Financial liberalization and bank risk-taking: International evidence

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Abstract

This paper analyzes the channels through which financial liberalization affects bank risk-taking in an international sample of 4,333 banks in 83 countries. Our results indicate that financial liberalization increases bank risk-taking in both developed and developing countries but through different channels. Financial liberalization promotes stronger bank competition that increases risk-taking incentives in developed countries, whereas in developing countries it increases bank risk by expanding opportunities to take risk. Capital requirements help reduce the negative impact of financial liberalization on financial stability in both developed and developing countries. However, official supervision and financial transparency are only effective in developing countries.

1. Introduction

The literature on financial liberalization and growth generally concludes that liberalization strengthens financial development and contributes to higher long-run growth (Henry, 2000; Bekaert et al., 2005).[1] But the main debate on financial liberalization focuses on its potential negative effects on financial stability. Financial liberalization has been considered one of the main causes of the increased frequency and intensity of banking crises over the last three decades (Demirgüç-Kunt and Detragiache, 1999; Kaminsky and Reinhart, 1999).

However, the precise channels through which financial liberalization affects bank stability are not well understood empirically and, to our knowledge, there is no direct evidence on the channels through which financial liberalization may affect financial stability. Moreover, empirical evidence on the effects of financial liberalization on financial stability is inconclusive for several reasons. First, although most theoretical studies explain a potential negative influence of financial liberalization on stability through increases in bank competition, there is a current debate on the empirical relation between bank competition and financial stability (Berger et al., 2009). The traditional "competition-fragility" view suggests that higher bank competition following liberalization erodes banks' charter value and reduces their incentives to behave prudently (Keeley, 1990; Hellman et al., 2000; Repullo, 2004). However, the traditional positive association between competition and financial fragility has recently been challenged by a "competition-stability view". Under this view, more bank competition may reduce bank risk if banks charge lower interest rates to borrowers and diminish their incentives to shift into riskier projects (Boyd and De Nicolò, 2005). According to this view, increases in bank competition would be a channel through which liberalization may even increase financial stability.

Second, financial liberalization might affect financial stability through different channels apart from changes in bank competition. For instance, financial liberalization may encourage bank risk-taking by expanding opportunities to take risk in foreign markets or in non-traditional activities. So, even if competition and banks' incentives to take risk do not change, banks might take greater risks by getting involved in new activities (Barth et al., 2004).

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[1] This positive effect is caused through both an improvement in capital allocation and an increase in the quantity of resources mobilized by improving risk-sharing. A positive effect on growth is found for both stock market liberalization and bank industry deregulation. Mixed results only are found by research focusing on capital account openness (see Eichengreen, 2001 for a survey).

Third, differences in bank regulation, supervision, and institutions across countries may affect potential changes in bank competition or the ease of taking higher risks following financial liberalization. These differences across countries may affect not only the relative importance of each channel but also the final impact of financial liberalization on bank stability, leading to cross-country heterogeneity. Beck et al. (2013) document a large cross-country variation in the relationship between bank competition and bank stability. However, to our knowledge, there are no studies analyzing the channels through which financial liberalization affects financial stability or cross-country heterogeneity regarding the relative importance of each channel depending on legal and institutional characteristics.

We aim to throw some light on these aspects, and specifically address three main questions in our empirical analysis: i) the importance of changes in bank competition versus other channels for explaining the effect of financial liberalization on bank risk-taking; ii) the relevance of institutions and development in the country for determining the relative importance of changes in competition as the channel through which financial liberalization affects bank risk; and iii) the effectiveness of capital requirements, official supervision, and accounting transparency for counteracting bank risk-taking promoted by financial liberalization. We use an international sample of a maximum of 4,333 banks from 83 developed and developing countries over 1991-2007 and a comprehensive dataset of proxies for financial liberalization.

We make several contributions. First, we separate the effects of financial liberalization on bank risk through changes in bank competition from those taking place through other alternative channels. We focus on changes in bank competition and do not specifically analyze empirically what the alternative channels are. We refer to them in general terms as the expansion of opportunities to take risk.

An empirical test of bank competition as a channel through which financial liberalization affects bank risk would require considering bank competition as an explanatory variable of bank risk while controlling for its potential endogeneity and dependence on financial liberalization. To the best of our knowledge, previous studies do not control for the simultaneous impact of financial liberalization on both bank competition and risk. We estimate a model of two simultaneous equations where bank competition and risk are the dependent variables, and financial liberalization is an explanatory variable in both equations. This procedure allows us to control for simultaneity and reverse causality between bank competition and risk, their potential endogeneity, and a potential joint influence of financial liberalization on both variables. Moreover, we control for the potential endogeneity of financial liberalization and apply

the generalized-method-of-moments (GMM) dynamic panel estimators in each stage of the simultaneous equations model. The GMM estimators allow us to control for the endogeneity of the bank-level variables, bank omitted variables, and to account for dynamic processes in our dependent variables.

Second, we analyze how the effect of financial liberalization and the channel through which it operates may differ across countries depending on their economic development and institutional quality. Because a better institutional environment favors well-functioning markets and strengthens market discipline, the effect of financial liberalization on bank risk might be smaller under these conditions. Demirgüç-Kunt and Detragiache (1999) provide consistent evidence in a sample of 53 countries. However, they do not analyze the relative importance of channels affecting bank stability across countries. Distinguishing the channels through which financial liberalization influences bank risk may also be an important issue. For instance, if good-quality institutions are necessary to promote banking competition, they might also increase the importance of this channel in developed countries.

Third, we analyze the effectiveness of capital regulation, official supervision, and accounting transparency as instruments for controlling bank risk-taking following financial liberalization. Moreover, we analyze if the effectiveness of these mechanisms depends on the channel through which financial liberalization influences bank stability. Since Basel II, regulators and international institutions, such as the Bank for International Settlements, the International Monetary Fund, and the World Bank, highlight the importance of capital regulation, bank supervision, and market discipline as tools for increasing bank stability. The current financial crisis has reactivated the debate about the design of these instruments in a scenario of increasing coordination among countries. As far as we know, there are no studies analyzing how the effectiveness of these instruments for counteracting bank risk associated with financial liberalization varies across countries. Such knowledge might provide guidelines for future international regulation, with policy implications, in terms of cross-country heterogeneity, for optimal, coordinated international bank regulation.

Finally, we analyze more countries and use more extensive datasets on financial liberalization than previous studies. We analyze a sample of a maximum of 4,333 banks in 83 countries over 1991-2007, compared to 53 countries in Demirgüç-Kunt and Detragiache (1999) and 20 countries in Kaminsky and Reinhart (1999), and compared to studies that only consider developing countries (Díaz Alejandro, 1985; Prasad et al., 2003), or focus on a specific developed country (Stiroh and Strahan, 2003; Bertrand et al., 2007). We can thus provide information on a greater range of institutional

differences to give us a deeper understanding on how the effect of financial liberalization on bank stability depends on legal, supervisory, and institutional variables. Moreover, a limitation in empirical studies on financial liberalization has been the lack of a comprehensive dataset documenting actual policy changes (Abiad et al., 2008). We check the robustness of the results using three comprehensive data sets on financial liberalization: the index of financial reforms constructed by Abiad et al. (2008), the index of financial freedom published by the Heritage Foundation, and the capital account openness index developed by Chinn and Ito (2008). All these measures vary annually. We close our analysis before the onset of the global financial crisis in 2007 in order to consider whether financial liberalization in previous years contributed to the current financial crisis. Moreover, proxies for financial liberalization during the global financial crisis might entail more problems of endogeneity and capture better the intervention policies adopted to solve and contain the crisis than an exogenous measure of financial liberalization. In the robustness section we analyze the extension of the analysis period up to 2011 to include the recent global financial crisis.

Our results indicate that financial liberalization increases bank risk-taking in both developed and developing countries. However, financial liberalization influences bank risk through different channels in both groups of countries. Increased bank competition is the main channel in developed countries, but we do not find increases in bank risk associated with increased bank competition in developing countries. It is the expansion of bank opportunities for taking risks, rather than increases in competition, that explains the positive relation between financial liberalization and bank risk in developing countries.

Our findings also indicate a different effectiveness of capital regulation, official supervision, and financial transparency for limiting bank risk-taking across countries. Capital requirements have helped reduce the negative impact of financial liberalization in both developed and developing countries. However, official supervision and financial transparency have been effective in developing, but not in developed countries, for counteracting the bank risk-taking incentives exacerbated by increases in banking competition. We check the robustness of our results using alternative proxies for bank risk, bank competition, and financial liberalization, as well as different instruments and estimation techniques.

The rest of the paper is organized as follows. Section 2 discusses the potential effects of financial liberalization on bank risk-taking. Section 3 explains the methodology. Section 4 describes the database and variables. Section 5 discusses the empirical results. Finally, Section 6 concludes.

2. Theoretical background and hypotheses

The literature traditionally assumes that financial liberalization is the main determinant of banking crises although the channel through which this link is created is less clear (Demirgüç-Kunt and Detragiache, 1999; Kaminsky and Reinhart, 1999). The theoretical literature highlights several channels. A set of theoretical literature models the link between financial liberalization and bank risk through increases in bank competition following the traditional "competition-fragility" view (Hellman et al., 2000; Repullo, 2004). This view suggests that more bank competition erodes market power, decreases profit margins and, therefore, reduces banks' charter value.[2] From the empirical point of view, several studies have examined the direct relationship between competition and bank stability. The results obtained by Levy-Yeyati and Micco (2007) for eight Latin-American countries indicate how a higher level of competition in their banking sectors increases bank risk-taking. Using the Lerner index as a proxy for bank market power, Jiménez et al. (2013), Turk-Ariss (2010) and Agoraki et al. (2011) obtain similar results for Spain, 60 developing countries, and the transition economies from Central and Eastern European countries, respectively. Claessens and Laeven (2004) find banking systems with greater foreign bank entry and fewer entry and activity restrictions to be more competitive. Thus, if financial liberalization increases bank competition, it would increase banks' incentives to take risk.

The link between financial liberalization and fragility through increases in bank competition, however, has recently been challenged by the "competition-stability" view. Boyd and De Nicolò (2005) suggest that more market power in the loan market may result in higher bank risk as the higher interest rates charged to loan customers make it harder to repay loans and exacerbate the moral hazard incentives of borrowers to shift into riskier projects. Boyd et al. (2006) provide empirical evidence indicating that the risk of bank insolvency rises in more concentrated markets, and Uhde and Heimeshoff (2009) show that bank market concentration impacts negatively on financial stability in the 25 countries of the European Union. Berger et al. (2009) show that the two strands of the literature need not necessarily yield opposing predictions. If banks enjoy higher franchise value derived from their market power, they may protect it from the higher loan risk through more equity capital or other risk-mitigating techniques. They find that, consistent with the "competition-fragility view", banks with a higher market power have less overall risk exposure in a sample of developed countries even though market power increases loan risk. Martínez-Miera and Repullo (2010) propose a non-linear

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[2] Empirical evidence finding a negative relation between charter value and bank risk-taking is extensive and, to our knowledge, exists for US banks (Keeley, 1990; Galloway et al., 1997; among others), Japanese banks (Konishi and Yasuda, 2004), a sample of EU banks (Gropp and Vesala, 2004), and for a sample of more than 30 countries (González, 2005; Berger et al., 2009).

relationship between competition and bank risk. More competition reduces the risk of bank failure in very concentrated markets but increases it in very competitive markets. Recently, Beck et al. (2013) show that the relationship between market power and bank stability varies across countries depending on bank activity restrictions, systemic fragility, development of stock markets, generosity of deposit insurance, and systems of credit information sharing.

The theoretical literature also considers that financial liberalization may influence bank risk through other channels apart from bank competition. Financial liberalization usually implies the reduction or removal of controls on international capital movements. This opens the door for financial intermediaries to take on foreign exchange risk by raising foreign currency funds on international markets and lending them to local borrowers. Kaminsky and Reinhart (1999) show how currency crises have often preceded banking crises. Moreover, the information asymmetries in financial markets are greater when transactions take place among agents separated by physical and cultural distances (Stiglitz, 2000). Moreover, relaxing restrictions on banking activities may increase banks' opportunities to take risks.[3]

The existence of opposing theoretical predictions on the relationship between changes in competition and financial stability prevents us from making unambiguous hypotheses on the effect of financial liberalization on bank risk-taking. We treat it as an empirical issue. However, the relative importance across countries of changes in competition for explaining the consequences of financial liberalization on bank risk is theoretically clearer. Since La Porta et al. (1997, 1998), a wide body of the literature stresses that well-functioning markets and financial development rely on contracts and their legal enforceability. In contrast, weak legal systems and poor institutional infrastructure impede market functioning (Haselmann and Wachtel, 2010; Levine et al., 2003). If institutions promote the development of competitive markets, they may also increase the relevance of changes in bank competition as a determinant of the influence of financial liberalization on bank risk.

Moreover, the literature on boom-bust cycles and bubbles in asset prices suggests that the ability of financial liberalization to increase bank risk-taking by expanding opportunities to undertake riskier investments is higher in less economically and developed countries (Tornell and Westermmann, 2005). Allen and Gale (2000) show that financial liberalization may trigger a financial crisis when there is uncertainty about

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[3] Although relaxing restrictions may also increase opportunities for bank diversification, Flannery (1998) and Hovakimian and Kane (2000) note that restrictions on bank activities have been viewed by regulators and academics alike more as a useful tool for reducing bank risk than as a block on opportunities for diversification.

the future course of credit creation in the economy and the risk-shifting problem leads investors to push up the prices of risky assets in fixed supply above their fundamental value, creating a bubble. Tornell and Westermann (2005) argue that these distortions are more prevalent in emerging markets. Kaminsky and Schmukler (2008) show that liberalization is followed by large financial cycles in the short run only in emerging economies whereas institutions improve and financial markets tend to stabilize in the long run. Demirgüç-Kunt and Detragiache (1999) also find evidence that a weak institutional environment makes liberalization of bank interest rates more likely to lead to a banking crisis.

According to these arguments, we expect that financial liberalization has a greater influence on bank risk through changes in bank competition in economically and institutionally developed countries. Not only because competitive markets require good-quality institutions but also because poor-quality institutions increase the ability of financial liberalization to expand opportunities to undertake riskier investments. Thus, our hypothesis is:

H.1.: Financial liberalization has a greater influence on bank risk through changes in bank competition in economically and institutionally developed countries.

Finally, we analyze if the influence of financial liberalization varies across countries depending on the country's capital regulatory requirements, official supervision, and financial transparency. Bank capital has been a particular target of regulation in most countries and is also one of the first facets of banking to be the focus of international coordination. Basel II and the new developments of Basel III are examples of this. Also the extent to which supervisors undertake prompt corrective action, restructure and reorganize troubled banks, and declare a deeply-troubled bank insolvent, can prevent banks from engaging in excessive risk-taking behavior. Financial transparency affects the extent to which market discipline exerted by investors controls bank risk-taking and, consequently, the final impact of financial liberalization on bank risk. [4]

We expect the positive (negative) relation between the degree of financial liberalization and bank risk-taking to be weaker (stronger) on average in countries with stronger regulatory capital stringency, more powerful official supervision, and better financial transparency. However, the influence of these mechanisms for controlling potential negative effects of financial liberalization on bank stability may differ not only in the stringency of each mechanism across countries but also in their effectiveness for

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[4] Over 100 countries implemented the 1987 Basel I Accord, which regulates bank capital (Barth et al., 2004). The new Basel II Accord continues to consider bank capital regulation as one of its three pillars (Pillar 1), alongside official supervision (Pillar 2) and market discipline (Pillar 3).

counteracting potential negative consequences of financial liberalization depending on the channel through which financial liberalization modifies bank risk.[5] We analyze these questions as an empirical issue and do not make hypotheses about the differences in the effectiveness of each mechanism depending on the channel through which financial liberalization affects bank risk.

3. Methodology

Our empirical analysis controls for potential endogeneity and reverse causality between bank competition and risk. We consider that financial liberalization may affect bank competition and risk simultaneously and that changes in bank competition may be one channel, but not the only one, leading to changes in bank risk. This analysis requires a procedure in two stages controlling for the potential endogeneity of both bank competition and risk and their potential simultaneous dependence on financial liberalization. Moreover, we control for simultaneity and reverse causality between bank competition and risk.

We estimate a model of two simultaneous equations. We regress our proxy for bank competition on bank risk and variables that capture financial liberalization, controlling for other relevant factors. We also regress bank risk on bank competition, financial liberalization, and other variables potentially influencing bank risk-taking. The structural equations to be estimated are:

$LERNER_{ijt} = \alpha_0 + \alpha_1 LERNER_{ijt-1} + \alpha_2 ZSCORE_{ijt} + \alpha_3 LIBERALIZATION_{jt} + \alpha_4 CONC_{jt} + \alpha_5 BANK_{ijt} + \alpha_6 COUNTRY_{jt} + \theta_j + \lambda_t + \mu_i + \varepsilon_{ijt}$

$$[1]$$

$ZSCORE_{ijt} = \beta_0 + \beta_1 ZSCORE_{ijt-1} + \beta_2 LERNER_{ijt} + \beta_3 LIBERALIZATION_{jt} + \beta_4 COVERDEP_{jt} + \beta_5 BANK_{ijt} + \beta_6 COUNTRY_{jt} + \theta_j + \lambda_t + \mu_i + \varepsilon_{ijt}$

$$[2]$$

where i, j, t refer to the bank, country, and year, respectively. The Lerner index ($LERNER_{ijt}$) is the proxy variable for bank market power, negatively related with bank competition. $ZSCORE_{ijt}$ is the proxy for bank risk, negatively related with the bank insolvency probability. $LIBERALIZATION_{jt}$ is a vector of alternative financial liberalization indexes. We include a predetermined variable in each equation: bank market concentration in country j in year t ($CONC_{jt}$) for the Lerner equation; and

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[5] Delis et al. (2012) show in 14 developed countries that the impact of capital regulation on bank risk is heterogenous across banks depending on ban, industry, and macroeconomic characteristics.

deposit insurance coverage in country j in year t (COVERDEP$_{jt}$) for the risk equation. In both equations, we include additional bank (BANK$_{ijt}$) and country (COUNTRY$_{jt}$) control variables following, among others, Corvoisier and Gropp (2002), Demirgüç-Kunt and Huizinga (2004), Laeven and Levine (2009) or Houston et al. (2010). As bank-level control variables, we include asset size, revenue growth, overhead costs, and the share of non-interest income in total bank income. As country-level variables, we include a dummy variable to classify countries as developed or developing, and to indicate the development of financial markets, growth in GDP per capita, GDP per capita, and inflation rate. Finally, θ_j is a set of country dummy variables to control for characteristics that are specific to each country, as long as these are persistent over time. λ_t is a set of time dummy variables to capture any unobserved bank-invariant time effects not included in the regression. For instance, they control for differences in the coverage of BankScope over the analysis period as this coverage is more limited in the early years. μ_i is a bank-specific effect, which is assumed to be constant for bank i over t, and ε_{ijt} is a white-noise error term.

If financial liberalization promotes bank competition and diminishes bank market power, we would expect a negative coefficient for α_3. The 2SLS approach now allows us to separate different effects of financial liberalization in the ZSCORE equation. β_2 would capture how liberalization influences bank risk through changes in market power, and β_3 would capture the effects of financial liberalization on bank risk through different channels apart from changes in market power.

We combine the 2SLS procedure with GMM estimators. We first calculate the predicted values of LERNER and ZSCORE by estimating two first-stage GMM regressions in which the observed values of these two variables are the dependent variable. As independent variables of both regressions we include all the explanatory variables in models [1] and [2]. The fitted values of LERNER and ZSCORE are then used in the second stage as independent variables to estimate models [1] and [2]. GMM estimations in all regressions are specifically designed to address three particular econometric issues: (i) the presence of unobserved bank-specific effects, eliminated by taking first differences of the bank-level explanatory variables; (ii) the autoregressive process in the data regarding the level of bank market power and risk (i.e., the need to use a lagged-dependent-variables model to capture the dynamic nature of market power and bank risk taking); and (iii) the likely endogeneity of all bank explanatory variables using lags as instruments. In particular, we use lags for bank-level variables. We apply the two-step system-GMM estimator developed by Blundell and Bond (1998) and specify the robust estimator of the variance-covariance matrix.

We observe that the above system of equations satisfies the rank and order conditions for model identification (see Green, 2011). That is, each equation has its own predetermined variables or instruments, with CONC and the lagged value of Lerner for the Lerner equation, and with COVERDEP and the lagged value of ZSCORE for the bank risk equation. Instruments should affect the second-stage variable only through their effect on the first-stage endogenous variable. As it is always difficult to find suitable instruments, we motivate the choice of our instruments with economic and statistical arguments, and carefully check the robustness of the results to alternative instruments. Bank market concentration has traditionally been used as a proxy for bank competition and we expect a positive coefficient for it to explain bank market power (Corvoisier and Gropp, 2002; Fernández de Guevara et al., 2005). Its suitability as an instrument also requires that it does not influence bank risk after controlling for bank market power. Moreover, the banking literature extensively suggests that deposit insurance coverage increases bank risk by making depositors less likely to enforce market discipline (Demirgüc-Kunt and Detragiache, 2002; Hovakimian et al. 2003; Delong and Saunders, 2011). Following these arguments, we expect a negative coefficient for the deposit insurance coverage to explain the Z-score of banks. Previous literature does not suggest an influence of deposit insurance coverage on market power.[6]

In addition to selecting our instruments based on economic arguments, we require them to pass relevance (correlation with the endogenous variable) and validity (orthogonality to the residual) conditions. First, we ensure that the first-stage Wald-test for the instruments is statistically significant, thereby indicating that they are jointly relevant. Second, we use the Hansen J statistic of over-identifying restrictions, which tests the overall validity of the instruments. This test confirms the absence of correlation between the instruments and the error term in our models. We also check for the potential misspecification of the models examining the hypothesis that there is no second-order serial correlation in the first-difference residuals (m_2). The lack of second-order serial correlation in the first-differenced errors indicates no evidence of model misspecification. First-order serial correlation (m_1) in the differentiated residuals is attributable to the first difference of models.

Moreover, we additionally address the likely endogeneity of financial liberalization using alternative instruments to lags of its observed values. The scarce year-variation of

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[6] We check the robustness of the results to alternative instruments. First, we drop CONC and COVERDEP from our estimations and use only the lagged value of LERNER and the lagged value of ZSCORE as instruments in the Lerner and Zscore equations, respectively. Second, we use the country's bank entry requirements as an alternative instrument to bank market concentration. Stricter entry requirements may give rise to greater bank market power and may be a suitable instrument in the Lerner equation. The results do not change compared to those reported in the paper.

financial liberalization in some countries may reduce the suitability of these lags as instruments. We follow Cetorelli and Gambera (2001) using as instruments: i) four binary variables indicating an English, German, French or Scandinavian legal origin, ii) the rule of law indicator from the *International Country Risk Guide,* and iii) the total country population and real Gross Domestic Product (GDP) as a proxy for market size. We estimate regressions using these instruments as explanatory variables. The predicted values of financial liberalization, instead of its observed values, are then used in models [1] and [2]. Although this procedure controls for potential endogeneity of financial liberalization, it does not control for reverse causality between market power and banking stability with financial liberalization. A lower impact would be expected for financial liberalization if, for instance, financial liberalization measures were endogenous with respect to the perceived relationship between market power and banking stability. It is, however, difficult to solve this problem in our worldwide sample of banks.

We extend the basic model to find if differences in development, institutional quality, and mechanisms to control bank risk-taking lead to heterogeneity across countries regarding the effects of financial liberalization on bank risk. The extended model is:

$LERNER_{ijt} = \alpha_0 + \alpha_1 LERNER_{ijt-1} + \alpha_2 ZSCORE_{ijt} + (\alpha_3 + \alpha_3' C_{j,t}) LIBERALIZATION_{jt} + \alpha_4 CONC_{jt} + \alpha_5 BANK_{ijt} + \alpha_6 COUNTRY_{jt} + \theta_j + \lambda_t + \mu_i + \varepsilon_{ijt}$

$$[3]$$

$ZSCORE_{ijt} = \beta_0 + \beta_1 ZSCORE_{ijt-1} + (\beta_2 + \beta_2' C_{j,t}) LERNER_{ijt} + (\beta_3 + \beta_3' C_{j,t}) LIBERALIZATION_{jt} + \beta_4 COVERDEP_{jt} + \beta_5 BANK_{ijt} + \beta_6 COUNTRY_{jtyh} + \theta_j + \lambda_t + \mu_i + \varepsilon_{ijt}$

$$[4]$$

Where $C_{j,t}$ is either just one of the country-specific characteristic or a vector containing all of them. We are interested in α_3', β_2' and β_3' coefficients that directly gauge the impact of different country characteristics on the channels through which financial liberalization affects bank risk.

4. Data and variables

We use several main data sources. Bank-level information comes from the Fitch-IBCA Ltd. BankScope Database. Whenever available, we use consolidated bank balance-sheet and income-statement data. We delete any unconsolidated entries of the group to avoid double counting and only include the unconsolidated data of banks for which this is the

only type of information available in BankScope. We require a minimum of three banks in the country for inclusion in our final sample. All data are expressed in US dollars and in real prices. The proxies for financial liberalization are provided by different databases. We use the Index of *Financial Reforms* of Abiad et al. (2008), the *Financial Freedom* component of the Index of Economic Freedom from the Heritage Foundation, and finally, the *Kaopen* index as measures of financial openness (Chinn and Ito, 2008). Information on bank market concentration and economic and financial development comes from Beck and Demirgüç-Kunt (2009). Data on countries' deposit insurance coverage come from Demirgüç-Kunt et al. (2005). Information on the growth of GDP per capita, GDP per capita, and inflation rate are obtained from the International Financial Statistics of the International Monetary Fund (IMF). We use the *Legal Rights Index* provided by the World Bank as an indicator of institutional quality. Country variables for capital requirements, official supervision, and statement transparency come from the World Bank's Bank Regulation and Supervision Database (Barth et al., 2004).

We begin our sample construction by selecting the 168 countries for which we have information on, at least, one proxy for financial liberalization. We exclude five countries because of the lack of data on the variables used as instruments for financial liberalization (rule of law, legal origin, real GDP or country population). We exclude a further 60 countries because of the lack of information on their stock market capitalization, bank concentration or bank entry requirements. Finally, we exclude 11 countries for which we have information on fewer than 20 observations. This selection process leads us to consider 83 countries. We follow Demirgüç-Kunt et al. (2004) by limiting our analysis to commercial banks because the regulatory data and theory on bank risk-taking focuses on incentives of private bank owners and on lending and deposit bank activities. Thus, we do not include saving, cooperative, real estate or investment banks. State or customer-owned banks may have different risk-taking incentives (Esty, 1997; La Porta et al., 2002). Also, focusing on commercial banks enhances the comparability of banks in our sample since the presence of different kinds of non-commercial banks is heterogeneous across countries. Finally, we exclude banks for which we do not have information on our bank-level control variables. This reduces the sample from the 5,075 commercial banks in 83 countries to a maximum of 4,333 banks in an unbalanced panel database for a period of 17 years (1991-2007).

Appendix A describes how we define the variables used in the empirical analysis and their sources. Most of the variables are self-explanatory and have been used in other cross-country studies on bank stability. We therefore only describe in greater detail the

proxies for our main variables: financial liberalization, bank risk, and bank market power.

4.1. Financial liberalization

We measure the degree of financial liberalization by several proxies. First, we use the *Financial Reform Index* (REFORM) constructed by Abiad et al. (2008). This index recognizes the multifaceted nature of financial reforms and is an annual aggregation of financial reforms in seven dimensions: 1) Credit controls and reserve requirements, 2) Interest rate controls, 3) Entry barriers, 4) State ownership in the banking sector, 5) Capital account restrictions, 6) Prudential regulations and supervision of the banking sector, and 7) Securities market policy. Since each of them can take values between 0 and 3 where 0 means fully repressed and 3 fully liberalized, the index of financial reforms takes values between 0 and 21. Therefore, higher values indicate greater financial liberalization. Information on this variable is only available until 2005.[7]

Second, we use the *Financial Freedom Index*, (FREEDOM), one of the ten components of the Index of Economic Freedom annually published by the Heritage Foundation. Financial freedom is a measure of the extent of government regulation of financial services; the extent of state intervention in banks and other financial services; the difficulty of opening and operating financial services firms (for both domestic and foreign individuals); and government influence on the allocation of credit. The index assigns an overall score on a scale of 0 to 100 where 0 means private financial institutions are prohibited and 100 means that government influence is negligible. Therefore, higher values of the index indicate greater financial freedom.

Third, we use the *Capital Account Openness Index* or *Kaopen Index* (KAOPEN) developed by Chinn and Ito (2008). This index can be a proxy for both liberalization and globalization. This index is the first principal component of four IMF variables reported in the Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). These are: (i) variable indicating the presence of multiple exchange rates, (ii) variable indicating restrictions on current account transactions, (iii) variable indicating restrictions on capital account transactions, and (iv) variable indicating the requirement to surrender export proceeds. Higher values of this index indicate greater openness of the country to cross-border capital transactions.

Table 1 reports the average country value of the three proxies for financial liberalization in our sample. Figure 1 shows their evolution in both developed and developing

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[7] Estimations are then carried out for the 1991-2005 period using this index, and for the 1991-2007 period using the other proxies for financial liberalization.

countries. The three proxies show greater financial liberalization in developed than in developing countries. There are, however, differences across indexes over time. Only the Financial Reform Index and the Kaopen Index suggest an average increase in financial liberalization over time, in both developed and developing countries, although the increase in the Kaopen Index is less stable over time. The financial freedom index hardly varies over time and even suggests an average reduction in financial liberalization from 2002 up to the current financial crisis. These differences in the proxies for financial liberalization confirm that the robustness of the results to alternative proxies should be checked.

INSERT TABLE 1 AND FIGURE 1 ABOUT HERE

4.2. *Bank risk*

We use the ZSCORE as a proxy for bank insolvency risk. This is the return on assets plus the capital-asset ratio divided by the standard deviation of asset returns. Specifically, ZSCORE = (ROA+CAR)/SDROA), where ROA is the rate of return on assets, CAR is the capital-asset ratio, and SDROA is an estimate of the standard deviation of the rate of return on assets. To calculate the standard deviation of ROA, we use a six-year moving window including the two previous years and the two subsequent years and we verify that using four or five years produces very similar results. A higher *Z-score* indicates that the bank is more stable because it is inversely related with the bank's insolvency probability. Because the *Z-score* is highly skewed, we use the natural logarithm of *Z-score*, which is normally distributed. Laeven and Levine (2009), Houston et al. (2010), Beck et al. (2013), among others, have recently used the *Z-score* as a proxy for bank insolvency risk in cross-country studies.

4.3. *Bank competition*

We use the Lerner index (LERNER) as a proxy inversely related to bank competition. The Lerner index has been widely and recently used in the banking sector as an indicator of the degree of market power (Beck et al., 2013). It defines the difference between price (interest rate) and marginal cost expressed as a percentage of price. It assumes that the divergence between product price and marginal cost of production is the essence of monopoly power. The Lerner index takes 0 in the case of perfect competition and 1 under perfect monopoly. We estimate a single indicator of the Lerner

index using the same procedure as Maudos and Fernández de Guevara (2004). Algebraically the Lerner index for each bank i is calculated as follows:

$$LERNER_i = \frac{p_i - MC_i}{p_i}$$

[5]

where the product price p_i is the total financial and operating income (interest income + commission income + fee income + trading income + total operating income) divided by total assets of bank i. MC_i is the marginal cost for bank i of producing an additional unit of output. The marginal cost is derived from a translog cost function (as explained in Appendix B).

Table 2 reports descriptive statistics and correlations for financial liberalization, bank-level, regulatory, supervisory, and institutional variables. It shows high positive correlations between our three measures of financial liberalization ranging from 0.919 to 0.971, all statistically significant at the one percent level. The table also shows a negative correlation between the three proxies for financial liberalization and the Lerner index, indicating that the market power of banks is lower where financial liberalization is higher. Financial liberalization is, however, positively correlated with the Z-score.

INSERT TABLE 2 ABOUT HERE

5. Empirical results

5.1. Financial liberalization, bank competition, and risk-taking

We empirically analyze in this section how financial liberalization influences bank market power and risk. Table 3 reports the 2SLS estimates for the two simultaneous equations specified in models [1] and [2]. We apply the system-GMM estimator in both the first and the second stage of the 2SLS procedure. The non-significant values of the Hansen test confirm the validity of the instruments in all the estimations. The Wald test in the first stage confirms that the excluded instruments are jointly significant. The hypothesis of the absence of second-order serial correlation in the first-difference residuals is not rejected and confirms the consistency of the GMM estimates in all regressions.

Columns (1) to (3) report the results for the Lerner equation using the three alternative proxies for financial liberalization. We use the predicted value of ZSCORE obtained from a first stage where we regress ZSCORE on all explanatory variables in models [1] and [2]. The coefficients of the three proxies for financial liberalization (REFORM,

FREEDOM, and KAOPEN) are negative and statistically significant. This indicates that financial liberalization reduces bank market power and, therefore, increases banking competition. The impact of liberalization is also economically important. For instance, using estimations in column (1), a one-standard deviation increase in the index of financial reforms (3.08) would cause a decrease in the Lerner index of 15% of its standard deviation.

The positive and statistically significant coefficients of the lagged dependent variable (LERNER$_{t-1}$) indicate that market power depends on the level of the previous year and confirm the convenience of using a partial adjustment model to explain the dynamic nature of market power. Bank concentration has the expected positive and significant influence on bank market power. Banks' asset size is negatively associated with bank market power after controlling for market concentration, although coefficients in columns (2) and (3) are not statistically significant at conventional levels. Revenue growth is positively associated with the Lerner index, indicating that a higher growth rate in total revenue allows banks to increase their market power. The coefficients of bank overhead costs, non-interest income, and country's financial development are not statistically significant for explaining the Lerner index. The inflation rate has a significant negative coefficient in column (1). Growth in GDP per capita and its natural logarithm are associated with higher market power of banks in columns (1) to (3).

Columns (4) to (6) report the 2SLS estimates for the bank risk equation. We use the predicted value of LERNER obtained from a first stage where we regress LERNER on financial liberalization and all explanatory variables in models [1] and [2]. In this specification, the coefficient of LERNER captures how financial liberalization impacts bank risk through changes in bank market power, whereas the coefficients of the proxies for financial liberalization capture how financial liberalization impacts bank risk through alternative channels that we associate with expanded opportunities to take risk.

We find positive and statistically significant coefficients for the Lerner index in all the estimations, showing that a reduction in market power, following financial liberalization, on average reduces financial stability. This result is consistent with the "competition-fragility" view, suggesting that more bank competition reduces banks' charter value and, therefore, their incentives to behave prudently (Keeley, 1990; Hellman et al., 2000; Repullo, 2004). On the contrary, it is not consistent with the "competition-stability" view, developed by Boyd and De Nicolò (2005), indicating that higher bank competition diminishes interest rates charged to firms and reduces borrowers' incentives to shift into riskier projects. The impact on bank risk is also important in economic terms. For instance, using estimations in columns (1) and (4), an

increase of one standard deviation in the index of financial reforms (3.08) would cause a decrease in the ZSCORE of 9.9% of its standard deviation through the reduction in bank market power.

Our three proxies for financial liberalization do not have statistically significant coefficients after controlling for market power in columns (4) to (6). This indicates that banking liberalization on average does not increase bank risk-taking through alternative channels other than increased banking competition.

The positive and statistically significant coefficients of $ZSCORE_{ijt-1}$ suggest that bank risk also follows a partial adjustment model. Deposit insurance coverage has negative and statistically significant coefficients in all the estimations. This result is consistent with the extensive evidence suggesting that greater deposit insurance coverage reduces market discipline enforced by depositors and leads banks to undertake riskier investments (Demirgüç-Kunt and Detragiache, 2002; Hovakimian et al., 2003). Banks' asset size has positive coefficients, although they are only statistically significant in column (4). Revenue growth is negatively associated with ZSCORE, indicating that banks with higher growth rates in total revenue have a higher insolvency risk. Overhead costs do not have statistically significant coefficients. Finally, the negative and significant coefficients of FINAN-DEV, GDPGR, and LOGGDP suggest that greater development of financial markets, greater economic growth, and higher per capita GDP in a country are associated with lower bank stability. INFLATION does not have significant coefficients in any estimation.

INSERT TABLE 3 ABOUT HERE

5.2. *Financial liberalization, economic development, and bank risk-taking*

We now examine whether the channel through which financial liberalization impacts financial stability varies across countries depending on their economic development and institutional quality. We report in Table 4 the results of the bank risk equation when we include an interaction of the dummy variable capturing the country's development (DEVELOP) with, respectively, LERNER and each proxy for financial liberalization. In this specification, the coefficients of the interaction terms indicate the difference in the influence of, respectively, bank market power and financial liberalization in more developed countries.

The results for the Lerner equation in columns (1) to (3) show differences in the influence of financial liberalization on bank market power between developed and

developing countries. The negative and significant coefficients of REFORMxDEVELOP, FREEDOMxDEVELOP, and KAOPENxDEVELOP indicate that the reduction in bank market power following financial liberalization increases with economic development. Moreover, the non-significant coefficients of REFORM, FREEDOM, and KAOPEN suggest that financial liberalization does not have a significant impact on bank market power in developing countries and only reduces bank market power in developed countries. These results are consistent with banking competition being more relevant in developed countries and with the Law and Finance literature that suggests that competitive markets rely on well-functioning institutions that also promote economic development. In developing countries, where poorer-quality institutions do not promote competitive markets, there is less margin for changes in competition following liberalization.

The results for the risk equation in columns (4) to (6) show differences in the channel through which financial liberalization influences bank stability. The positive and significant coefficients of LERNER indicate that the reduction of market power resulting from financial liberalization in developed countries diminishes financial stability in these countries. Moreover, the positive and significant coefficients of LERNERxDEVELOP in columns (4) and (6) suggest that the traditional positive association between market power and financial stability (the "competition-fragility" view) is stronger in developed countries. This means that a given change in bank market power gives rise to a stronger negative impact on bank stability in developed countries. Coefficients of the remaining bank and country variables are similar to those in Table 3.

These results are consistent with our hypothesis H.1 and indicate that financial liberalization only reduces bank stability through increases in bank competition in developed countries: financial liberalization does not change bank market power in developing countries, and a reduction in market power in developed countries leads to a greater reduction in bank stability the greater the country's development.

Moreover, we now find significant negative coefficients for REFORM, FREEDOM, and KAOPEN in columns (4) to (6). This indicates that financial liberalization reduces bank stability through channels other than increases in bank competition. The positive coefficients of the respective interaction terms with DEVELOP suggest that the importance of these other channels, which we associate with the expansion of opportunities to take risk more than changes in incentives, disappears in developed countries.

Our results, therefore, suggest that the channel through which financial liberalization impacts financial stability differs across countries depending on their economic

development. In developed countries, financial liberalization reduces financial stability through increases in bank competition whereas, in developing countries, it reduces financial stability through expanded opportunities to take risk rather than through increased bank competition.

<center>INSERT TABLE 4 ABOUT HERE</center>

We check in Table 5 whether the results change when we use a dummy variable for institutional quality instead of for economic development. We now interact LERNER and financial liberalization with the index of Legal Rights (LEGALRIGHTS) as a proxy for the strength of institutions in a country protecting lending. The results confirm the findings in Table 4. Similar results for DEVELOP and LEGALRIGHTS are consistent with the Law and Finance literature indicating that economic development relies on good-quality institutions (La Porta et al., 1997, 1998; Rajan and Zingales, 1998).

<center>INSERT TABLE 5 ABOUT HERE</center>

5.3. Capital regulation, supervision, financial transparency, and financial liberalization

We now analyze whether regulatory capital requirements, official supervision, and financial transparency shape the influence of financial liberalization depending on the channel through which it impacts bank risk. To address this issue, we sequentially add each proxy for these variables and their interactions with bank market power and financial liberalization. Table 6 reports the results for the entire sample of countries and separately for developed (values 2 and 3 for DEVELOP) and developing countries (values 0 and 1 for DEVELOP). To save space, we only report results for the variables of most interest, using the financial reform index as a proxy for financial liberalization. The results are similar when we use FREEDOM or KAOPEN.

Panel A reports the results for the influence of more stringent capital requirements (CAPREG). The results for the Lerner equation suggest that financial liberalization only reduces bank market power in developed countries as the coefficient of REFORM is not statistically significant in developing countries (column 3).

In the risk equations, the coefficients of LERNER and LERNERxCAPREG are only statistically significant in developed countries whereas in developing countries only the

<center>21</center>

coefficients of REFORM and REFORMxCAPREG are significant. This analysis of sub-samples confirms the results in Table 4 indicating that financial liberalization impacts on bank stability through changes in bank market power in developed countries and through other channels in developing countries. The significant positive coefficient of LERNER and the negative coefficient of LERNERxCAPREG in column (5) indicate that capital requirements reduce the negative impact of reductions in bank market power on financial stability following financial liberalization in developed countries. We even find a positive effect of financial liberalization on bank stability through a reduction in bank market power in developed countries whose capital regulatory index is between 7 and 10. The negative coefficient of REFORM and the positive coefficient of REFORMxCAPREG in column (6) indicate that more stringent capital requirements are useful for counteracting in developing countries the negative impact of financial liberalization on bank stability through different channels apart from changes in bank competition. We even find that financial liberalization may impact positively on bank stability by expanding opportunities to take risk in developing countries whose capital regulatory index ranges from 7 to 10. These results confirm the usefulness of more stringent capital requirements for counteracting bank risk-taking promoted through different channels by financial liberalization in both developed and developing countries.

Panel B reports the results for official supervisory power (OFFICIAL). Again, REFORM does not have a significant negative coefficient in the Lerner equation for developing countries, i.e., financial liberalization only reduces bank market power in developed countries. The significant negative coefficients of REFORM and the positive coefficient of REFORMxOFFICIAL in columns (5) and (6) indicate, respectively, that stronger official supervision, on average, has helped eliminate in developed countries and reduce in developing countries the negative impact of financial liberalization on financial stability through different channels apart from changes in bank competition. We even find a positive impact of financial liberalization on bank stability in developing countries whose official supervision index ranges between 11 and 14. However, the positive coefficient of LERNERxOFFICIAL in column (5) indicates that stronger official supervision reinforces the positive association between market power and financial stability in developed countries. This effect increases the negative influence of financial liberalization on stability through reductions in bank market power in developed countries.

Finally, Panel C reports the results for financial statement transparency (TRANSP). The results for the risk equation indicate that financial statement transparency has only been effective in developing countries for counteracting bank risk-taking promoted by

financial liberalization. The non-significant coefficient of LERNERxTRANSP and the positive coefficient of LERNER in column (5) suggest that financial transparency has not been especially effective in developed countries for counteracting the adverse effects of financial liberalization on bank stability through reductions in bank market power. The positive and significant coefficient of REFORMxTRANSP and the negative coefficient of REFORM in column (6) suggest, however, that financial transparency in developing countries is useful for reducing the negative effects of financial liberalization on bank stability. Our results suggest a switching point for a value of 5 in the index of financial statement transparency because we even find a positive influence of financial liberalization on bank stability by expanding the opportunities to take risk in developing countries where TRANSP ranges from 5 to 6.

INSERT TABLE 6 ABOUT HERE

6. Additional robustness tests

In this section, we discuss the results of additional robustness tests. First, following Laeven and Levine (2009) and Beck et al. (2013), among others, we check that the results do not change when we use alternative proxies for bank risk. Besides studying the Z-score we separately analyze its components. In particular, we check that the results do not change when we use the natural logarithm of the standard deviation of ROA (using the six-year rolling time window) or the capital buffer, measured as the difference between bank capital and capital requirements. We choose the capital buffer because this is the main variable used by regulators and supervisors to evaluate a bank's soundness. The banking literature has recently used this variable to evaluate bank risk (Flannery and Bauman, 2006). We also check the robustness of the results using non-performing loans and loan-loss provisions to total gross loans. However, the much more limited data on these two variables in BankScope reduces the validity of the comparisons.

Second, the results do not change when we exclude systemically large banks in our sample. Small banks may operate mainly domestically whereas large banks will most likely operate on an international scale. This difference might be a relevant variable in our analysis if financial liberalization stimulates the internationalization of banks. Although we control for unobserved specific effects in our GMM estimations, we check that the results do not change when we 1) eliminate banks whose assets in relation to country's GDP exceed 0.1 or 2) eliminate banks whose share in the country's banks' total assets exceeds 5%.

Third, we check that the dispersion in the number of banks per country does not affect our main results. First, we eliminate countries with 10 or less banks from our sample (12 countries). Second, we eliminate countries with less than 100 observations (31 countries). Third, we limit the overrepresentation of Russia and US. We include the 250 largest banks in each of the two countries to analyze a similar number of banks as in the following group of countries with many banks (France, Germany, and Switzerland). The results are similar to those reported in the tables. We also replicate estimations including countries with data available for only one or two banks. We include nine additional countries (Armenia, Azerbaijan, Guyana, Honduras, Iceland, Kyrgyzstan, Namibia, Qatar, and Swaziland). The lower availability of data in developing countries might bias our results as we exclude developing countries from our estimations. We check that the results do not change when we include these additional nine countries.

Fourth, we check that the results do not change when we use the Boone indicator as an alternative to the Lerner index as a proxy for bank market power. Since the Boone indicator is calculated at country level we estimate our models at country level and apply random effects panel data models in the 2SLS estimations. We calculate a ZSCORE at country level as a weighted average of banks' Zscore in each country for each particular year. The results confirm that financial liberalization only impacts negatively on bank stability through changes in bank competition in developed countries.

Fifth, we analyze if our basic results change when we extend the analysis period up to 2011 to include the recent global financial crisis. We make two extensions: First, we re-estimate our models for the whole period 1991-2011. Second, we analyze if there is a different pattern in the period 2008-2011 in countries that suffered a systemic or borderline banking crisis during the current financial crisis. To do this, we use the data on the 1991-2011 period and define a dummy variable that takes the value of one for the period 2008-2011 in countries that suffered a systemic or borderline crisis according to Laeven and Valencia (2012). Thus, we introduce interaction terms of LERNER and LIBERALIZATION with DCRISIS08-11 in our basic estimation. The main results do not change for the 1991-2011 period. We also test the presence of structural breaks in our time series. We run separated systems of equations including the interaction of LIBERALIZATION and each of the year dummy variables in the Lerner equation and including the interaction of LERNER and the particular year dummy variable in the Zscore equation. This estimation procedure allows us to analyze if the influence of financial liberalization on both LERNER and ZSCORE in one particular year is different to the average of the other years. The results do not suggest a structural break in any particular sub-period.

7. Conclusions

We analyze how financial liberalization affects bank risk-taking and differentiate potential channels. We separate the influence through changes in bank competition from alternative channels that we broadly associate with the expansion of opportunities to take risk. We also analyze the relative importance of each channel in developed and developing countries and the effectiveness of capital regulation, official supervision, and financial statement transparency for counteracting potential adverse effects on bank stability. We combine a 2SLS procedure with GMM dynamic panel estimators to estimate a simultaneous equations model using data for a maximum of 4,333 banks in 83 countries over the 1991-2007 period. This procedure controls for the potential endogeneity of bank competition and the fact that financial liberalization can simultaneously affect bank market power and risk.

Our results indicate that financial liberalization increases bank risk-taking worldwide but through different channels depending on economic development or institutions. In developing countries, financial liberalization negatively impacts bank stability, not as a result of changes in bank competition, but by expanding opportunities to take risk. It is in economically and institutionally developed countries that financial liberalization reduces bank stability through increases in bank competition. We find that capital requirements help reduce the negative impact of financial liberalization on financial stability in both developed and developing countries. We even find that the negative influence of financial liberalization becomes positive in both groups of countries if stringent capital requirements are adopted. However, official supervision and financial transparency have been effective in developing, but not in developed, countries for counteracting the bank risk-taking incentives that are exacerbated by increases in bank competition.

These finding have policy implications. First, financial liberalization gives rise to costs in terms of banking fragility in both developed and developing countries. However, differences in the channels may also lead to differences between developed and developing countries in the benefits stemming from financial liberalization. Bank competition is usually associated with gains in efficiency and greater financial development. Thus, financial liberalization may be more harmful in developing countries without well-developed institutions, where increases in bank risk are not outweighed by the benefits traditionally associated with increases in bank competition.

Second, the greater importance of increases in bank competition as a source of financial fragility in developed countries suggests that antitrust regulation is especially important in such countries. Finally, our results reveal the advisability of adopting more stringent

capital requirements in developed countries, as they are the most effective instrument for counteracting negative effects on financial stability.

Appendix A. variable definitions and data sources

The table shows the definition of variables used in the paper and their sources

Name	Definition	Source
FINANCIAL LIBERALIZATION		
REFORM	This index recognizes the multifaceted nature of financial reforms and is an annual aggregation of financial reforms in seven dimensions: 1) Credit controls and reserve requirements, 2) Interest rate controls, 3) Entry barriers, 4) State ownership in the banking sector, 5) Capital account restrictions, 6) Prudential regulations and supervision of the banking sector, and 7) Securities market policy. Since each of them can take values between 0 and 3 where 0 means fully repressed and 3 fully liberalized, the index of financial reforms takes values between 0 and 21. Therefore, higher values indicate greater financial liberalization. Information on this variable is only available until 2005.	Abiad et al. (2008)
BFREEDOM	Composite index of the extent of government regulation of financial services; the extent of state intervention in banks and other financial services; the difficulty of opening and operating financial services firms (for both domestic and foreign individuals); and government influence on the allocation of credit.	Heritage Foundation
KAOPEN	This index is the first principal component of four IMF variables reported in the Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). These are: (i) variable indicating the presence of multiple exchange rates, (ii) variable indicating restrictions on current account transactions, (iii) variable indicating restrictions on capital account transactions, and (iv) variable indicating the requirement to surrender export proceeds. Higher values of this index indicate greater openness of the country to cross-border capital transactions.	Chinn and Ito (2008)
BANK RISK		
ZSCORE	The natural logarithm of (ROA+CAR)/SDROA, where ROA is the rate of return on assets, CAR is the capital-asset ratio, and SDROA is an estimate of the standard deviation of the rate of return on assets. To calculate the standard deviation of ROA, we use a six-year moving window including the two previous years and the two subsequent years and we verify that using four or five years produces very similar results. A higher *Z-score* indicates that the bank is more stable because it is inversely related with the bank's insolvency probability.	BankScope
BANK COMPETITION		
LERNER	The difference between the interest rate and marginal cost expressed as a percentage of price. It takes the value of 0 in perfect competition and 1 under perfect monopoly.	BankScope
PREDETERMINED VARIABLES		
CONC	The fraction of assets of the three largest banks over assets of all commercial banks in a country.	BankScope
COVERDEP	The natural logarithm of one plus the ratio of deposit insurance coverage to deposits per capita.	Demirgüç-Kunt et al. (2005)
CONTROL VARIABLES AT BANK LEVEL		
SIZE	The natural logarithm of total bank assets	BankScope
REVENUE	The annual growth rate in total revenues of the bank	BankScope
OVERHEAD	Personnel expenses and other non-interest expenses over total bank assets	BankScope
NONINTEREST	Non-interest income over total bank income	BankScope
OTHER COUNTRY VARIABLES		
DEVELOP	Dummy variable that takes a value of 1 for developed countries and 0 for developing countries. Developed countries are countries classified as high income and upper middle income and developing countries are countries classified as low income and lower middle income according to GNI per capita, calculated using the World Bank's Atlas method.	Financial Structure Dataset (World Bank)
LEGALRIGHTS	Indicator of the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. The index ranges theoretically from 0 to 10, with higher scores indicating that these laws are better designed to expand access to credit.	World Bank
CAPREG	A Capital regulatory index defined as the sum of two measures of capital stringency: *Overall Capital Stringency,* which indicates whether there are explicit regulatory requirements regarding the amount of capital that a bank must have relative to various guidelines; and *Initial Capital Stringency,* which indicates whether the source of funds counted as regulatory capital can include assets other than cash or government securities and borrowed funds, as well as whether the sources are verified by the regulatory or supervisory authorities. CAPREG may range in value from 0 to 9, with a higher value indicating greater stringency.	World Bank's Regulation and Supervision Database
OFFICIAL	Official supervisory power, ranging from 0 to 14, captures the power of supervisors to take prompt corrective action, to restructure and reorganize troubled banks, and to declare a troubled bank insolvent. Higher values indicate greater power of supervisors.	World Bank's Regulation and Supervision Database

TRANSP	Index of Financial statement transparency. It includes information on whether accrued, though unpaid, interest/principal enter the income statement; whether financial institutions are required to produce consolidated accounts covering all bank and any non-bank financial subsidiaries; whether off-balance sheet items are disclosed to the public; whether banks are required to disclose their risk management procedures to the public; and whether bank directors are legally liable if information disclosed is erroneous or misleading. The index ranges from 0 to 6 with higher values indicating better financial statement transparency.	World Bank' s Regulation and Supervision Database)

MACROECONOMIC VARIABLES

FINAN-DEV	The value of stock market capitalization in the country as a percentage of GDP	Financial Structure Dataset. World Bank
GDPGR	The rate of real per capita GDP growth	International Financial Statistics. IMF
LOGGDP	The natural logarithm of GDP per capita	International Financial Statistics. IMF
INFLATION	Consumer price inflation rate	International Financial Statistics. IMF

Appendix B. Estimating marginal cost for the Lerner Index

We estimate the marginal cost on the basis of the following translogarithmic cost function:

$$\ln C_{it} = \alpha_0 + \ln TA_{it} + \frac{1}{2}\alpha_k (\ln TA_{it})^2 + \sum_{z=1}^{3}\beta_z \ln w_{zit} + \frac{1}{2}\sum_{z=1}^{3}\sum_{k=1}^{3}\beta_{zk} \ln w_{zit} \ln w_{kit}$$

$$+ \frac{1}{2}\sum_{z=1}^{3}\gamma_z \ln TA_{it} \ln w_{zit} + \mu_1 Trend + \mu_2 \frac{1}{2}Trend^2 + \mu_3 Trend \ln TA_{it}$$

$$+ \sum_{z=1}^{3}\lambda_z Trend \ln w_{zit} + \ln u_i$$

[B.1]

where C_{it} are the total financial and operating costs (interest expense + commission expense + fee expense + trading expense + total operating expense) of bank i at time t, TA_{it} total assets and w_z the price of the different factors of production (z). We consider the price of three inputs: labor (w_1), fixed assets (w_2), and borrowed funds (w_3). They are calculated as follows:

w_1 = personnel expense / total assets.

w_2 = (total operating expense - personnel expense) / fixed assets

w_3 = interest expense / deposits and short term funding

We estimate the costs function (and hence marginal costs) separately for each country over the sample period. We allow the parameters of the cost function to vary from one country to another to reflect different technologies. To capture the influence of variables

specific to each bank, we estimate the function by introducing fixed individual effects. We capture the influence of technical change in the cost function over time by including Trend.

Acknowledgements

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Table 1. Financial liberalization

REFORM is an index of financial reforms (Abiad et al., 2008), FREEDOM is the Financial Freedom index of the Heritage Foundation, and KAOPEN measures the degree of capital account openness (Chinn and Ito, 2008). Average values of liberalization proxies refer to the 1991-2005 period for REFORM and to the 1991-2007 period for FREEDOM and KAOPEN.

	# obs.	# banks	REFORM	FREEDOM	KAOPEN		# obs.	# banks	REFORM	FREEDOM	KAOPEN
ARGENTINA	224	68	15.27	52.94	0.52	LUXEMBOURG	828	101	.	77.65	.
AUSTRALIA	191	30	19.87	90.00	1.98	MACEDONIA	50	10	.	69.41	-0.37
AUSTRIA	357	59	16.63	78.24	2.28	MALAYSIA	263	36	15.20	42.35	0.62
BAHRAIN	43	10	.	75.29	2.47	MALTA	51	8	.	58.24	-0.41
BELGIUM	277	39	19.67	70.59	2.20	MAURITIUS	62	11	.	68.24	1.18
BOLIVIA	82	11	16.40	57.65	1.13	MEXICO	34	14	17.33	44.71	0.91
BOTSWANA	26	4	.	64.12	0.74	MOLDOVA	42	12	.	38.24	-1.10
BRAZIL	641	143	9.60	49.41	-0.74	MOROCCO	53	9	11.80	47.06	-0.95
BULGARIA	49	19	11.98	54.12	-0.41	NETHERLANDS	296	45	20.20	89.41	2.53
CANADA	340	51	20.67	70.00	2.53	NEW ZELAND	20	6	19.93	89.41	2.53
CHILE	127	19	16.87	57.06	0.03	NIGERIA	238	54	13.97	37.06	-1.02
CHINA	73	23	5.68	41.76	-1.21	NORWAY	142	17	17.52	50.00	1.91
COLOMBIA	183	31	13.53	69.41	-1.01	OMAN	56	9	.	50.00	2.10
COSTA RICA	115	22	9.40	49.41	0.60	PAKISTAN	117	21	9.53	54.12	-1.17
CROATIA	199	41	.	54.12	0.55	PANAMA	131	35	.	84.71	2.53
CYPRUS	96	18	.	70.00	-0.18	PARAGUAY	81	17	15.10	62.35	0.73
CZECH REP.	125	27	15.53	89.41	1.72	PERU	143	20	17.38	69.41	2.02
DENMARK	640	60	20.30	77.06	2.52	PHILIPPINES	264	35	14.88	48.82	0.12
ECUADOR	114	28	12.47	48.24	0.43	POLAND	218	45	14.93	55.88	-0.68
EL SALVADOR	61	9	14.12	70.00	1.44	PORTUGAL	219	27	16.50	50.00	2.02
ESTONIA	36	6	17.18	77.06	2.53	ROMANIA	84	21	12.85	48.24	0.31
FINLAND	70	10	16.87	57.65	2.28	RUSSIAN FED.	1509	707	14.83	44.71	-0.49
FRANCE	1908	242	20.20	50.59	2.23	SAUDI ARABIA	122	11	.	43.53	1.74
GERMANY	1781	209	18.73	58.24	2.44	SINGAPORE	64	15	18.40	67.65	2.41
GHANA	73	12	8.87	48.82	-1.17	SLOVAKIA	68	17	.	61.18	-0.09
GREECE	118	24	15.87	37.65	1.08	SLOVENIA	119	17	.	60.59	1.23
HONG KONG	351	40	19.27	84.12	2.53	SOUTH AFRICA	149	28	16.32	52.94	-1.07
HUNGARY	123	22	16.28	63.53	0.74	SPAIN	657	80	20.03	68.24	1.89
INDIA	564	64	8.87	30.00	-1.07	SRI LANKA	98	13	11.92	57.65	0.31
IRELAND	150	29	20.67	78.24	2.14	SWEDEN	111	22	20.00	67.65	2.12
ISRAEL	136	15	16.33	50.00	0.83	SWITZERLAND	1616	203	19.27	80.59	2.40
ITALY	1311	182	17.53	61.18	2.29	TAIWAN	82	35	11.88	53.53	.
IVORY COAST	47	6	13.50	57.06	-0.95	THAILAND	108	19	13.23	50.00	-0.15
JAPAN	129	25	17.27	53.53	2.36	TRINIDAD&TOBAGO	63	10	.	70.00	1.92
JORDAN	116	11	17.37	69.41	1.23	TUNISIA	67	13	12.02	50.00	-0.89
KAZAKHSTAN	65	17	10.77	34.12	-1.13	TURKEY	189	46	14.22	60.59	-0.82
KENYA	166	33	12.38	54.71	0.34	UKRAINE	181	45	11.32	41.76	-1.13
KOREA	111	19	14.80	59.41	-0.38	UNITED KINGDOM	931	127	20.60	90.00	2.53
KUWAIT	50	5	.	50.00	1.74	URUGUAY	46	15	14.87	57.06	1.92
LATVIA	105	25	17.89	62.94	2.40	USA	5058	553	20.13	77.65	2.53
LEBANON	282	47	.	70.00	1.75	VENEZUELA	230	41	15.65	51.76	0.37
LITHUANIA	51	8	14.95	52.94	2.53						

Table 2. Descriptive statistics and correlations

LERNER is a proxy of bank market power and it is defined as the difference between the price and the marginal cost, divided by the price. ZSCORE is the natural logarithm of *Zscore*, a proxy for insolvency risk that equals the return on assets plus the capital asset ratio divided by the standard deviation of asset returns. A six-year moving window is used to estimate the standard deviation of asset returns for each bank in each year REFORM, FREEDOM, and KAOPEN are our three indicators of financial liberalization. REFORM is an index of financial reforms (Abiad et al. 2008), FREEDOM is the Financial Freedom index of the *Heritage Foundation*, and KAOPEN measures the degree of capital account openness (Chinn and Ito, 2008). CONC is the fraction of assets of three largest banks as a share of assets of all commercial banks in a country (Beck and Demirgüç-Kunt, 2009). COVERDEP is deposit insurance coverage defined as the natural logarithm of one plus the ratio of deposit insurance coverage to deposits per capita (Demirgüç-Kunt et al., 2008). SIZE is the natural logarithm of total assets. REVENUE is the annual growth rate in total revenues of the bank. OVERHEAD is personnel expenses and other non-interest expenses over total assets. NONINTEREST is the non-interest income to total operating income ratio. DEVELOP is a dummy variable that measures level of development of a country. It comes from the database on financial development and structure drawn up by Beck and Demirgüç-Kunt (2009) and takes values from zero to three depending on the income level of the country. A value of zero means the lowest income level and a value of three the highest income level. LEGALRIGHTS is an index that measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. It ranges from 0 to 10, with higher scores indicating that these laws are better designed to expand access to credit. CAPREG is a capital regulatory index. OFFICIAL is a measure of country´s official supervisory power. TRANSP is a measure of the transparency of bank financial statement practices. Bank data are from the BankScope data base of Fitch IBCA, macro data are from the IMF's International Financial Statistics. The sample period is 1991-2007.

Panel A: Descriptive statistics

	LERNER	ZSCORE	REFORM	FREEDOM	KAOPEN	CONC	COVERDEP	SIZE	REVENUE	OVERHEAD	NONINTEREST	DEVELOP	LEGAL RIGHTS	CAPREG	OFFICIAL	TRANSP
Median	0.4155	1.2652	18.2695	64.5088	1.6991	0.5184	0.4424	6.1352	0.1649	0.0409	0.3796	2.6302	6.6108	6.1713	10.7328	4.9777
SD	0.1442	0.5320	3.0801	18.4065	1.3484	0.2212	0.1556	0.9120	0.9065	0.0541	1.4486	0.6946	2.1492	1.5644	2.4968	0.7046
Minimum	0.0000	-24.4050	3	30	-1.8116	0.1484	0.1860	2.2407	-30.6133	0.0003	-19.3462	0	1	3	5	3
Maximum	0.9967	3.9641	21	90	2.5318	1	0.8917	9.2897	28.4165	2.7433	206.4374	3	10	10	14	6

Panel B: Correlations

	LERNER	ZSCORE	REFORM	FREEDOM	KAOPEN	CONC	COVERDEP	SIZE	REVENUE	OVERHEAD	NONINTEREST	DEVELOP	LEGAL RIGHTS	CAPREG	OFFICIAL	TRANSP
ZSCORE	0.147***															
REFORM	-0.026***	0.256***														
FREEDOM	-0.021***	0.273***	0.971***													
KAOPEN	-0.066***	0.252***	0.919***	0.922***												
CONC	-0.129***	0.0001	0.156***	0.041***	0.198***											
COVERDEP	0.033***	0.030***	0.006	0.201***	0.003	-0.513***										
SIZE	-0.134***	0.055***	0.231***	0.269***	0.262***	-0.009	0.219***									
REVENUE	0.006	-0.067***	-0.047***	-0.043***	-0.061***	-0.053***	0.020***	-0.026***								
OVERHEAD	0.018***	-0.183***	-0.209***	-0.226***	-0.226***	-0.066***	-0.061***	-0.283***	0.034***							
NONINTERST	-0.039***	-0.048***	0.015**	0.005	0.025***	0.040***	-0.050***	0.001	-0.205***	0.037***						
DEVELOP	-0.020***	0.214***	0.829***	0.790***	0.829***	0.015**	-0.094***	0.232***	-0.042***	-0.166***	0.025***					
LEGALRIGHTS	0.051***	0.206***	0.532***	0.592***	0.473***	0.024***	0.126***	0.083***	-0.016**	-0.143***	-0.013**	0.344***				
CAPREG	0.013*	-0.002	-0.254***	-0.238***	-0.213***	0.107***	-0.019***	-0.131***	0.019***	0.070***	-0.019***	-0.233***	-0.004			
OFFICIAL	0.134***	0.116***	-0.039***	0.038***	-0.070***	-0.218***	0.100***	-0.095***	0.017**	0.067***	-0.041***	-0.124***	0.241***	0.283***		
TRANSP	0.080***	0.099***	0.208***	0.204***	0.037***	0.202***	0.007	0.031***	0.000	-0.030***	-0.033***	0.035***	0.251***	0.065***	0.354***	1

Table 3. Financial liberalization, bank competition, and risk-taking

Regressions are estimated by combining a 2SLS procedure with the GMM system estimation for panel data with lagged dependent variables. In the first three columns, (1), (2), and (3), the dependent variable is LERNER. It is a proxy of bank market power and is defined as the difference between the price and the marginal cost, divided by the price. In columns (4), (5), and (6), the dependent variable is ZSCORE. ZSCORE is the natural logarithm of *Zscore*, a proxy for insolvency risk that equals the return on assets plus the capital asset ratio divided by the standard deviation of asset returns. A six-year moving window is used to estimate the standard deviation of asset returns for each bank in each year. As explanatory variables, we include one lag of the dependent variables (LERNER$_{t-1}$ and Z-SCORE$_{t-1}$ respectively) and the predicted value of ZSCORE (LERNER) obtained in the first stage when LERNER (ZSCORE) is the dependent variable. REFORM, FREEDOM, and KAOPEN are our three indicators of financial liberalization. REFORM is an index of financial reforms (Abiad et al. 2008), FREEDOM is the Financial Freedom index of the Heritage Foundation, and KAOPEN measures the degree of capital account openness (Chinn and Ito, 2008). We control for the potential endogeneity of financial liberalization variables using as instruments (Cetorelli and Gambera, 2001): i) four binary variables indicating an English, German, French or Scandinavian legal origin, ii) the rule of law indicator from the International Country Risk Guide, and iii) the total country population and real Gross Domestic Product (GDP) as proxy for market size. CONC is the fraction of assets of three largest banks as a share of assets of all commercial banks in a country (Beck and Demirgüç-Kunt, 2009). COVERDEP is deposit insurance coverage defined as the natural logarithm of one plus the ratio of deposit insurance coverage to deposits per capita (Demirgüç-Kunt et al., 2008). SIZE is the natural logarithm of total assets. REVENUE is the annual growth rate in total revenues of the bank. OVERHEAD is personnel expenses and other non-interest expenses over total assets. NONINTEREST is the non-interest income to total operating income ratio. DEVELOP is a dummy variable that measures level of development of a country. It comes from the database on financial development and structure drawn up by Beck and Demirgüç-Kunt (2009) and takes values from zero to three depending on the income level of the country. A value of zero means the lowest income level and a value of three the highest income level. FINAN-DEV is the value of stock market capitalization as a percentage of GDP (Beck and Demirgüç-Kunt, 2009). GDPGR and LOGGDP are the annual growth rate and the natural logarithm of real GDP per capita respectively. INFLATION is the annual inflation rate from the GDP deflator. Although not reported, all estimations control for country, year, and bank-specific effects. The sample period is 1991-2007 when we use FREEDOM and KAOPEN, and 1991-2005 when we use REFORM as a proxy for financial liberalization. ***; ** and * indicate statistical significance at 1, 5, and 10 percent, respectively.

Dependent variable:	LERNER			ZSCORE		
2SLS	(1)	(2)	(3)	(4)	(5)	(6)
LERNER $_{t-1}$	0.5980***	0.6743***	0.6746***			
	(9.26)	(9.92)	(9.51)			
ZSCORE $_{t-1}$				0.6937***	0.6646***	0.6724***
				(15.05)	(16.08)	(16.84)
ZSCORE	0.0585***	0.0274**	0.0408***			
	(5.54)	(2.10)	(3.91)			
LERNER				2.5095***	2.0243***	2.0947***
				(4.66)	(4.45)	(4.80)
REFORM	-0.0068*			-0.0043		
	(-1.72)			(-0.41)		
FREEDOM		-0.0015*			-0.0036	
		(-1.87)			(-1.53)	
KAOPEN			-0.0229**			0.0112
			(-2.16)			(0.43)
CONC	0.0808***	0.0667***	0.0756***			
	(6.35)	(5.53)	(5.89)			
COVERDEP				-3.0788***	-0.4749	-0.9342
				(-3.24)	(-0.59)	(-1.29)
SIZE	-0.0291*	-0.0066	-0.0163	0.1118*	0.0495	0.0385
	(-1.90)	(-0.36)	(-1.02)	(1.90)	(0.80)	(0.82)
REVENUE	0.1081***	0.1261***	0.1426***	-0.4164***	-0.3785***	-0.4054***
	(4.39)	(4.48)	(5.59)	(-5.15)	(-4.82)	(-5.07)
OVERHEAD	0.0612	0.2293	0.1669	-0.1378	0.2534	-0.3495
	(0.48)	(0.73)	(0.75)	(-0.55)	(0.32)	(-1.07)
NONINTEREST	-0.0358	-0.0046	-0.0028	0.0328	0.0187	-0.0311
	(-1.46)	(-0.31)	(-0.15)	(0.39)	(0.14)	(-0.34)
DEVELOP	0.0448	0.0577*	0.0620*	0.9154***	0.4775***	0.4379***
	(1.20)	(1.64)	(1.75)	(4.60)	(3.16)	(3.23)
FINAN-DEV	0.0040	-0.0012	-0.0091	-0.0869***	-0.0704***	-0.0355**
	(0.68)	(-0.23)	(-1.51)	(-3.40)	(-3.33)	(-2.19)
GDPGR	0.0530***	0.0697***	0.0738***	-0.1261***	-0.1321***	-0.1441***
	(3.48)	(4.35)	(4.45)	(-2.93)	(-3.19)	(-3.55)
LOGGDP	0.0323**	0.0285**	0.0352***	-0.1643***	-0.1452***	-0.1760***
	(2.38)	(2.29)	(2.61)	(-3.43)	(-3.33)	(-4.21)
INFLATION	-0.0007*	-0.0004	-0.0006	-0.0005	-0.0013	-0.0008
	(-1.91)	(-1.27)	(-1.54)	(-0.50)	(-1.29)	(-0.91)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes
m$_1$ statistic	-7.43***	-7.31***	-6.89***	-11.77***	-12.87***	-12.85***
m$_2$ statistic	-0.42	-0.49	-0.95	0.45	-0.15	0.05
Hansen J statistic (p-value)	16.57 (0.553)	29.91 (0.152)	16.14 (0.242)	15.00 (0.525)	23.53 (0.317)	15.80 (0.467)
First stage Wald statistic	232.35***	177.45***	224.32***	146.56***	137.26***	123.50***
# observations	21,752	26,556	25,216	21,752	26,556	25,216
# banks	3,662	4,333	4,181	3,662	4,333	4,181
# countries	66	83	81	66	83	81

Table 4. Financial liberalization, economic development, and bank risk-taking

Regressions are estimated by combining a 2SLS procedure with the GMM system estimation for panel data with lagged dependent variables. In the first three columns, (1), (2), and (3), the dependent variable is LERNER. It is a proxy of bank market power and is defined as the difference between the price and the marginal cost, divided by the price. In columns (4), (5), and (6), the dependent variable is ZSCORE. ZSCORE is the natural logarithm of *Zscore*, a proxy for insolvency risk that equals the return on assets plus the capital asset ratio divided by the standard deviation of asset returns. A six-year moving window is used to estimate the standard deviation of asset returns for each bank in each year. As explanatory variables, we include one lag of the dependent variables (LERNER$_{t-1}$ and Z-SCORE$_{t-1}$ respectively) and the predicted value of ZSCORE (LERNER) obtained in the first stage when LERNER (ZSCORE) is the dependent variable. REFORM, FREEDOM, and KAOPEN are our three indicators of financial liberalization. REFORM is an index of financial reforms (Abiad et al. 2008), FREEDOM is the Financial Freedom index of the Heritage Foundation, and KAOPEN measures the degree of capital account openness (Chinn and Ito, 2008). We control for the potential endogeneity of financial liberalization variables using as instruments (Cetorelli and Gambera, 2001): i) four binary variables indicating an English, German, French or Scandinavian legal origin, ii) the rule of law indicator from the International Country Risk Guide, and iii) the total country population and real Gross Domestic Product (GDP) as proxy for market size. CONC is the fraction of assets of three largest banks as a share of assets of all commercial banks in a country (Beck and Demirgüç-Kunt, 2009). COVERDEP is deposit insurance coverage defined as the natural logarithm of one plus the ratio of deposit insurance coverage to deposits per capita (Demirgüç-Kunt et al., 2008). SIZE is the natural logarithm of total assets. REVENUE is the annual growth rate in total revenues of the bank. OVERHEAD is personnel expenses and other non-interest expenses over total assets. NONINTEREST is the non-interest income to total operating income ratio. DEVELOP is a dummy variable that measures the level of development of a country. It comes from the database on financial development and structure drawn up by Beck and Demirgüç-Kunt (2009) and takes values from zero to three depending on the income level of the country. A value of zero means the lowest income level and a value of three the highest income level. FINAN-DEV is the value of stock market capitalization as a percentage of GDP (Beck and Demirgüç-Kunt, 2009). GDPGR and LOGGDP are the annual growth rate and the natural logarithm of real GDP per capita respectively. INFLATION is the annual inflation rate from the GDP deflator. Although not reported, all estimations control for country, year, and bank-specific effects. The sample period is 1991-2007 when we use FREEDOM and KAOPEN, and 1991-2005 when we use REFORM as a proxy for financial liberalization. ***; ** and * indicate statistical significance at 1, 5, and 10 percent, respectively.

Dependent variable:	LERNER			ZSCORE		
2SLS	(1)	(2)	(3)	(4)	(5)	(6)
LERNER $_{t-1}$	0.5976*** (9.25)	0.5777*** (2.83)	0.6767*** (9.54)			
ZSCORE $_{t-1}$				0.7097*** (15.87)	0.7498*** (10.99)	0.6804*** (17.30)
ZSCORE	0.0591*** (5.58)	0.0343 (1.11)	0.0410*** (3.92)			
LERNER				1.1692** (2.17)	2.4813* (1.95)	1.3853*** (3.27)
LERNER*x*DEVELOP				0.4493** (2.44)	-0.0293 (-0.31)	0.1871* (1.83)
REFORM	0.0052 (0.64)			-0.0460* (-1.95)		
REFORM*x*DEVELOP	-0.0059* (-1.66)			0.0177* (1.75)		
FREEDOM		0.0072 (1.25)			-0.0242*** (-3.12)	
FREEDOM*x*DEVELOP		-0.0034* (-1.63)			0.0121*** (4.01)	
KAOPEN			0.0206 (0.71)			-0.1241** (-2.05)
KAOPEN*x*DEVELOP			-0.0198* (-1.67)			0.0597** (2.35)
CONC	0.0824*** (6.44)	0.0804*** (4.45)	0.0774*** (6.01)			
COVERDEP				-2.3709*** (-2.63)	-0.3398* (-1.75)	-0.6262 (-0.88)
SIZE	-0.0295* (-1.94)	0.0244 (0.83)	-0.0164 (-1.02)	0.1022* (1.87)	0.1112 (0.92)	0.0231 (0.52)
REVENUE	0.1087*** (4.41)	0.1725*** (3.25)	0.1427*** (5.59)	-0.3989*** (-5.27)	-0.5852** (-2.22)	-0.3688*** (-5.07)
OVERHEAD	0.0621 (0.48)	1.2599 (1.39)	0.1720 (0.75)	-0.1374 (-0.68)	2.7937 (1.18)	-0.3039 (-1.34)
NONINTEREST	-0.0360 (-1.47)	-0.0169 (-0.81)	-0.0025 (-0.14)	0.0361 (0.44)	-0.0883 (-1.61)	-0.0346 (-0.37)
DEVELOP	0.1588** (2.14)	0.2581** (2.04)	0.0973** (2.56)	0.2246 (0.82)	-0.6148*** (-3.10)	0.1821 (1.20)
FINAN-DEV	0.0032 (0.54)	-0.0093 (-0.75)	-0.0097 (-1.61)	-0.0674*** (-3.00)	0.0312** (2.02)	-0.0218 (-1.46)
GDPGR	0.0545*** (3.53)	0.0843*** (4.03)	0.0748*** (4.47)	-0.1237*** (-2.92)	-0.2253** (-2.50)	-0.1367*** (-3.48)
LOGGDP	0.0295** (2.21)	0.0493** (2.15)	0.0319** (2.43)	-0.1614*** (-3.53)	-0.1545*** (-2.81)	-0.1643*** (-4.15)
INFLATION	-0.0007* (-1.89)	-0.0009* (-1.88)	-0.0005 (-1.51)	-0.0015 (-1.47)	-0.0030** (-2.27)	-0.0014 (-1.61)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes
m$_1$ statistic	-7.40***	-3.93***	-6.89***	-11.96***	-8.65***	-12.94***
m$_2$ statistic	-0.43	-0.51	0.84	0.44	-0.07	0.02
Hansen J statistic (p-value)	16.59 (0.551)	9.22 (0.757)	16.03 (0.247)	15.43 (0.565)	10.40 (0.581)	17.73 (0.406)
First stage Wald statistic	232.35***	197.03***	224.32***	146.56***	77.62***	123.50***
# observations	21,752	26,556	25,216	21,752	26,556	25,216
# banks	3,662	4,333	4,181	3,662	4,333	4,181
# countries	66	83	81	66	83	81

Table 5. Financial liberalization, legal rights, and bank risk-taking

Regressions are estimated by combining a 2SLS procedure with the GMM system estimation for panel data with lagged dependent variables. In the first three columns, (1), (2), and (3), the dependent variable is LERNER. It is a proxy of bank market power and is defined as the difference between the price and the marginal cost, divided by the price. In columns (4), (5), and (6), the dependent variable is ZSCORE. ZSCORE is the natural logarithm of *Zscore*, a proxy for insolvency risk that equals the return on assets plus the capital asset ratio divided by the standard deviation of asset returns. A six-year moving window is used to estimate the standard deviation of asset returns for each bank in each year. As explanatory variables, we include one lag of the dependent variables (LERNERt-1 and Z-SCOREt-1 respectively) and the predicted value of ZSCORE (LERNER) obtained in the first stage when LERNER (ZSCORE) is the dependent variable. REFORM, FREEDOM, and KAOPEN are our three indicators of financial liberalization. REFORM is an index of financial reforms (Abiad et al. 2008), FREEDOM is the Financial Freedom index of the Heritage Foundation, and KAOPEN measures the degree of capital account openness (Chinn and Ito, 2008). We control for the potential endogeneity of financial liberalization variables using as instruments (Cetorelli and Gambera, 2001): i) four binary variables indicating an English, German, French or Scandinavian legal origin, ii) the rule of law indicator from the International Country Risk Guide, and iii) the total country population and real Gross Domestic Product (GDP) as proxy for market size. CONC is the fraction of assets of three largest banks as a share of assets of all commercial banks in a country (Beck and Demirgüç-Kunt, 2009). COVERDEP is deposit insurance coverage defined as the natural logarithm of one plus the ratio of deposit insurance coverage to deposits per capita (Demirgüç-Kunt et al., 2008). SIZE is the natural logarithm of total assets. REVENUE is the annual growth rate in total revenues of the bank. OVERHEAD is personnel expenses and other non-interest expenses over total assets. NONINTEREST is the non-interest income to total operating income ratio. LEGALRIGHTS is an index that measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. It ranges from 0 to 10, with higher scores indicating that these laws are better designed to expand access to credit. FINAN-DEV is the value of stock market capitalization as a percentage of GDP (Beck and Demirgüç-Kunt, 2009). GDPGR and LOGGDP are the annual growth rate and the natural logarithm of real GDP per capita respectively. INFLATION is the annual inflation rate from the GDP deflator. Although not reported, all estimations control for country, year, and bank-specific effects. The sample period is 1991-2007 when we use FREEDOM and KAOPEN, and 1991-2005 when we use REFORM as a proxy for financial liberalization. ***; ** and * indicate statistical significance at 1, 5, and 10 percent, respectively.

Dependent variable:	LERNER			ZSCORE		
2SLS	(1)	(2)	(3)	(4)	(5)	(6)
LERNER $_{t-1}$	0.6024***	0.5854***	0.6755***			
	(9.18)	(2.85)	(9.36)			
ZSCORE $_{t-1}$				0.6938***	0.7241***	0.6755***
				(15.21)	(11.82)	(16.63)
ZSCORE	0.0596***	0.0335	0.0409***			
	(5.54)	(1.10)	(3.80)			
LERNER				1.9254***	1.7060*	1.7273***
				(3.58)	(1.82)	(4.12)
LERNERxLEGALRIGHTS				0.0746*	0.0176	0.0343
				(1.69)	(0.72)	(1.25)
REFORM	0.0217***			-0.0528**		
	(2.63)			(-2.25)		
REFORMxLEGALRIGHTS	-0.0053***			0.0082**		
	(-3.41)			(2.21)		
FREEDOM		0.0088***			0.0019	
		(2.74)			(0.30)	
FREEDOMxLEGALRIGHTS		-0.0017***			0.0010	
		(-3.15)			(0.92)	
KAOPEN			0.0531**			-0.0827
			(2.13)			(-1.44)
KAOPENxLEGALRIGHTS			-0.0156***			0.0185**
			(-3.19)			(1.99)
CONC	0.0801***	0.0760***	0.0758***			
	(6.19)	(3.99)	(5.78)			
COVERDEP				-2.7358***	-0.2074**	-0.5650
				(-2.79)	(-2.17)	(-0.75)
SIZE	-0.0294*	0.0284	-0.0163	0.1054*	0.0241	0.0278
	(-1.89)	(0.95)	(-1.04)	(1.84)	(0.24)	(0.60)
REVENUE	0.1130***	0.1774***	0.1483***	-0.4064***	-0.4562**	-0.3867***
	(4.45)	(3.16)	(5.58)	(-5.24)	(-2.28)	(-5.17)
OVERHEAD	0.0650	1.4208	0.1749	-0.1719	1.3157	-0.2893
	(0.49)	(1.48)	(0.75)	(-0.60)	(0.63)	(-1.23)
NONINTEREST	-0.0343	-0.0176	-0.0010	0.0181	-0.0793*	-0.0213
	(-1.38)	(-0.83)	(-0.05)	(0.22)	(-1.64)	(-0.23)
LEGALRIGHTS	0.0850***	0.1046***	0.0257***	-0.0073	-0.0531	0.0284
	(3.52)	(2.95)	(3.28)	(-0.10)	(-0.66)	(1.03)
FINAN-DEV	0.0038	-0.0096	-0.0090	-0.0873***	0.0145	-0.0321**
	(0.64)	(-0.76)	(-1.47)	(-3.52)	(1.14)	(-2.05)
GDPGR	0.0578***	0.0925***	0.0814***	-0.1331***	-0.2249***	-0.1495***
	(3.63)	(4.11)	(4.59)	(-3.13)	(-3.13)	(-3.67)
LOGGDP	0.0237*	0.0487*	0.0266**	-0.1599***	-0.0825**	-0.1673***
	(1.78)	(1.88)	(1.98)	(-3.35)	(-2.15)	(-4.06)
INFLATION	-0.0007*	-0.0010*	-0.0005	-0.0006	-0.0032***	-0.0010
	(-1.90)	(-1.86)	(-1.46)	(-0.62)	(-3.56)	(-1.13)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes	Yes	Yes
m_1 statistic	-7.12***	-3.82***	-6.66***	-11.74***	-9.67***	-12.74***
m_2 statistic	-0.48	-0.41	-1.04	0.42	-0.11	-0.02
Hansen J statistic (p-value)	15.87 (0.602)	8.71 (0.794)	15.17 (0.297)	17.21 (0.440)	14.38 (0.277)	17.01 (0.453)
First stage Wald statistic	232.35***	197.07***	217.11***	146.56***	79.07***	125.89***
# observations	21,752	26,376	25,026	21,752	26,376	25,026
# banks	3,662	4,297	4,145	3,662	4,297	4,145
# countries	66	80	78	66	80	78

Table 6. Capital Regulation, official supervision, financial transparency, and financial liberalization

Regressions are estimated by combining a 2SLS procedure with the GMM system estimation for panel data with lagged dependent variables. In the first three columns, (1), (2), and (3), the dependent variable is LERNER. It is a proxy of bank market power and is defined as the difference between the price and the marginal cost, divided by the price. In columns (4), (5), and (6), the dependent variable is ZSCORE. ZSCORE is the natural logarithm of *Zscore*, a proxy for insolvency risk that equals the return on assets plus the capital asset ratio divided by the standard deviation of asset returns. A six-year moving window is used to estimate the standard deviation of asset returns for each bank in each year. As explanatory variables, we include one lag of the dependent variables (LERNER$_{t-1}$ and Z-SCORE$_{t-1}$ respectively) and the predicted value of ZSCORE (LERNER) obtained in the first stage when LERNER (ZSCORE) is the dependent variable. REFORM is an index of financial reforms (Abiad et al. 2008). CAPREG is a capital regulatory index. OFFICIAL is a measure of a country´s official supervisory power. TRANSP is a measure of the transparency of bank financial statement practices. Country and time dummies are included in all regressions. The sample period is 1991-2005. Columns (1) and (4) refer to all countries in the sample. Columns (2) and (5) refer to developed countries (values 2 and 3 of DEVELOP) and columns (3) and (6) refer to developing countries (values 0 and 1 of DEVELOP). Although not reported, all estimations control for country, year, and bank-specific effects. ***; ** and * indicate statistical significance at 1, 5, and 10 percent, respectively.

Dependent variable:	LERNER			ZSCORE		
	ALL	DEVELOPED	DEVELOPING	ALL	DEVELOPED	DEVELOPING
2SLS	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Capital regulatory						
REFORM	-0.0069*	-0.0095**	-0.0018	0.0492	-0.0063	-0.3522***
	(-1.69)	(-2.03)	(-0.20)	(1.34)	(-0.10)	(-3.47)
REFORM*x*CAPREG				-0.0074	0.0028	0.0546***
				(-1.38)	(0.32)	(3.04)
LERNER				3.1674***	1.8983**	-1.8327
				(4.81)	(2.11)	(-0.48)
LERNER*x*CAPREG				-0.0404	-0.2992**	0.3706
				(-0.76)	(-1.98)	(0.66)
m$_1$ statistic	-7.18***	-6.88***	-1.86*	-9.15***	-11.16***	-4.39***
m$_2$ statistic	-0.80	-0.71	0.04	0.38	-0.68	0.01
Hansen J statistic (p-value)	18.29 (0.437)	19.19 (0.380)	10.19 (0.252)	10.28 (0.591)	20.57 (0.113)	6.97 (0.936)
First stage Wald statistic	210.99***	191.86***	17.28***	54.38***	127.35***	11.06***
# observations	20,059	17,894	2,165	20,059	17,894	2,165
# banks	3,440	3,049	391	3,440	3,049	391
# countries	63	46	17	63	46	17
Panel B: Official Supervision						
REFORM	-0.0070*	-0.0085*	-0.0040	-0.1029**	-0.2243***	-0.3554**
	(-1.76)	(-1.82)	(-0.47)	(-2.15)	(-2.91)	(-2.11)
REFORM*x*OFFICIAL				0.0099**	0.0214***	0.0233*
				(2.11)	(3.03)	(1.67)
LERNER				1.1082**	0.9787*	-1.3880
				(2.20)	(1.89)	(-0.56)
LERNER*x*OFFICIAL				0.1145**	0.1321**	0.0662
				(2.38)	(2.51)	(0.32)
m$_1$ statistic	-7.33***	-7.15***	-2.79***	-11.86***	-11.05***	-3.89***
m$_2$ statistic	-0.43	-0.31	0.66	0.52	0.52	-0.39
Hansen J statistic (p-value)	16.59 (0.551)	19.64 (0.354)	6.23 (0.622)	19.47 (0.302)	20.42 (0.253)	16.42 (0.173)
First stage Wald statistic	237.74***	228.05***	17.38***	130.66***	128.63***	7.37**
# observations	21,665	19,491	2,174	21,665	19,491	2,174
# banks	3,630	3,246	384	3,630	3,246	384
# countries	64	47	17	64	47	17
Panel C: Financial Transparency						
REFORM	-0.0088**	-0.0084*	-0.0122	0.1175	0.0792	-0.3393**
	(-2.19)	(-1.80)	(-1.09)	(1.23)	(0.68)	(-2.02)
REFORM*x*TRANSP				-0.0233	-0.0168	0.0719**
				(-1.20)	(-0.73)	(2.32)
LERNER				2.3822***	2.0514***	0.0951
				(3.33)	(2.69)	(0.06)
LERNER*x*TRANSP				0.0291	0.0488	-0.1694
				(0.32)	(0.47)	(-0.76)
m$_1$ statistic	-7.32***	-7.20***	-3.22***	-11.80***	-11.12***	-3.91***
m$_2$ statistic	-0.60	-0.29	-0.13	0.27	0.28	-0.01
Hansen J statistic (p-value)	19.41 (0.367)	19.26 (0.376)	21.05 (0.277)	21.28 (0.321)	23.23 (0.227)	16.12 (0.649)
First stage Wald statistic	238.90***	227.54***	23.90***	145.04***	130.51***	5.00*
# observations	21,622	19,524	2,098	21,622	19,524	2,098
# banks	3,626	3,259	367	3,626	3,259	367
# countries	64	48	16	64	48	16

Figure 1

The figure shows the average evolution of the three proxies for financial liberalization (the Financial Reform Index, the Financial Freedom Index, and the Kaopen Index) in our sample of countries. It also separates between developed and developing countries.