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Improving Credit Information, Bank Regulation and Supervision:

On the Role and Design of Public Credit Registries

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Abstract

This paper analyzes how data in public credit registries can be used both to strengthen bank supervision and to improve the quality of credit analysis by financial institutions. Empirical tests using public credit registry data were performed in collaboration with the central banks in Argentina, Brazil and Mexico. The results of the empirical tests confirm the value of the data for credit risk evaluation and provide insights regarding its use in supervision, including in calculations of credit risk for capital and provisioning requirements or as a check on a bank's internal ratings for the Basel II's internal rating-based approach. We also define a set of critical design parameters and use the results to comment on appropriate public registry design. Finally, the paper includes a discussion of the relationship between the different objectives of a public credit registry and how they influence the registry's design.

I . Introduction

Information problems have long been at the fore of analyses of credit markets. Indeed, one rationale for banks is as institutions to gather information and establish relationships with borrowers in an effort to surmount these problems.[1] A striking feature of banks is the plethora of services that they offer and the economies of scope between them. For example, accounts and payments' services provide valuable data to the bank on the creditworthiness of clients as potential borrower.[2]

A limited number of papers have focused on whether banks should share information. Jappelli and Pagano (1993), in a model with adverse selection, show that exchanging information on borrower type decreases default rates and reduces average interest rates. In a related paper, Padilla and Pagano (1997) show that information sharing among borrowers would lead to lower interest rates and increased lending. There is also a growing body of empirical evidence that suggests that the existence of credit information sharing is associated with deeper credit markets[3]. Barron and Staten (2003), Kalberg and Udell (2003) and Cowan and de Gregorio (2003) all suggest there is value in the existence of private credit bureau reporting services.

However, it is not clear that banks will voluntarily share information even when it is in a broader social interest to do so. Jappelli and Pagano (1993) show conditions under which information sharing will and will not occur. Moreover, there is virtually no theoretical analysis regarding the organizational structure of the private credit bureau industry. As there are almost certainly increasing returns to scale in this industry, and hence there are likely to be market power, less than optimal service provision and higher than competitive pricing, an important question is whether there should be public sector intervention to enhance credit information sharing and, if so, what form that intervention should take.

In practice public intervention does indeed take place. First, private sector credit bureaus are frequently regulated. However, this regulation normally takes the form of monitoring privacy

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[1] See, for example, Diamond (1991), Rajan (1992) and Freixas and Rochet (1997) for a review.
[2] For example, a consumer who receives a regular paycheck, pays credit cards in full and those and other bills on time is normally considered a better credit risk than one that does not.
[3] Jappelli and Pagano (1997), Doing Business (2003), Love and Mylenko (2003)

concerns and individual protection issues rather than attempting to enhance credit information per se. Monopoly pricing or other restrictive practices that might limit competition or service provision are generally the responsibility of competition authorities that have in practice rarely intervened in this specialized sector. The second form of intervention that has taken place is the direct (and frequently forced) provision of credit information sharing services by central banks or banking supervisors known as public credit registries (PCRs).

World Bank surveys have documented that PCRs exist in about 60 countries worldwide and more nations are planning to create them in the future.[4] In countries with PCRs, supervised financial institutions are required to provide data on individual borrowers on a periodic basis, usually monthly. Core PCR data are information on the identity of borrowers, the size of any loans or credit lines outstanding with reporting institutions and their status. Status implies whether a loan is in good standing, past due, in default or other non-accrual status.

There are multiple motivations behind the development of PCRs. Recent research has linked the existence of a PCR with the absence of significant private credit bureaus, weak creditor protection and a French civil code legal system – see Jappelli and Pagano (2003) and World Bank (2003). Anecdotal evidence suggests some countries originally developed PCRs to monitor credit by sector in the days when banks were forced into particular lending patterns. Others were motivated by the simple desire that financial institutions should know the total debts (and the standing of the various loans) of potential borrowers in the whole financial system to make informed lending decisions. Another motivation was so that bank supervisors could identify the main debtors of the financial system and analyze more carefully loan concentration risk and monitor and enforce banks' reserve policies against problem loans.

Whatever the primary motivation, countries that have developed these tools have tended to find them useful for a wider variety of reasons that often go beyond their original thinking. This paper reviews many of the current uses and discuses the relationship between these competing roles and the design of PCRs. There are also potential pitfalls related to PCR design and management

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[4] Not all countries replied to the World Bank survey that found PCRs in 58 countries. The actual number is then likely to be significantly more than 58 worldwide.

and we discuss several sensitive issues regarding, for example, what data should be made public and when, and the relationship between PCRs and private credit bureaus. The main focus of the paper is, however, on how PCRs can be used to improve the quality of credit analysis by financial institutions and to strengthen bank regulation and supervision. We present multi-country evidence of the importance of credit information sharing and on the importance of including positive and not just negative information. We also discuss the potential role of PCRs in banking regulation in the context of the proposed new capital accord known as Basel II.

The plan of the paper is as follows. In the next section we briefly discuss the development of PCRs across the globe, in Latin America and in more detail in the three countries where we conduct our empirical research. In section III we present the empirical analysis on the gains to information sharing and in section IV we present a policy discussion. This is organized around the various roles of credit bureaus. In section V we then discuss the main design parameters of PCRs relevant to using a PCR as a complementary tool to aid in the implementation of the Basel II proposals. Section VI concludes.

II.   On the Development of Public Credit Bureaus

Public credit registries (PCRs) contain information on the performance of borrowers in a financial system and are administered and maintained by either the central bank or bank supervisor. According to survey data collected by the World Bank, almost 60 countries have PCRs.[5] The region with the highest coverage of public credit registries is Latin America, where 17 countries have established PCRs, including all the largest economies (Argentina, Brazil, Chile, Colombia, Mexico).

The first countries to establish public credit registries were in Western Europe – Germany in 1934 followed by France in 1946. By the mid-1960s, three other European countries – Italy, Spain and Belgium – had also established PCRs. Early adopters included the former French

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[5] This data is based on the 2002 survey of PCRs conducted jointly by the Credit Information Group in the Vice Presidency for Financial Services (FSE) and by the Doing Business Unit in the Vice Presidency for Private Sector (PSD) as well as from previous FSE surveys on this topic. Not all countries responded to the 2002 survey, especially in Africa and Asia, so the actual number of PCRs is likely to be slightly greater than 58.

colonies in Western Africa which formed the West African Monetary Union in 1962 and immediately established public credit reporting following the French example. Also several Middle Eastern and North African nations adopted PCRs in the 1950s and 1960s - Egypt (1957), Tunisia (1958), Morocco (1966) and Jordan (1966), and Turkey (1951).

In Latin America, Mexico's PCR is the oldest, established in 1964, with a primary aim related to the policy of directing credit by sector at that time. While a few Latin American countries established PCRs in the 1970s and 1980s, the phenomenon really took off in the 1990s, when ten further PCRs were established in the region. Latin America was not alone, however, in the development of public credit registries in the 1990s – numerous countries in Eastern Europe and Asia developed PCRs over the last ten years. Moreover, many developing countries which do not currently have PCRs are debating their establishment including notably, China and Russia. Table 1 in the Appendix provides basic information on countries with PCRs organized by region.

We now turn to a more detailed analysis of the PCRs that we use for the empirical analysis in the following section. Although Mexico's PCR was established for other motives, its main objective today is to provide data for banking supervision and economic analysis. Having said that, the registry also distributes information on individual borrowers to banks. In line with these objectives, the Mexican PCR focuses on larger loans that pose a major risk to the financial system; data are only collected on credit exposures of US $20,000 or more and the primary concentration is commercial credit.

The PCRs in Argentina and Brazil were established in the 1990s in response to financial crises also with the primary goal of supporting banking supervision. Over time, though, these registries were transformed to also enhance the information to private financial institutions. The minimum loan size that banks must report was then reduced, increasing the scope of information provided to the financial sector. In Argentina, the PCR first focused on large loans in excess of US $200,000 (i.e.: 200,000 pesos at the 1:1 exchange rate of the early 1990s) but the minimum loan was reduced to only 50 pesos (US$50 before the 2002 devaluation and now about US$17.50). The Central de Risco run by the Brazilian Central Bank began operations in 1998 and has

steadily expanded, progressively reducing the threshold of loan size recorded.[6]   The initial minimum loan size of approximately US $50,000 has now been reduced to about US $2,000.

Table 1 describes the key characteristics of the data collected in each registry. There are some key similarities in the structure of the three registries but also important differences. An important element in common is that all three collect positive as well as negative information. In other words, information on loans in good standing is collected as well as on loans that are delinquent. Also, two fields common to all three are the total amount of credit outstanding and the "rating" of the loan or borrower. Moreover each registry contains fields to identify borrowers including legal names and tax codes or national identity numbers. None of the these three regsitries contain descriptive or demographic information.   Differences include different minimum loan sizes or cutoff amounts, and also differences in the way that data are reported. Argentina's PCR was revised to collect data by credit line while Mexico and Brazil maintain a more aggregated and standard reporting by borrower. Mexico does not collect data on interest rates as the others do and Brazil and Argentina collect information on maturities.

The registries also all employ a "rating" which is determined by the bank subject to the rules of the regulator. This rating is determined largely by the delinquency status of the loan but in each case may also take into account the financial status of the loan and the security or collateral available. In the case of Argentina, for consumer lending and small corporate lending (of less than 200,000 pesos and a small part of a bank's capital) the rating is solely determined by delinquency but in the case of larger corporate borrowers the rating was designed to be more forward looking. In the case of Brazil where the PCR has 9 categories (compared to Argentina's and Mexico's 5), the financial status becomes more important especially to categorize loans in the non-delinquent (or in other words, performing) categories.

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[6] Resolution 2.390 of May 22 1997, of the National Monetary Council Central Bank of Brazil, establishes the legal foundation for Central de Risco, while Central Bank Circulars 2.768 of 07/16/9, Circular 2.977 from 04/06/00 and Circular 2.999 of 8/24/0 specify details of its operations.

III.   Empirical Analysis

Apart from providing information to bank supervisors, the standard *raison d'être* of a PCR, is to share information across financial institutions. However, there has been no empirical work published assessing the value of this information sharing that we are aware of, neither at the national or international level.   Moreover, there remains the important question as to what information to share.   In particular, banks are more likely to voluntarily share negative information. Hence some private credit bureaus essentially work with negative information only. Some PCRs also only contain negative information. However, there are certainly advantages to sharing both positive and negative information. In this section we employ data from the three PCRs of Argentina Brazil and Mexico to illustrate the potential value of these databases.   In particular, we conduct two analyses.   First, we show the importance of a PCR having both positive and negative information. Second we attempt to assess the importance of information sharing generally.

Positive versus negative information

The first part of the empirical exercise tests the importance of including both positive and negative information in empirical models estimating borrower default. The term "negative information" refers to data on late payments and defaults. "Positive information" refers to information on borrowers that have paid their obligations on time and other descriptive data including loan amounts, interest rates, and loan maturities.

Following Barron and Staten (2003), a credit scoring model is developed to test the importance of using both positive and negative data to predict loan defaults. The following equation is then estimated separately for Argentina, Brazil and Mexico.[7]

$$\text{Pr. (Deafult)}_i = \alpha\{NEGATIVE\}_i + \beta\{POSITIVE\}_i + e_i \qquad (1)$$

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[7] We use the probit procedure for estimations in Argentina and Mexico and a logit model for Brazil.

Where $\{NEGATIVE\}_i$ is a vector of variables conveying negative information regarding borrower *I*; $\{POSITIVE\}_i$ is a vector of variables conveying positive information regarding borrower *i*. Even though the datasets in the three PCRs are somewhat different, the variables are defined in a conceptually consistent manner to allow for comparability of the results. Table 2 describes the actual PCR data used in the regressions for each of the three countries.

The dependent variable is binary and takes a unit value if the borrower defaults, meaning a late payment of 90 days or more, and is zero otherwise. The last year of the data available is the default horizon and is used for defining the binary dependent variable. Data available prior to that, which goes back 18 months in Argentina, 12 month in Brasil, and up to 59 months in Mexico, is used to define explanatory variables and represents the credit history of a borrower with individual banks and the banking system.

Only Mexico provides straight-forward information on the number of days late for loans in arrears, so for Argentina and Brazil[8] borrower ratings were used as a proxy for delinquency status. Ratings are based on a set of criteria including the number of days pastdue. In Argentina default corresponds to a "3" rating, and in Brazil the rating "E" was used as the default threshold. For Argentina, a borrower was considered to be in default for our exercise if their average rating across banks in the system was "3" or worse at any time during the year-long default horizon. In the case of Brazil there are eight ratings categories; the borrower is considered in default if it had a rating "E" or worse with a given financial institution.

The negative variables then include information on past late payments and defaults while positive variables include a borrower's (non-default) rating, aggregate exposure, the number of open credit lines, and availability of collateral. To ensure consistency across countries, we restrict the dataset to private sector non-financial enterprises. The Mexican public registry only includes loans above US $20,000, this is adopted as the baseline for empirical testing in Argentina and Mexico. For the case of Brazil a higher cutoff, of US $300,000, was adopted.

Table 3 presents a set of regression results for Argentina, Brazil, and Mexico. The model using only negative information performed as expected – the explanatory variables for past defaults and missed payments were highly significant and positively impact default for all three countries. The specification of the model with both positive and negative information also provides results which are broadly consistent across countries. More importantly, in each country we found that positive information adds to the explanatory power of the model. If lenders can better identify risky borrowers, then they can reduce portfolio risk or extend more credit. We discuss this result in greater depth below.

The positive information variables also performed consistently between countries in the sample. Longer credit histories were highly significant and negatively associated with default. In Mexico and Argentina where data on collateral were available, the relevant coefficient was statsitically significant and greater collateral anmounts were associated with lower default probabilities. Ratings data were also shown to be valuable predictors of default. For example, in the case of Brazil a loan with a rating of "D" was twice as likely to enter default as one rated "C" and almost five times more likely than one with a "B" rating. Borrowers with more open credit lines (Argentina) or those with accounts in several banks (Brazil) were found to be more risky. In the only country where data on interest rates were used - Mexico - we found a positive and significant relationship between the probability of default and the interest rate.

In some cases, the behavior of explanatory variables was uneven across countries. For example, evidence on the effect of loan size on default probability was mixed. Loan size exhibits a strong negative impact on default in Brazil, as well as in Argentina where the coefficient is also negative but much weaker. In Mexico, however, loan size is shown to be positively linked to default, but only weakly significant.

The simple credit scoring model similar to the one reported above was then used to define default probabilities for borrowers in country samples, using both the negative-only estimation coefficients and those from the complete information model with both positive and negative data.

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[8] The PCR in Brazil also contains information on days past due, however loans are grouped into buckets of 15 to 60, 61 to 180 days past due and so on. Since 90 days past due is used as a definition of default in our exercise, this PCR

Borrowers were then sorted for each model specification according to two different criteria: (A) to determine the number of borrowers who would default at given acceptance rates; and (B) to estimate the number of firms that would receive credit at a given default rate.

Table 4A presents information on the percent of borrowers who would be expected to default at given approval rates for Argentina and Brazil. The exercise shows that for any target approval rate, a loan portfolio selected using the complete information model has a lower default rate than the one selected using only negative information. For example, in the case of Argentina, if one wanted to extend credit to 60% of the sample population, then having access to positive information would reduce the default rate from 3.81% to 2.98%, a reduction of approximately 20% on portfolio losses.

In Table 4B the gains from using positive information in terms of increased access to credit is demonstrated, controlling for the riskiness of borrowers. In this ex-post exercise, borrowers again are sorted in order of increasing predicted default probability and the percentage of approved loan applications is computed once the portfolio default rate reaches the set target. In both cases, more borrowers gain access to credit for a given default rate when using the complete information model than in the case of only negative information. Taking the case of Brazil, if a target default rate of 3% is desired, then the full model permits more than 82% of the sample population to obtain credit whereas this figure is only 55.8% for the negative only model – a difference of more than 30% in terms of providing access to credit.

Individual bank versus shared information

Having established the importance of including both positive and negative information, we now turn to the more general issue: the value of sharing information. Using data from the Argentine PCR we estimate the following equation for individual financial institutions:

$$\text{Pr. (Deafult)}_i = \alpha \text{INDIVIDUAL}_i + \beta \text{SHARED}_i + e_i$$

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information could not be used for defining dependent variable. It was used for designing explanatory variables.

Where INDIVIDUAL refers to data provided only by a single institution on individual i. For example, total debt with a given bank (and not total system wide debt) is employed, and initial rating with a given bank (and not the average or worse rating across the system)[9].

We use the scoring model to predict default probabilities for cases when banks do and do not share information. In Table 5 we construct tables using the same methodology as in Table 4, to demonstrate gains in access to credit and improved portfolio quality for a large and a small financial institution[10]. Information sharing is shown to significantly improve a bank's ability to determine the likelihood of default for its customers. For a target approval rate of 40%, access to data from a PCR reduced the predicted default rate by 41% for a large bank, from 2.2% to 1.3% of the relevant portfolio. The results are even more impressive when repeated with a smaller financial institution – the expected default rate falls by 78% when PCR data are added to the institution's own information for a targeted approval rate of 40%. Since larger institutions have a larger and potentially more varied portfolio to begin with, it is logical that smaller institutions would benefit more from sharing information. As the target approval rate is increased, the difference between the gains for a large versus a small bank is virtually eliminated: at a 60% target approval rate both institutions lower defaults by about 35% and at a target 80% approval rate by about 20%.

Data sharing can also enable both large and small lenders to increase their lending activities for a given level of risk or default. Panel B of Table 5 presents the results of this exercise with Argentine data where a default rate is targeted and then the number of borrowers who could be approved for that level of default is calculated. If a large bank was targeting a 5% default rate, then without information sharing it could extend credit to approximately 75% of the applicant pool compared with 84% if they had access to the PCR data – an increase of approximately 12%. For the small bank, the increase is even greater: approximately 18%.

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[9] We acknowledge that there may be an overstatement of the case for sharing information, as individual bank is not limited to the information supplied to the credit registry. However, the variables used and supplied to the credit registry are normally used for credit scoring purposes and typically have a positive marginal effect in terms of the predictive power of scoring models and hence we believe that this remains a useful demonstration of the potential gains from sharing information.

[10] We report results for arbitrarily selected large and small bank. Similar results hold for other financial institutions.

IV.   PCR Objectives and Design Parameters: A Policy Discussion

As reviewed, the original motivations for the development of PCRs around the world have been many and varied. However, in many instances PCRs are now used for purposes going beyond their original objectives. In particular we argue below that irrespective of the original motivation, it is likely that an established PCR can be useful to bank regulators to analyze, more scientifically, banking regulations pertaining to capital and provisioning. However, we provide a broader policy discussion here on the often-competing objectives of PCRs and the implications and tensions in their design thus created. We focus the discussion on 5 basic objectives: (1) to improve credit-\ access, (2) to strengthen bank supervision, (3) to promote competition, (4) economic research to inform macroeconomic policy making, and (5) to improve bank regulation. The final objective is dealt with in somewhat more depth. A theme throughout is also the relation between private credit bureaus and a PCR.

1. Improving access to credit

Perhaps surprisingly, according to World Bank survey results, two-thirds of the respondents (39/57) consider supervised financial institutions the primary users of PCR data, while bank supervisors were identified by only one-third (18/57) as the primary users. Moreover, more than three-quarters of supervisors (44/57), indicated that the PCR was the primary source of credit data for financial institutions – Miller (2003). There are several ways PCRs may enhance credit access. First, and as illustrated in the empirical results above, the use of a PCR may, for a constant level of risk, allow a financial institution to expand its loan portfolio. The marginal increase in the loan portfolio will particularly benefit those companies or individuals that have a sound repayment history but lack other obvious indicators of creditworthiness such as wealth or that lack guarantees.

The use of PCR data may then enable lenders to predict credit risk more accurately and more efficiently. Credit registry data facilitates the evaluation of prospective borrowers, reducing the need for more costly and intrusive background and reference checks. If an adequate supply of data is available for statistical analysis, then automated or semi-automated credit decision tools

can be developed, reducing the cost and time required for processing loan applications. Under competitive market conditions this should increase the supply of credit and reduce its cost.

However, there are other ways in which a PCR can affect access to credit. A list of negative information, often referred to as a "blacklist", can encourage borrowers to repay obligations so as to stay off the list. The existence and use of such a database then enhances "willingness to pay". However, as shown above, negative-only databases have several shortcomings compared to those with complete (both positive and negative) information. Negative information alone has less predictive power than positive and negative information combined. Decision tools, such as credit scoring, are difficult to develop without positive data. Databases with only negative information then tend to focus only on reducing "willingness to pay" and not on enhancing predictions on repayment probabilities.

More generally, a database of positive and negative information assists borrowers in developing "reputation collateral" or proof of a good payment history. The value that the debtor attaches to his or her good credit history or "reputation collateral" is likely to be greater than the value associated with being off the "blacklist", especially since most negative information databases enable borrowers to settle claims to remove themselves from the list. This prompts eventual repayment of obligations but does not provide strong incentives for borrowers to conduct themselves responsibly over longer periods of time. The greater the value "reputation collateral" is to borrowers, the harder borrowers will work to maintain good standing. Thus, if it is known that the database is used extensively for credit decisions then willingness to pay risks will be reduced further. Again, this is particularly important for borrowers who lack physical collateral, such as low-income individuals or small firms.

The above discussion has focused on PCRs, but a potentially valid question is that private credit bureaus may do something very similar, so why might a PCR be required? There are several important differences between private credit bureaus and PCRs, related to the issue of credit access, and these differences suggest that PCRs and private credit bureaus may be complements and not substitutes.

One difference is that private institutions may only be willing to share negative information voluntarily even though it may be in a wider social interest to share positive and negative information – see Japelli and Pagano (1993). The intuition is relatively simple. Sharing information has a cost and a benefit. The cost for a bank is that a competitor may learn something about that bank's portfolio and the benefit is that the bank may be able to make more informed lending decisions and to predict default probabilities more accurately. It is more likely that the private benefits exceed the costs for negative information as revealing information about bad clients is not so costly. However, there may be net private costs to revealing positive information even though it may be beneficial to society to have that information shared.[11] And a regulator may compel regulated institutions to share both positive and negative information. In more than 80% of the PCRs surveyed, institutions are required to report on loans in good standing as well as loans in arrears.[12] While private credit bureaus may be able to develop some of this positive credit history data, it is often a slow process and they are unlikely to be able to achieve full reporting from supervised institutions as in a standard PCR.

A second important difference between PCRs and private credit bureaus is the type of information collected and the type of services offered. PCRs in general only supply very basic information and many do not supply a true credit history, but only a snapshot of the current status of a borrower with the financial system. Private credit bureaus tend to supply a greater quantity of information and finer information and also develop other products using that information, including, for example, credit-scoring products. One view is that PCRs should only provide very basic information and at very low cost while private credit bureaus can take this information, add to it, and develop value added information services. In this way a PCR may enhance the competitiveness of the private credit bureau industry.[13]

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[11] A counter argument is that society may wish banks to retain some positive information as private. We consider the merits of this argument in the discussion on competition below.

[12] In some PCRs the positive information is reported but not shared or is shared subject to some cut-off. For example, in the case of Argentina, information on loans with ratings 1 and 2 of less than 200,000 pesos are not shared in database format and there are restrictions on the number of individual hits someone can make on internet inquiries regarding this type of information to protect to some degree banks' rents and hence their incentives to gather information on smaller clients.

[13] We come back to this point in the discussion regarding competition.

A third difference is that while PCRs may compel regulated institutions to supply data, they rarely seem to include data supplied voluntarily from other sources. Of the 57 PCRs surveyed worldwide, only three (France, Slovenia and Taiwan) indicated they received any data on a voluntary basis and in the case of Slovenia, the voluntary data were information received from another government agency. It appears that firms and businesses do not wish to report sometimes sensitive financial data to the government on a voluntary basis in most countries. Important sources of credit data, typically beyond the scope of PCRs, include retail credit, trade credit, microfinance and information from other non-regulated financial institutions such as leasing firms and finance companies or independent credit card issuers.[14] Private credit registries not only seek to expand their access to information from a variety of lenders, but they also dedicate significant resources to obtaining data from other sources, such as court records and diverse public databases, which may not otherwise be readily available.

Another important difference between public credit registries and private credit reporting firms is the distribution (or degree of transparency) of the data. PCRs frequently provide access to data only to those regulated financial institutions that are also compelled to report their data. This practice, known as reciprocity, is followed by 49 of the 57 PCRs in the survey. As a result, not only are non-reporting financial institutions denied any access to the data but also small businesses, non-financial businesses that provide credit and insurance firms, among others, do not typically have access to the data.[15] Limiting access to the data to these groups, which have may have justifiable business reasons for requesting the data including even the data subject's consent reduces the overall impact of the data and limits the role they can play in contributing to transparency in an economy. In only a handful of countries do PCRs share their data with private credit bureaus; this also restricts the development of the credit information industry. Finally, only 15 of the 57 PCRs in the survey are required by law to allow consumers access to their own credit reports and 29 PCRs explicitly deny borrowers any access – a violation of internationally recognized data protection rules. Not surprisingly therefore, countries with PCRs tend also to

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[14] Argentina's PCR does include data from credit card companies given on a voluntary basis under an agreement of reciprocity.
[15] According to survey results, non-financial firms may access PCR data in only 2 countries, insurance firms may only access PCR data in 3 and in general small businesses cannot request reports from the PCR, even with the authorization of the borrower - these remarks exclude the case of Argentina where information was freely available to all on the internet for "punctual inquiries" - inquiries regarding a single individual.

have private credit bureaus. The survey from the World Bank finds that private credit bureaus exist in at least half of the countries surveyed (26/57 reported the existence of a private credit bureau).[16] See Figure 1 in the Appendix for a map of public credit registries and private credit reporting worldwide. Here, we strongly suggest that PCRs and private credit bureaus are complements and not substitutes.

In the three countries studied in this paper, Argentina, Brazil and Mexico, private credit bureaus exist and are the primary sources of information for many lending institutions. However, the public registries have played an important role in supplementing the data available from the private sector. For example, in Brazil most private sector credit reporting is focused on negative information. Since loans in good standing are not regularly reported to the private registries, private credit reports do not provide a full picture of the total indebtedness of borrowers. Brazil's public registry provides this important information to the banking community. In Argentina, the PCR has helped to fill in gaps in coverage in the private reporting system since all regulated financial institutions are required to report to the central bank on virtually all loans. Lenders can obtain both positive and negative information on a case-by-case basis from the public registry for borrowers they are evaluating. They also receive information on all borrowers who are in arrears or who are in default on a monthly basis. In Argentina, the negative information from the PCR is also available to the private credit bureaus. In Mexico, the public registry was the only source of centralized credit information available to financial institutions until the mid-1990s when private credit bureaus were established. The development of the private industry led to a decision by the Mexican central bank to end the distribution of the public registry data to banks in 2002.

2. Banking supervision

A second main objective for establishing a public credit registry is to strengthen banking supervision. In a prior survey of PCRs from 2000-2001, approximately half indicated that banking supervision was the most important reason for operating the public registry. In that same survey, 65% stated that the PCR had been "very important" in strengthening supervision of

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[16] PCR data is shared with private credit reporting firms or bureaus in Bolivia, Chile, the Dominican Republic, Peru and Slovenia. In Argentina, negative data from the PCR is publicly available and included in private credit reports.

financial institutions and another 30% stated it had been "somewhat important". Only one PCR, notably that of Mexico, was deemed "of little importance" for supervision; Argentina and Brazil both indicated that the registry was "very important" for banking supervision.[17] Argentina, Brazil and Mexico all view bank supervisors as the primary users of PCR data.

Regulators overwhelmingly report that they look at the financial institutions' use of credit reports in lending as part of the supervision process (53/57) and most use PCR data to support both their on-site (53/57) and off-site (49/57) supervision responsibilities. More than 80% (47/57) use PCR-data to analyze trends in banking and credit. However, only about 30% (17/57) report that they use statistical models to analyze PCR data; Argentina and Mexico are among this group of 30 but Brazil is not. The most frequent use of public registry data is to calculate the total indebtedness of borrowers with the financial system. A simple summation by borrower across institutions is the most important application for the rich datasets found in public registries for 30 of the 57 PCRs in the survey.[18]

Supervisors also indicated the importance of the ratings in PCRs as a supervisory tool. Ratings are often used to support more forward-looking provisioning policies. Rather than relying solely on information on a loan's past-due status, regulators may require banks to assign a more forward-looking "rating". The rating is typically assigned by the lender to either the borrower (the most common) or to each line of credit according to a common scale determined by the regulator. Ratings may depend on arrears and cash-flow projections and estimated probabilities of repayment to obtain a more forward-looking measure.[19] Consistency rules between the ratings of different lenders to the same borrower are often established e.g.; two lenders cannot input ratings that differ by say more than one point on the scale otherwise the system rejects both. Depending on the sophistication of the system, including ratings will require a higher degree of supervisory oversight to ensure that 'ratings' are consistent and to resolve disputes. Nearly 60% (33/57) of the PCRs surveyed, collect rating information including all Latin American countries

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[17] These questions were not asked in the subsequent 2002 PCR survey.

[18] Other answers to the question on the most important supervisory use of PCR data included: to track conglomerate borrowing (3); for use in calculating provisions (6); to identify discrepancies between institutions in risk ratings of borrowers (5); for information on the status of credits (7); and other (2).

with the sole exception of Venezuela. Of the 33 PCRs which collect ratings, 26 distribute these ratings back to the financial institutions. As public credit registries become tools to monitor and analyze forward-looking provisions, they may also be used to analyze capital.[20]

Many public credit registries, including the world's oldest PCR in Germany, were established in response to a banking crisis prompted by defaults of large borrowers. Monitoring credit risk concentrations and informing individual banks of these risks remains a key objective for most public credit registries. At the same time, in many developing countries improving access to credit also has high priority. Information from the public credit registry can serve both objectives by allowing banks to better assess the creditworthiness of borrowers at the same time that supervisors use the data to monitor for risks. However, there are tensions which are created by these different objectives and which can affect the design of the public registry and the data collected.

One of these tensions concerns the size of loans to be included in the PCR. From a lender's perspective it would be preferable to have data available on all loans regardless of size, since credit reports are particularly important for consumer and small business lending. Supervisors, however, may prefer to focus the database on large loans which pose a systemic threat. Also, by establishing a minimum loan size for inclusion in the PCR, supervisors can drastically reduce the size of the database, making it easier to manage and to enforce quality standards.[21]

Figure 1 provides information on the minimum loan sizes included in PCRs by region measured by the ratio of the cutoff amount to GNI per capita. In the World Bank survey 23 countries did not have any minimum loan size or had a very low minimum loan size indicating the important role these registries play as a provider of information to financial institutions. Virtually all

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[19] In some PCRs where the rating is on the credit line, collateral may also affect the rating. Another view however is that the rating should be that of the borrower and that collateral only enters in determining the level of provisioning to ensure greater comparability of ratings across borrowers.

[20] We come back to this in the discussion on banking regulation below.

[21] Some years ago, the cost in terms of computer hardware may also have been an issue however given the effective doubling of computing power every two years (so-called Moore's Law – see http://www.intel.com/research/silicon/mooreslaw.htm) and the even faster development of computer storage media, this does not seem to be the relevant constraint. As indicated in the text the constraint is really related to the management and particularly on the issue of ensuring reasonable quality control.

countries in Latin America, are in this category. Thirteen countries had a minimum loan size requirement of ten times or more GNI per capita. Saudi Arabia (USD 1.3 million), Jordan (USD 1.4 million) and Germany (EURO 1.5 million) are the countries with the largest cutoff requirements where the credit registry is used mostly for bank supervision and systemic risk monitoring. Regarding the countries analyzed in this paper, Argentina has a very low minimum cut-off, of 50 Argentine pesos (previously US$50 and now roughly US$18), Brazil has a minimum of US$ 2,100 down from US$ 50,000 several years ago and Mexico begins at US$ 20,000.

The supervisory agenda is also often apparent in the type of data collected in a PCR. The most obvious example of this is the lack of transparent data on payment status for loans, which is the heart of most private credit bureaus. Only about one-third (18/57) of PCRs collect a straight-forward borrower payment history which shows the number of on-time and late payments and defaulted loans and which indicates the extent of arrears (30 days, 90 days, 180 days late, etc.). To some extent this data is contained in ratings as described above, since payment status is a key determinant of a rating. However, since other more subjective factors can bear on the rating, such as a bank's estimate of the probability of default, ratings data are less transparent and more difficult to verify than objective payment data. Another variable which is very valuable for credit evaluation but often neglected by public bureaus is address information, which is lacking in about 40% of PCRs. Other data which are important for assessing creditworthiness, such as employment data and demographic data are also absent from a significant proportion of PCRs.

3. *Economic research, macroeconomic policy and control*

Credit bureau information can also be important for macroeconomic intelligence. Credit bureau information can be considered by region, by sector, by quality of borrower and used to analyze the credit market and interest rate developments in detail. Moreover, the dynamics of asset-quality can be highly illuminating in assessing activity and growth, by region or sector and macroeconomic risks. For example, an increase in the movement of loans to lower grades in a particular sector or region may highlight particular economic problems and risks in that area or sector. This information may be invaluable for a Central Bank to understand the transmission of

monetary policy and to guide monetary policy decisions. Credit bureau information can also be used by the tax authorities to improve fiscal control and to analyze the effect of different tax policies on credit flows.

4. Competition

A further set of objectives relates to competition and performance in the credit market. The effects of information on market structure and market conduct may be somewhat complex, however, more information regarding credit risk is likely to make a banking system more competitive and indeed as more credit information is made more publicly available, competition between banks and non-banks should also be heightened.

Arguably the very raison d'être of banks is to establish profitable lending relationships with clients where information is costly to acquire. Given that relationships tie borrowers in to particular lending institutions, that institution may then acquire a type of local monopoly power. However, relationship lending may still be preferable to issuing a security (non relationship lending), as the return that would have to be offered to the market (given the assumed poor information) may still be more than the price that the local monopolist bank would offer having invested in the relationship. Rajan (1992) computes an equilibrium in which firms may borrow from both banks and in the open (bond) market such that issuing in the market controls the local monopoly power of the bank. In a model that allows entry into the banking sector, if information is very poor and local monopoly rents very high, then we may expect a highly fragmented banking system with many banks, low economies of scale and a high cost of credit.

Typically, theoretical models assume some type of asymmetric information that a bank may overcome by investing (a fixed cost) in a relationship. However, as discussed above, a PCR may force banks to share this information. This may reduce the rents available to the bank and may lead to multiple and quite subtle effects. One concern is that banks will lose the incentives to search for clients thus potentially even having a negative effect on credit availability. On the other hand, making such information available cheaply may push more credits from banks to non-banks reducing overall intermediation costs and increasing credit availability. Perhaps more

realistically for the case of developing countries, forcing banks to share some of the information may reduce the rents from private information and push the sector towards larger, less fragmented and more efficient institutions. In short, there is then a subtle relationship between information availability and credit market competition and this remains an area where further research on the implications of sharing credit information would be helpful.

The competitiveness of the credit market is also related to the competitiveness of the market in information itself and as we have argued above a PCR will normally, and should normally, co-exist with private credit bureaus. This is most definitely **not** an issue of either/or. However, the private credit bureau market, in general, will have sharply increasing returns to scale, and is often dominated by a few large players - especially in smaller countries where there is a very real danger of only one significant private company that will then have severely diminished incentives for responsiveness to client demands and innovation and may charge high prices. The existence of a PCR can assist entry into the private credit bureau market by lowering entry costs in making a set of basic credit information available at low cost. A healthy, competitive private credit bureau industry should then be free to compete on adding additional information and developing other value-added services such as credit scoring products rather than surviving on information-rents alone.

The design features of public credit registries can also impact upon the role they will have in promoting competition in both financial and non-financial markets. For example, it is important to attempt to widen the access to PCR data beyond common rules regarding reciprocity for access to the data. This may impact considerably on competition in other sectors including insurance and even trade where trade credit is important.

The policy with respect to the assignment and distribution of borrower ratings by a PCR also may potentially impact competition in a financial market. For example, if ratings are tied in a one-to-one fashion to provisioning requirements, this could discourage lenders from undertaking more detailed analysis of marginal borrowers and unduly restrict credit to this market segment. Distributing the borrower ratings back to the financial system as part of the PCR credit report may also create incentives problems. For example, if banks know that when they lower a

borrower's credit rating, other institutions will be asked to follow suit[22] they may be reluctant to change ratings to accurately reflect a borrower's situation. This is especially true if their exposure to the client is significant and they don't want other banks to shut off credit. Small banks may also be tempted to just follow the lead of large institutions in assigning borrowers ratings and limit or forego independent risk analysis which both detracts from competition in the market and also introduces additional risk if these smaller institutions are not performing due diligence on their own lending portfolios.

4. Banking regulation

Credit registry information can also assist in the determination or refinement of the regulatory rules themselves. Many public credit registries are intimately tied to provisioning rules. PCR information can be used to analyze if current provisioning is adequate. In some cases, the very design of the PCR reflects the provisioning rules in place so there is an important feedback between rules, the information that is generated and the subsequent refinement of those rules. However, PCR information can be used more widely. In particular it may be employed to assess, not only provisioning, but also capital and also complementary regulations on concentration and related lending. In short, a PCR can be a valuable tool to understand the portfolio credit risks of either individual institutions or the whole financial system and assess the overall level of reserving (capital and provisioning) in relation to those risks.

In relation to regulations regarding capital adequacy, a common view is that forward-looking provisions should reflect expected losses and capital should reflect unexpected losses. These are simply two statistics from the same probability of loss distribution curve and hence if PCR data is useful for considering expected loss it is surely useful to analyze unexpected loss as well. The sum of expected and unexpected loss (up to some statistical confidence limit) is normally referred to as the Value at Risk. As reviewed in a companion paper in this project, countries may be able to build on PCR databases in order to transition to the more advanced approaches of Basel II that uses an estimate of a loan's Value at Risk to calibrate capital requirements.[23]

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[22] Many PCRs require that borrower ratings be uniform across institutions or at least similar, such as differing by only one rating category.
[23] See Basel Committee for Banking Studies (2003) and in particular the Internal Rating Based Approach.

As of today, however, few public registries are using their data in these more sophisticated ways. Only six of the 60 public registries surveyed indicated that the main use of PCR data in supervision was for provisioning[24] and even then, it was in the context of ensuring that problem loans were identified so that adequate provisions could be assigned, not for forward looking risk mitigation.

An important observation is that the typical structure of a PCR does not match Basel II's minimum requirements for data for the IRB approach. Basel II suggests that there should be at least two dimensions for such data (i) on the risk of the borrower and (ii) on the instrument. Regarding the risk of the borrower, there should be at least 7 rating buckets or grades for loans that are not in default and at least one grade for loans in default. The proposals state that, "a borrower grade should be defined as an assessment of borrower risk on the basis of a specified and distinct set of rating criteria, from which PD (probability of default) estimates are derived." Banks with loans concentrated in one a particular market segment should define rating grades such that loans are not unduly concentrated in a particular grade. The description of the ratings grades should be sufficiently detailed and clear to ensure loans of similar risks are classified in the same grades and that a third party can understand the assignment of borrower ratings. Rather than countries' rushing to adapt their PCRs to this standardized description, we suggest here that PCRs may play two useful distinct and roles in terms of Basel II implementation.

First, and as suggested in a companion paper, for those countries applying the simpler Basel II approaches, the databases may be used to enhance forward looking provisioning such that capital plus provisions reflect an overall estimated Value at Risk. This implies setting capital requirements equal to, say, those given by the Standardized Approach (SA) and then setting provisions to equal the Value at Risk minus the SA capital requirement. This would allow countries with a low penetration by rating agencies (the majority of developing countries) to link banks' reserving policies to risk but falling short of full IRB implementation.[25] The ratings would be those of the banks but as the rating scale would be centralized, and the database would not comply with the full Basel II requirements, this could not formally be referred to as an IRB

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[24] These six countries are: Brazil, Costa Rica, Dominican Republic, Madagascar, Peru and Vietnam.
[25] The standardized approach links banks' capital requirements to the external credit rating of borrowers.

23

approach. In the companion paper, and after Powell (2004), we name this the Centralized Rating Based approach – CRB.

Second, for countries that do allow some banks to apply the Basel IRB approaches, PCRs may play an invaluable role to monitor banks' internal ratings to allow for more effective control of these new regulations. In this case, the critical variable would be banks' internal ratings and the other information that allows for the calculation of the capital requirement. There are two paths that a regulator might choose here which we designate here as the "leader" and the "follower" approach. To a large extent the appropriate choice will depend on the degree of sophistication of the financial institutions in the country concerned and the stage of Basel II, IRB preparedness.[26]

A "follower" approach would be to solicit how banks' internal ratings information systems are constructed and (re)-design the PCR to reflect the best practice (or a common denominator of best practice). A "leader" approach would be to suggest to banks, ex ante, what data the supervisor will require, for a bank to be allowed to implement the IRB approach, and what subset of that data will be required to be reported for inclusion and possible distribution to a wider public as part of the PCR. This approach implies that the regulator will influence more strongly the format of the internal databases that banks will then maintain.

The result of the two approaches will be somewhat similar in that banks will have to maintain their own internal information systems (that should comply with Basel II's minimum requirements) and be able to send from those databases, the data that the regulator requires; a subset of which may appear within the PCR. In turn this requires a mapping from banks' own internal rating systems to a regulator's standardized scale, where the latter may not comply with Basel II minimum requirements.

Naturally, not all variables that banks have in their internal databases need necessarily be included in the PCR, and not all variables that are included in the PCR need necessarily be shared across all institutions nor reported more widely to other interested parties. There are

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[26] To a large extent this reflects a standard problem for regulators when considering a new regulation. The only issue here is that in this case the databases can be very large in principle covering all clients of the bank.

strong distinctions to be made between a) what is reported to the regulator for supervisory purposes, b) what is to be shared between financial institutions to improve information on the debtors of the financial system and to improve the risk management practices of non-best practice banks and c) what is disclosed more widely to enhance creditworthiness assessments more generally and further sharpen "willingness to pay" incentives.

IV. Conclusions

We believe that this is the first paper that has presented multi country empirical evidence on the value of Public Credit Registries. The empirical tests show that PCRs may improve credit access for borrowers for the same level of bank risk or reduce bank risk for the same level of credit access.

The empirical results also highlight several interesting features related to the design of PCRs. First, the empirical tests showed the added value of having positive as well as negative information on borrowers. These results were robust across countries. Second the results showed that small banks benefit even more than larger institutions from sharing credit information. Third, the results illustrated the importance of having a bank rating, as ratings were highly predictive in determining default risk.

While the three countries included in the empirical work (Argentina, Brazil and Mexico) all have private credit bureaus as well as PCRs, we argued that PCRs and private credit bureaus are complements and not substitutes. PCRs generally include positive information while banks may only be willing to share negative information voluntarily. PCRs typically cover all regulated financial institutions but tend to lack other voluntary data providers that private firms may capture. The private credit bureau industry is typically one of strong increasing returns to scale and hence prone to monopoly and restrictive practices; a PCR may lower entry costs and hence make the private industry more competitive. Finally, PCRs typically only share very basic information while private credit bureaus can add further information and supply higher value-added services on a more competitive basis.

PCRs have been found to have more uses than their original motivation. We presented a discussion of five key objectives of PCRs and the design tensions that these competing motivations often imply regarding PCR design. For example, banking supervisors are typically interested in the larger debtors of the financial system, loan concentration risk and the risks that they present to regulated institutions, while financial institutions have more interest in sharing information on smaller borrowers where information gathering is more costly.

Finally we discussed the possibility of using PCRs to enhance monitoring of forward-looking provisioning rules and to assess bank capital adequacy. The relevance of this discussion is sharpened by the recent Basel II proposals to link bank capital requirements more closely with economic risk and in particular value at risk type estimates of bank claims. In particular we suggest that PCRs may play two distinct roles depending on the Basel II implementation strategy of the country concerned.

For those countries that have decided to implement the Basel II simpler approaches such as the Standardized Approach but that wish to link bank reserving policies more closely with risk, PCRs may be useful to enhance forward looking provisioning. For those countries that wish to implement Basel II's Internal Rating Based Approach, then PCRs may play an important role in monitoring and checking the consistency of banks' internal ratings. Each approach has strong implications for PCR design.

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Figure 1. Minimum Loan Size for Inclusion in the PCR.
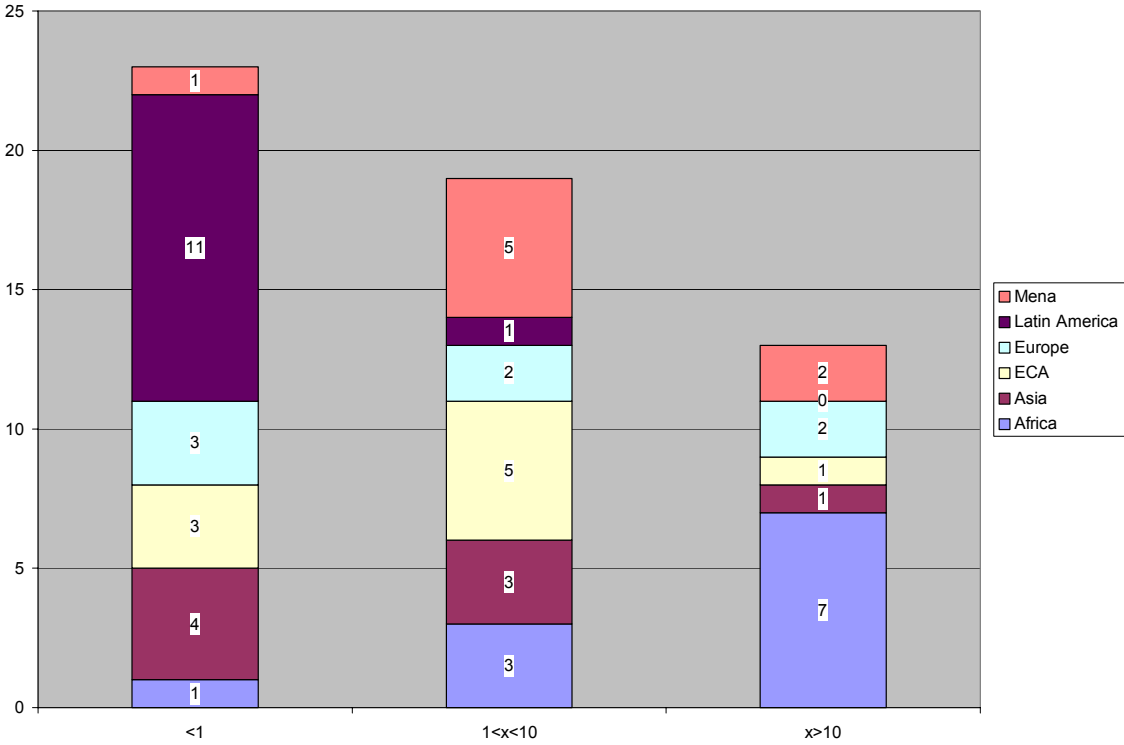
Horizontal axis measures ratio of minimum loans size requirement to GNI per capita. Vertical axis refers to a number of countries in each category.

Table 1. Key characteristics of the credit registries in Argentina, Brazil and Mexico

	Argentina	Brazil	Mexico
Name of the registry	Central de Deudores del Sistema Financiero (CDSF)	Credit Risk Center	Public Registry of Credit Information
Year of establishment	1991	1997	1964
Minimum cutoff amount (USD, 2001)	50	2,000	20,000
Number of borrowers in the registry	Firms: 113,000 Individuals: 5.5mil	Firms: 1.35 mil Individuals: 6.1 mil	
Level of data aggregation	Each credit line is reported separately for each borrower with each bank.	Credit is aggregated for each borrower within each bank	Each credit line is reported separately for each borrower with each bank.
Information collected			
Borrower identification	Name, ID number	Name, ID number	Name, ID
Industry or sector	Industry, sector	Industry	Industry
Region	N/A	N/A	Yes
Other information identifying borrower	Residence	N/A	
Currency	Yes		Yes
Days past due	No	Yes, in buckets: from 15 to 60 days, from 61 to 180 days, from 181 to 360 days and more than 360 days	No
Total amount of credit outstanding	Yes	Yes	Yes
Total number of open credit lines for a given borrower	Yes	No	Yes
Provisions	Yes	No	No
Collateral	Type, coverage	No	No, but the type of the loan allows to determine whether the loan is collateralized
Ratings	5 categories; for retail loans rating is mostly based on delinquency status; for corporates – it also includes analysis of the financial status of the borrower	9 categories; classification is based on delinquency status as well as financial standing of the borrower and security	5 categories; classification is based on delinquency status as well as financial standing of the borrower and security
Interest rate	Yes	No	Yes
Maturity	Yes	No	Yes
Other	Financial statements and balance sheet data for large borrowers; ratings and ownership of banks	No	Renewals

Table 2. Data description and definition of variables

	Argentina	Brazil	Mexico
Number of observations	93,000		197,000
Min loan size	USD 21,000	USD 300,000	USD 21,000
Credit history	June, 1999 – December, 2000	October 2000 - October 2001	
Default horizon	January, 2001 – December, 2001	November, 2001 – October,2002	
Dependent variable	*Default* – dummy variable equals 0 if a borrower average rating across the system is less than 2, and equals one otherwise. One of the criteria for assigning a rating 3 or worse is delinquency of 90 days or more.	*Default* – dummy variable equals 1 if a borrower rating with a given bank equals E or worse, and zero otherwise. One of the criteria for assigning a rating E or worse is delinquency of 90 days or more.	*Default* – dummy variable equals 1 if borrower has missed 3 or more consecutive payments (equivalent to 90 days or more) over the period of default horizon
NEGATIVE	*Previous Default* – dummy variable equals 1 if average rating across the system was higher than 3 at any point in time, equals 0 otherwise *Missing Payments* – dummy variable equals 1 if average rating across the system falls between 1.5 and 2.5 (a proxy for delinquencies of less than 90 days) at any point in time, and equals 0 otherwise.	*Previous Default*- proportion of the total debt of the borrower in categories E through H (overdue of 90 days or more) *Missing Payments* – 3 variables: (i) dummy variable equals 1 if borrower has delinquent payments in October 2001; (ii) dummy variable equals 1 if in a given month more than 10% of credit outstanding is past due; (iii) proportion of outstanding credit that is past due in October 2001	*Previous Default* – dummy variable equals one if borrower has defaulted before (missed 3 or more payments in a row), 0 otherwise *Missing Payments* – dummy variable equals 1 if borrower has missed payments (less than 3 in a row), and 0 otherwise *Restructure* – dummy variable equals one if loan was restructured, and 0 otherwise
POSITIVE	*Total Debt* –debt consolidated across all financial system for a given borrower *Credit lines* – number of open credit lines in the system *Collateral* – ratio of value of collateral to the value of the loan *Average rating* – average rating of the borrower over the credit history period *Length of Credit History* – number of months borrower appears in the Central de Deudores over the credit history period	*Initial Rating* – initial rating of a borrower is decomposed into 4 dummy variables corresponding to risk classification A – D, AA is used as base. *Worst rating* – worst rating that the borrower has received over the period of credit history, the variable is decomposed into 8 dummy variables corresponding to risk classifications A – G, AA is used as base	*Initial Amount* – initial loan amount *Total Debt* –debt consolidated across all financial system for a given borrower *Collateral* – dummy variable equals 1 if loan is backed by collateral, 0 otherwise *Initial Rating* – variable takes discrete values from 0 (best) to 5 (default) *Renewals* – dummy variable equals one if loan was previously renewed, 0 otherwise *Interest Rate* – ratio of interest paid to loan amount

Table 3.   Regression results

Models for Argentina and Mexico are estimated using probit procedure. Logit was used to estimate results in case of Brazil. See Table 2 for description of variables. Standard error in parenthesis, *** indicates significance at 1%,   ** at 5%, and * at 10% level.

Variable	Argentina		Brazil		Mexico	
	Only Negative Information	Complete Information	Only Negative Information	Complete Information	Only Negative Information	Complete Information
Previous defaults	0.6184 ***	0.2957 ***	3.0542 ***	2.2780 ***	0.4368 ***	0.2039 ***
	(0.0191)	(0.0250)	(0.1670)	(0.1735)	(0.00468)	(0.0087)
Missing payments	0.6915 ***	0.7453 ***	1.4836 ***	1.2255 ***	0.0243 ***	0.0019 ***
	(0.0156)	(0.0160)	(0.0475)	(0.0511)	(0.00062)	(0.0002)
Restructure					0.0030 **	0.00009
					(0.00172)	(0.0001)
Total debt		-0.0108 *		-0.0656 ***		0.0000 *
		(0.0062)		(0.0111)		(0.0000)
Collateral		-0.2015 ***				-0.0001
		(0.0180)				(0.00008)
History length		-0.0157 ***		-0.0037		-0.00007 ***
		(0.0025)		(0.0065)		(0.00001)
Currency1						-0.00049 ***
						(0.00006)
Currency2						-0.00690 ***
						(0.00034)
Renewals						-0.00031 **
						(0.00012)
Interest rate						0.00573 ***
						(0.00067)
Initial amount						0.00000
						(0.00000)
Initial rating (A)				-0.0023		0.00008 ***
				(0.0679)		(0.00002)
Initial rating (B)				0.4667 ***		
				(0.0648)		
Initial rating (C)				1.0059 ***		
				(0.0649)		
Initial rating (D)				2.2611 ***		
				(0.0730)		
Credit lines		0.2702 ***		0.0269 ***		
		(0.0118)		(0.0042)		
Number of observations	70017	70017	26631	26631	196934	176447
Pseudo R2	.12	0.14	0.068	0.129	0.56	0.65

Table 4. Positive versus negative information sharing

Panel A. Default risks

Target approval rate	Argentina (loans of $20,000 and more)			Brazil (loans of $300,000 and more)		
	Default rate, percent		Percent decrease in default rate when using positive and negative model	Default rate, percent		Percent decrease in default rate when using positive and negative model
	Negative only model	Positive and Negative model		Negative only model	Positive and Negative model	
40 %	2.45	1.53	-37.6	2.78	1.30	-53.2
60 %	3.81	2.98	-21.8	3.37	1.84	-45.4
80 %	6.03	5.70	-5.5	3.74	2.88	-23.0
100 %	12.19	12.19	0.0	6.77	6.77	0.0

Panel B. Access to credit

Argentina

Target default rate	Percent of borrowers approved for a loan		Percent increase
	Negative only model	Negative & Positive Model	
3%	49.50%	60.22%	21.7%
5%	75.76%	76.37%	0.8%
7%	84.26%	86.02%	2.1%
9%	91.95%	92.76%	0.9%
10%	94.71%	95.24%	0.6%
11%	97.10%	97.50%	0.4%
12%	99.55%	99.59%	0.0%

Brazil

Target Default Rate	Percent of borrowers approved for a loan		Percent Decrease
	Full Model	Negative-only Model	
2%	65.08%	49.20%	24.39%
3%	82.27%	55.84%	32.13%
4%	91.53%	84.81%	7.34%
5%	96.23%	94.36%	1.95%

Table 5. Gains from sharing information in Argentina.

Panel A: Default rates:

Target approval rate	Large Bank			Small Bank		
	Information from registry	Model with individual bank information only	Decrease in default rate, percent	Information from registry	Model with individual bank information only	Decrease in default rate, percent
40%	1.31	2.22	-41.0%	0.52	2.42	-78.5%
60%	2.48	3.78	-34.4%	2.94	4.5	-34.7%
80%	4.39	5.37	-18.2%	5.54	7.27	-23.8%
100%	9.52	9.52	0	12.11	12.11	0.0%

Panel B. Access to credit.

Target default rate	Large Bank			Small Bank		
	Information from registry	Model with individual bank information only	Increase in approval rate, percent	Information from registry	Model with individual bank information only	Increase in approval rate, percent
4%	76.68	63.05	21.6%	69.72	54.33	28.3%
5%	83.86	74.82	12.1%	77.16	65.4	18.0%
6%	88.46	87.1	1.6%	82.87	74.57	11.1%
7%	93.12	92.48	0.7%	85.64	79.58	7.6%

Main Characteristics of Public Credit Registries in Countries Around the World.

Country	Name of Registry	Year established	Institution operating PCR	Min Loan Size (US$)	Number of borrowers	Number of employees
AFRICA						
Benin	Centrale des Risques	1979	BCEAO	6,717	5,895	35
Burkina Faso	Centrale des Risques	1979	BCEAO	6,717	11,895	35
Cameroon	Centrale Recapitulative des Risques	1972	Central Bank	0	5,488	17
Cote d'Ivoire	Centrale des Risques	1979	BCEAO	6,717	16,163	35
Madagascar	Banque Centrale de Madagascar	1973	Central Bank	7,688	27,580	10
Mali	Centrale des Risques	1979	BCEAO	6,717	7,185	35
Mozambique	Central De Riscos De Credito	1997	Central Bank	437	11,466	2
Niger	Centrale des Risques	1979	BCEAO	6,717	7,112	35
Nigeria	Credit Risk Management System	1998	Central Bank	8,333	17,861	
Senegal	Centrale des Risques	1979	BCEAO	6,717	15,360	35
SOUTHERN AND EASTERN ASIA						
Bangladesh	Credit Information Bureau	1993	Central Bank	878	171,003	51
China	Bank Credit Register and Consultation System	1999	Central Bank	0	4,000,000	6
Indonesia	Debtor Information System	1988	Central Bank	4,802	574,873	10
Malaysia	Central Credit Reference Information System	2001	Central Bank	0	2,500,000	16
Mongolia	Credit Information Bureau	1995	Central Bank	907	37,434	2
Pakistan	Credit Information Bureau	1992	Central Bank	8,312	105,552	12
Taiwan	Joint Credit Information Center	1992	Ministry of Finance	0	610,000	115
Vietnam	Credit Information Centre	1999	Central Bank	3,316	155,032	30
EASTERN EUROPE AND CENTRAL ASIA						
Belarus	Data Base on Loans Issued	1996	Central Bank	10,000		1
Bulgaria	Central Credit Register	1999	Central Bank	4,525	40,000	2
Lithuania	Loan Risk Data Base	1995	Central Bank	13,218	24,800	2
Romania	Credit Information Bureau	2000	Central Bank	6,300	24,241	8
Slovakia	Registry of Bank Loans and Guarantees	1997	Central Bank	0	11,634	3
Slovenia	Kreditni portfelj bank	1994	Central Bank	0	27,837	1
Turkey	The Risk Center	1951	Central Bank	6,900	487,943	25
Yugoslavia	Credit Information System	2002	Central Bank	75,207	1,513	7

Country	Name of Registry	Year established	Institution operating PCR	Min Loan Size (US$)	Number of borrowers	Number of employees
EUROPEAN UNION						
Austria	Major Loan Register	1986	Central Bank	308,420	70,697	8
Belgium	Central Credit Registers	1967	Ministry Economic Affairs, Ministry of Finance	22,030	700,000	16
France	Service Central des Risques	1946	Central Bank	66,971	700 000	47
Germany	Evidenzzentrale für Millionenkredite	1934	Central Bank	1,321,800	388,785	
Italy	Centrale dei Rischi	1962	Central Bank	66,090	3,156,488	33
Portugal	Central de Responsabilidades de Crédito	1978	Central Bank	44	5,077,929	14
Spain	Central de Informacion de Riesgos	1962	Central Bank	5,287	12,066,861	25
LATIN AMERICA AND CARIBBEAN						
Argentina	Central de Deudores Del Sistema Financiero	1991	Central Bank	50	5,579,149	16
Bolivia	Central de Información de Riesgo Crediticio	1988	Superintendency of Banks	0	468,651	5
Brazil	Credit Risk Center	1997	Central Bank	2,162	7,509,964	
Chile	Central de Riesgos	1977	Superintendency of Banks	0	3,214,573	6
Colombia	Sistema Integral de Riesgos	1994	Superintendency of Banks	11,000	83,000	7
Costa Rica	Servicio de Informacion Crediticia	1996	Superintendency of Banks	0	28,000	3
Dominican Republic	Central de Riesgos	1994	Superintendency of Banks	0		6
Ecuador	Central De Riesgos	1997	Superintendency of Banks	0	1,059,220	8
Guatemala	Sistema de Información de Riesgos	2002	Superintendency of Banks	0		
Honduras	División Central de Riesgos	1998	National Banking and Securities Commission	0	295,900	5
Mexico	Reportes Crediticios	1964	National Banking and Securities Commission	20,000		
Nicaragua	Central de Riesgo	1994	Superintendency of Banks	0	258,854	2
Peru	Central de Riesgos	1983	Superintendency of Banks	0	2,397,928	9
Uruguay	Central de Riesgos	1989	Superintendency of Banks	16,323	165,015	4
Venezuela	Sistema de Informacion Central de Riesgo	1975	Superintendency of Banks	0	2,377,695	5
MIDDLE EAST AND NORTHERN AFRICA						
Egypt	Credit Risk Dept.	1957	Central Bank	8,753	83	80
Iran	Banking Information Department	1990	Central Bank	1,714		28
Jordan	Credit Risk Division	1966	Central Bank	42,325	97,000	6
Morocco	Central Risks Service	1966	Central Bank	8,620		5
Saudi Arabia	Banking Credit Center	1985	Saudi Arabia Monetary Authority	1,333,209	5,778	10
Tunisia	Centrale Des Risques	1958	Central Bank	13,605	40,000	8
United Arab Emirates	Credit Risk Bureau	1982	Central Bank	68,068	34,289	6
Yemen	Credit Risk Information Department	1975	Central Bank	2,926	125,000	5

APPENDIX Figure 1: Map

This map was produced by the Map Design Unit of The World Bank. The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.

Both private bureau and public credit registry exist
Only private bureau exists
Only public credit registry exists
No private bureau or public credit registry exists
Not in the *Doing Business* sample

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