Bank competition and stability: Cross-country heterogeneity*

Thorsten Beck† Olivier De Jonghe‡ Glenn Schepens§

Abstract

This paper documents large cross-country variation in the relationship between bank competition and bank stability and explores market, regulatory and institutional features that can explain this variation. We show that an increase in competition will have a larger impact on banks' risk taking incentives in countries with stricter activity restrictions, more homogenous bank revenue structures, more generous deposit insurance and more effective systems of credit information sharing. The effects are economically large and thus have important repercussions for the current regulatory reform debate.

Keywords: Competition, Stability, Banking, Herding, Deposit Insurance, Information Sharing, Risk Shifting

JEL Classifications: G21, G28, L51

*The authors would like to thank Charles Calomiris, Fabio Castiglionesi, Hans Degryse, Jakob de Haan, Claudia Girardone, Iftekhar Hasan, Simon Kwan, Klaus Schaeck, two anonymous reviewers, the editor (Phil Strahan) and seminar participants at ASSA meeting (Chicago), HEC Paris, Ghent University, Tilburg University, Cass Business School, Roma II Tor Vergata, Université Libre de Bruxelles, Bangor Business School, the Bank of England, Carefin-Bocconi (Milan) and the FIRS conference (Sydney) for interesting discussions and helpful comments. Thorsten Beck acknowledges support from the European Commission under Marie Curie Grant, IRG 239469. Glenn Schepens acknowledges support from the Fund for Scientific Research (Flanders) under FWO project G.0028.08N.

†CentER, European Banking Center, Tilburg University and CEPR. T.Beck@uvt.nl

‡CentER, European Banking Center, Tilburg University. o.dejonghe@uvt.nl

§Department of Financial Economics, Ghent University. glenn.schepens@ugent.be

1 Introduction

The impact of bank competition on financial stability remains a widely debated and controversial issue, both among policymakers and academics.[1] The belief that fiercer competition among banks would lead to a more effective banking system initiated a deregulating spiral in the late 1970s and early 1980s. While the deregulation of branching and activity restrictions may have resulted in more intense competition among banks, with positive repercussions for financial depth (**?**, **?**), income distribution (**?**), growth (**?**) and efficiency (**?**), it may as well have had the unintended consequence of increasing banking sector instability (see e.g., **?** and **?**). Similarly, the international process of banking liberalization has gone hand in hand with an increased occurrence of systemic banking crises in the last two decades of the 20th century[2], culminating in the global financial crisis of 2007-2009. However, there is no academic consensus on whether bank competition leads to more or less stability in the banking system.

A similarly inconclusive debate has been led on the effect of the regulatory framework on banks' risk-taking incentives and ultimately bank stability. On the one hand, capital requirements and restrictions on interest rates and banks' activities are seen as fostering stability (**?**); on the other hand, they might lead to rent-seeking and might prevent banks from reaping necessary diversification and scale benefits. The role of deposit insurance schemes has been especially controversial. While often introduced to protect small depositors' lifetime savings and to prevent bank runs, they also provide perverse incentives to banks to take aggressive and excessive risks. These perverse incentives are held less in check in weak supervisory frameworks (**?**).

This paper combines the two literatures and provides empirical evidence that the relationship between competition and stability varies across markets with different regulatory frameworks, market structures and levels of institutional development. While we show, on average, a positive relationship between banks' market power, as measured by the Lerner index, and banks' stability, as measured by the Z-score (a gauge of banks' distance to insolvency), we find large cross-country variation in this relationship. Our results suggest that an increase in competition is associated with a larger rise in banks' risk taking incentives in countries with stricter

[1] See **?**, **?**, **?** and **?** as well as **?** and **?**. For a recent on-line debate on this topic, see http://www.economist.com/debate/overview/205.

[2] For a detailed overview of the timing of systemic banking crises and the timing of deregulation, we refer to **?** and **?**, respectively.

activity restrictions, more homogenous bank revenue structures, more generous deposit insurance and more effective systems of credit information sharing.

Exploring the variation in the competition-stability relationship is important for academics and policy makers alike. The academic debate on the effect of competition on bank stability has been inconclusive to date and by exploring factors that can explain cross-country variation in the relationship, this paper contributes to the resolution of the puzzle. Policy makers have been concerned about the effect of deregulation and the consequent impact of competition on bank stability but have also discussed different elements of the regulatory framework that have both an impact on competition and directly on stability, including deposit insurance, capital regulation and activity restrictions. After the recent crisis, there are reform suggestions focusing on activity restrictions, capital standards, deposit insurance and the institutional structure of supervision. This paper shows a critical role for the regulatory framework in explaining the variation across countries and over time in the relationship between competition and stability and has therefore important policy repercussions.[3] For example, we conduct a simulation that mimics a post-crisis scenario with more generous deposit insurance schemes and stronger restrictions on bank activities and, hence, more herding.[4] The relationship between market power and soundness is almost twice as large compared to the average country in the absence of such a change, suggesting a very negative impact of competition on stability in this scenario. In the base scenario, a one standard deviation reduction in market power leads to a drop in the Z-score of 17%. In our fictitious post-crisis scenario[5], a similar loss in market power leads to a 37% reduction in the average Z-score. This economically large effect of regulatory reform comes in addition to any direct effect (positive or negative) that such reforms might have on banks' stability. It also widens the trade-off between positive effects of competition on efficiency, on the one

[3]If such a country-specifc factor affects both competition and banking sector stability, then a spurious relationship between competition and stability may be the outcome. Therefore, by including country-year fixed effects, we only exploit the within country-year variation in bank market power and bank soundness. More detailed information is in the Methodology section.

[4]This simulation scenario, which reflects recent regulatory reforms or reform suggestions, is based on the results reported in Table 6.

[5]The results of this fictitious post-crisis scenario are similar whether or not we include the period 2007-2009 in the estimation. In a robustness check, we show that neither the 2007-09 crisis in particular or other systemic banking crisis in general affect our main findings.

hand, and negative effects of competition on stability.

Our paper builds on a rich theoretical and empirical literature exploring the relationship between competition and stability in the banking system.[6] On the one hand, the competition-fragility view posits that more competition among banks leads to more fragility. This "charter value" view of banking, as theoretically modeled by **?** and **?**, sees banks as choosing the risk of their asset portfolio. Bank owners, however, have incentives to shift risks to depositors, as in a world of limited liability they only participate in the up-side part of this risk taking. In a more competitive environment with more pressure on profits, banks have higher incentives to take more excessive risks, resulting in higher fragility. On the other hand, in systems with restricted entry and therefore limited competition, banks have better profit opportunities, capital cushions and therefore fewer incentives to take aggressive risks, with positive repercussions for financial stability. In addition, in a more competitive environment, banks earn fewer informational rents from their relationship with borrowers, reducing their incentives to properly screen borrowers, again increasing the risk of fragility (**?**, **?**, **?**). The competition-stability hypothesis, on the other hand, argues that more competitive banking systems result in more, rather than less, stability. Specifically, **?** show that lower lending rates reduce the entrepreneurs' cost of borrowing and increase the success rate of entrepreneurs' investments. As a consequence, banks will face lower credit risk on their loan portfolio in more competitive markets, which should lead to increased banking sector stability. However, more recent extensions of the **?** model that allow for imperfect correlation in loan defaults (**?**; **?**) show that the relationship between competition and risk is U-shaped. Hence, the impact of an increase in competition can go either way, depending on other factors and the existing intensity of competition.[7]

[6] For an excellent overview of the existing (pre-2008) models and empirical evidence on the relationship between competition and stability, see **?** and **?**.

[7] **?** extends the **?** model and allows for risk choices made by borrowers as well as banks. If lending rates decline due to more competition, banks have less to lose in case a borrower defaults. Hence, a bank may find it optimal to switch to financing riskier projects, which overturns the **?** results. Other authors have also shown that more intense competition may induce banks to (i) switch to more risky, opaque borrowers (**?**), and (ii) acquire less information on borrowers (**?**). **?** provide empirical evidence of a margin as well as a risk effect. Exploiting exogenous variation in market contestability, they find that deregulation explains at least 10% of the rise in bankruptcy rates. However, they also find that credit risk, measured as the loss rate on loans, decreases following deregulation. Thus, while banks made more bad loans, which explains the increase in bankruptcies, the default risk among all borrowers fell. This suggests that banks increased credit to both existing low risk customers as well as new, riskier ones, because of banks' enhanced ability

Numerous authors have used different samples, risk measures and competition proxies to discriminate between the competition-fragility and competition-stability view.[8] Empirical studies for specific countries – most for the U.S. – have not come to conclusive evidence for either a stability-enhancing or a stability-undermining role of competition. The cross-country literature has found that more concentrated banking systems are less likely to suffer a systemic banking crisis as are more competitive banking systems (**?**; **?**). There is also evidence that banks in more competitive banking systems hold more capital, thus compensating for potentially higher risks they are taking (**?**, **?**).

Unlike previous papers we do not test the validity of one of the two hypotheses on the relationship between competition and stability, but rather their relative importance and strength as function of the market, regulatory and institutional framework in which banks operate. Specifically, building on existing literature, we argue that country-specific features may affect the existing empirical evidence on the relationship between competition and stability via three possible channels. First, a certain type of regulation may limit the extent to which banks can or will engage in riskier activities if their franchise values are eroded. This would thus influence the strength of the competition-fragility relationship. Second, country-specific characteristics may also affect the adverse selection problem that banks face if they charge higher loan interest rates. This would thus influence the strength of the competition-stability relationship. Third, institutional characteristics may affect the proportion of systematic and idiosyncratic risk in loan defaults and may make it hence more likely that the data favor one theory over the other. The relative importance of each of these three channels may explain why different studies obtain different results in terms of magnitude or even sign. That is, certain country-specific features may make the assumptions and predictions of a given theoretical model more realistic. Building on existing theories, we will relate different country characteristics to the overall impact of market power on stability in section 3.3.

While this paper builds on the cross-country literature on the competition-stability relationship, it is the first - to the best of our knowledge - to explore the heterogeneity of this link across countries and over time and thus connects directly to the current debate on regulatory reforms. It is important to note some limitations of our analysis, however. First, we focus on a specific measure of bank competition, the Lerner index. Since

to discriminate between different levels of risk.

[8] For an overview, see **?**.

we want to exploit cross-country heterogeneity of the competition-stability relationship, we cannot use indicators of competition at the country level, such as the H-statistic. Nevertheless, we show that in our sample, the country-averaged Lerner index is meaningfully and statistically related to other competition and market structure measures. Second, and for the same reason, we focus on a bank-level indicator of stability rather than indicators of systemic distress. It is important to stress, therefore, that we do not want to settle the competition-stability debate, but rather show the importance of cross-country heterogeneity and the need to take into account regulatory and other policies when assessing the effect of competition on stability. Nevertheless, we conduct numerous robustness tests regarding the choice of the market power and bank soundness measure and refer to these results throughout the paper. Third, this paper does not investigate the direct impact of regulation on competition or risk, questions that have been the topic of previous research. Rather, we focus on the impact of regulation on the competition-stability trade-off. The former effects are controlled for by including time-varying country fixed effects, which imply that we only exploit the within-country year information in market power and stability. Fourth, in this study, we focus on the estimated net effect of bank market power on stability, which is the combination of the three underlying relationships discussed above. Analyzing whether this change is due to either of these three effects requires an alternative setup in which an (unexpected) change in regulation is used as a natural experiment.

2 Methodology

In the literature, there are two main approaches to assessing the relationship between competition and stability: a multiple country or single country setup. In a cross-country setup, one provides insight into the average relationship between competition and stability for the set of countries under investigation (e.g.: developing countries as in **?**, developed countries as in **?**, the European Union as in **?**), while controlling for other country-specific factors such as macro-economic conditions, regulation and supervision. However, single country studies (such as **?**, **?**, **?**, **?**) document a large degree of variation in the competition-stability relationship. We therefore use the following setup:

$$Risk_{i,j,t} = c + \beta_{j,t} \cdot Competition_{i,j,t-1} + \gamma \cdot X_{i,j,t-1} + \nu_{j,t} + \varepsilon_{i,j,t} \quad (1)$$

In this setup, the indices $i,\ j\ ,t$ stand respectively for bank, country and time. The relationship between competition and risk, $\beta_{j,t}$, is allowed to vary across countries and over time. The vector of bank-specific variables, $X_{i,j,t-1}$, characterizes a bank's business model. In particular, we include proxies for the funding structure (share of wholesale funding in total funding), asset (loans to assets ratio) and revenue mix (share of non-interest income in total income) as well as bank size (natural logarithm of total assets), credit risk (loan loss provisions to interest income) and asset growth. In addition, we include specialization dummies to allow for different intercepts for commercial banks, saving banks and cooperatives. Summary statistics on these variables are reported in Table 1.[9] Furthermore, time-varying country-fixed effects are also included, $\nu_{j,t}$ (i.e., a dummy variable for each country-year pair).

As hypothesized in the introduction, $\beta_{j,t}$ is modelled as a function of country-specific factors. To gain insight in the potential drivers of heterogeneity in β, we run the following regression:

$$Risk_{i,j,t} = c + (\beta_0 + \beta_1 Z_{j,t}) * Competition_{i,j,t-1} + \gamma X_{i,j,t-1} + \nu_{j,t} + \varepsilon_{i,j,t} \quad (2)$$

where $Z_{j,t}$ is either just one of the country-specific characteristics or a vector containing all of them. We are interested in the β_1 coefficients that directly gauge the impact of different country characteristics on the competition-stability relationship. We also include country-time fixed effects, $\nu_{j,t}$. Many other papers have documented that regulation, supervision and the business cycle may have an impact on competition and market

[9] These variables are often used in similar studies. See e.g.: **?**; **?** or **?**. Banks in our sample are on average smaller, have less wholesale funding and a lower share of non-interest revenue compared to, for example, **?**. This is due to differences in sample composition. We include all banks, whereas they focus on listed banks only. If we exclude the smaller banks up to the point that the average bank size is similar in both samples, we obtain a similar average share of wholesale funding and non-interest revenue. The loans to total assets ratio is similar to, for instance, **?**, who report 0.61 and 0.57 respectively. The loan loss provisions to net interest revenues is also used by **?**. Their sample is restricted to one year (2001) and covers the ten largest banks in 48 countries. They report an average of 0.23. In our sample, the average is lower (0.15).This need not be surprising as many countries were in a recession in 2001. When we try to mimic their sample (only using data from 2001 and focus on large banks (ln(TA)>10), which leaves us approximately the same number of observations as their sample), we obtain a ratio of 0.20, which is in line with the number they report.

structure, as well as banking system stability and bank crises. This could create a spurious correlation between market power and stability driven by a third country-specific variable. We reduce this possibility by only exploiting the within country-year variation.[10] In addition, the country-year fixed effects also absorb the impact of global factors affecting the relationship. Furthermore, we also cluster the error terms on the country-year level.

3 Data

3.1 Data sources

To gauge the relationship between bank competition and stability, we combine data from several sources. We obtain information on banks' balance sheets and income statements from Bankscope, which is a database compiled by Fitch/Bureau Van Dijk that contains information on banks around the globe, based on publicly available data-sources. We have data available for the period of $1994 - 2009$. If banks report information at the consolidated level, we delete the unconsolidated entries of the group from the sample to avoid double counting. We apply a number of selection criteria to arrive at our sample. First, we exclude countries for which we have information on fewer than 50 bank-year observations. Second, we limit our analysis to commercial, saving and cooperative banks, which represent, respectively, 53.4%, 28.2% and 18.4% of the sample. Third, we delete banks that report information for fewer than three consecutive years, as our risk measure is computed over rolling windows of three years.[11] Fourth, we drop bank-year observations that do not have data available on basic variables. Subsequently, we winsorize all variables at the 1 percent level to mitigate the impact of outliers. While most of the bank-specific variables are ratios, variables in levels (such as size) are expressed in

[10] In mathematical terms, an (un)observed country-specific variable $Z_{j,t}$ may affect the average level of risk and competition in a country in a given year ($\overline{Risk}_{j,t}$ and $\overline{Competition}_{j,t}$). This may create a spurious relationship between $Risk_{i,j,t}$ and $Competition_{i,j,t}$. This paper's setup examines the relationship between ($Risk_{i,j,t} - \overline{Risk}_{j,t}$) and ($Competition_{i,j,t} - \overline{Competition}_{j,t}$) and how this relationship varies because of $Z_{j,t}$.

[11] One of the components of the Z-score, the bank soundness measure, is an indicator of profit volatility. As we use accounting information, we compute volatility of return on assets over a three year (rolling) window. More detailed info on the construction of the variables follows in the next section.

2007 US dollars.

The bank-specific data are linked to various country-level databases that contain information on the regulatory framework, strength of supervision and other institutional features. More specifically, we employ data from the three waves (1997, 2001 and 2005) of the Bank Regulation and Supervision database[12] compiled by the World Bank (**?**). Additional information is obtained from the World Development Indicators and the Doing Business database. A detailed list of the country-level variables used and the database from which they are collected can be found in Appendix A. Filtering the bank-specific database and matching it with the country-level databases yields a sample of banks from 79 countries. The sample consists of a mix of developed and developing countries (see Appendix B).

3.2 Indicators of market power and bank soundness

In order to test for cross-country and cross-time variation in the bank competition-stability relationship, we need indicators of competition and stability that vary on the bank-level over time, as indicators on the country level would not allow us to exploit the cross-country heterogeneity in the relationship between the two. We therefore focus on two standard indicators of banks' market power and soundness, respectively, which we will discuss in depth in the following two subsections.

3.2.1 The Lerner index: measure of pricing power

The Lerner index is the only measurable market power indicator, besides market share, that varies at the bank level. The Lerner index is a proxy for current and future profits stemming from pricing power. As such, it fits well with the theoretical concept of banks' franchise value. Market share, on the other hand, not only is a proxy for pricing power, but also captures the rents extracted from being too-big-to-fail. Hence, market share as a proxy for pricing power is subject to measurement error in a similar fashion as Tobin's Q (**?**). Moreover, the Lerner index captures both the impact of pricing power on the asset and funding side of the bank. Finally, the Lerner index does not necessitate to define the geographical market, in contrast to market share or market

[12]The four regulatory measures we use are pre-constructed indices. The construction of the indices as well as the underlying survey questions are described in detail in the book 'Rethinking Bank Regulation: Till Angels Govern' by **?**.

concentration measures.[13] Conditional on having an estimate of the price and marginal cost, we can construct the Lerner index for each bank and each year, as follows:

$$Lerner_{i,t} = \frac{P_{i,t} - MC_{i,t}}{P_{i,t}} \tag{3}$$

where $P_{i,t}$ is proxied by the ratio of total operating income to total assets. As banks have the opportunity to expand their activities into non-interest generating activities, we include both interest and non-interest revenues. The marginal cost, $MC_{i,t}$, is derived from a translog cost function (as explained in Appendix C). Table 1 presents summary statistics on the variables needed to construct the Lerner index (middle panel) as well as the estimated Lerner index (lower panel). The average Lerner index at the country level is 12.4%, but varies across countries, from -5% in Thailand to 30.3% in Saudi Arabia (see Appendix B). The bottom panel of Table 1 shows that most of the variation in the Lerner index is between banks as opposed to within banks over time. Interestingly, we also find a larger variation across banks for a given country and year than between countries.

<**Insert Table 1 around here**>

In many other cross-country studies that examine the bank competition-stability relationship, authors have relied on country-level measures of market power or market structure. For aforementioned reasons, these measures can not be used in this setup. However, the results in Table 2 indicate that aggregate Lerner indices are meaningfully and statistically related with other measures of competition and market structure. Table 2 provides correlations between non-structural measures of market power and concentration, such as the number of banks, the Hirschmann-Herfindahl index, a CR3 concentration ratio as well as a structural indicator of competition, the Panzar-Rosse H-statistic (**?**). All these indicators are measured at the country-year level. In addition, we also include the country average of the Lerner index and market share. We define all measures such that an increase in the measure indicates less competition.[14]

<**Insert Table 2 around here**>

[13] Admittedly, one has to make a choice of the scope of the market when estimating the cost function. In the reported results, we estimate the cost function by country. However, using average cost rather than marginal cost (which does not necessitate defining the relevant market) or estimating a global cost function lead to very similar results.

[14] More specifically, we take the inverse number of banks and the negative of the Panzar-Rosse H-statistic.

The Lerner index is positively related to all other indicators and the correlation is significant for all but the Herfindahl index. In addition, the correlation table shows that all significant correlations are positive (except the one between the H-statistic and the number of banks). To conclude, the Lerner index is preferred over all other proxies both from a modelling perspective (variation across banks) as well as from a theoretical perspective (current and future pricing power constitute a bank's franchise value, which lies at the core of the theoretical models). It is reassuring, however, that our preferred competition proxy, the Lerner index, is significantly related to other competition proxies.

3.2.2 The Z-Score: measure of bank soundness

Bank risk is measured using the natural logarithm of the Z-score (as in e.g. **?**, **?**, **?** and many others). The Z-score measures the distance from insolvency (**?**) and is calculated as

$$Z_{i,t} = \frac{ROA_{i,t} + (E/A)_{i,t}}{\sigma(ROA)_{i,t}} \tag{4}$$

where ROA is return on assets, E/A denotes the equity to asset ratio and $\sigma(ROA)$ is the standard deviation of return on assets. We use a three-year rolling time window, rather than the full sample period, to compute the standard deviation of ROA to allow for time variation in the denominator of the Z-score. This approach avoids that the variation in Z-scores within banks over time is exclusively driven by variation in the levels of capital and profitability (**?**). Moreover, given the unbalanced nature of our panel dataset, it avoids that the denominator is computed over different window lengths for different banks. The Z-score can be interpreted as the number of standard deviations by which returns would have to fall from the mean to wipe out all equity in the bank (**?**). A higher Z-score implies a lower probability of insolvency, providing a more direct measure of soundness than, for example, simple leverage measures. Because the Z-score is highly skewed, we use the natural logarithm of Z-score to smooth out higher values.[15] Table 1 shows that the average value of ln(Z-score) slightly exceeds four with a standard deviation of 1.32. The average Z-score ranges from 4.97 in Switzerland to 2.37 in Uruguay (see Appendix B). The bottom panel of Table 1 shows that - as in the case of the Lerner index - most of the

[15] Others have used the transformation ln(1+Z-score) to avoid truncating the dependent variable at zero. We take the natural logarithm after winsorizing the data at the 1% level. As none of the Z-scores is lower than zero after winsorizing, this approach is similar, save for a rescaling, to the former approach and winsorizing after the transformation.

variation is between banks rather than over time within a given bank. We also find a larger variation across banks within a specific country and year than across countries.

3.2.3 Lerner index and Z-score: a spurious correlation?

One concern in our empirical analysis is that Lerner index and Z-score both include profitability in the numerator and any positive relationship between the two might thus be mechanical rather than economically meaningful. As a first approach, we therefore gauge the relationship between the Lerner index and Z-score over time as well as between Lerner index and the denominator of the Z-score, profit volatility. Figure 1 provides information on the time series evolution of the Lerner index, the Z-score as well as the denominator of the latter, i.e. profit volatility. The variables are first averaged by country and then across countries, to give equal weight to each country. The values of the market power measure (the Lerner index) are measured at the right-hand axis, while the values of the Z-score on the left-hand axis.

<**Insert Figure 1 around here**>

There is a close correspondence between the time series pattern of bank soundness (Z-score) and bank market power, which documents that competition and fragility are positively correlated over time. The lower graph, which plots the Lerner index and the volatility of bank profits, confirms this finding. An increase in market power is associated with a reduction of profit volatility. As both plots yield a similar insight, this is already a first indication that the empirical relationship between the Lerner index and the Z-score is not spuriously created by including bank profits in the numerator of the Z-score. Below, we provide further evidence that our main results are not driven by a spurious relationship between the Z-score and the Lerner index.

3.3 Country-level indicators of herding, regulation and institutional environment

We now discuss how different country-specific factors may create cross-country variation in the competition-stability relationship. Our hypothesis tests are informed by existing theories that show a differential impact of various policies on bank stability, when the degree of competition varies. Table 3 presents descriptive statistics for the different country-level variables, while Table 4 reports correlations. All variables exhibit substantial

variation, both over time and across countries, as documented by the within-country and between-countries variation.

<**Insert Table 3 around here**>

<**Insert Table 4 around here**>

3.3.1 Institutional and financial development

A first set of country traits that can influence the competition-stability relationship is the institutional framework and financial system structure in which banks operate. The institutional framework may affect the scope for adverse selection and moral hazard by entrepreneurs, which is one of the crucial ingredients in the model of **?**. First, we use an indicator of the **Depth of Information Sharing**, which captures the difference in information content between the credit registries in different countries. Credit registry institutions are public or private entities which collect information on the creditworthiness of borrowers and can help reduce both adverse selection and moral hazard problems that are inherent to the lending business (**?** and **?**). The index ranges between 0 and 6, with a higher value indicating that more information is available, and has an average of 3.9 across the countries in our sample. As borrowers realize that it will be harder to get a loan at another institution when they default on their current loan, they will have a stronger incentive to repay and they will choose a safer project (**?**, **?**).[16] Hence, a first testable cross-country hypothesis is that in countries with better information sharing systems an increase in market power is less detrimental to stability[17], since better information sharing systems will lower the entrepreneurs' incentive to take more risk .

In addition, we consider financial structure and, more specifically, competition for banks coming from financial markets. Specifically, we use **Stock Market Turnover**, i.e. the ratio of stocks traded to stocks

[16] **?** show for a sample of nearly 2400 banks in 69 countries that greater information sharing leads to higher bank profits and lowers bank risk.

[17] The empirical result that a loss in market power is more detrimental for bank soundness when there is more information sharing is also consistent with the theoretical predictions of **?**. They show that changes in the information structure of the market can have a significant impact on the likelihood of a banking crisis. More specifically, a reduction in the information asymmetries across banks may lead to an easing of lending standards (less screening), a deterioration of bank portfolios, and more volatile profits. Moreover, they show that the introduction of the threat of competition may actually induce the switch from screening to borrower pooling

listed, as an indicator of financial market development and thus an indicator of alternative funding sources for enterprises. The turnover ranges from zero in countries without stock exchanges to over 16, with an average of 0.54. More developed stock markets make it easier for firms to switch between bank-based and market-based funding. However, it also implies that firms who behave or default strategically (i.e., moral hazard) will suffer reputation losses in other markets as well. Moreover, a stock listing also requires more information disclosure and transparency (even in the absence of credit registries). This could lead to an additional effect of a change in competition on bank risk behavior. This leads us to hypothesize that, ceteris paribus, it is less likely to find a negative relationship between market power and bank stability in countries with well developed financial markets. Stock market turnover and credit information sharing are positively and significantly correlated with each other.

3.3.2 Regulatory and supervisory framework

A second group of country traits that influence the relationship between competition and stability consists of regulation and supervision designed to protect bank charter values and to prevent risk-seeking behavior if charters are eroded. Risk-adjusted deposit insurance or appropriate capital requirements would help to control risk taking, even in the presence of intense competition (**?**, **?**, **?** and **?**). These effects allow us to hypothesize that more stringent (risk-based) capital regulation may limit the negative influence that competition may have on stability. We therefore use a **Capital Stringency** index that indicates whether there are explicit requirements regarding the amount and source of capital that a bank should have.[18] A higher index indicates greater stringency. Capital Stringency ranges from 2 to 10, with an average of 5.8.

Another, popular regulatory measure to increase the stability of banking systems is deposit insurance, as it reduces the risk of bank runs (**?**). On the other hand, too generous deposit insurance schemes or inappropriately priced deposit insurance might increase moral hazard (see, e.g., **?** and **?**) since the safety net subsidy increases the liquidation value of the bank. Thus, a generous deposit insurance system will increase banks' risk-taking

[18] It measures the regulatory approach to assessing and verifying the degree of capital at risk in a bank. Specificaly, it includes information on whether the source of funds that count as regulatory capital can include assets other than cash, government securities, or borrowed funds, and whether the authorities verify the sources of capital.

incentives in more competitive environments. **Deposit Insurance Coverage** is proxied by deposit insurance coverage relative to GDP per capita. Deposit insurance[19] coverage ranges from less than 20% of GDP per capita to more than 20 times GDP per capita; in the regressions we will use this variable in logs.

In addition to regulation, such as capital requirements and deposit insurance, effective banking supervision is important. Monitoring banks is costly and difficult for both depositors and shareholders. Therefore, more effective supervision should provide incentives to limit bank risk taking and thus could soften the effect of competition on risk taking. Having **Multiple Supervisors** may lead to different supervisory approaches, which can generate useful information which would otherwise be neglected (**?**). However, it might also lead to regulatory arbitrage, exacerbating the effect of competition on stability. 16% of our sample observations (country-years) have multiple bank supervisors. Banking supervision may be supplemented by external governance which serves the same purpose. The **External Governance Index** includes information on the effectiveness of external audits, the transparency of financial statements and the evaluations by rating agencies and the incentives for future monitoring by creditors. This variable thus serves as a proxy for the influence of private monitoring mechanism. External Governance ranges from 6 to 16.5, with an average of 12.7.

Interestingly, these four indicators of the regulatory and supervisory framework are not strongly correlated with each other. The correlation table, however, shows a positive and significant correlation between Depth of Information Sharing and External Governance as well as between Stock Market Turnover and Multiple Supervisors. Deposit Insurance Coverage is correlated with both proxies of institutional and financial development.

3.3.3 Herding and market structure

A third important country characteristic that can influence the relationship between competition and stability is the covariation of banks' behavior, also known as herding. From a supervisory perspective, an important factor in deciding whether or not to intervene is whether the whole system or only a minor fraction of banks are at risk. **?** and **?** show that the supervisory decision to intervene a failing bank is subject to an implicit too-many-to-fail problem: when the number of bank failures is large, the regulator finds it ex-post optimal to bail out some or all failed banks. This, however, gives banks incentives to herd and increases the risk that

[19] **?**'s model also implies an interaction effect between competition and deposit insurance.

many banks may fail together. Hence, herding behavior may affect banks' incentives to increase risk-taking in response to an increase in competition. In addition, **?** and **?** show that a lower correlation of loan defaults makes it more likely that fiercer competition harms stability. When there is herding in risk-taking behavior, there will be fewer idiosyncratic defaults and the assumption of perfectly correlated loan defaults becomes more plausible. Therefore, if default correlation is high, we expect to see a reduction in the probability that the competition-fragility view is favoured over the competition-stability model.

An indicator of the too-many-to-fail and herding problem is the aggregate Z-score, which is the country-wide Z-score across all banks for a given year and country (i.e., how large is the aggregate capital buffer against industry wide losses). This variable - **Systemic Stability** - ranges from 0.185 to 6.297, with an average of $3.60\dot{4}$. An alternative indicator refers to activity restrictions, which may have the unwanted consequence of encouraging herding, as they limit banks' potential to venture in new markets if the bank faces fiercer competition in its core market. The **Activity Restrictions** index measures the degree to which banks are prohibited from engaging in fee-based activities related to securities, insurance and real estate and thus diversify away from more traditional interest spread-based activities. Lower values of the index indicate that fewer restrictions are placed on this type of diversification by banks; the index ranges from 4 to 15, with an average of 9.5. Herding can also occur without activity restrictions. When some banks invest in one type of product that generates high profits, other banks may be forced to imitate them, as otherwise shareholders will hold them responsible for the lower profitability of the institution. **Heterogeneous Bank Revenues** measures whether there are substantial revenue differences among financial institutions within a country and is calculated as the within-country, within-year standard deviation of the non-interest income share. A higher value indicates that there is less herding in revenues in the banking system. Heterogeneity-Revenues ranges from 0.031 to 0.340, with a mean of 0.180 and a standard deviation of 0.059. Activity restrictions is negatively and significantly correlated with both Heterogeneity-Revenues and Systemic Stability, i.e. countries with more homogenous and riskier banking systems also experience higher activity restrictions, while the other two variables are not correlated with each other.

The expected effects of these three sets of variables is summarized in the following table. The first column

represents the variable of interest. The second column contains the expected impact on the market power-soundness relationship (β). In two cases, theory does not make unambiguous predictions and it will be to the data to discriminate between competing hypotheses.

Variable	Expected Impact on β
Institutional and financial development	
Information Sharing	$+$
Stock Market Development	$+$
Regulation and Supervision	
Capital Regulation	$-$
Deposit Insurance	$+$
Multiple Supervision	$+$ or $-$
External Governance	$-$
Herding	
Activity Restrictions	$+$
Heterogeneous Bank Revenues	$-$
Systemic Stability	$-$ or $+$

4 Results

In the following, we first present results on simple cross-country estimations of the competition-stability relationship, before exploring co-variates of cross-country, cross-time heterogeneity in this relationship. Finally, we explore variation of the competition-stability relationship with specific bank characteristics.

4.1 Homogenous relationship between competition and stability

Regression-based evidence on the relationship between bank market power and bank soundness is reported in Table 5, where we assume a homogenous relationship between the two variables across countries and over time. In this pooled cross-country setup, we regress the ln(Z-score) on the Lerner index and a set of control variables, as described in regression equation (2) and impose that $\beta_1 = 0$. This assumption will be relaxed below.

The results in column 1 of Table 5 show a positive and significant relationship between market power and bank soundness. Put differently, an increase in competition, which erodes banks' pricing power, increases banks' risk taking behavior and is hence detrimental for financial stability. This result is in line with existing literature that also uses the Lerner index as a market power proxy (see, e.g., **?**). In contrast to Figure 1, where we identified the relationship in a time-series dimension, we now exclusively rely on the heterogeneity in the variables within a country and a given year (as we include time-varying country fixed effects).

<**Insert Table 5 around here**>

The effect is not only statistically, but also economically large. As the dependent variable is the natural logarithm of the Z-score, the point estimate can be interpreted as a semi-elasticity. A one-standard deviation reduction in the Lerner index, which equals 0.142, is associated with a drop in the Z-score of 28%. Put differently, the number of standard deviations profits have to fall before capital is depleted is reduced by 28% if market power is reduced by one standard deviation.

We verify the sensitivity of this result in several robustness tests, available upon request. First, we verify whether or not the results are dominated by countries that constitute the lion's share of our sample and weigh each observation with the inverse of the number of banks in the corresponding country.[20] We again find a positive and significant relationship between market power and bank stability, though with a slightly smaller coefficient. Second, we confirm the results for the pre-2007 sample, which is hence not contaminated by the exceptional events of the 2007-09 global financial crisis. Third, bank market power may be endogenous and the estimated relationship may reflect reverse causality if bank failures affect market structure and possibly the intensity of competition. While in all equations, we use lagged independent variables to address this possibility,

[20]To avoid overrepresentation of US banks in the pooled sample, we already limited the dominant presence of the US banks in the sample. For each time period, we include the largest 100 US banks as well as 1500 randomly selected banks.

we confirm the positive relationship between banks' market power and stability including bank-fixed effects and thus exploiting only within-bank variation over time. Finally, we confirm our results using IV (2SLS) regression results, with loan growth, the cost-income ratio and lagged values of the Lerner index as instruments. The F-statistic and J-statistic confirm the appropriateness of these instruments. In the pooled IV approach, we again find a positive impact of market power on bank soundness. The estimated coefficient is only slightly larger compared to the baseline case.

The results in column 2 of Table 5 show that the positive relationship between banks' market power and soundness is not spuriously created by regressing a price markup on a variable related to bank profitability. An increase in market power is associated with less volatile profits, in line with the lower panel of Figure 1. More market power (a higher Lerner index) is also positively affecting the capital to asset ratio, which is another component of the Z-score (coumn 3).[21] Next, we gauge the robustness of our findings to alternative measures of bank soundness. In the fourth column of Table 5, we employ a Z-score where profit volatility is measured over five-year rolling windows (instead of three years[22]). Even though the measure is different and the sample size is reduced, we do not find that the relationship between competition and stability is significantly different from the baseline approach in column 1.

In the following three columns of Table 5, we confirm the pooled sample evidence on the positive relationship between market power and stability by looking at alternative bank-level competition measures. In column five, we simultaneously include the subcomponents of the Lerner index, which is a relative markup of price over marginal cost. The average price of bank activities is a proxy for market power in the loan market, while the marginal cost is a proxy for the cost of funding (among other costs). Both price and marginal cost affect

[21] We do not report the results for the third component of Z-score, being ROA, as the link between profits and the Lerner index is mainly mechanical (the coefficient is positive and significant), as we discussed in Section 3.2.3.

[22] In an additional robustness check, available upon request, we examine whether deleting banks with less than three years of data affects our results. There are multiple reasons why banks are in the sample for only one or two years. Banks may have defaulted, they could be de novo banks, large acquisitions may result in a new entity, etc. All of these explanations are related to either risk (default) or competitiveness/market structure (entry or M&A). Hence, it may be a valid concern that this potentially introduces a sample selection bias and affects our results. Therefore, we also estimate a Heckman selection model to account for this possible sample selection bias. The results of the latter unreported test confirm that restricting the sample does not affect our results.

banks' risk-taking significantly and indicate that a reduction in the mark-up (more competition) originating from prices, costs or both leads to less stability. In column six and seven, we include the loan market share and market share in total assets[23] in addition to the Lerner index (which proxies for market power). Banks with more market power behave more prudently, while a large market share has a negative, but insignificant, impact on bank soundness.[24] In the last column we exclude loan loss provisions and annual asset growth as control variables. These variables capture credit risk and asset expansion, which are in itself first order drivers of bank risk. The coefficient of the Lerner index is slightly larger in this specification.

4.2 The competition-stability relationship across countries

So far, we have shown a conditional positive correlation between banks' market power and soundness. Behind this average relationship, however, is a large variation both over time and across countries, as illustrated in Figures 2 and 3.

<**Insert Figure 2 around here**>

Figure 2 shows the coefficient estimate on β if the baseline regression (as in Equation (2)) is run separately for each year in the sample period, including country fixed effects and the same group of bank-level control variables as discussed above. We find a positive and significant relationship between market power and stability across all years, but the estimated relationship varies significantly, with coefficient estimates ranging from over three to (1995) to less than one (1998). The time variation in the estimated relationship is much lower from 2001 onwards.

<**Insert Figure 3 around here**>

Figure 3 shows the conditional correlation between banks' market power and soundness across countries, with a very similar finding. In the first panel of Figure 3, the height of the bars shows the magnitude of the

[23] Since we include time-varying country fixed effects and hence look at within country variation, there is a high correlation between market share and bank size (and the rank correlation is perfect). Therefore, in the latter two specifications, we do not include bank size as a separate regressor in the regression.

[24] If we do not include the Lerner index in the latter two columns, we obtain that market share picks up the effect of the Lerner index. Market share has, in these unreported regressions, a positive and significant impact on bank soundness.

coefficient of the Lerner index when estimating Equation 1 for each country separately, using ln(Z-score) as the dependent variable. The coefficients that are significantly different from zero have a lighter shade. The average of the 79 estimated coefficients equals 1.63. Hence, on average, it seems that the franchise value paradigm dominates the risk-shifting hypothesis. The bar charts show that the conditional correlations in the left hand side graph are positive in most countries. However, there is a large amount of heterogeneity in the competition-stability relationship, ranging from a negative and significant relationship to a coefficient estimate of almost six. The standard deviation of the coefficient across the 79 countries is 1.40. A quick look at the country labels[25] on the X-axis also reveals that it is not just a developed versus developing countries story or that countries within specific regions exhibit similar behavior.

We also re-ran the regressions underlying Figure 3 using the negative of profit volatility for each country as dependent variable. These results are reported in the right hand side graph. On average, the relationship is still positive, although there are many more countries for which the estimated coefficient is negative compared to using the ln(Z-score) as the dependent variable. The rank correlation between the two sets of country-specific gauges of the market power-bank risk relation exceeds 0.90. Furthermore, a regression of one on the other has an R-squared of 0.80 and a slope coefficient not significantly different from one. This again confirms that the relationship between market power and fragility is not driven by having profitability in both dependent and explanatory variable.[26]

4.3 The competition-stability relationship: explaining cross-country variation

We first compute the pairwise correlation between the country-specific market power-bank soundness estimates (as reported in the left panel of Figure 3) and the different country characteristics. This creates some initial insights in the sources of the cross-country heterogeneity in the market power-bank soundness relationship. These correlations are reported in the last rows of Table 4. The results of this correlation analysis suggest that competition is more harmful for stability in countries where (i) there are more effective systems of credit

[25] Info on the country names, labels and exact numbers can be found in Appendix B.

[26] These results are available upon request. Furthermore, the estimated intercept is not significantly different from 1.2 (point estimate of 1.07 and standard error of 0.09), which is the difference in the coefficient on the Lerner index in columns 10 and 11 of Table 6, where we further explore this robustness test.

information sharing (pairwise correlation is 0.279), (ii) stock markets are more liquid (0.253), (iii) deposit insurance is more generous (0.654), (iv) there are more restrictions on the permissible range of activities (0.511) and (v) the banking system is more stable (0.429). The signs of the significant correlations are in line with the theoretical predictions as explained in Section 3.3. Capital stringency, multiple supervisors, external governance and herding in revenues are not significantly correlated with the estimated country-specific competition-stability trade-off.

Table 6 documents that these preliminary findings of the correlation analysis are confirmed using regression analysis to estimate equation (2). For ease of comparability of the economic significance, all country-specific variables have again been normalized to have zero mean and unit variance, before interacting them with the Lerner index.

<**Insert Table 6 around here**>

In the first nine columns of Table 6, we analyze one interaction term at a time. The results in Table 6 indicate that the relationship between banks' market power and soundness is, on average, positive. This relationship is stronger in countries and periods where and when (i) there are more effective systems of credit information sharing (ii) stock markets are more liquid, (iii) deposit insurance is more generous, (iv) there are multiple supervisors, (v) there are more restrictions on the permissible range of activities, (vi) banks herd more in terms of revenue structure and (vii) there is more systemic stability. When including the interaction of the Lerner index with all variables simultaneously (column 10), we continue to find that the relationship between market power and soundness is stronger in countries with more effective systems of credit information sharing, better developed stock markets, more generous deposit insurance, higher activity restrictions and more stable banking systems. This confirms the previously documented evidence of the correlation analysis.

Interestingly, the absolute value of the coefficients of the significant variables varies between 0.167 and 0.66. The coefficient on the Lerner index without interaction is 1.384. A one standard deviation increase in one of these variables hence leads to a 14% to 31% change[27] in the relationship between competition and

[27] A one standard deviation increase in the stock market turnover ratio (deposit insurance coverage) leads to an estimated impact of Lerner on bank soundness of 1.51 (2.044). This is an 11% (39%) increase compared to the average bank in the average country, for

fragility. The results in Table 6 are thus not only statistically, but also economically large. This is also indicated in the right hand side part of the table. Specifically, we report the predicted β coefficients at the 5th and the 95th percentile of the respective country-specific characteristic. We note that in all cases, there is a positive relationship between banks' market power and soundness. The magnitude of the relationship, however, varies significantly. For example, the magnitude of the market power-soundness relationship is more than twice as high at the 95^{th} percentile of deposit insurance generosity compared to the 5^{th} percentile. A similarly large difference in economic impact is obtained when switching the variables credit information sharing or activity restrictions from the value at the 5^{th} percentile to the 95^{th} percentile.

Finally, the two cases mentioned in the lower end of these columns show the impact of a change in competition corresponding to one of the following two scenarios. Case 1 reports the predicted relationship between banks' market power and soundness for a country that is average for each of the country-specific variables. The predicted value is 1.384. A one standard deviation increase in competition (drop in Lerner of 0.127) results in a 17.6% lower Z-score. Case 2 resembles a fictitious post-crisis scenario with generous deposit insurance schemes (1.65 standard deviations increase) and stronger restrictions on bank activities (a 1.65 standard deviation increase), reflecting recent regulatory reforms or reform suggestions. Compared to the average country (case 1), the relationship between banks' market power and soundness is almost 110% higher, suggesting a very negative impact of competition on stability in this scenario. In this scenario, the number of standard deviations by which profits can fall before equity is depleted drops with 37% in response to a one standard deviation reduction in market power. The economic magnitude of this scenario analysis is similar if we restrict the sample to pre-2007 observations.

4.4 Sign of the trade-off

The previous section documents a substantial amount of variation in the competition-stability relationship and offers insight into the drivers of this heterogeneity. When using the Z-score as the dependent variable, we find cross-country variation, but the relationship is almost always positive. Hence, one could argue that we mainly confirm previous empirical evidence that showed that more competition is harmful for bank stability. However,

which the impact is 1.384.

we offer two more important insights. First, even if the relationship between competition and stability would not flip sign, the magnitude of this heterogeneity is economically important. A one-standard deviation change in the Lerner index equals 0.127 (within country-year variation). For the average country (across countries, the average coefficient is 1.63, as can be seen in Figure 3), this implies that a one-standard deviation reduction in market power leads to a 21% reduction in the Z-score. The cross-country standard deviation in the market power-stability relationship is 1.40. This implies that the impact of a similar change in market power varies substantially across countries from almost zero (mean, 1.63, minus one standard deviation, 1.40) to almost 40% (mean plus one standard deviation).

Second, while we follow most of the literature and use the Z-score as the bank soundness measure, we acknowledge that this may cause a mechanical relationship. The Lerner index, our proxy for bank market power, relies on bank profitability, which is also one of the constituents of the Z-score. Hence, we redo the entire analysis and use the volatility of profits as the risk measure, thus avoiding the build-in or hard-wired relationship between the Z-score and the Lerner index. We find that on average the relationship is still positive but much lower. For almost half of the countries, the market power-stability relationship is negative or statistically indistinguishable from zero. More importantly, it does not affect the coefficient of the interaction terms. The results in column 11 of Table 6 show that the interactions between country characteristics and banks' market power, on the one hand, and bank risk, on the other hand, are not driven by having a proxy of profitability/revenues in both the dependent and explanatory variable. When using the negative of the denominator of the logarithmic Z-Score (the log of the standard deviation of ROA), the coefficients on the interaction variables are similar in statistical and economic importance as in column 10.[28] Given its magnitude, the economic impact analysis documented in the right hand side panel indicates that in some countries an increase in competition might lead to no effect on bank soundness or even an increase in stability (rather than support for the franchise value hypothesis), depending on the deposit insurance coverage, depth of information sharing and activity restrictions.

[28] We take the negative of profit volatility such that an increase also indicates more stability.

4.5 Additional results: bank failure, contestability, globalization, and too big to fail

So far, we have exploited cross-country and time-series variation in the competition-stability relationship. However, banks' risk-taking incentives might also be influenced by their own relative position in the market. Specifically, we posit that failing banks have a greater incentive to exploit competition towards more aggressive risk-taking. Further, banks with a larger market share that therefore consider themselves too-big-to-fail might also exploit increasing competition to take more aggressive risks. Finally, banks in markets with varying degrees of foreign-owned banks might react differently to changes in the competitive environment. This subsection assesses whether such bank-level variation exists.

<**Insert Table 7 around here**>

Table 7 shows the relationship between competition and bank stability while controlling for the potential impact of failing banks and banking crises. The first column shows our baseline competition-stability regression, as reported in column 10 of Table 6. In the second column, we interact the Lerner index with a distressed exit dummy. The distressed exit dummy equals one for banks that make losses in the two years before the bank exits the sample. In this way, we only capture the banks that actually were in distress before they leave the sample. The significant and positive interaction term between competition and the exit dummy indicates that banks that are in trouble before leaving the sample react more strongly to a change in competition. Thus, banks that are in distress gamble even more than others when competition rises, probably because there is not much left to loose for them. In the third regression, we only look at banks that did not exit the sample (Distressed Exit Dummy=0), while adding interaction terms between the Lerner index and country-specific characteristics that potentially influence the competition-stability relationship. The results show that market power still has a positive impact on bank stability for these banks. Furthermore, as shown in our previous analysis, banks operating in a country with overall more effective systems of credit information sharing, generous deposit insurance, higher activity restrictions and higher systemic stability react stronger to a change in competition. This shows that our main results are not driven by bank-specific distress situations. In the last two columns, we control for the potential impact of systemic banking crises. Based on **?**, we create a dummy variable indicating whether a country was experiencing a systemic banking crisis in a specific year. We then add an interaction term between

this variable and the Lerner index to our baseline specification. Column 4 shows that adding this interaction term has a limited impact. The systemic stability variable turns insignificant (because of the strong negative correlation with the dummy variable), while all other results still hold. The interaction term itself is not significant. In column 5 we control whether the recent financial crisis is driving our results. Therefore, we rerun the regression on the pre-2007 period. The majority of our results still hold, only the credit information sharing variable turns insignificant.

<**Insert Table 8 around here**>

Table 8 shows the results for the baseline competition-stability regression while controlling for the impact of bank specialisation, bank market share and foreign bank presence. The first column retakes our baseline results. In the second column, we restrict our sample to commercial banks only. Focussing on one particular type of banks reduces concerns on the potential impact of differences in the regulatory framework for different types of banks. We only look at commercial banks as they are the largest subgroup in our sample and allow us to keep all countries in the sample. The results for the commercial banks mainly confirm our baseline results for the full sample. The interaction term with two of the herding variables loses significance (activity restrictions and systemic stability), but our other herding variable turns significant with the expected negative sign. In the third column, we add a squared term of the Lerner index. Including the squared term does not affect the main results on the interaction variables as can be inferred from comparing column 1 and 3. The only variable that turns insignificant after including the squared Lerner variable is credit information sharing. We still obtain that banks operating in a country with more generous deposit insurance, higher activity restrictions and higher systemic stability react stronger to a change in competition. We estimate a significant and negative coefficient on the squared term, suggesting a non-linear, inverse U-shaped relationship between market power and bank soundness, which is in line with **?**'s theoretical predictions. However, the relationship does not turn negative until a value of 0.28 for the Lerner index is reached, which is more than one standard deviation above its mean and does not turn significant and negative below 0.33 (which corresponds to only 5% of all bank-year observations). In the subsequent tests, we always include the squared Lerner term to avoid that the measure of market share and TBTF would spuriously pick up this effect. In the third column, we add the interaction of the

Lerner index with a bank's market share (measured in terms of total assets). This allows us to check whether banks with a higher market share have an incentive to take more risk in more competitive environments, because they can potentially see themselves as too-big-to-fail. Since we also include bank size, our interaction term only captures the extent to which TBTF may affect bank incentives in response to changes in market power. The results indicate that there is no direct too-big-to-fail effect influencing the competition-stability relationship.[29] In the fifth column, we do a similar exercise, but now using a market share dummy that equals one for banks with a market share that is larger than 10 percent. Again, we do not find a significant direct effect of a banks' market share on the competition-stability relationship. In columns 6 and 7, we use the interaction of the Lerner index with dummies indicating banks whose assets are above 10% or 25% of GDP of its home country. Banks that are large relative to the country's GDP are systemically important and could be perceived to be too-big-to-fail. This may affect their risk-taking incentives as well as the Lerner index through lower funding costs. The interaction enters significantly in neither case, indicating that these banks do not drive the results, nor behave differently. Overall, we cannot find evidence that competition exacerbates the too-big-to-fail phenomenon.

In the last column, we interact the Lerner index with the share of foreign banks.[30] Banking markets with a higher fraction of foreign banks are more contestable, which should lead to more disciplining of the incumbent banks. At the same time, the behavior of foreign banks is influenced not only by the structure and competition in the local market, but also in the home and global market, thus reducing the impact of local market power on risk-taking. We find a negative and significant interaction term between the Lerner index and the share of foreign banks, suggesting that a higher share of foreign banks in the total number of banks reduces banks' incentives to take on risks in response to a drop in market power.

[29] As mentioned at the end of the previous section, the findings are also robust to including banks' market share and its interaction with the same country-specific factors. Few of the interaction terms with banks' market share are significant and their inclusion does not affect the sign, size or significance of the interaction terms of the Lerner index with country-specific factors.

[30] Measured at the country level as the percentage of foreign banks among total banks, see **?**. Unfortunately, our database does not allow us to measure each bank's foreign activities.

We further subject our findings to a battery of unreported robustness tests.[31] While the dependent variable throughout our analysis is the Z-score in which the denominator, volatility of profits, is measured over a three year interval, the results are robust to using a Z-score in which the denominator is measured using five year rolling windows. The findings are also robust to including banks' market share and its interaction with the same country-specific factors. Few of the interaction terms with banks' market share are significant and their inclusion does not affect the sign, size or significance of the interaction terms of the Lerner index with country-specific factors. We also run a regression in which we include year and country fixed effects (rather than their interaction). In such a setup, we can also include the nine country characteristics as independent variables (in addition to their interaction with the Lerner index). This alternative setup does not affect the findings on the interaction terms. In addition, we find that banks are more stable in countries with stricter capital regulation, a more stable banking system, less restrictions on the range of activities and a single supervisor.[32] Furthermore, dropping the loan loss provision ratio and asset growth from the set of bank-specific control variables leads to a slightly higher coefficient on the Lerner index (as in the case without interaction terms, see the last column of Table 5), but does not affect the interaction variables. Finally, the number of countries and observations vary in each specification of Table 6 due to the availability and coverage of different country-specific characteristics. When repeating the regressions reported in columns 1-10 using a common sample (the sample used in column 10), we obtain similar results.

5 Robustness and limitations of the dataset

In various sections of the paper, we talked about robustness tests or potential limitations of the analysis. In order not to interrupt the flow of the paper, we only discussed them briefly. In what follows, we discuss these and

[31] We also conduct the regressions reported in Table 7 and Table 8 with the volatility of profits as the dependent variable. Almost all results contrinue to hold.

[32] Hence, two of these country-specific factors affect the dependent variable directly, but the impact is related according to the level of the Lerner index. We find that the negative impact of activity restrictions on bank soundness is reduced the more pricing power a bank has. Hence, limiting the scope for expansion in non-traditional banking activities will harm the banks with limited market power and may benefit banks with pricing power. Systemic stability has a positive effect on individual bank soundness and the effect is stronger for banks with more market power.

other robustness tests in more detail. All results are available upon request but not reported to save on space.

5.1 Globalization

One potential limitation of the results and dataset might be that banks have expanded abroad in many dimensions. Nowadays, banks may be funded with foreign deposits, originate foreign loans and are (partly) foreign-owned. If banks operate internationally, they also compete internationally and price-cost margins should reflect this. Moreover, this could create a harmonization of the competition-stability trade-off across countries, mitigating the scope for country-specific features to explain the remaining heterogeneity. As globalization increased substantially over the sample period, we indeed observe a decrease over time in the cross-country variation in the competition-stability relationship. The cross-country standard deviation in the competition-stability relationship reduces from 1.80 in the early sample years to approximately 1.30 for the latter part of the sample. The main source of the reduction is the lower mass in the left tail of the competition-stability trade-off. The minimum increases from -4 in the early sample years to -2 in the second half of the sample. Notwithstanding the reduction in heterogeneity, the variability across countries is still sufficiently large to perform an investigation into the sources of this variation.

The previous argument assumes that all banks within a country expand abroad to the same extent. This may not be true. Most smaller banks still operate almost entirely domestically. As we use consolidated data, this may create a wedge between the measurement of market power for domestic versus international banks. Unfortunately, bank-level data on the decomposition of assets and liabilities in domestic or cross-border origin is not available.[33] Assuming that there is a strong correlation between size and foreign activities, we run several robustness checks, both on the specification with and without the interaction terms. We run a regression where we exclude the 10 (20) largest banks of each country, where the top 10 (20) is allowed to change every year. We also run a regression on a reduced sample of banks that have a cumulative market share (after sorting on market share from low to high, by country and on a yearly basis) of less than 50% (20%), such that we only focus on the smallest banks in a country. The results are similar for these samples of banks which contain mainly

[33] **?** recently constructed a database on international banking, but only focus on the ownership structure. However, this need not be informative on cross-border loans or funding.

domestically oriented banks.

5.2 Reconciling seemingly conflicting empirical evidence

The majority of the existing papers finds support for the franchise value hypothesis. On the other hand, ? obtain support for the competition-stability view. Our setup and results may provide a framework to rationalize the seemingly conflicting findings. For example, ? only include developing countries in their cross-country setup.[34] However, the amount of information sharing and the liquidity of the stock market is significantly lower in developing countries compared to the countries they omit (US, Japan and Western Europe). In our sample, the difference between the average value of these two indicators in both groups is approximately 0.7 standard deviation (for both measures). These factors mostly affect the risk-shifting incentives of the entrepreneurs. In addition, deposit insurance coverage is also significantly lower in the developing countries. The difference in means is 0.32 standard deviations with the omitted group of developed countries. The results in column 11 of Table 6 indicate that on average the coefficient of the Lerner index is 0.199. However, a 0.70 standard deviation reduction in information sharing and stock market liquidity and a 0.32 drop in deposit insurance coverage yields a coefficient of -0.32.[35] Our results thus indicate that, compared to the average country, combining these three effects can eventually lead to a negative impact of the Lerner index on profit volatility, which is in line with the competition-stability view. When doing a similar analysis on the point estimates of column 10 of Table 6, we see an equally large drop in the implied market power-bank soundness relationship. However, the point estimate now drops from an average impact of 1.38 to 0.87, which is still significantly positive (but also affected by the hard-wired effect of profitability). Therefore, we would like to stress that we focus more on the magnitude of the cross-country variation rather than the exact sign (as the latter is measure specific and the former is not).

[34] There are also other differences. We use a bank level measure of market power whereas they use a country-level indicator of concentration (HHI). In contrast to concentration indices, the Lerner index does not necessarily imply defining the relevant banking market. In addition, market structure does not need to be related to market power, as has been shown in other studies (see e.g. **?**)

[35] I.e.: $0.20 - 0.70 * 0.32 - 0.70 * 0.13 - 0.32 * 0.64$, and putting all other interaction terms at zero (as the country variables are standardized).

5.3 Limiting market power

We document that certain country-specific characteristics mitigate or amplify the effect of market power on stability and conclude from this that these country characteristics create heterogeneity in the competition-stability relationship. An alternative explanation would be that certain types of regulation affect the extent to which banks can exercise market power. While time-varying country fixed effects absorb the direct effect of various regulations on the level of competition (and stability), it may still be that these regulations lead to the absence of within-country variation in banks' market power and hence artificially drive down the impact of market power on stability (as there would be little variation in the independent variable). To check the validity of this argument, we first compute the variation in the Lerner index for each country and year. Subsequently, we regress this variation on the country characteristics used in our analysis. A number of conclusions can be drawn from this analysis. First, the R-squared of such a regression is low (0.13), indicating that the within country-year variation in banks' pricing power is largely unaffected by the country-characteristics. Second, while some coefficients are significant, they are quite small and leading to a low economic impact. As all right hand side variables are standardized, we see for instance that even a four standard deviation decrease in deposit insurance would only lead to a drop in the standard deviation of the Lerner index from 0.14 to 0.11, which is still sufficiently large such as not to cause an automatic zero relationship between market power and bank stability.

5.4 Z-Score decomposition

Other papers have looked at different risk metrics or competition measures. Throughout the paper, we have motivated substantially why the Lerner and the Z-score are our preferred market power and risk measures. Nevertheless, we have run numerous robustness checks. We decompose the Z-score in its constituents and find that a higher Lerner index increases bank profits, as well as lowers the volatility of profits. Moreover, banks with more market power also hold higher capital buffers (see results reported in Table 5). The latter finding is in line with **?**.[36] Hence, the Lerner index is significantly related with each of the three components

[36] A positive relationship between market power and bank capital is in line with the franchise value hypothesis but in contrast to for instance **?**. However, the strong and positive relationship between the Lerner index and capital ratio is also in line with stylized empirical facts about corporate (and bank) capital structure (see e.g.: **?**, **?**). Firms/banks with higher profits (e.g. due to more pricing power)

of the Z-score individually, with the expected sign. In addition, we check the robustness of the results when we include the capital ratio as an independent variable. We compare the results obtained by including the capital ratio in four alternative specifications (specification with and without interaction between Lerner and country characteristics; combined with alternating the Z-score and profit volatility as the dependent variable). All the results reported in the paper still hold. Hence, controlling for bank capital in either a specification with or without a possible mechanical relationship (due to profitability) between the Lerner index and bank risk does not affect the results regarding the sources of cross-country variation in the competition-fragility relationship. We also document throughout the paper that the impact of country characteristics on the market power-bank soundness relationship is similar when using either the Z-score or profit volatility as the dependent variable.

5.5 Endogeneity

The relationship between market power and bank risk-taking might be endogenous. We try to control for its potential impact in various ways, including by using lagged values for the explanatory variables and using instrumental variables. In this final robustness test, we combine an instrumental variable approach with bank-fixed effects. We use the cost-to-income ratio, market share $\times$ bank sector concentration, and loan growth as instruments. The choice of instruments is motivated by **?** who has developed a new measure of competition that incorporates the idea that competition favors efficient firms. Hence, the cost-to-income ratio, a proxy for cost efficiency, should be a good instrument for market power. The interaction between market power and concentration is included as it has been shown by **?** that one of the main factors affecting banks' franchise values is its market share in a weakly concentrated market. As **?**, we also use loan growth as an instrument, the idea being that a strong increase in loan growth can be one of the characteristics of a more aggressive institution.

will be able to manage their capital ratio 'passively' by means of retained earnings (or dividend distributions), rather than deciding to change leverage actively via external funding. The choice between active and passive capital management (and hence the relationship between the Lerner index and bank capital) will also be affected by country characteristics. Passive management will be more frequent in countries where external financing is more costly (less liquid stock markets), whereas earnings retention may be less in countries where the principal agent problem between bank equityholders and debtholders is larger (more deposit insurance reduces monitoring incentives). We leave a detailed analysis of the impact of country characteristics on the profit (market power)-bank capital relationship for further research.

?, for example, show that banking deregulation in the U.S. led to higher growth in credit card loans. In addition, we also include bank fixed effects to mitigate reverse causality or endogeneity stemming from time-invariant bank-specific heterogeneity such as ownership characteristics or a time-invariant international focus.[37] The results are reported in Table 9 and confirm the previous findings. The dependent variable in the first column is the Z-score, while we use the inverse of the denominator of the Z-score (minus the logarithm of the standard deviation of profit volatility) as a dependent variable in the second column. The last two columns are similar to the first two but also include instrumented interaction effects, and are hence the counterpart of the results reported in the last two columns of Table 6, while controlling for endogeneity by means of bank fixed effects and instrumental variables. The statistical and economic significance of the coefficient estimates is similar to the ones reported in Table 6, confirming that our findings are not driven by endogeneity.

6 Conclusion

This paper documents significant cross-country heterogeneity in the competition-stability relationship. While, on average, it seems that the franchise-value paradigm dominates the risk-shifting hypothesis, this full sample relationship hides a substantial amount of cross-country heterogeneity, with estimates ranging from significantly negative, over insignificant to mostly strong positive relationships between market power and stability.

We develop a framework to assess how regulation, supervision and other institutional factors may make it more likely that the data favor one theory over the other, i.e. the charter-value paradigm over the risk-shifting paradigm. We show that an increase in competition will have a larger impact on banks' risk taking incentives in countries with stricter activity restrictions, more homogenous bank revenue structures, more generous deposit insurance and more effective systems of credit information sharing. Our findings help understand the seemingly conflicting empirical evidence. Most studies tend to find results in favour of the competition-fragility view. However, if one would sample banks from countries/regions with less strict activity restrictions and

[37] Unfortunately the latter information is not available in the database and is infeasible to hand-collect for such a large scale database. For example, **?** hand collect information on governance, but they limit the sample to the 10 largest banks in a limited number of countries (244 banks in total)

capital regulations, less homogenous bank revenue structures, no deposit insurance and credit registries, obtaining insignificant or the opposite result need not be inconsistent. Understanding the market, regulatory and institutional framework in which banks operate is thus critical in gauging the effect of competition on stability.

Our findings have important policy repercussions. They suggest that activity restrictions and herding trends can exacerbate the negative impact of competition on bank stability so that regulatory reforms have to take this into account. We show that the too-many-to-fail phenomenon is worse in more competitive environments. They also stress the importance of the moral hazard risk of generous deposit insurance, exacerbated in more competitive environments. In the midst of the 2007-2009 crisis, many countries increased the generosity of the deposit insurance schemes. At the same time, there were calls for restrictions on banks' activities (as was the case after the Great Depression when the U.S. imposed the Glass-Steagall Act). Mimicking this post-crisis scenario in a fictitious ceteris paribus analysis reveals that the relationship between market power and soundness is almost twice as strong compared to the benchmark case, suggesting a very negative impact of competition on stability in this scenario. In the base scenario, a one standard deviation reduction in market power leads to a drop in the Z-score of 17.6%. In our fictitious post-crisis scenario, a similar loss in market power leads to a 37% reduction in the average Z-score (which is the buffer of capital against losses expressed in terms of profit volatility). In the post-crisis scenario with more generous deposit insurance in place, the sensitivity of the Z-score (or profit volatility) to changes in the Lerner index has increased. Whether this ultimately is good or bad depends on the direction of the change in the Lerner index. If banks' pricing power has been reduced after the crisis, then our results indicate that the regulatory changes after the crisis aggravated the negative impact on bank instability. Our findings underline the importance of regulatory policies and market structure for stability. In addition to a direct effect of these policies on risk-taking incentives of banks, they also have an indirect effect by dampening or exacerbating the effect of competition on banks' riskiness.

Figure 1: Evolution over Time of Market Power, Bank Stability and Profit Volatility

This graph contains information on the relationship between bank market power and bank soundness. The upper figure shows the evolution over time of our two main variables of interest: market power and bank soundness. Market power is proxied by the Lerner index, which is the relative markup of price over marginal cost. Bank soundness is captured by the natural logarithm of the Z-score. The Z-score equals the sum of equity over total assets and return on assets divided by the three year rolling standard deviation of return on assets. Both indicators are initially calculated at the bank-year level and then averaged by country on a yearly basis between 1994 and 2009. The plotted lines correspond with the yearly averages of these cross-country averages. The evolution of the Z-score is shown on the left axis, whereas the evolution of the Lerner index is shown on the right axis. The lower figure depicts the evolution, between 1994 and 2009, of the Lerner index and the volatility of return on assets, which is the denominator of the Z-score. The volatility of bank profits (ROA) is again calculated on a three year rolling window basis. Again, we first compute this measure by bank-year observation, before averaging first at the country-year level and subsequently by time period.

Figure 2: Evolution over Time of the Conditional Correlation between Bank Market Power and Stability

This graph shows the evolution of the conditional correlation between a bank market power measure and a bank stability measure between 1994 and 2009. Bank market power is proxied by the Lerner index, which is the relative markup of price over marginal cost. Bank soundness is captured by the logarithm of the Z-score, which equals the number of standard deviations bank profits have to fall before the equity cushion is depleted. The height of the bars shows the magnitude of the coefficient of the Lerner index when running year-by-year regressions of the Z-score on the Lerner index, and a group of bank-specific control variables. We also include country fixed effects to control for unobserved effects at the country level. Standard errors are robust and clustered at the country level. All depicted correlations are significant at the 5 percent level.

Figure 3: Correlation of Bank Market Power and Stability

This graph contains information on the relationship between bank market power and bank soundness for all 79 countries in our sample between 1994 and 2009. Bank market power is proxied by the Lerner index. In the left graph, bank soundness is captured by the Z-score, which equals the number of standard deviations bank profits have to fall before the equity cushion is depleted. In the right graph, bank soundness is captured by the negative of the volatility of bank profits, which equals to one over the denominator of the Z-score. In the graph, the height of the bars shows the magnitude of the coefficient of the Lerner index when regressing bank soundness on the Lerner index and a group of bank-specific control variables for each country separately. The bars are sorted from low to high and the country labels are mentioned on the X-axis. The coefficients that are significantly different from zero at the 10 percent level have a lighter shade. Significance is determined based on robust standard errors clustered at the bank level. Appendix B contains information on the country names, abbreviations, average Lerner, average Z-score and the correlation between them.

Table 1: Bank-specific Variables: Summary Statistics

This table shows the total sample summary statistics for the bank specific variables used throughout the paper. Bank specific data is retrieved from the Bureau Van Dijck Bankscope database. The full sample contains 80822 observations. The table consists of three parts. The first panel contains information on the mean and standard deviation of the variables that are used as control variables in the competition - stability regressions. The impact of banks' business model on bank soundness is proxied via its funding structure (share of wholesale funding equals the share of money market funding in money market funding and total deposits), asset mix (loans to total assets) and revenue composition (non-interest income in total income). We also control for bank size, credit risk (loan loss provisions to total interest income) and bank strategy (annual growth in total assets). We have three types of banks in our sample: Commercial Banks, Cooperative Banks and Savings Banks. The second panel summarizes the variables that are needed to construct the Lerner index. The Lerner index is the relative markup of price over marginal cost. The average price of bank activities equals the ratio of total revenues over total assets. Marginal costs are obtained after estimating a translog cost function. Using a translog specification, we relate banks' total operating cost to three input prices (price of fixed assets, price of labor and price of funding). They are constructed as respectively the share of other operating and administrative expenses to total assets, the ratio of personnel expenses to total assets and the ratio of interest expenses to total deposits and money market funding. The third panel contains information on the main variables of interest: market power and bank riskiness. Market power is proxied by the Lerner index, whereas our bank stability indicator is the natural logarithm of the Z-score. The Z-score is calculated as the sum of equity over total assets and return on assets divided by the three year rolling standard deviation of return on assets. For all variables, we depict the full sample standard deviation. In the lower panel, we also provide additional information on the variation of market power and bank soundness (i) across bank averages, (ii) within banks, i.e. after subtracting the bank-specific mean, (iii) across banks after subtracting the country-year average, and (iv) between countries (after averaging over banks within a country).

Variable	Mean	Standard Deviation
Determinants of Bank Soundness		
Share of Wholesale Funding	0.0559	0.1347
Loans to Total Assets	0.5830	0.1882
Non-Interest Revenue Share	0.2635	0.1763
ln(Total Assets)	6.4467	1.857
Loan Loss Provisions to Interest Income	0.1496	0.1926
Annual Growth in Total Assets	0.1028	0.2534
Commercial Bank dummy	0.5335	0.4989
Cooperative Bank dummy	0.2822	0.4501
Savings Bank dummy	0.1844	0.3878
Translog Cost Function		
Total Operating Cost	280.3789	877.9428
Price of Fixed Assets	1.7468	3.2794
Price of Labor	0.0158	0.0097
Price of Funding	0.0411	0.0338
Average Price of bank activities	0.0769	0.0419
Marginal Cost	0.0672	0.0386
Bank Soundness and Market Power		
ln(Z-score)	4.0064	1.321
	Between Bank Variation	1.108
	Within Bank Variation	0.841
	Within Country-Year variation	1.146
	Between Country Variation	0.532
Lerner	0.1239	0.143
	Between Bank Variation	0.138
	Within Bank Variation	0.089
	Within Country-Year variation	0.127
	Between Country Variation	0.060

Table 2: Bank Competition and Market Structure Measures: Correlations

This table provides information on the correlation between various proxies of bank market power, market structure and competition. Correlation measures are obtained at the country-year level. All competition or market structure measures are constructed such that an increase indicates more market power or concentration. If a variable varies at a more detailed level (e.g. the Lerner index varies at the bank level) it is first averaged at the time-country level. The Lerner index is a bank-specific, time-varying measure of market power. It is calculated as the relative markup of price over marginal costs. Market Share is the average market share of a bank in a country in a given year, based on total assets. In this table, we use the inverse of the number of banks, such that a higher value indicates an increase in market concentration. HHI(TA) is the Hirschmann-Herfindahl index of concentration of total assets. It measures market concentration by adding the squares of the market shares of all banks in a country. The more disperse the market structure, the lower this value will be. CR3 is an alternative concentration measure. It reflects the market share of the three largest banks in a country. The last measure is the Panzar-Rosse H-statistic, which is an estimated structural competition measure. The estimations are done at the country level over five year rolling windows. We take the negative of the H-statistic, such that a higher value also indicates an increase in market power. p-values are in parentheses.

Variables	Lerner	Market Share	Inv(number of banks)	HHI(TA)	CR3
Market Share	0.114				
	(0.000)				
Inverse(number of banks)	0.132	0.352			
	(0.000)	(0.000)			
HHI(TA)	0.028	0.134	0.165		
	(0.351)	(0.000)	(0.000)		
CR3	0.072	0.229	0.154	0.887	
	(0.018)	(0.000)	(0.000)	(0.000)	
-H-statistic	0.135	-0.003	-0.060	-0.004	0.021
	(0.000)	(0.932)	(0.054)	(0.893)	(0.498)

Table 3: Determinants of Heterogeneity in the Competition-Stability Relationship: Summary Statistics

This table shows the summary statistics for the country-specific variables used in this paper. We categorize them in three groups. First, the institutional and financial development of a country is captured by the depth of the information that is available at credit bureaus and the development of the stock market. The second set of variables is related to regulation and supervision with proxies for the strength of capital regulation, deposit insurance, the number of supervisors and the strength of external governance. The last group of variables captures market structure and herding behavior: activity restrictions, revenue heterogeneity (the within country dispersion of non-interest income share) and systemic risk (measured by the country-level Z-score). Not all variables are available for all countries or for the full sample period (1994-2009). This explains why the number of observations ranges between 876 and 1073. Detailed information on the construction and data source of these country-specific variables are provided in Appendix A. For each variable, we report some basic summary statistics (mean, standard deviation, minimum and maximum) as well as information on the variation. We report the between variation (variation between countries) as well as the within variation (variation over time) as well as the ratio of between to within variation.

Variable	Observations	Mean	St. Dev.	Min.	Max.	Nr. of countries	Between variation	Nr. of years	Within variation	$\frac{\text{Between}}{\text{Within}}$
Institutional and Financial development										
Depth of Information Sharing	969	3.893	1.969	0.000	6.000	71	1.928	13.648	0.554	3.478
Stock Market Turnover	1018	0.541	0.803	0.000	16.781	76	0.549	13.395	0.610	0.900
Regulation and Supervision										
Capital Stringency	906	5.786	1.804	2.000	10.000	72	1.432	12.583	1.170	1.224
Deposit Insurance Coverage	1069	0.148	1.515	-1.661	3.271	78	1.339	13.705	0.783	1.711
Multiple Supervisors	899	0.164	0.370	0.000	1.000	72	0.251	12.486	0.259	0.970
External Governance Index	898	12.686	2.058	6.000	16.500	72	1.576	12.472	1.447	1.090
Herding and Market Structure										
Activity Restrictions	876	9.471	2.332	4.000	15.000	72	2.116	12.167	1.162	1.821
Heterogeneous Bank Revenues	1073	0.180	0.059	0.031	0.340	79	0.044	13.582	0.039	1.148
Systemic Stability	989	3.604	1.141	0.185	6.297	79	0.659	12.519	0.942	0.699

Table 4: Determinants of Heterogeneity in the Competition-Stability Relationship: Correlation Table

This table provides information on the correlation between the country-specific variables used throughout the paper. The variables used for this table are averages at the country level. The table contains pairwise correlation coefficients as well as p-values (in brackets) that indicate the significance of the correlation. We also indicate the number of countries that are used to calculate each correlation coefficient. Detailed information on the construction of these variables can be found in Appendix A. The last set of rows contains the correlation between the country characteristics and the estimated relationship between market power and bank soundness (as reported in Figure 3 (left panel).

Variables	Depth of Information Sharing	Stock Market Turnover	Capital Stringency	Deposit Insurance Coverage	Multiple Supervisors	External Governance	Activity Restrictions	Heterogeneity-Revenues	Systemic Stability
Stock Market Turnover	0.260								
	(0.032)								
Nb. Obs.	68								
Capital Stringency	-0.151	0.039							
	(0.231)	(0.748)							
Nb. Obs.	65	70							
Deposit Insurance Coverage	0.208	0.202	-0.107						
	(0.084)	(0.083)	(0.374)						
Nb. Obs.	70	75	71						
Multiple Supervisors	0.151	0.370	-0.093	0.173					
	(0.231)	(0.002)	(0.438)	(0.148)					
Nb. Obs.	65	70	72	71					
External Governance	0.269	0.074	0.098	-0.063	0.054				
	(0.030)	(0.543)	(0.412)	(0.603)	(0.652)				
Nb. Obs.	65	70	72	71	72				
Activity Restrictions	0.045	-0.131	0.034	0.078	-0.064	0.181			
	(0.722)	(0.281)	(0.775)	(0.520)	(0.593)	(0.129)			
Nb. Obs.	65	70	72	71	72	72			
Heterogeneous Bank Revenues	0.269	0.110	0.146	0.075	0.047	0.145	-0.320		
	(0.023)	(0.346)	(0.220)	(0.513)	(0.694)	(0.224)	(0.006)		
Nb. Obs.	71	76	72	78	72	72	72		
Systemic Stability	0.112	-0.021	0.039	-0.146	-0.186	0.094	-0.205	-0.096	
	(0.353)	(0.856)	(0.747)	(0.201)	(0.117)	(0.432)	(0.084)	(0.401)	
Nb. Obs.	71	76	72	78	72	72	72	79	
β	0.279	0.253	0.069	0.654	0.111	0.115	0.511	-0.049	0.429
	(0.019)	(0.028)	(0.567)	(0.000)	(0.354)	(0.335)	(0.000)	(0.669)	(0.000)
Nb. Obs.	71	76	72	78	72	72	72	79	79

Table 5: The Market Power-Bank Soundness Relationship: Full Sample Regressions

This table contains information on the relationship between bank competition and stability in the total sample. The total sample consists of 79 countries and spans the time period 1994-2009. Bank soundness (ln Z-score) is the dependent variable and is regressed on a competition proxy (Lerner index) and a group of bank specific control variables (including specialization dummies). For each regression, we control for unobserved heterogeneity at the country-year level by including country-year dummies. Hence, we exploit the within country-year variation in the competition-stability relationship. The standard errors are robust and clustered at the country-year level. Also, to mitigate the impact of reverse causality, we use one period lagged values of the independent variables. The first column shows the results for our baseline regression, where we use our preferred competition and stability measure, being the Lerner index and the Z-score. The following four columns confirm our baseline results when using alternative competition or stability proxies. In column two and three, we use two subcomponents of the Z-score as alternative risk measures, being the (negative of the) standard deviation of a bank's return on assets and the equity over assets ratio. Using these indicators, we avert potential spurious correlation problems due to using bank profits for calculating both the Lerner index and the Z-score. In the fourth column, the original Z-score with the volatility of returns calculated based on a three year rolling window is replaced by a Z-score where the volatility of the returns is calculated using a five year rolling window. In column five we replace the Lerner index with its two subcomponents, being the average price of bank activities and marginal cost. In column six and seven we control for market share using an indicator based on total loans or total assets. Column eight shows the results when leaving out loan loss provisions to interest income and annual growth in total assets as control variables.

VARIABLES	ln(Z-score)	-ln(sd(ROA))	Eq / TA	ln(Z-score5)	ln(Z-score)	ln(Z-score)	ln(Z-score)	ln(Z-score)
Lerner	1.946***	0.841***	7.443***	1.845***		1.987***	1.988***	2.324***
	(0.105)	(0.117)	(0.487)	(0.114)		(0.109)	(0.109)	(0.139)
Share of Wholesale Funding	0.0912	0.0242	1.926***	0.0677	0.0899	0.143	0.143	0.0794
	(0.138)	(0.144)	(0.452)	(0.126)	(0.129)	(0.115)	(0.115)	(0.144)
Loans to Total Assets	-0.0566	0.171**	-4.664***	-0.0982	0.0824	-0.0336	-0.0348	-0.147*
	(0.0715)	(0.0788)	(0.345)	(0.0843)	(0.0723)	(0.0722)	(0.0721)	(0.0782)
Non-Interest Revenue Share	-1.061***	-1.406***	3.247***	-1.082***	-0.855***	-1.020***	-1.020***	-1.163***
	(0.0844)	(0.115)	(0.480)	(0.0870)	(0.0695)	(0.0800)	(0.0800)	(0.0859)
ln(Total Assets)	0.0265***	0.137***	-1.304***	0.0249***	0.0255***			0.0185*
	(0.00947)	(0.0115)	(0.0703)	(0.00909)	(0.00907)			(0.0101)
Loan Loss Provisions to Interest Income	-0.555***	-0.727***	1.822***	-0.423***	-0.820***	-0.532***	-0.532***	
	(0.0737)	(0.0738)	(0.219)	(0.0805)	(0.108)	(0.0735)	(0.0734)	
Annual Growth in Total Assets	-0.472***	-0.402***	-1.035***	-0.378***	-0.585***	-0.465***	-0.465***	
	(0.0436)	(0.0569)	(0.269)	(0.0451)	(0.0534)	(0.0425)	(0.0425)	
Constant	3.875***	1.092***	19.09***	3.572***	4.296***	4.017***	4.018***	3.817***
	(0.0885)	(0.114)	(0.594)	(0.0979)	(0.0911)	(0.0610)	(0.0610)	(0.0898)
Average Price of bank activities					7.846***			
					(0.862)			
Marginal Cost					-12.58***			
					(1.083)			
Market Share of Loans						-0.176		
						(0.228)		
Market Share of Total Assets							-0.221	
							(0.233)	
Observations	80822	80822	80822	59484	80822	80822	80822	80822
R-squared	0.336	0.452	0.437	0.375	0.322	0.335	0.335	0.326
Type dummies	YES	YES	YES	YES	YES	YES	YES	YES
Time x Country dummies	YES	YES	YES	YES	YES	YES	YES	YES
Number of Countries	79	79	79	79	79	79	79	79

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Determinants of Heterogeneity in the Competition-Stability Relationship: Regression Results

This table contains information on the drivers of the relationship between competition and stability in the total sample. The starting point for the regressions in this table is the baseline regression in table 5, i.e. a regression of a stability measure (Z-score) on the Lerner index and a group of bank-specific control variables. In the first nine columns, we add an interaction term of the Lerner index with a country-specific characteristic to the baseline regression. In the tenth column, we show the result when we add all interaction terms simultaneously. The last column shows the results when using an alternative risk measure, the (negative of the) standard deviation of the return on assets. We employ the panel structure of the database and control for fixed heterogeneity at the country-year level by interacting country and time fixed effects. We also add bank-type dummies to the regressions. Furthermore, to mitigate the impact of reverse causality, we use one period lagged values of the independent variables. The standard errors are robust and clustered at the country-year level. For ease of comparability (in terms of economic significance), all country-specific variables have been normalized to have zero mean and unit variance. Differences in the number of countries used in the regressions are due to differences in data availability for the country-specific variables.
In the right hand side panel, we provide an indication of the economic effect of each (statistically significant) characteristic on the market power-bank soundness relationship. We report the estimated impact of the Lerner index on bank stability for countries that differ from the average country in one dimension only. We report the impact for the countries corresponding with the 5th and the 95th percentile when ranking them according to the country specific characteristic of interest. For each characteristic, we report the impact of Lerner on both the Z-score (first row) and (the negative of) profit volatility (second row). The two cases mentioned in the lower part of these columns show the impact of a change in competition corresponding with the following two scenarios. Case 1 corresponds to the effect for a country that is average in each dimension. Case 2 resembles a fictitious post-crisis scenario with generous deposit insurance schemes (1.65 standard deviations increase) and stronger restrictions on bank activities (a 1.65 standard deviation increase), reflecting recent regulatory reforms or reform suggestions.

VARIABLES	lnZscore3	lnZscore3	lnZscore3	lnZscore3	lnZscore3	lnZscore3	lnZscore3	lnZscore3	lnZscore3	lnZscore3	-ln(sd(ROA))	Impact of	If X=	
												Lerner on ↓	*p5*	*p95*
Lerner index	1.654***	1.631***	1.924***	1.650***	1.853***	1.946***	1.993***	1.904***	1.834***	1.384***	0.199*			
	(0.103)	(0.119)	(0.102)	(0.0980)	(0.123)	(0.108)	(0.0864)	(0.0930)	(0.128)	(0.121)	(0.105)			
Depth of Information Sharing	0.598***									0.253*	0.322***	lnZscore3	*0.884*	*1.654*
x Lerner	(0.110)									(0.146)	(0.124)	-ln(sd(ROA))	*-0.437*	*0.543*
Stock Market Turnover		0.398***								0.167**	0.133*	lnZscore3	*1.270*	*1.853*
x Lerner		(0.0671)								(0.0796)	(0.0796)	-ln(sd(ROA))	*0.107*	*0.574*
Capital Stringency			0.128							0.0436	0.0252			
x Lerner			(0.105)							(0.0881)	(0.0951)			
Deposit Insurance Coverage				0.761***						0.660***	0.644***	lnZscore3	*0.971*	*2.052*
x Lerner				(0.0905)						(0.125)	(0.118)	-ln(sd(ROA))	*-0.203*	*0.850*
Multiple Supervisors					0.217**					-0.0388	0.103			
x Lerner					(0.0936)					(0.0748)	(0.0764)			
External Governance Index						0.154				-0.00701	0.0554			
x Lerner						(0.150)				(0.126)	(0.121)			
Activity Restrictions							0.645***			0.283***	0.426***	lnZscore3	*0.816*	*1.666*
x Lerner							(0.105)			(0.101)	(0.103)	-ln(sd(ROA))	*-0.655*	*0.623*
Heterogeneous Bank Revenues								-0.487***		-0.0810	0.0928			
x Lerner								(0.115)		(0.130)	(0.132)			
Systemic Stability									0.298***	0.171**	0.116	lnZscore3	*1.235*	*1.703*
x Lerner									(0.102)	(0.0859)	(0.0833)	-ln(sd(ROA))	*0.097*	*0.416*
Constant	3.863***	3.870***	3.892***	3.894***	3.884***	3.891***	3.912***	3.857***	3.886***	3.914***	1.195***			
	(0.0915)	(0.0934)	(0.0917)	(0.0895)	(0.0945)	(0.0929)	(0.0969)	(0.0892)	(0.0917)	(0.101)	(0.130)			
													Case 1	*Case 2*
Observations	79365	80281	77533	80767	77425	77481	76967	80821	79410	75333	75333	*lnZscore3*	*1.384*	*2.940*
R-squared	0.333	0.337	0.325	0.339	0.325	0.324	0.327	0.337	0.331	0.320	0.437	*-ln(sd(ROA))*	*0.199*	*1.964*
Control Variables	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES			
Type dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES			
Year x Country dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES			
Number of Countries	71	76	72	78	72	72	72	79	79	60	60			

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Failing Banks and Banking crises

This table shows regression results for the competition-stability trade-off while controlling for the impact of distressed banks and banking crises. The first column replicates the results from column 10 in table 6, i.e. regressing the Z-score on the Lerner index and all interaction terms between the Lerner index and the country-specific variables, while controlling for bank-specific characteristics and country-year fixed effects. In the second and the third regression, we add an interaction term of the Lerner index with an exit dummy. For the second regression, the exit dummy equals one in the two years before the bank leaves the sample. Notice that this dummy does not discrimate between defaults and distressed mergers on the one hand and 'normal' mergers or acquisitions on the other hand. Therefore, in the third regression, the exit dummy only equals one in the two years before a bank leaves the sample if the bank had a negative ROA in that period. In this way, we only capture the banks that actually were in distress before they leave the sample. In the fourth regression, we only look at banks that did not exit the sample due to a distressed situation (Distressed Exit Dummy =0). In column five and six we control for the potential impact of a banking crisis. In column 5 we interact the Lerner index with a systemic banking crisis dummy defined as in Laeven and Valencia (2010). Column 6 shows the results when limiting our sample to the pre-2007 period. For each regression, error terms are clustered at the country-year level.

VARIABLES	Baseline	Distressed Exit	Not Distressed	Crisis Indicator	Pre2007
Lerner index	1.384***	1.214***	1.090***	1.383***	1.477***
	(0.121)	(0.126)	(0.137)	(0.117)	(0.116)
Depth of Information Sharing	0.253*	0.261*	0.313**	0.253*	0.191
x Lerner	(0.146)	(0.143)	(0.159)	(0.146)	(0.136)
Stock Market Turnover	0.167**	0.0906	0.0291	0.166*	0.0440
x Lerner	(0.0796)	(0.0733)	(0.0946)	(0.0919)	(0.103)
Capital Stringency	0.0436	0.0848	0.137	0.0436	0.0713
x Lerner	(0.0881)	(0.0848)	(0.101)	(0.0876)	(0.0817)
Deposit Insurance Coverage	0.660***	0.602***	0.759***	0.659***	0.610***
x Lerner	(0.125)	(0.115)	(0.138)	(0.153)	(0.114)
Multiple Supervisors	-0.0388	-0.0490	-0.0456	-0.0389	-0.0793
x Lerner	(0.0748)	(0.0696)	(0.0833)	(0.0747)	(0.0778)
External Governance Index	-0.00701	-0.0380	-0.0427	-0.00719	-0.163
x Lerner	(0.126)	(0.122)	(0.143)	(0.130)	(0.125)
Activity Restrictions	0.283***	0.236**	0.309***	0.283***	0.293***
x Lerner	(0.101)	(0.0969)	(0.104)	(0.100)	(0.103)
Heterogeneous Bank Revenues	-0.0810	-0.0998	-0.00480	-0.0809	-0.0145
x Lerner	(0.130)	(0.126)	(0.136)	(0.132)	(0.132)
Systemic Stability	0.171**	0.241***	0.234**	0.172	0.313***
x Lerner	(0.0859)	(0.0752)	(0.0954)	(0.120)	(0.0929)
Last Observation Distressed		1.399***			
x Lerner		(0.212)			
Systemic Banking Crisis Dummy				0.00573	
x Lerner				(0.413)	
Constant	3.914***	3.958***	3.990***	3.914***	3.840***
	(0.101)	(0.0979)	(0.0974)	(0.101)	(0.0957)
Observations	75333	75333	73233	75333	61870
R-squared	0.320	0.322	0.285	0.320	0.305
Control Variables	YES	YES	YES	YES	YES
Type dummies	YES	YES	YES	YES	YES
Year x Country dummies	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Robustness test - Contestability, globalization, too big to fail and bank specialisation

This table shows regression results for the competition-stability trade-off while controlling for the potential impact of nonlinearities, a banks' market share, too big to fail status and bank specialisation. The first column replicates the results from column 10 in table 6, i.e. regressing the Z-score on the Lerner index and all interaction terms between the Lerner index and the country-specific variables, while controlling for bank-specific characteristics and country-year fixed effects. In the second column, we limit our sample to commercial banks only. Using this subset limits the possibility that our results are driven by differences in regulation for the different types of banks in our baseline sample. In the following columns, we expand our baseline regression with extra interaction terms. In the third column we control for non-linearities in the competition-stability relationship by adding a squared Lerner index. Doing so, we reduce the possibility that the other interaction terms are picking up a non-linear effect. In regression four and five we take into account the potential impact of a banks' market share by adding an interaction term of the Lerner index with a banks' market share (column 4) or a dummy indicating whether the bank has a market share that is higher than 10 percent (column 5). In the following two regressions, we control for the impact of too-big-to-fail banks. We proxy too-big-to-fail by the ratio of bank size to a country's GDP. We construct a dummy indicating whether this ratio is higher than 10 or 25 percent. We then interact this dummy with the Lerner index to see whether these banks react differently to a change in competition. In the last column we control for the potential impact of the presence of foreign banks. For each regression, error terms are clustered at the country-year level.

VARIABLES	Baseline	Commercial Banks	Lerner	Market Share	Large Market Share	TBTF10	TBTF25	Foreign Banks
Lerner	1.384***	1.429***	1.725***	1.748***	1.730***	1.734***	1.732***	1.604***
	(0.121)	(0.116)	(0.108)	(0.123)	(0.113)	(0.112)	(0.110)	(0.105)
Depth of Information Sharing	0.253*	0.333**	0.147	0.141	0.146	0.145	0.146	0.0808
x Lerner	(0.146)	(0.142)	(0.122)	(0.125)	(0.123)	(0.123)	(0.123)	(0.127)
Stock Market Turnover	0.167**	0.244***	0.137**	0.130*	0.135**	0.134**	0.135**	0.0945
x Lerner	(0.0796)	(0.0725)	(0.0677)	(0.0679)	(0.0677)	(0.0676)	(0.0676)	(0.0715)
Capital Stringency	0.0436	0.0588	0.00250	-0.00243	0.00118	-0.000848	-0.00122	-0.0520
x Lerner	(0.0881)	(0.0888)	(0.0779)	(0.0772)	(0.0775)	(0.0775)	(0.0776)	(0.0801)
Deposit Insurance Coverage	0.660***	0.587***	0.389***	0.388***	0.389***	0.387***	0.385***	0.320***
x Lerner	(0.125)	(0.129)	(0.111)	(0.112)	(0.111)	(0.111)	(0.111)	(0.112)
Multiple Supervisors	-0.0388	-0.0857	0.0235	0.0229	0.0234	0.0231	0.0229	0.0727
x Lerner	(0.0748)	(0.0690)	(0.0664)	(0.0662)	(0.0663)	(0.0663)	(0.0664)	(0.0706)
External Governance Index	-0.00701	-0.00473	-0.0125	-0.00846	-0.0113	-0.00910	-0.00977	0.144
x Lerner	(0.126)	(0.134)	(0.106)	(0.105)	(0.105)	(0.105)	(0.105)	(0.104)
Activity Restrictions	0.283***	0.126	0.249***	0.254***	0.250***	0.250***	0.249***	0.281***
x Lerner	(0.101)	(0.0977)	(0.0880)	(0.0887)	(0.0883)	(0.0882)	(0.0880)	(0.0884)
Heterogeneous Bank Revenues	-0.0810	-0.399***	-0.0712	-0.0719	-0.0716	-0.0713	-0.0699	-0.0162
x Lerner	(0.130)	(0.104)	(0.114)	(0.113)	(0.113)	(0.114)	(0.114)	(0.115)
Systemic Stability	0.171**	0.0834	0.353***	0.348***	0.352***	0.353***	0.354***	0.341***
x Lerner	(0.0859)	(0.0666)	(0.0729)	(0.0732)	(0.0730)	(0.0731)	(0.0730)	(0.0749)
Lerner			-3.082***	-3.077***	-3.081***	-3.080***	-3.081***	-3.030***
x Lerner			(0.314)	(0.315)	(0.314)	(0.314)	(0.314)	(0.310)
Market Share				-1.509				
x Lerner				(1.687)				
Dummy Large Market Share					-0.0918			
x Lerner					(0.191)			
I(Size/GDP $>$ 10%)						-0.191		
x Lerner						(0.223)		
I(Size/GDP $>$ 25%)							-0.355	
x Lerner							(0.285)	
Foreign banks								-0.338***
x Lerner								(0.0920)
Constant	3.914***	4.041***	4.044***	4.038***	4.043***	4.040***	4.041***	4.043***
	(0.101)	(0.0748)	(0.0919)	(0.0953)	(0.0933)	(0.0942)	(0.0933)	(0.0944)
Observations	75333	38134	75333	75333	75333	75333	75333	73669
R-squared	0.320	0.304	0.328	0.328	0.328	0.328	0.328	0.328
Control Variables	YES	YES	YES	YES	YES	YES	YES	YES
Type dummies	YES	NO	YES	YES	YES	YES	YES	YES
Year x Country dummies	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: IV regressions

This table shows the results for our baseline regression and the interaction term regression when using an IV approach. In column one and two, we run a regression similar to the first column in table V, but we instrument the Lerner index by loan growth, the cost-income ratio and an interaction term between the Herfindahl index (based on total assets) and a banks market share (also based on total assets). The dependent variable in the first column is the Z-score, while we use the inverse of the denominator of the Z-score (minus the standard deviation of the volatility of profits) as a dependent variable in the second column. Both regressions are estimated using bank and time dummies. Standard errors are clustered at the bank level. For column three and four, we use a two stage regression approach. In the first stage, we regress the Lerner index on loan growth, the cost-income ratio ,an interaction term between the Herfindahl index (based on total assets) and a bank's market share (also based on total assets), a group of bank-specific control variables and bank dummies. In the second stage, we use the instrumented values of the Lerner index and interact it with country-specific variables which enter as independent variables. The last two columns are hence the counterpart of the results reported in the last two columns of Table 6, but control for endogeneity by means of bank fixed effects and instrumental variables.

VARIABLES	ln(Z-score)	-ln(sdROA)	ln(Z-score)	-ln(sdROA)
Lerner	1.814***	1.290***	2.296***	0.897***
	(0.0862)	(0.0796)	(0.145)	(0.135)
Depth of Information Sharing			0.431***	0.435***
x Lerner			(0.144)	(0.128)
Stock Market Turnover			0.177*	0.233**
x Lerner			(0.104)	(0.102)
Capital Stringency			-0.134	-0.246**
x Lerner			(0.118)	(0.113)
Deposit Insurance Coverage			0.390**	0.393***
x Lerner			(0.160)	(0.144)
Multiple Supervisors			-0.192	-0.0505
x Lerner			(0.124)	(0.117)
External Governance Index			-0.155	-0.0182
x Lerner			(0.186)	(0.168)
Activity Restrictions			0.827***	0.708***
x Lerner			(0.145)	(0.137)
Heterogeneity - Revenues			-0.0244	0.199
x Lerner			(0.162)	(0.161)
Systemic Stability			0.195	0.189
x Lerner			(0.128)	(0.128)
Constant			3.933***	1.215***
			(0.0929)	(0.124)
Observations	76,592	76,752	74,942	74,942
R-squared	0.052	0.041	0.312	0.432
Time dummies	YES	YES	YES	YES
Bank Dummies	YES	YES	YES	YES
instruments	Cost to Income, Loan Growth, MS x HHI			
Control Variables	YES	YES	YES	YES
Year x Country dummies	YES	YES	YES	YES
Number of Countries	79	79	79	79

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

A Appendix - Country-specific Characteristics: Description and Source

Variable	Source	Description
	Institutional and financial development	
Depth of Information Sharing	Doing Business database	Strength of the information content of the credit bureaus
Stock Market Turnover	Financial structure database	Ratio of the value of total shares traded
	?	to average real market capitalization
	Regulation and Supervision	
Capital Stringency	Bank regulation and supervision database	The strength of capital regulation in a country
	Barth et al. (2000, 2003, 2008)	
Deposit Insurance coverage	Deposit insurance around the world database,	Deposit insurance coverage relative to GDP per capita
	?	
Multiple supervisors	Bank regulation and supervision database	Dummy equal to one when there are
	Barth et al. (2000, 2003, 2008)	multiple bank supervisors
External governance index	Bank regulation and supervision database	The strength of external auditors, financial statement
	Barth et al. (2000, 2003, 2008)	transparancy, and the existence of an external rating
	Herding and Market Structure	
Activity restrictions	Bank regulation and supervision database	Degree to which banks can participate
	Barth et al. (2000, 2003, 2008)	in various non-interest income activities.
Heterogeneous Bank Revenues	Bankscope, own calculations	Within year, within country standard deviation of
		non-interest income share
Systemic Stability	Bankscope, own calculations	Z-score at the country level

B Appendix - Country Labels, Lerner index and Z-score by country

Country
Argentina
Armenia
Australia
Austria
Bangladesh
Belarus
Belgium
Bolivia
Brazil
Bulgaria
Canada
Chile
China
Colombia
Costa Rica
Croatia
Cyprus
Czech Republic
Denmark
Dominican Republ
Ecuador
El Salvador
France
Germany
Ghana
Greece
Honduras
Hong Kong SAR, C
Hungary
Iceland
India
Indonesia
Ireland
Israel
Italy
Japan
Kazakhstan
Kenya
Korea, Rep.

This table shows the average Lerner index, Z-score and conditional market power-stability correlation coefficient for each country in our sample. The total sample consists of 79 countries. We calculated the Lerner index and the Z-score on the bank-year level and then averaged by country. The conditional correlation coefficient equals the coefficient of the Lerner index when running country-by-country regressions of the Z-score on the Lerner index and a group of bank-specific control variables while also controlling for time fixed effects.

C Appendix - Estimating marginal cost using a translog cost function

As **?,** we model the total operating cost of running the bank as a function of a single, aggregate output proxy, $Q_{i,t}$, and three input prices, $w^j_{i,t}$, with $j \in \{1,2,3\}$. More specifically, we estimate:

$$\ln C_{i,t} = \alpha_0 + \alpha_1 \ln Q_{i,t} + \alpha_2 (\ln Q_{i,t})^2 + \sum_{j=1}^{3} \beta_j \ln w^j_{i,t} + \sum_{j=1}^{3}\sum_{k=1}^{3} \beta_{j,k} \ln w^j_{i,t} \ln w^k_{i,t} + \sum_{j=1}^{3} \gamma_j \ln w^j_{i,t} \ln Q_{i,t} + v_t + \varepsilon_{i,t} \tag{C.1}$$

in which $C_{i,t}$ measures total operating costs (interest expenses, personnel and other administrative or operating costs), $Q_{i,t}$ represents a proxy for bank output or total assets for bank i at time t. The three input prices w capture the price of fixed assets (w_1), the price of labor (w_2) and the price of borrowed funds (w_3). They are constructed as, respectively, the share of other operating and administrative expenses to total assets, the ratio of personnel expenses to total assets and the ratio of interest expenses to total deposits and money market funding. Following **?**, the cost function is estimated separately for each country in the sample over the sample period to reflect potentially different technologies. We also include time dummies to capture technological progress as well as varying business cycle conditions, and a bank specialization dummy. Homogeneity of degree one in input prices is obtained by imposing the restrictions: $\sum_{j=1}^{3} \beta_j = 1$, $\sum_{j=1}^{3} \gamma_j = 0$ and $\forall$ $k \in \{1,2,3\} : \sum_{j=1}^{3} \beta_{j,k} = 0$. Marginal cost is then obtained as follows:

$$MC_{i,t} = \frac{\partial C_{i,t}}{\partial Q_{i,t}} = \frac{C_{i,t}}{Q_{i,t}} \left(\widehat{\alpha}_1 + 2\widehat{\alpha}_2 \ln Q_{i,t} + \sum_{j=1}^{2} \widehat{\gamma}_j \ln \frac{w^j_{i,t}}{w^3_{i,t}} \right) \tag{C.2}$$