

Bank Competition, Concentration, and Credit Reporting

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Abstract

This paper explores the empirical relationship between bank competition, bank concentration, and the emergence of credit reporting institutions. The authors find that countries with lower entry barriers into the banking market (that is, a greater threat of competition) are less likely to have a credit bureau, presumably because banks are less willing to share proprietary information when the threat of market entry is high. In addition, a credit bureau is significantly less likely to emerge in economies characterized by a high degree of bank concentration. The authors argue that the reason for this

finding is that large banks stand to lose more monopoly rents from sharing their extensive information with smaller players. In contrast, the data show no significant relationship between bank competition or concentration and the emergence of a public credit registry, where banks' participation is mandatory. The results highlight that policies designed to promote the voluntary creation of a credit bureau need to take into account banks' incentives to extract monopoly rents from proprietary credit information.

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1. Introduction

Extensive credit information sharing can have several benefits for the financial system. First, economic theory predicts that reliable credit information can address the fundamental problem of asymmetric information between borrowers and lenders (Padilla and Pagano, 2000, and Stiglitz and Weiss, 1981). Cross-country evidence confirms that the availability of detailed information about the borrowing and repayment behavior of prospective clients places banks in a better position to assess default risk, counter adverse selection, and monitor institutional exposures to credit risk (Pagano and Jappelli, 1993, Japelli and Pagano, 2002, Miller 2003). A recent study of a Guatemalan micro-lender provides evidence that information sharing is also effective at altering borrower behavior, countering moral hazard, and improving repayment rates (de Janvry, McIntosh, and Sadoulet, 2010). Perhaps most importantly, credit reporting allows borrowers to build a credit history and to use a documented track record of responsible borrowing and repayment as “reputational collateral” to access credit outside established lending relationships (Love and Mylenko 2003).² In addition, financial regulators can draw on credit reporting systems to understand the credit risk faced by financial institutions and systemically important borrowers, to define capital provisioning requirements, and to conduct essential oversight functions.

Despite the numerous benefits of information sharing for credit market efficiency, credit reporting institutions do not always emerge spontaneously. About 26 percent of countries do not have any credit reporting institution at all. Another 19 percent have only a public (i.e. government mandated) credit registry, but no credit bureau³. One reason why a credit bureau may not emerge voluntarily is that the private returns to information sharing are not necessarily aligned with its public returns. This paper examines two features of the banking market – competition and concentration – that can influence private returns to joining a credit bureau and that can thus affect the probability of a credit bureau emerging.

Pagano and Jappelli (1993) develop a model which predicts that the incentive to share information is greater when lenders are protected from competition by barriers to entry. Brown and Zehnder (2010) find empirical evidence for a negative relationship between competition and

² See also Padilla and Pagano (2000)

³ Based on the Doing Business dataset that is described in more detail in section 3.

emergence of voluntary information sharing in a laboratory experiment. To our knowledge, our paper is the first to empirically test the relationship between banking competition and the voluntary emergence of a credit bureau with cross-country data. We use two recent, underexplored datasets on credit reporting institutions and bank entry barriers that allow us to study this relationship in a sample of close to 195 countries. In line with the existing literature, we find that countries with higher bank entry barriers (i.e. a lower threat of competition) are significantly more likely to have a credit bureau. However, we also show that where a credit bureau exists, the absence of competitive pressures is associated with less depth and transparency of the credit information that is made available by lenders.

We also test an additional set of related hypotheses. Pagano and Jappelli (1993) argue that banks may not join a credit bureau, or share only limited or incomplete client data, since they can capture monopoly rents by not sharing proprietary credit information. We point out that, due to increasing returns to scale, the disincentive for information sharing is particularly relevant for very large banks. This implies that barriers to credit information sharing may be particularly pronounced in markets characterized by a high degree of bank concentration. Our data support this hypothesis: countries with higher bank concentration are significantly less likely to have a credit bureau. We also find some evidence that bank concentration is associated with lower coverage of the information reported to existing credit bureaus, potentially because banks try to hold on to monopoly rents by sharing only partial information.

Finally, bank competition or concentration should not be correlated with the probability of having a credit registry since participation in a registry is mandatory and banks' incentives are only relevant for voluntary information sharing. Confirming this hypothesis, we find no correlation between bank competition or concentration and the existence of a credit registry.

This paper contributes to the broader empirical literature on the relevance of bank competition and concentration for the efficiency of financial intermediation. One strand of this literature argues that *competition* has a negative impact on systemic stability and the efficiency of financial intermediation since greater bank competition may weaken screening incentives (Boot and Thakor, 1993) and can lead to excessive risk-taking (Allen and Gale, 2000, and Hellman,

Murdock, and Stiglitz, 2000). Our results suggest an additional reason why greater bank competition may hamper stability and efficiency of financial intermediation: when the threat of entry is high, private credit reporting institutions are less likely to emerge, leading to a reduced availability of credit information for screening and risk-management. While stronger competitive pressures in a country's banking sector hinder the establishment of a private credit reporting institution, greater bank competition is not unambiguously negative. In additional results we show that, conditional on having a private credit bureau, information sharing is more comprehensive and transparent in economies characterized by greater bank competition.

The existing literature has also argued that a high degree of bank *concentration* (as measured for example by the market share of the largest financial institutions) tends to have a negative impact on the efficiency of financial intermediation. Banks with greater market power can exploit their position to charge higher interest rates (Boyd and De Nicoló, 2005) and large banks in highly concentrated banking systems are more likely to benefit from implicit government guarantees that may distort market incentives (Schaeck, Čihák, and Wolfe, 2009). The findings presented in this paper suggest an additional reason why bank concentration may lower the efficiency of financial intermediation: high concentration is accompanied by sizable monopoly rents to information and thus lowers the returns to voluntary information sharing.

The remainder of this paper proceeds as follows. In section 2, we summarize related research on the emergence of credit reporting institutions and state our hypotheses. Section 3 describes the data. Section 4 discusses our empirical strategy. In section 5, we present the results and section 6 concludes.

2. Background and hypotheses

As outlined in the introduction, the exchange of comprehensive credit information among lenders is beneficial for credit market efficiency and financial stability. However, private returns to information sharing are not necessarily aligned with its public returns. This misalignment can limit the voluntary exchange of credit information among lenders. We study two features of the competitive structure of a country's financial sector – bank competition and bank concentration –

that can influence private returns to joining a credit bureau and can thereby also affect the emergence, coverage, and depth of credit reporting systems.

Pagano and Jappelli (1993) point out that membership in a credit bureau entails both benefits and costs. On the one hand, lenders gain access to better information about potential borrowers. On the other hand, they also lose the informational advantage over their own borrowers. This leads to more competition among lenders and reduces monopoly rents to information. Paganao and Jappelli develop a model which predicts that the incentive to share information is greater when lenders are protected from competition by barriers to entry. They cite anecdotal evidence supporting this prediction. In the US, branching regulation has traditionally limited competition among banks in different states, which may have contributed to voluntary information sharing among lenders as early as the 1920s. In Italy, in contrast, banks compete nationwide and the initiative to create the first credit bureau in 1990 was taken by local lending institutions with national banks joining only later.

Brown and Zehnder (2010) analyze the relationship between competition and emergence of voluntary information sharing empirically, in a laboratory setting, where they create an experimental credit market. In the experiment, lenders have to decide whether or not to join a credit bureau under different market conditions, including two different levels of entry costs into the local market. The results show that lenders are more likely to share information when entry barriers are high (i.e. the threat of competition is low), confirming Pagano and Jappelli's theoretical prediction.

To our knowledge, our paper is the first to empirically test the relationship between bank competition and the voluntary emergence of a credit bureau outside the laboratory setting. Based on the theoretical argument in Pagano and Jappelli, we first test the following hypothesis:

H.1: Countries with lower banking sector competition (high barriers to entry) have a higher probability of having a private credit reporting institution.

Intuitively, this hypothesis arises from the fact that lenders sharing credit information in a market characterized by high barriers to entry are shielded from the possibility that new competitors will use this information to gain market share. This protection reduces the private cost of sharing credit information relative to the case in which barriers to market entry are low. It also resonates with stylized evidence on the persistence of “closed user groups”, consisting of a small number of lenders that seek to limit entry by capturing the market for credit information.

Our next hypothesis starts with the observation that for any given bank the costs and benefits of joining a credit bureau also depend on how much information the bank already has relative to other lenders in the market. Banks with a large market share earn higher monopoly rents on their borrower information than banks with a smaller market share, and they thus also stand to lose more informational rents after joining a credit bureau. In addition, these large players may have relatively little to gain from sharing information since their set of potential borrowers is comparatively small to their set of existing borrowers. Taken together, these points lead to our second hypothesis:

H.2: Countries with lower bank concentration have a higher probability of developing private credit reporting institutions, since returns to information sharing are declining in a bank’s market share.

Note that the theoretical arguments leading to both hypotheses 1 and 2 rely on the assumption that banks voluntarily decide whether to share information in a credit reporting institution or not. These arguments do thus not apply to intuitions that make information sharing obligatory, i.e. publicly mandated credit registries. This point leads to our third hypothesis:

H.3: Concentration and competition in the banking market are not associated with the probability of having a credit registry, as participation in credit registries is not voluntary and usually mandated by law.

Finally, we look beyond the existence of credit reporting intuitions and ask whether banking competition and concentration also influence the coverage and depth of information reported to

the credit bureau in countries where a bureau exists. Bouckaert and Degryse (2006) develop a model where banks benefit from strategically sharing only partial data on their borrowers. It is thus possible that banks use partial information sharing as a tool to maintain their informational rents after joining a credit bureau. In particular, conditional on a credit bureau being in place, banks that are protected from entry by new players may be more willing to share full information. We test the following hypothesis:

H.4: Lower banking sector competition (high barriers to entry) is associated with higher coverage, depth, and transparency of information reported to the credit bureau in countries where a bureau exists.

In addition, banks with a large market share may be more reluctant to share full information with an existing credit bureau in an effort to preserve their market share, resulting in our last hypothesis:

H.5: Lower bank concentration is associated with higher coverage, depth, and transparency of information reported to the credit bureau in countries where a bureau exists.

To the best of our knowledge, this paper is the first to test these hypotheses systematically for a large set of countries. Our empirical analysis is made possible by two recent and previously underexplored datasets, as described in the following section.

3. Data description

3.1 Doing Business database on credit reporting institutions

Our data on credit reporting institutions come from a survey conducted by the World Bank's Doing Business team. This survey has been implemented yearly since 2003 and the Doing Business team uses it to generate their indicator on the ease of "Getting Credit" in countries around the world. In each country that is part of the exercise, the Doing Business survey always covers the credit registry if it exists and the largest credit bureau if more than one is in

existence⁴. For this paper, we obtained raw survey data from the Doing Business team, for years 2005 through 2010, covering more than 180 countries.

Based on this raw data, we constructed two variables indicating the existence of credit reporting institutions in 2010. The first variable is a dummy that is equal to one if the country has a credit bureau and zero otherwise. The second variable is a dummy that is equal to one if the country has a credit registry and zero otherwise⁵. The Doing Business team defines a credit registry as a publically owned entity that collects information on borrowers and shares it with regulated financial institutions. A credit bureau is a privately owned entity which collects information on borrowers in the financial system and facilitates the exchange of credit among lenders. For the purpose of this paper and the hypotheses stated in section 2, the key distinction is that the credit registry makes reporting of loan information mandatory for banks (in many cases for loans above a certain threshold only), whereas participation in a credit bureau is voluntary. From a broader perspective, credit registries contain primarily information on loans made by regulated lenders and capture a loan at the time of origination. This information is often used for regulatory and supervisory purposes. Credit bureaus tend to contain more repayment information that allows for the tracking of loans and credit risks over time and they also provide additional data processing services, such as calculating credit scores. Panel A of table 1 shows that 54.5 percent of the countries in our sample have a credit bureau and 45.1 percent have a credit registry. Figure 1 further shows that about 74 percent of countries have either institution (26 percent have no credit reporting institution). Low and middle income countries have a relatively higher presence of credit registries while credit bureaus are more common in high income countries (Figure 1).

For countries with a credit bureau, we constructed an indicator measuring the coverage of the information captured in the bureau, by dividing the total loan volume recorded in the bureau by the country's GDP. We calculated this indicator as an average over the years 2005 through 2010, considering only years when a credit bureau existed during this period, since data is missing for different countries in different years. Panel A in table 1 shows that the average ratio of credit

⁴ In recent years and in very few cases, the survey has covered more than one credit bureau. The bureaus that are covered are typically the largest ones in a country.

⁵ Information on whether a country has a credit bureau or a credit registry is also available on the Doing Business website.

listed to GDP is 0.29, ranging from a value very close to zero to 2.68. We chose to scale credit listed by GDP instead of the outstanding volume of credit the country since this yields more observations. One caveat with this variable is that reliable information on volume of credit listed in the credit bureau is only available for 55 out of 104 countries that have a credit bureau. We therefore use an alternative measure of credit bureau coverage, as reported by the Doing Business team and defined as: the total number of individuals plus firms listed in the credit bureau divided by the adult population of a country. For consistency, we also calculate this Doing Business measure of credit bureau coverage as the 2005 through 2010 average. As shown in table 1, this variable is available for 102 countries and has an average of 0.347.

Figure 2 compares both measures of credit bureau coverage across country income groups. The Doing Business measure indicates higher coverage in middle and high income countries compared to the credit listed measure. In low income countries, on the other hand, the ratio of credit listed to GDP is 0.41 while the coverage of individuals plus firms divided by the adult population is only 0.02. This large discrepancy suggests that in low income countries a small fraction of individuals or firms hold very large loan volumes.

We also constructed indices measuring (i) the extent of information distributed on each borrower by the credit bureau and (ii) the transparency of the credit bureau. The *information index* is constructed as follows: the Doing Business survey asks a series of questions capturing what type of information credit bureaus distribute on borrowers, loans, and the repayment history of borrowers. The questions have a yes (=1) or no (=0) response. The index is constructed by adding all the questions with an affirmative response and dividing by the number of total questions. The summary statistics in table 1 show that the values of the index range from 0 to 0.89, with an average of 0.424. The index is available for 94 countries.

With respect to the information reported by credit bureaus, we use another variable that indicates whether the bureau shares positive information. The exchange of positive information is particularly costly for banks since it allows borrowers to establish reputational collateral and to access credit outside established lending relationships. From the perspective of the borrower,

reputational collateral can increase access to finance. Credit bureaus in about 65 percent of the 94 countries for which this variable is available share positive information (Table 1).

Figure 3 plots the two measures of depth of credit bureau information across country income groups. Both measures follow a similar pattern in that middle income countries have the greatest depth of information, followed by low income countries and then high income countries.

Finally, the *transparency index* is a tally of affirmative responses to five questions. These questions ascertain whether borrowers are guaranteed access to their credit history data by law, whether they can inspect their data in practice, and whether there is a cost for inspecting one's own credit information. The average of this index is about 2.5 (table 1). Middle income and high income countries have higher levels of credit bureau transparency on average than low income countries (figure 4).

3.2 Measures of competition and concentration

As a measure of banking competition, we chose to use the log minimum capital requirement (in millions of USD) for banks in 2001 from the World Bank's 2013 Global Financial Development Report (GFDR) database. We prefer this measure of bank entry regulation over measures of market power in banking, such as the Lerner index or the Boone indicator for two reasons. First, the variable is conceptually closest to the entry barriers that Pagano and Jappelli (1993) include in their theoretical model and also to the way in which Brown and Zehnder (2010) vary entry barriers in the lab setting (i.e. through transactions costs for entering a new market). Second, market power is a function of entry regulation as well as other factors, including the existence and depth of credit information, and is thus more likely to be endogenous to our outcome variables (see section 4 for a discussion about reverse causality).

We have data on the minimum capital requirement for 137 countries, ranging from zero to USD 15 billion. Close to 90 percent of the sample have a minimum capital requirement below USD 20 million, with a median of 5.7 million. Figure 5 shows the distribution of minimum capital requirements below USD 20 million. Since the full distribution of the variable has a long left tail,

we use the log minimum capital recruitment in the analysis. Summary statistics for this variable are in panel B of table 1.

Our measure of bank concentration is the asset share of the three largest banks in a country in the year 2000 from the GFDR 2013 database. We chose this variable as opposed to other measures of bank concentration that include a larger number of players in the banking market (asset share of the five largest banks or Herfindahl index) since our hypothesis 2 in section 2 relates specifically to the existence of a few very large banks. That is, the disincentives to sharing credit information are particularly strong for banks that capture a very large share of the market. Panel B of table 1 shows that the average level of bank concentration in our sample is 0.73, with a minimum of 0.21 and a maximum of 1.

Data on the minimum capital requirement and on bank concentration is only available for about 135 countries, thus reducing the number of countries included in our empirical analysis.

3.3 Control variables

The last panel of table 1 shows the descriptive statistics for the control variables used in this paper. The first two variables are (i) a measure of economic development (log of GDP per capita in the year 2000 from the World Development Indicators) and (ii) a proxy for the depth of the financial sector (ratio of private credit to GDP in 2000 from the Financial Structure database).

We include two measures of a country's institutional environment. The first one is an indicator of the quality of contract enforcement: the log number of days it takes to enforce a contract from the Doing Business database. We use the first available year for this variable (2003), covering 144 countries. Our second institutional variable is a proxy of creditor rights quality: the credit rights index from Djankov, McLiesh, and Shleifer (2007) for the year 2000. This index measures the strength of legal rights of creditors against defaulting debtors and ranges from 0 (weak creditor rights) to 4 (strong creditor rights). Also from Djankov, McLiesh, and Shleifer, we use dummy variables for the legal origin of a country (French, Scandinavian, German or socialist/transition origin, with British legal origin being the omitted category). We add these variables based on the findings of Djankov, McLiesh, and Shleifer (2007), who find that legal

origin is a strong predictor of whether a country has credit information sharing institutions. Both creditor rights and the legal origins dummies are available for 133 countries.

Finally, we include controls for the ownership structure of the banking sector in 2001: the assets shares of government and foreign owned banks. Similarly to our measures of banking competition and concentration these variables come from the GFDR 2013 database. Appendix A includes more information on the variables used in the analysis and the data sources.

4. Empirical strategy

In order to test empirically whether lower competition and concentration in the banking market are associated with a higher probability of a credit bureau emerging, we estimate the following cross-country equation

$$Bureau_i = \alpha + \beta Competition_i + \gamma Concentration_i + \delta X_i + \varepsilon_i. \quad (1)$$

In this equation, i indexes countries, the outcome variable $Bureau_i$ is equal to one if the country has a credit bureau and equal to zero otherwise, $Competition_i$ is our measure of bank competition (log minimum capital requirement), $Concentration_i$ is our measure of banking concentration (asset share of the largest three banks), X_i is a vector of country control variables and ε_i is the error term. We estimate the equation through a Probit regression with robust standard errors.

The country control variables X_i include several characteristics that could be correlated with both our explanatory variables of interest (competition and concentration) and the emergence of a credit bureau. As discussed in section 3, these variables are GDP per capita, the credit to GDP ratio, measures of the institutional environment, legal origin dummies, the asset share of government-owned banks and the asset share of foreign-owned banks.

In line with hypothesis 1 stated in section 2, we expect the coefficient on competition (β) to be positive. Banks in countries with a higher minimum capital requirement, i.e. with higher entry

barriers, should be more willing to share information since the entry barriers shield them from competition. Hypothesis 2 implies that the coefficient on bank concentration (γ) should be negative. We expect countries with higher bank concentration to have a lower probability of having a private credit bureau since large banks stand to gain more from not sharing information with other banks.

In order to test hypothesis 3, we replace the outcome variable in equation (1) with an indicator variable that is equal to one if the country has a credit registry and equal to zero otherwise. We expect to find that the coefficients on competition (β) and concentration (γ) are statistically equal to zero in the regression that uses the credit registry indicator as the outcome variable.

Our tests of hypotheses 4 and 5 also use regressions based on equation (1), but with indicators for the reach, depth, and transparency of credit information as the outcome variables. These regressions are estimated through OLS whenever outcome variables are not dichotomous (Probit otherwise). If hypotheses 4 and 5 are correct, we should find a positive coefficient on competition (β) and a negative coefficient on concentration (γ) in these regressions.

Two important concerns when using cross-country estimation as in equation (1) are omitted variable bias and reverse causality. We include the control variables X_i to mitigate omitted variable bias as much as possible. To address potential reverse causality we use explanatory variables that are pre-determined relative to the outcome variable. Our outcome variable is measured in 2010, while all the explanatory variables are measured in a year close to 2000⁶. In addition, we chose to use a regulatory variable (log minimum capital requirement) as our measure of competition instead of a measure of market power, such as the Lerner index. Market power is determined by entry regulation and other factors, including the existence and depth of credit information (see GFDR, Box 3.6). Entry regulation on the other hand, is less likely to respond to availability of credit information, assuming that regulators set minimum capital requirements independently of the existence of a credit bureau.

⁶ Section 3 specifies the year of observation for each variable.

5. Results

We first estimate equation (1) by including either competition or concentration in the regressions (table 2 and table 3) and then include both variables together from table 4 on. Columns 1 through 4 of table 2 display marginal effects from estimating equation (1). Column 1 includes only log GDP per capita and the credit to GDP ratio as control variables. In column 2, we add our measures of the institutional environment to the regressions. The model in column 3 additionally controls for legal origin dummy variables, where British legal origin is the omitted category, and in column 4, we also include the shares of government and foreign ownership of banks in the regression. As we add more controls to the basic specification, the sample size drops since not all variables are available for all countries in the sample.

The results in columns 1 through 4 show that countries with a higher minimum capital requirement are statistically significantly more likely to have a credit bureau, confirming hypothesis 1 stated in section 2. The magnitude of this relationship implies that going from the 25th percentile of the log minimum capital requirement (0.689) to the 75th percentile (2.326), is associated with a 15 percentage point increase in the likelihood of having a credit bureau. The size and statistical significance of this result are relatively robust across the different regression specifications in table 2. The coefficient drops in size and statistical significance when we control for the shares of government and foreign owned banks, but the sample also drops to 81 countries, compared to close to 100 countries included in the other specifications.

Columns 5 through 8 replicate the regressions in column 1 and 4, but use the probability that a country has a credit registry as the outcome variable. According to hypothesis 3 in section 2, we do not expect competition to be negatively associated with the emergence of a credit registry since participation in a credit registry is mandatory and thus not dependent on banks' willingness to share information. The results in columns 5 through 8 of table 2 confirm this hypothesis. We do not find a statistically significant relationship between the log minimum capital requirement and the probability of having a credit registry.

Many of the control variables included in table 2 are not statistically significant in the regressions, with the exception of the legal origin dummies and bank ownership variables. Countries with French, German, or transition legal origin are less likely to have a credit bureau than countries with British legal origin. In contrast, countries with French or German legal origin are more likely to have a credit registry than countries with British origin⁷. A higher share of government owned banks is associated with a *lower* probability of having a credit bureau and with a *higher* probability of having a credit registry. More foreign bank ownership is correlated with a lower likelihood of having a credit bureau, perhaps because coordination between banks is more difficult when some are headquartered abroad.

Table 3 shows the estimated relationship between bank concentration and the emergence of credit reporting. Columns 1 through 4 illustrate that countries with higher concentration in the banking market are less likely to have a credit bureau, confirming hypothesis 2 in section 2. Going from the 25th percentile of bank concentration (0.598) to the 75th percentile (0.925), is associated with a 17.6 percentage point decrease in the likelihood of having a credit bureau. On the other hand, columns 5 through 8 of table 3 show no statistically significant relationship between bank concentration and the probability of having a credit registry, as predicted by hypothesis 3.

Table 4 replicates the analysis from tables 2 and 3, but includes both our measures of competition and concentration in the regressions⁸. The findings are largely consistent with the results in table 2 and 3. In columns 1 through 4, the coefficients on both log minimum capital requirement and bank concentration decrease in magnitude relative to tables 2 and 3, but remain statistically significant in the specifications that include the larger sets of control variables.

We test hypotheses 4 and 5 in tables 5 through 7. That is, we investigate whether, conditional on a credit bureau having emerged, bank competition and concentration are associated with

⁷ This is consistent with the findings in Djankov, McLiesh and Shleifer (2007) and Jappelli and Pagano (2002).

⁸ A potential issue with including both the measures of competition and concentration in the same regression is that they may be highly correlated. However, although banking competition and concentration are related concepts, they are conceptually distinct. A banking sector can be open to competition (i.e. have low barriers to entry) and concentrated at the same time. In fact, in our sample, the correlation between the log minimum capital requirement and bank concentration is relatively low (-0.24).

coverage, depth, and transparency of the information listed in the credit bureau. Tables 5 through 7 keep only countries that have a credit bureau. They display OLS or Probit regressions based on equation 1 with our measures of reach, depth, and transparency of credit information as the outcome variables. In tables 5 through 7, we only present results for the two regression specifications that include the largest sets of control variables (corresponding to columns 3 and 4 of tables 2 through 4).

The results in table 5 indicate no robust relationship between bank competition and coverage of the credit bureau, for both measures of coverage described in section 3. In line with hypothesis 5, bank concentration shows a weak negative relationship with the volume of credit listed in the credit bureau. This relationship is, however, not statistically significant in most specifications.

In table 6 we examine the relationship between bank competition, concentration and the type of credit information that is voluntarily shared, again conditional on the existence of a credit bureau. Panel A uses the index of different types of credit information as the outcome variable, whereas panel B focuses on the probability that the credit bureau reports positive information. The results suggest that both entry barriers and bank concentration have a negative relationship with depth of information shared and the probability of reporting positive information, but the estimated coefficients are significant in only two of the specifications (columns 2 and 6). The positive relationship between competition and depth of information shared contradicts our hypothesis 4 which predicts that when entry barriers are high banks are more willing to share extensive information. A possible reason why we find the opposite result from what we expected is that extensive information sharing has administrative costs in addition to costs in terms of losing informational rents. Banks may be less willing to incur the administrative costs of sharing comprehensive and positive information in a less competitive lending environment since they face less pressure to reach out to new clients.

Finally, in Table 7, we investigate how bank competition and concentration are related to the transparency of credit reporting, using the credit bureau transparency index (described in section 3) as the outcome of interest. Similarly to our results on the depth of information, we find that higher bank entry barriers are associated with lower transparency in credit reporting. This finding

may again be due to the administrative costs of providing transparent information. Banks may be reluctant to incur these administrative costs in the absence of competitive pressures that would make having transparent information on potential clients more valuable.

The findings in table 6 and 7 are also consistent with stylized evidence on the tendency for “closed user groups” to emerge in a financial sector that is not competitive. This term refers to groups of lenders that formally or informally exchange credit information between each other, but restrict access to smaller competitors and new entrants by limiting either the quality or extent of information that is disclosed to the market as a whole.

Overall, the results in tables 2 through 4 provide empirical support for hypotheses 1 through 3. Lower bank competition is associated with a higher probability of a credit bureau emerging, and lower bank concentration is associated with a higher probability of a credit bureau emerging voluntarily. As expected, neither bank competition nor concentration is correlated with the existence of a credit registry where participation is mandatory. We do not find evidence in favor of hypothesis 4. On the contrary, the results show that, countries with higher entry barriers tend to have less comprehensive and transparent credit bureau information (possibly because administrative costs of providing extensive information weigh more heavily than gains to this information in the absence of competitive pressures). However, in line with hypothesis 5, some of the results weakly suggest that higher bank concentration is associated with lower coverage of the credit bureau.

6. Conclusion

This paper explores the empirical relationship among banking sector competition, bank concentration, and the emergence of a credit bureau across countries. Based on the previous theoretical literature (Pagano and Jappelli, 1993), we argue that countries with higher entry barriers should be more likely to have a credit bureau since entry barriers lower the threat of competition and of losing monopoly rents by sharing proprietary credit information. The data confirm this hypothesis: going from the 25th percentile of entry barriers to the 75th percentile is associated with a 15 percentage point increase in the likelihood of having a credit bureau.

However, we also show that where a credit bureau exists, the absence of competitive pressures is associated with less depth and transparency of the credit information that is made available by lenders.

We further argue that, due to increasing returns to scale, the disincentive for information sharing in order to maintain monopoly rents is particularly relevant for very large banks. This implies that barriers to credit information sharing may be particularly pronounced in markets characterized by a high degree of bank concentration. Our empirical results support this argument. They indicate that going from the 25th percentile of bank concentration to the 75th percentile, is associated with a 17.6 percentage point decrease in the likelihood of having a credit bureau. We also find some evidence that bank concentration is associated with lower coverage of the information reported to existing credit bureaus, potentially because banks try to hold on to monopoly rents by sharing only partial information.

Finally, bank competition or concentration should not be correlated with the probability of having a credit registry since participation in a registry is mandatory and banks' incentives are only relevant for voluntary information sharing. Confirming this hypothesis, we find no correlation between bank competition or concentration and the existence of credit registries.

Taken together, results highlight that policies designed to promote the voluntary exchange of credit information need to take into account banks' incentives to extract monopoly rents from proprietary credit information. In addition, policymakers who determine entry barriers into the banking market should be aware of the side-effects that these barriers can have on voluntary information sharing.

References

- Allen, Franklin, and Douglas Gale. 2000. *Comparing Financial Systems*. Cambridge, MA: MIT Press.
- Allen, Franklin, and Douglas Gale, 2004. "Competition and Financial Stability." *Journal of Money, Credit and Banking* 36(3), Part 2, pp. 453–480.
- Boot, Arnoud W. A., and Anjan Thakor. 2000. "Can Relationship Banking Survive Competition?" *Journal of Finance*, 55: 679–713.
- Bouckaert, J., Degryse, H.. 2006. "Entry and strategic information display in credit markets." *Economic Journal*, 116: 702–720.
- Boyd, John H., and Gianni De Nicoló. 2005. "The Theory of Bank Risk-taking and Competition Revisited." *Journal of Finance*, 60: 1329–1343.
- Brown, M., Jappelli, T., and Pagano, M. 2009. "Information sharing and credit: firm-level evidence from transition countries." *Journal of Financial Intermediation*, 18: 151–172.
- Brown, M. and Zehnder, C. 2010. "The emergence of information sharing in credit markets." *Journal of Financial Intermediation*, 19: 255–278.
- de Janvry, A., McIntosh, C. and Sadoulet, E. 2010. "The supply - and demand – side impacts of credit market information." *Journal of Development Economics*, 93 173-188.
- Djankov, S., McLiesh, C. and Shleifer, A. 2007. "Private Credit in 129 Countries." *Journal of Financial Economic*, 84: 299-329.
- Thomas F., Kevin C. Murdock, and Joseph E. Stiglitz, 2000. "Liberalization, Moral Hazard in Banking, and Prudential Regulation: Are Capital Requirements Enough?" *American Economic Review*, 90(1): 147-165.
- Jappelli, T. and Pagano, M. 2002. "Information sharing, lending and defaults: Cross-country evidence." *Journal of Banking and Finance*, 2017-2045.
- Love, Inessa, Nataliya Mylenko. 2003. "Credit Reporting and Financing Constraints." Policy Research Working Paper 3142, World Bank, Washington, DC.
- Miller, M. 2003. Credit Reporting systems around the globe: The state of the art in public credit registries and private credit reporting firms. In *Credit Reporting Systems and the International Economy*, by Margaret J. Miller, 25-79. Cambridge, Massachusetts: The MIT Press.
- Padilla, A. and Pagano, M. 2000. "Sharing default information as a borrower discipline device." *European Economic Review*, 1951–1980.
- Pagano, M. and Jappelli, T. 1993. "Information sharing in credit markets." *Journal of Finance*, 1693-1718.

Schaeck, Klaus, Martin Čihák, and Simon Wolfe. 2009. “Are Competitive Banking Systems More Stable?” *Journal of Money, Credit, and Banking* 41(4): 711–734.

Stiglitz, Joseph E., and Andrew Murray Weiss. 1981. “Credit Rationing in Markets with Imperfect Information.” *American Economic Review*, 71(3): 393–410.

World Bank. 2013. *Global Financial Development Report*. Washington, DC.

Figure 1: Prevalence of credit reporting across country income groups

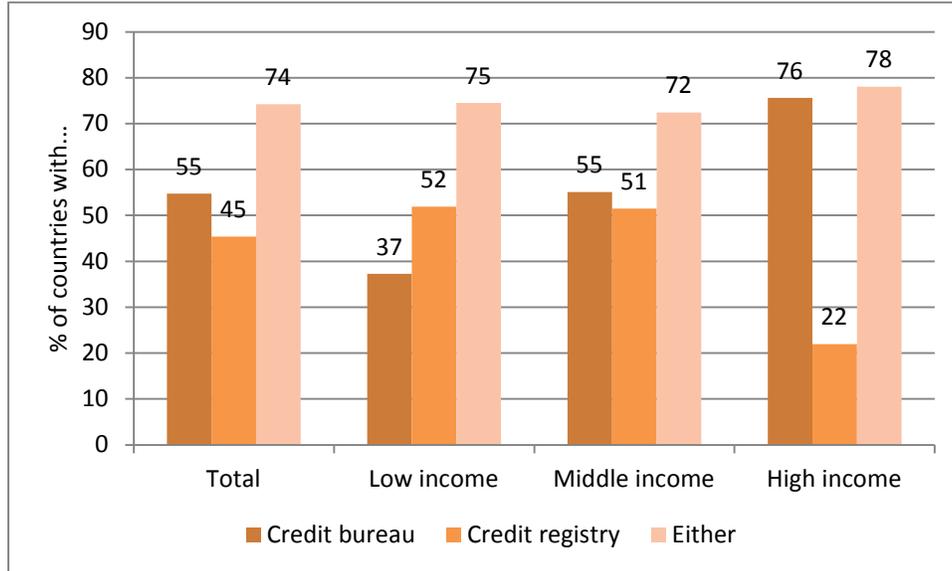


Figure 2: Credit bureau coverage across country income groups

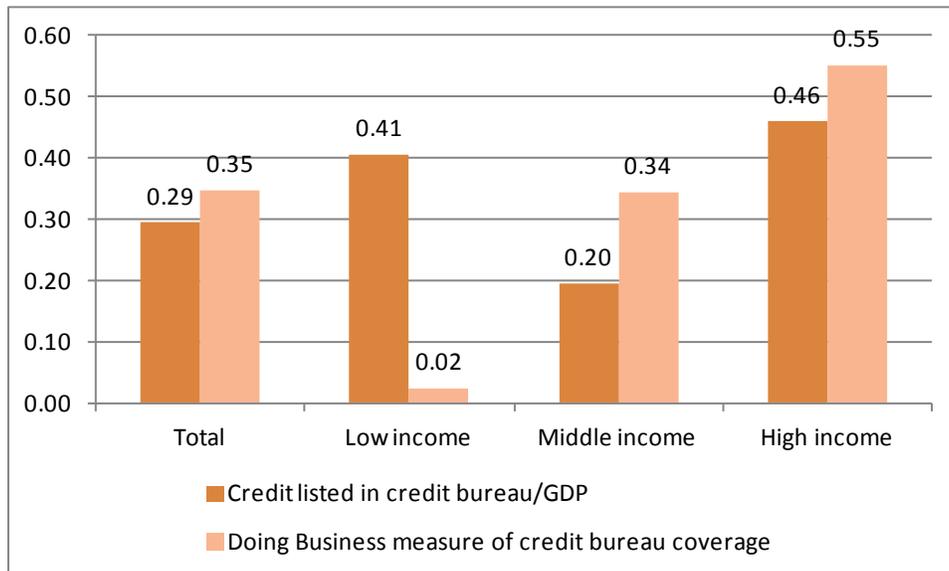


Figure 3: Depth of information in the credit bureau across country income groups

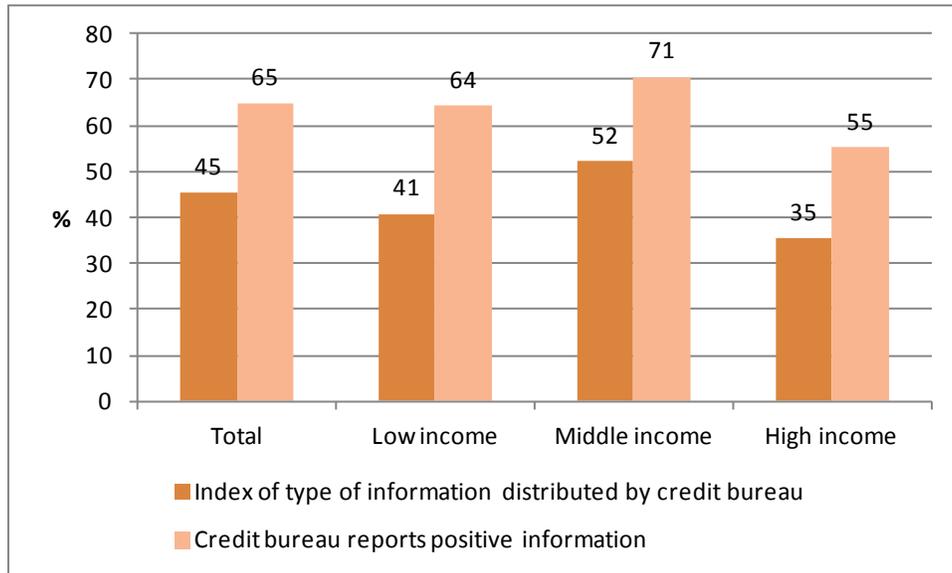


Figure 4: Credit bureau transparency index across country income groups

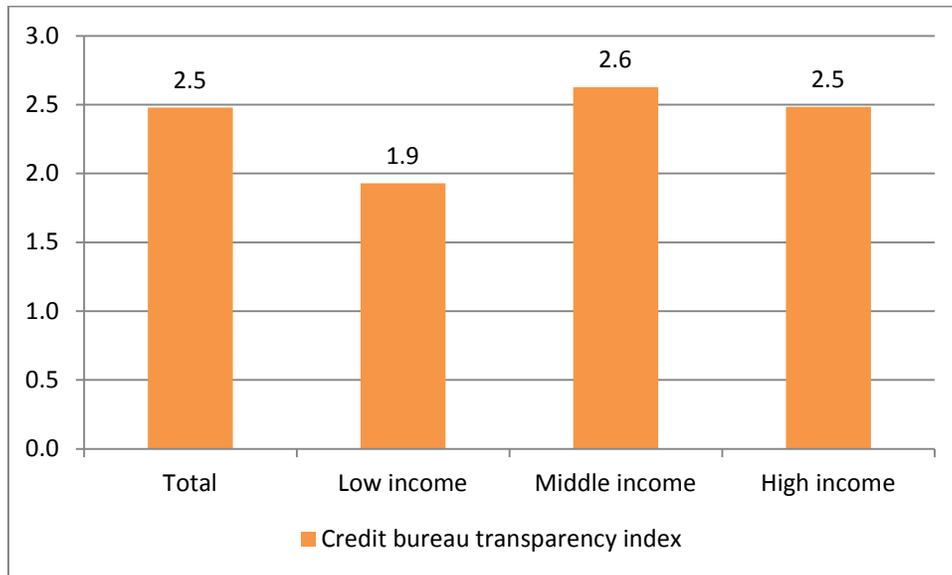


Figure 5: Distribution of minimum capital requirement

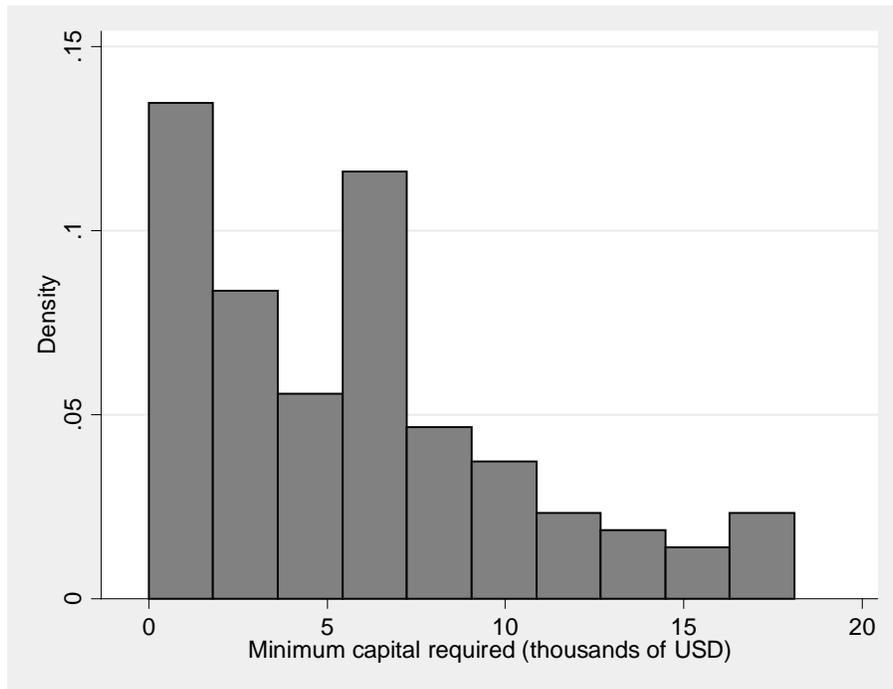


Table 1: Summary statistics

	Obs	Average	Std. dev.	Min	Max
Panel A: Credit information variables					
Country has a credit bureau dummy	191	0.545	0.499	0	1
Country has a credit registry dummy	195	0.451	0.499	0	1
Credit listed in credit bureau/GDP	55	0.294	0.536	0	2.684
Doing Business measure of credit bureau coverage	102	0.347	0.341	0	1
Index of type of information distributed by credit bureau	94	0.453	0.274	0	0.964
Credit bureau reports positive information dummy	94	0.649	0.480	0	1
Credit bureau transparency index	94	2.479	1.326	0	5
Panel B: Measure of competition and concentration					
Log minimum capital requirement	137	1.889	1.449	-0.667	10
Bank concentration (asset share of the largest three banks)	135	0.733	0.206	0.211	1.000
Panel C: Control variables					
Log GDP per capita	186	7.666	1.638	4.463	11.233
Credit/GDP ratio	171	41.863	42.128	0	222.277
Contract enforcement (log # of days to enforce a contract)	144	6.290	0.451	4.787	7.320
Creditor rights index	132	1.795	1.151	0	4
French legal origin dummy	132	0.485	0.502	0	1
Scandinavian legal origin dummy	132	0.129	0.336	0	1
German legal origin dummy	132	0.030	0.172	0	1
Transition legal origin dummy	132	0.083	0.277	0	1
Share of gov't owned banks	125	0.176	0.238	0	0.981
Share of foreign owned banks	121	0.405	0.332	0	1

Table 2: Banking sector competition and the emergence of credit reporting

	Probit regressions							
	Pr[Credit bureau]=1				Pr[Credit registry]=1			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log min. capital req.	0.185*** (0.046)	0.091** (0.038)	0.085** (0.041)	0.064* (0.035)	0.054 (0.035)	0.012 (0.038)	0.013 (0.042)	0.016 (0.053)
Log GDP per capita	0.060 (0.040)	0.091*** (0.040)	0.092*** (0.040)	0.053** (0.032)	-0.054 (0.038)	-0.048 (0.043)	-0.071 (0.060)	-0.096 (0.073)
Credit/GDP ratio	0.001 (0.002)	-0.000 (0.002)	-0.000 (0.001)	-0.000 (0.001)	-0.002* (0.001)	-0.001 (0.002)	-0.001 (0.002)	-0.001 (0.002)
Contract enforcement		0.003 (0.091)	-0.018 (0.088)	-0.027 (0.082)		0.127 (0.118)	-0.031 (0.138)	-0.155 (0.163)
Creditor rights index		0.029 (0.033)	0.005 (0.033)	0.017 (0.028)		-0.068 (0.042)	0.020 (0.054)	0.032 (0.067)
French legal origin			-0.277*** (0.112)	-0.157* (0.109)			0.658*** (0.114)	0.695*** (0.133)
German legal origin			-0.496** (0.219)	-0.343* (0.246)			0.415*** (0.081)	0.432*** (0.105)
Transition legal origin			-0.400* (0.280)	-0.408* (0.342)			0.089 (0.213)	-0.070 (0.292)
Share of gov't banks				-0.304** (0.126)				0.799** (0.370)
Share of foreign banks				-0.206* (0.156)				0.020 (0.269)
Observations	133	103	99	81	133	103	99	81
Pseudo R2	0.259	0.326	0.381	0.366	0.065	0.094	0.311	0.346

Notes: Marginal effects from Probit regressions. Robust standard errors in parentheses. Statistical significance levels:
*** p<0.01, ** p<0.05, * p<0.1

Table 3: Bank concentration and the emergence of credit reporting

	Probit regressions							
	Pr[Credit bureau]=1				Pr[Credit registry]=1			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Bank concentration	-0.473** (0.227)	-0.457** (0.203)	-0.537** (0.197)	-0.355*** (0.176)	-0.379 (0.237)	-0.224 (0.276)	-0.063 (0.281)	0.140 (0.335)
Log GDP per capita	0.037 (0.032)	0.070** (0.036)	0.083** (0.039)	0.014 (0.019)	-0.051 (0.037)	-0.022 (0.041)	-0.059 (0.057)	-0.084 (0.073)
Credit/GDP ratio	0.002 (0.001)	0.001 (0.002)	0.001 (0.002)	0.001 (0.001)	-0.002 (0.001)	-0.002 (0.001)	-0.001 (0.002)	-0.001 (0.002)
Contract enforcement		-0.092 (0.097)	-0.161 (0.110)	-0.072 (0.068)		0.156 (0.123)	0.025 (0.136)	-0.094 (0.171)
Creditor rights index		0.029 (0.035)	0.017 (0.041)	0.024 (0.020)		-0.056 (0.042)	0.024 (0.054)	0.019 (0.068)
French legal origin			-0.196* (0.111)	-0.172** (0.096)			0.619*** (0.099)	0.690*** (0.141)
German legal origin			-0.293 (0.206)	-0.419** (0.285)			0.357*** (0.078)	0.400** (0.113)
Transition legal origin			0.377* (0.236)	-0.657** (0.329)			0.074 (0.185)	-0.079 (0.305)
Share of gov't banks				-0.177** (0.102)				0.749** (0.361)
Share of foreign banks				-0.140* (0.094)				-0.077 (0.283)
Observations	129	112	108	77	129	112	108	77
Pseudo R2	0.131	0.257	0.290	0.380	0.069	0.079	0.304	0.379

Notes: Bank concentration is measured by the asset share of the largest three banks per country. Marginal effects from Probit regressions. Robust standard errors in parentheses. Statistical significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table 4: Bank competition, concentration and the emergence of credit reporting

	Probit regressions							
	Pr[Credit bureau]=1				Pr[Credit registry]=1			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log min. capital req.	0.116*** (0.040)	0.088** (0.036)	0.074** (0.035)	0.045* (0.025)	0.039 (0.037)	0.029 (0.038)	0.057 (0.043)	0.050 (0.059)
Bank concentration	-0.268 (0.223)	-0.231 (0.196)	-0.338** (0.174)	-0.333*** (0.182)	-0.383 (0.267)	-0.275 (0.303)	-0.016 (0.310)	0.170 (0.328)
Log GDP per capita	0.038 (0.035)	0.065** (0.036)	0.047* (0.033)	0.012 (0.018)	-0.067 (0.042)	-0.053 (0.044)	-0.091 (0.067)	-0.086 (0.079)
Credit/GDP ratio	0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)	0.000 (0.001)	-0.002* (0.001)	-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)
Contract enforcement		-0.037 (0.096)	-0.100 (0.086)	-0.059 (0.072)		0.100 (0.136)	-0.053 (0.156)	-0.097 (0.178)
Creditor rights index		0.011 (0.031)	-0.007 (0.029)	0.017 (0.019)		-0.064 (0.044)	0.033 (0.061)	0.023 (0.069)
French legal origin			-0.276*** (0.114)	-0.183** (0.115)			0.710*** (0.114)	0.710*** (0.136)
German legal origin			-0.478** (0.223)	-0.465** (0.294)			0.407*** (0.087)	0.418** (0.114)
Transition legal origin			-0.617** (0.284)	-0.649** (0.374)			0.056 (0.229)	-0.036 (0.300)
Share of gov't banks				-0.192** (0.104)				0.715* (0.376)
Share of foreign banks				-0.123 (0.109)				-0.055 (0.290)
Observations	109	94	90	75	109	94	90	75
Pseudo R2	0.202	0.294	0.370	0.399	0.089	0.099	0.371	0.369

Notes: Bank concentration is measured by the asset share of the largest three banks per country. Marginal effects from Probit regressions. Robust standard errors in parentheses. Statistical significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table 5: Reach of credit information

	OLS regressions					
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A						
	Credit listed in the credit bureau/GDP					
Log minimum capital req.	0.031 (0.064)	0.011 (0.054)			0.046 (0.077)	0.046 (0.066)
Bank concentration			-0.330 (0.584)	-0.795* (0.442)	-0.398 (0.606)	-0.884* (0.522)
Observations	46	39	47	37	44	37
R2	0.135	0.339	0.146	0.394	0.153	0.405
Panel B						
	Doing Business measure of credit bureau coverage					
Log minimum capital req.	-0.035* (0.021)	-0.029 (0.029)			-0.027 (0.024)	-0.022 (0.030)
Bank concentration			-0.127 (0.166)	-0.253 (0.186)	-0.084 (0.184)	-0.215 (0.194)
Observations	79	68	85	65	75	64
R2	0.371	0.434	0.428	0.440	0.364	0.418
Controls for bank ownership	No	Yes	No	Yes	No	Yes

Notes: This table only includes countries that have credit bureau. Bank concentration is measured by the asset share of the largest three banks per country. All regressions include the following control variables: log GDP per capita, credit/GDP ratio, contract enforcement, creditor rights index, legal origins dummies. Robust standard errors in parentheses. Statistical significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table 6: Depth of credit information

	(1)	(2)	(3)	(4)	(5)	(6)
OLS regressions						
Panel A	Index of type of information distributed by credit bureau					
Log minimum capital req.	-0.018 (0.022)	-0.029 (0.018)			-0.020 (0.023)	-0.031* (0.018)
Bank concentration			0.028 (0.171)	-0.062 (0.165)	-0.001 (0.172)	-0.092 (0.167)
Observations	74	65	77	62	70	61
R2	0.251	0.285	0.220	0.296	0.259	0.293
Probit regressions						
Panel B	Pr[Credit bureau reports positive information]=1					
Log minimum capital req.	-0.034 (0.039)	-0.072* (0.041)			-0.043 (0.039)	-0.072* (0.042)
Bank concentration			0.013 (0.313)	-0.098 (0.320)	-0.053 (0.342)	-0.142 (0.340)
Observations	70	62	73	59	66	58
Pseudo R2	0.083	0.173	0.069	0.161	0.098	0.167
Controls for bank ownership	No	Yes	No	Yes	No	Yes

Notes: This table only includes countries that have credit bureau. Bank concentration is measured by the asset share of the largest three banks per country. All regressions include the following control variables: log GDP per capita, credit/GDP ratio, contract enforcement, creditor rights index, legal origins dummies. Robust standard errors in parentheses. Statistical significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table 7: Transparency of credit information

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS regressions					
Panel A	Credit bureau transparency index					
Log minimum capital req.	-0.156 (0.100)	-0.212** (0.086)			-0.161 (0.098)	-0.219** (0.086)
Bank concentration			0.682 (0.780)	0.152 (0.832)	0.321 (0.772)	-0.077 (0.820)
Observations	74	65	77	62	70	61
R2	0.253	0.310	0.257	0.313	0.285	0.344
Controls for bank ownership	No	Yes	No	Yes	No	Yes

Notes: This table only includes countries that have credit bureau. Bank concentration is measured by the asset share of the largest three banks per country. All regressions include the following control variables: log GDP per capita, credit/GDP ratio, contract enforcement, creditor rights index, legal origins dummies. Robust standard errors in parentheses. Statistical significance levels: *** p<0.01, ** p<0.05, * p<0.1

Appendix A

Definition and sources of variables used in regression analysis

Variable	Definition	Source
Credit registry dummy	The variable equals 1 if a credit registry operates in a country. A credit registry is defined as an entity managed by the public sector (central bank or superintendent of banks) which collects information on creditworthiness of borrowers and shares this information with banks and other regulated financial institutions. If no credit registry exists, the variable is 0.	Doing Business
Credit bureau dummy	The variable equals 1 if a credit bureau operates in a country. A credit bureau is defined as an entity managed by a private firm or non-profit organization which collects information on the creditworthiness of borrowers and facilitates the exchange of credit information among lenders. If no credit bureau exists, the variable is 0.	Doing Business
Credit listed in the credit bureau/GDP	Total value of credit listed in a credit bureau as a share of GDP	Doing Business and World Development Indicators
Doing Business measure of credit bureau coverage	Total number of individuals and firms listed in a private credit bureau as a share of the adult population.	Doing Business
Index of type of information distributed	Type of information distributed (by a registry or a bureau) pertains to three different aspects of lending which includes data on i) borrowers, ii) loan and iii) loan repayment. Under each category the survey lists a number of questions with a 1 (yes) and 0 (no) response option. The index is constructed as a ratio of the sum of all the questions with a response of 1 to total questions listed.	Doing Business

Credit bureau reports positive information dummy	Dummy variable indicating whether the credit bureau reports positive information	Doing Business
Credit bureau transparency index	Tally of affirmative responses to five questions (thus ranging from 0 to 5), asking whether borrowers are guaranteed access to their credit history data by law, whether they can inspect their data in practice, and whether there is a cost for inspecting one's own credit information.	Doing Business
Log minimum capital requirement	Log of the minimum amount of capital needed by banks for entry.	GFDR 2013 Database
Bank concentration	Share of assets of three largest banks to total assets of banking sector.	GFDR 2013 Database
GDP per capita	Log of GDP per capita based on constant local currency.	World Development Indicators
Credit to GDP	Deposit money banks and other financial institutions claims on the private sector as a percentage of GDP.	Raw data are from the electronic version of the IMF's International Financial Statistics. Claims on Private Sector by deposit money banks and other financial institutions (IFS lines 22d and 42d); GDP in local currency (IFS line 99B..ZF
Contract enforcement	Log of number of days it takes from the time plaintiff files a lawsuit in court until payment.	Doing Business
Creditor rights index	The index ranges from 0 (weak creditor rights) to 4 (strong creditor rights) and is based on whether the following rights of secured lenders are defined in laws and regulations. First, whether there exist any restrictions, such as creditor consent or minimum dividends, for a debtor to file for	Data is from "Private Credit in 129 Countries", Djankov, Simeon, Caralee McLiesh and Andrei Shleifer, Journal of Financial Economics, 2007

	<p>reorganization. Second, whether secured creditors are able to seize their collateral after the reorganization petition is approved i.e., there is no automatic stay or asset freeze. Third, whether secured creditors are paid first out of the proceeds of liquidating a bankrupt firm, or other creditors take priority. Fourth, whether management is not able to retain administration of its property pending the resolution of the reorganization. Each category is assigned a value 1 if it is defined in laws and the index is a sum of the four categories.</p>	
Legal origin	<p>A dummy variable that captures the legal origin of a country. The five legal origins are: English, French, German, Scandinavian, and Socialist.</p>	<p>Data is from "Private Credit in 129 Countries", Djankov, Simeon, Caralee McLiesh and Andrei Shleifer, Journal of Financial Economics, 2007</p>
Share of government banks	<p>Share of assets of government owned banks to total assets of the banking sector.</p>	<p>GFDR 2013 Database</p>
Share of foreign banks	<p>Share of assets of foreign owned banks to total assets of the banking sector.</p>	<p>GFDR 2013 Database</p>