.²⁷ Most sophisticated larger banks had gone through a rapid evolution of their risk management. Financial innovations had found mechanisms to evade or arbitrage away the Basel I capital standard, mainly through securitizations, masking the true riskiness of the bank. Therefore, there was an increasing debate as to whether institutions were adequately capitalized given the nature and extent of the risks they were exposed to. With this knowledge, the Basel Committee on Bank Supervision issued in 2006 the Revised International Capital Framework (Basel II), attempting to better align bank capital requirements to economic risk by associating more precise estimates of risks. However, in hindsight, Basel II was ill equipped to handle the new

disaster myopia – disappointing, but perhaps unsurprising? Or network externalities – we understood how difficult these were to capture?

No. There was a much simpler explanation according to one of those present. There was absolutely no incentive for individuals or teams to run severe stress tests and show these to management. First, because if there were such a severe shock, they would very likely lose their bonus and possibly their jobs. Second, because in that event the authorities would have to step-in anyway to save a bank and others suffering a similar plight.” (Haldane, 2009).

²⁷ For small, simple institutions Basel I-based prudential arrangements are probably still suitable. This is in fact reflected in Basel II (now part of Basel III), to the extent that the standardized approach is similar in its philosophy to Basel I.

financial products that emerged during Basel II's implementation stage—namely CDOs, re-securitizations and securitization liquidity facilities, all of which indirectly led to the 2008 crisis.

The new International Regulatory Framework for Banks (Basel III) is the response engineered by the BCBS to avoid the repeat of a similar crisis in the future. Basel III builds on a refurbished Basel II – enhanced in July 2009 with amendments to its three pillars – which is complemented with bold reforms, including: a global liquidity standard, a framework for neutralizing externalities imposed by SIFIs and a countercyclical capital framework.

Basel III will impose challenges to regulators and supervisors. This is even relevant to those that are not Basel Committee member countries and will not adopt it, such as the case with host supervisors of banks whose home supervisor adopts Basel III. It represents a change to traditional supervision techniques. In addition to the ordinary on-site and off-site supervisory processes, under Pillar 2 supervisors are responsible for revising banks validation of their internal rating systems and their assessment of their risk profile and capital adequacy.

- **Impact studies.** It is important that, prior to migrating to a Basel III-based prudential framework, regulators and supervisors simulate the likely effects of its implementation. Impact studies are useful to anticipate possible undesired outcomes from Basel III, such as its ability to tilt the playing field in financial systems when competing banks adopt different approaches to portfolios with a similar risk profile.²⁸

In the run-up to the publication of Basel II, and now to calibrate and refine many of the enhancements in Basel III, the BCBS has conducted Quantitative Impact Studies (QIS) in member jurisdictions. These exercises have been performed bottom-up (i.e. by the banks themselves) and their outcomes have been quite detailed. However, it is unclear as to what extent the results between financial institutions are totally comparable. The possibility that authorities can perform the impact studies themselves (top-down approach) should not be discarded as a means to obtaining a readily and consistent, although perhaps rough, estimate of the impact of Basel III.

Banks typically report to PCRs their borrowers risk classification, produced either by the rules issued by the central bank or bank superintendency, or by their own rating system. If further basic information is available such as the type of borrower and credit, outstanding debt, residual maturity, type of mitigation securing each credit, simulating the impact of adopting Basel III is straightforward.²⁹

²⁸ Exposures that under Basel I carry an 8% capital requirement, under the IRB approach in Pillar 1 may experience dramatic shifts in their capital charge. This situation may tilt the playing field between Basel I and Basel III banks by shifting the incentives to assign capital to different types of credits. Bank regulators should carefully assess the effect on competition in the credit market and on the availability of credit.

²⁹ Bank of Spain conducted several impact assessment exercises with its PCR information. Saurina and Trucharte (2004) analyze the impact of Basel II on lending to SMEs, while Saurina and Trucharte (2007) assess the effect procyclicality in mortgage portfolios. Repullo, Saurina and Trucharte (2009) analyze the procyclicality of Point-in-Time (PIT) and Through-the-Cycle (TTC) rating systems. A study on the stability of TTC ratings systems with PCR data of the Central Bank of Argentina can be found in Valles (2006).

- **Calibration issues.** To what extent the Pillar 1 is properly calibrated is an issue for supervisors of non-G10 countries, whose loss experience has not been systematically taken into consideration in the architecture of the capital framework.

In the case of the simpler, standardized approach, regulators and supervisors will most likely need to revise aspects such as the definition of the regulatory retail portfolio. This is particularly true for small and medium enterprises (SMEs), in which they will be treated as retail borrowers and therefore will receive a lower risk weight than corporate obligors. Also the suitability of the supervisory risk weights will need to be reviewed. Risk weights of 35% and 75% for residential mortgages and retail credits (including eligible SMEs) may be unrealistically low in some jurisdictions. Loan default and recovery data stored in PCRs would allow the regulators to assess if the loss experience in these credits would warrant that those risk weights should be increased.

Recalibrating the IRB model is a fairly more complex and controversial issue because it implies deviating from the new standard in regulatory capital. Policymakers must nevertheless bear in mind that its parameters were adjusted to ensure that, when applied to G10 banks, IRB results (i.e. unexpected losses) are similar to those obtained from conventional credit portfolio models. However, that may not be the case when applied to emerging markets banks. Therefore, the impact of the systematic factor on borrowers' creditworthiness (asset correlation), the suitability of the SME definition, the adjustment in capital requirements for credits with long maturities and the convenience of using a different confidence level (compared to the standard 99.9%) are issues that may need be reconsidered by local authorities. This could complicate and lengthen the adoption of the Revised International Capital Framework. For example, using bootstrapping³⁰ techniques Majnoni *et al* (2004b) and Gutierrez Girault (2007) find evidence indicating that the IRB formula for corporate obligors may not be properly calibrated to unexpected losses in commercial portfolios of banks in certain Latin American countries. With data from the Argentine PCR, Balzarotti *et al* (2004) revised how the IRB model might be recalibrated to ensure it appropriately covers credit risk losses.

- **Validation.** Supervisors of banks adopting the IRB approach are expected to revise the internal validation of bank rating systems. This revision has a qualitative dimension, focused on data quality and rating system use, design and documentation, and a quantitative dimension to assess their predictive power. In the latter case, and by means of statistical tests (e.g. the Kolmogorov-Smirnov test), graphical tools (e.g. the Cumulative Accuracy Profile or ROC curve) and database programming, supervisors can validate these systems with the credit information stored at their PCR. Their results can be used to evaluate how the discriminatory power of a bank rating system evolves through a business cycle, or if different bank's rating systems concerning the same type of portfolio display a significantly different predictive power. PCRs can also be helpful to validate banks' estimates of other risk dimensions required by the IRB. In some countries

³⁰ Given a real portfolio of borrowers that displays certain loss rate, thousands of hypothetical portfolios are simulated drawing randomly with replacement borrowers from the real portfolio. For each simulated portfolio a loss rate is computed. The resulting simulated loss rates are an empirical approximation to the distribution of the loss rate for that type of portfolio.

(e.g. Mexico and Panama) PCR data collect, for each credit, date of origination, contractual maturity and amortizing profile, and register the occurrence of early amortizations. With this information the effective maturity for different credit lines can be estimated. Also, it is quite simple to track and analyze the behavior of borrowers' balances prior to the event of default, and hence estimate the exposure at default of credit lines at different banks.

Bank deviation from the IRB underlying assumptions should also be of concern for bank supervisors, and some of them can be addressed with PCR data. The IRB approach relies on the assumption that banks portfolios are perfectly granular and have therefore diversified away all the idiosyncratic risk. Therefore, it is important that supervisors inspect that loan portfolios are sufficiently fine grained (for example, computing a Herfindahl index). Consideration should be given to adopting corrective measures, for example with granularity add-ons that adjust capital requirements for undiversified idiosyncratic risk (Gordy, 2002). However, Tarashev and Zhu (2008) show that a violation to perfect granularity has a more limited impact on IRB measures of risk than a deficient calibration of the IRB model, resulting for example from wrong asset correlations.

The possibility to perform these exercises on an off-site fashion without using bank internal data facilitates the supervisory assessment of their internal rating systems.

- **Auxiliary rating systems.** Whether to level the playing field in the banking sector or to facilitate banks gradual adoption of more advanced risk management tools, supervisors can use PCR data to build risk rating systems themselves. These can be provided to those banks that are unable or unwilling to develop their own systems (for example because they lack sufficient historical data, resources or experience). They can also be used by the supervisors to benchmark banks' internal rating systems; for example, flagging those borrowers who are rated abnormally well.

The macroprudential revolution in Basel III

The traditional approach to banking sector regulation and supervision has been predominantly microeconomic, mainly concerned with stand-alone bank solvency, implicitly assuming that the stability of the financial sector was a by-product obtained by "aggregation." This philosophy was rooted in Basel II.

In the last years, though, regulations and supervisory policies have been incorporating elements of a complementary, macroprudential approach, principally concerned with overall macroeconomic stability. This approach is characterized as having two perspectives:³¹ i) a time dimension, that tries to mitigate the natural pro-cyclicality of banking systems due to feedback/second round effects between the financial and the real sectors of the economy and ii) a cross sectional dimension, which addresses systemically important institutions and their inter-linkages and spillovers that are key drivers of domino problems in banks. Basel III reflects a policy shift towards this pronged approach; focused not only on bank solvency but also on macroeconomic stability.

³¹ For an analysis on the distinction between the macro and microprudential perspectives, see Borio (2003).

- **Countercyclical buffer decisions.** The countercyclical capital framework is a stellar enhancement in Basel III; it crystallizes the BCBS effort to introduce a macroprudential layer in banking sector regulation. In particular, this mechanism attempts to make banking sector less pro-cyclical, and is composed of two elements. First, a *capital conservation buffer* to ensure banks hold a capital reservoir that can be used to absorb losses during periods of stress while still being above the minimum capital requirements. This buffer, set at 2.5% of banks' risk weighted assets (RWAs), will require profit retention in banks with capital ratios that do not meet this excess capital. The second element, the *countercyclical capital buffer*, has been engineered to address junctures of excess – and potentially destabilizing – credit growth. In practice, it amplifies the *conservation buffer*, leading banks to increase their capital ratios and lean against the build-up phase of the credit cycle.³²

The countercyclical buffer will, in a given jurisdiction, be zero most of the times. Local authorities (e.g. the banking sector supervisor) will “activate” this add-on, and hence expand the conservation buffer when they judge there is potential evidence of a destabilizing trend in credit growth. The BCBS envisages a common reference guide – based on the deviations in credit-to-GDP from its trend – to aid supervisors in their judgment. But it also recognizes that they may inform their decisions with further variables which can be useful indicators of rising tensions in the credit market. Some of these include interest rates, collateral valuations, delinquency rates and other variables commonly encountered in complete PCRs. For example, to the extent that PCRs have information about credits origination date, a simple *vintage analysis*³³ can indicate if credits that have recently been granted are displaying an abnormally high delinquency rate. This, for example, could lead to conclude the convenience of activating the countercyclical add-on.

- **Evaluation of systemic importance.** Recognizing that the macroprudential approach has also an important cross-section aspect, Basel III will also include particular – more stringent – provisions for Systemically Important Financial Institutions (SIFIs). A precondition for such a framework is counting with sound elements for their identification.

PCRs can provide a valuable input for measuring the degree of systemic importance of banks that, as a result of their size, inter-linkages or lack of substitutability, must be more conservatively regulated and intensively supervised. Examples include banks that are the unique creditors of certain geographic regions or business sectors, or are extensively interconnected with other financial institutions.

³² For a thorough explanation of the mechanics of the countercyclical capital framework, see BCBS (2010b).

³³ *Vintage analysis* partitions the credit portfolio by date of origination and compares the evolution of the respective cumulative delinquency rates – i.e. *delinquency maturation curves* –. The steeper a curve is towards delinquency, the riskier the vintage is. If recent vintages display a steeper pattern, they can be indicating deterioration in lending standards or in the credit environment. This kind of analysis is typically used as a portfolio management tool in the banking industry, but should also be used by bank supervisors and can be readily performed with PCR data.

V. A broader macroprudential surveillance

As lessons began to emerge from the current crisis, the G20 leaders envisioned a redesign of the regulatory and supervisory frameworks for financial systems. As part of the redesign, suggested principles include a heightened micro level supervision supplemented by a macro prudential framework that requires a more inclusive approach to credit supervision. Embodied in Basel III, this ultimately would promote more prudent risk taking and a more accurate reflection of system-wide credit leverage in the banking sector.

However, the necessity for a wider oversight scope has become more evident in light of the current global financial crisis, where seeds of the crisis were sowed outside the banking sector.

- **The scope of prudential oversight.** Besides banks, the stability of financial systems is also affected by the operations of other creditors that are seldom regulated and supervised. The genesis of the subprime crisis has raised awareness on the systemic importance of “shadow banking systems.” However, other sources of non-bank credit that “shadow” the banking system can be as important in other latitudes. For example, in some countries of Latin America this is evident by considering large retail stores disbursing lines of credit, which at times comprise a large segment of the credit market and that is neither regulated nor subject to oversight. Although they do not intermediate deposits, they are interconnected with the financial system through a variety of channels:
 - i. They obtain loans from the banking sector.
 - ii. They fund indirectly from the banking sector, when banks hold significant portions of their commercial papers or securitization tranches; these securities are backed by pools of credits granted with unknown credit standards.
 - iii. When banks act as underwriters or enhancers of their securitizations (exposing banks to more subtle, although not least important, types of risks).
 - iv. Since they provide credit to banks borrowers, particularly families, typically by issuing their own non-bank credit cards.

On the ground of potential spillover effects and to shed more transparency in this area, PCRs could include credit data from large non-bank creditors. Although they do not fall under the sphere of bank regulators and supervisors, preliminary lessons of the current crisis suggest that the scope of financial regulation should be widened to account for the operations of non-bank systemic players. These non-bank creditors may overstretch the repayment capacity of bank borrowers, making the banking sector vulnerable to their credit policies. This is of paramount importance if they are heavily intertwined with their activity as creditors, sponsors, investors or enhancers of their ABSs.

- **Macroprudential indicators.** In addition to serving the supervisors’ need to monitor an array of indicators that summarize bank’s financial and economic condition, indicators must also be constructed to monitor the stability of the overall financial system.

A set of “systemic early warning indicators” would allow supervisors to detect, monitor and address the buildup of vulnerabilities that may otherwise become a source of financial and economic distress in the future. Examples of these are the extent to which households are overstressing their repayment capacity, or exposed to interest or currency risk. This is especially relevant for banks actively involved in cross-border lending.

- **Systemically important borrowers.** PCRs should be used to detecting and monitoring systemically important borrowers (e.g. the largest borrowers of the financial system, typically accounting for a large share of total credit in the economy). Much of the traditional toolkit used in the off-site supervision, such as early warning indicators and stress tests, is being revisited and adapted to take into consideration the potential spillover effects imposed by these obligors.

VI. Optimal PCR architecture

In the preceding sections we explored how PCR data can be best used to strengthen banking sector regulation and supervision and to monitor the global performance of the credit market. It is therefore important that PCRs contain accurate, timely and sufficient data to those purposes. They should be able to provide timely information of each borrower (i.e. full name and ID number, address or location, type of obligor - household, SME or corporate obligor) and for each of their corresponding credits (i.e. type of credit, outstanding debt, days past due, date of origination and contractual maturity, type of interest rate and currency of the credit). Information of any risk mitigation measures securing the credits (e.g. credit derivatives, guarantors, financial collateral) is useful to estimate the severity of losses in the event of default and is of paramount importance to support supervisors in jurisdictions admitting the use of IRB models, particularly to estimate or revise banks’ Loss Given Default (LGD) estimates. **Figure 1** depicts in more detail the basic set of information that PCRs should contain.

Figure 1. Minimum set of information that a PCR should contain

<p>Information on the Credit</p> <ul style="list-style-type: none"> • Credit's internal number • Purpose or type of credit • Date of origination • Contractual maturity (date the credit will be completely repaid) • Currency • Amount outstanding (if revolving: drawn amount) • Initial amount (if revolving: authorized limit) • Interest rate • Days past due • Indicate if the credit is considered to be in default. • Indicate if the credit has been refinanced • Risk rating (of the borrower or the credit) • Include "transversality indicator": before a borrower ceases to be reported (for example, the last month it is reported), indicate the reason (write-off, matured, securitized, etc.) <p>Credit Risk Mitigation</p> <ul style="list-style-type: none"> • Type: guarantee, collateral, credit risk derivative, on-balance sheet netting agreement • Amount • Date of last valuation • Valuation • Seniority • Risk rating of the guarantor or protection seller 	<p>Information on the Borrower <i>(including each cosigner)</i></p> <ul style="list-style-type: none"> • Name • ID number • Economic group's name (if belongs to one) • Business activity • Region or country • Type of borrower • Size • Rating – Internal Model • If connected to the bank, the type of connection
<p>Information on the Creditor</p> <ul style="list-style-type: none"> • In case of syndicated loans, all the creditors must be identified. • In case of credits sold to another bank or securitized: both the originating bank and the bank/structure holding the credit should be identified. In these cases, some basic features of the structure should also be collected. 	

Their coverage should be as wide as possible: PCRs must receive data from all the financial intermediaries (i.e. the regulated financial system). Local authorities must consider if there are other creditors that, although not being financial intermediaries, must also report on the ground of their systemic importance and macroprudential concerns (e.g. large retail stores, microfinance institutions, credit cooperatives, etc.). And the concept of credit should also be broad to ensure collecting all operations with credit characteristics: all sorts of outstanding financings should be reported, both on-balance and off-balance (e.g. unused revolving credit lines, securitization liquidity facilities and other contingent liabilities such as financial guarantees and credit derivatives). This includes credits spun off to asset pools backing ABSs, CDOs and other complex structures. It is important that the design of PCRs is flexible: their layout and information requirements must be constantly revised to ensure new forms of credit can be monitored with the information therein contained.

The ability to collect information on the credits underlying structured assets is of paramount importance, particularly when there is uncertainty as to what is the best way to assess the risk of those structures. For example, by looking-through into the risk profile of the underlying credits (i.e. having information on the types of borrowers, types of credits, maturities and interest rates of the claims, associated collateral, number of obligors and extent of portfolio concentration in the asset pool) and knowing how the structures have been designed (e.g. number of tranches to a securitization and amounts associated) it is more feasible to model the risk profile of those structures (e.g. ABSs, CDOs) and thus benchmark external ratings attached to them, such as those produced by the credit rating agencies.

In some cases, PCRs impose a floor for the credits that are to be reported. This leaves unregistered a large number of borrowers that account for a small share of bank credit. While these floors prevent the databases from ballooning, by systematically excluding small debt data (e.g. microcredit data) they impose a censoring on the database that may undermine the reliability of some of the analysis performed. In the end, operators of the PCR need to strike a balance between the advantages of a complete picture of the credit market with the challenge that an enlarged PCR may impose (e.g. the potentially higher marginal cost and time implications of collecting and managing smaller credit information by both the banks³⁴ and regulators/supervisors).

Given the need to strike a balance, PCRs can outweigh such costs undertaken by banks by providing them with credit information that can facilitate their credit risk management practices. This is of particular importance when PCRs are the only source of positive information in the credit information market, since in some countries private credit bureaus are nonexistent or unable to obtain and distribute positive information. In these cases, by downscaling PCRs, lower income borrowers are able to demonstrate their payment behavior.

VII. Concluding remarks

Much of the recent literature in banking and financial stability topics has addressed the causes of the subprime crisis. In some cases, the literature highlights the flaws and loopholes of rigid regulations and supervisory processes that failed to react to the imbalances and vulnerabilities as they built up in the preface of the crisis. Other literature stresses the psychological drivers of the subprime crisis; analyzing how borrowers embarked into a borrowing frenzy fueled by myopic investors and insufficient knowledge of ABSs and CDOs. Once the crisis was rolling, the panic in the market place also played a prominent role. In all these factors some sort of informational vacuum was present: the extent to which households had overstretched their repayment capacity and their exposure to an upside in interest rates, banks holdings of equity tranches of securitizations and their off-balance sheet exposure to securitization conduits (i.e. liquidity facilities), banks concentration to certain protection sellers, and protection sellers concentration to subprime mortgages.

Alas, although regulatory and supervisory frameworks are being enhanced with the lessons learnt, the financial industry will likely find ways (i.e. new instruments) to circumvent the improved regulatory fence. And while the authorities are willing to embrace a macroprudential approach to financial system oversight, its ability to neutralize the pro-cyclical nature of banking systems and to unwind market manias, are still uncharted waters. Financial crisis have been frequent in the past and, unfortunately, they will likely repeat in the future.

Against this backdrop, the importance of complete, accurate and timely information on the credits in the financial system is evident. Both in normal times and during crises,

³⁴ Reporting institutions - particularly smaller ones - may also benefit from having to report to PCRs, to the extent that it requires that they collect and organize data on their credit exposures. In these cases, regulatory/supervisory reporting requirements operate as a guide to building their internal databases for credit risk management purposes.

authorities need a device that allows them to look at the universe of credits in a detailed and readily way. And more importantly, they need to develop tools that exploit as much as possible the information therein contained. In this respect, it is envisioned that the existence of a PCR will be a key factor to enhance the supervision and regulation of the financial system. The extent, accuracy and availability of the information collected by the authorities will determine the usefulness of the PCR as part of their toolkit to monitor the potential vulnerabilities not only on a microprudential, but also on a macroprudential perspective.

Abbreviations and Acronyms

ABS	Asset Backed Security
BCBS	Basel Committee on Banking Supervision
Basel II	Revised International Capital Framework
Basel III	International Regulatory Framework for Banks
CDO	Collateralized Debt Obligation
CEMLA	<i>Centro de Estudios Monetarios Latinoamericanos</i>
CRS	Credit Reporting System
FSA	Financial Services Authority
GDP	Gross Domestic Product
G10	Group of Ten Finance Ministers and Central Bank Governors
G20	Group of Twenty Finance Ministers and Central Bank Governors
ID	Personal Identification
IRB	Internal Rating Based
LGD	Loss Given Default
OTC	Over-the-Counter
PCR	Public Credit Registry
PD	Probability of Default
PIT	Point-in-Time
QIS	Quantitative Impact Study
ROC	Receiver Operating Characteristic
RWA	Risk Weighted Asset
SIFI	Systemically Important Financial Institution
SME	Small and Medium Enterprise
TTC	Through-the-Cycle
VaR	Value at Risk
WB	World Bank
WHCRI	Western Hemisphere Credit and Loan Reporting Initiative

References

- Adasme, O., G. Majnoni and M. Uribe (2006). Access and Risk: Friends or Foes? Lessons from Chile, Policy Research Working Paper Series 4003, The World Bank.
- Balzarotti V., C. Castro and A. Powell (2004). Reforming Capital Requirements in Emerging Countries: Calibrating Basel II using Historical Argentine Credit Bureau Data and CreditRisk+, Business School Working Papers, Universidad Torcuato Di Tella.
- Balzarotti V., M. Falkenheim and A. Powell (2002). On the use of portfolio risk models and capital requirements in emerging markets: the case of Argentina, World Bank Economic Review, Vol. 16, N° 2, pp. 197-212.
- Barron J. and M. Staten (2003). The Value of Comprehensive Credit Reports: Lessons from the U.S. Experience, Purdue University and Georgetown University, 2003.
- Basel Committee on Banking Supervision (2000). Range of Practice in Banks' Internal Ratings Systems, Bank for International Settlements.
- Basel Committee on Banking Supervision (2006). International Convergence of Capital Measurement and Capital Standards: a Revised Framework, Bank for International Settlements.
- Basel Committee on Banking Supervision (2009a). Enhancements to the Basel II framework, Bank for International Settlements.
- Basel Committee on Banking Supervision (2009a). Revisions to the Basel II market risk framework, Bank for International Settlements.
- Basel Committee on Banking Supervision (2010a). An assessment of the long-term economic impact of stronger capital and liquidity requirements, Bank for International Settlements.
- Basel Committee on Banking Supervision (2010b). Countercyclical capital buffer proposal. Consultative Document, Bank for International Settlements.
- Borio C. (2003). Towards a macroprudential framework for financial supervision and regulation? BIS Working Paper, N°128, Basel, February.
- Brown, M. and Zehnder C. (2005). Credit Registries, Relationship Banking and Loan Repayment, Institute for Empirical Research in Economics, University of Zurich, WP N°240.
- Brunnermeier, M., A. Crockett, C. Goodhart, A. Persaud, H. Shin (2009). The Fundamental Principles of Financial Regulation, Geneva Reports on the World Economy, Centre for Economic Policy, London.
- Credit Suisse First Boston (1997). CreditRisk+: A Credit Risk Management Framework.
- Cronemberger Parente G., M. Koyama, V. Salomão Garcia and R.Schechtman (2004). Credit Risk Measurement and the Regulation of Bank Capital and Provision Requirements in Brazil – A Corporate Analysis, Central Bank of Brazil, Working Paper Series N°91.
- Falkenheim M. and A. Powell (2000). The Use of Credit Bureau Information in the Estimation of Appropriate Capital and Provisioning Requirements, Central Bank of Argentina, mimeo.
- Gordy, M. (2002). A Risk-Factor Model Foundation for Ratings-Based Bank Capital Rules, Board of Governors of the Federal Reserve System.
- Group of Twenty (2008). Declaration: Summit on Financial Markets and the World Economy, Washington, G-20 *Communiqué*.
- Group of Twenty (2009). Declaration on Strengthening the Financial System, London, G-20 *Communiqué*.

Gutierrez Girault, M. (2007). Non – Parametric Estimation of Conditional and Unconditional Loan Portfolio Loss Distributions with Public Credit Registry Data, Central Bank of Argentina, Technical Document.

Haldane, A. (2009). Why Banks Failed the Stress Test, Bank of England, mimeo.

Haldane, A (2010). The \$100 Billion Question, Speech at the Institute of Regulation & Risk, North Asia, Hong Kong.

Hoggarth, G., R. Reis and V. Saporta (2001). Costs of Banking System Instability: Some Empirical Evidence, EFA 2001 Barcelona Meetings, Bank of England Working Paper No. 144.

Japelli, T. and M. Pagano (1993). Information Sharing in Credit Markets, *Journal of Finance* 43 (5), 1693 – 1718.

Jappelli, T. and M. Pagano (1999). Information Sharing in Credit Markets: International Evidence, Inter-American Development Bank, Working Paper R-371, June.

Jiménez, G. and J. Mencía (2009). Modelling the Distribution of Credit Losses with Observable and Latent factors. *Journal of Empirical Finance*, vol 16, March, pp. 235-253.

Majnoni, G., M. Miller, N. Mylenko and A. Powell (2004a). Improving credit information, bank regulation, and supervision: on the role and design of public credit registries, Policy Research Working Paper Series 3443, The World Bank.

Majnoni, G., M. Miller and A. Powell (2004b). Bank capital and loan loss reserves under Basel II - implications for emerging countries, Policy Research Working Paper Series 3437, The World Bank.

Marullo Reedtz P. and M. Trapanese (2000). Credit Registers and Early Warning Systems of Bank Fragility, in *Bank Fragility and Regulation: Evidence from Different Countries* (edited by G. Kaufman), Research in Financial Services: Private and Public Policy, Volume 12.

Negrin J. (2001). Mecanismos para compartir información crediticia. Evidencia internacional y la experiencia mexicana, *El Trimestre Económico*, Vol. LXVIII (3), N°271, July – September.

Repullo, R., J. Saurina and C. Trucharte (2009). Mitigating the Procyclicality of Basel II, in *Macroeconomic Stability and Financial regulation: Key Issues for the G20*, edited by M. Dewatripont, X. Freixas and R. Portes. RBWC/CEPR.

Sahajwala R. and P. Van den Bergh (2000). Supervisory Risk Assessment and Early Warning Systems, Basel Committee on Banking Supervision, Working Paper N°4.

Saurina, J. and C. Trucharte (2004). The impact of Basel II on Lending to Small-and-Medium-sized Firms. A Regulatory Policy Assessment Based on Spanish Credit Register Data, *Journal of Financial Services Research*, Vol. 26, N°2, pp. 121-144.

Saurina, J. and C. Trucharte (2007). An assessment of Basel II Procyclicality in Mortgage Portfolios. *Journal of Financial Services Research*, Vol 32, N°1-2, October, 81-101.

Tarashev, N. and H. Zhu (2008). Specification and Calibration Errors in Measures of Portfolio Credit Risk: The Case of the ASRF Model, *International Journal of Central Banking*, Vol 4, N°2.

Trucharte Artigas C. (2004). A Review of Credit Registers and their Use for Basel II, Financial Stability Institute, September.

Vallés V. (2006). Stability of a “Through-the-Cycle” Rating System During a Financial Crisis, Central Bank of Argentina, FSI Award Winning Paper.

Western Hemisphere Credit and Loan Reporting Initiative (2003). Glossary, Working Paper N°3, The World Bank and Centro de Estudios Monetarios Latinoamericanos, Mexico.