Bank competition and stability: Cross-country heterogeneity*

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Abstract

This paper documents a large cross-country variation in the relationship between bank competition and stability and explores market, regulatory and institutional features that can explain this heterogeneity. Combining insights from the competition-stability and regulation-stability literatures, we develop a unified framework to assess how regulation, supervision and other institutional factors may make it more likely that the data favor the charter-value paradigm or 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 market structures, more generous deposit insurance and more effective systems of credit information sharing.

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

JEL Classifications: G21, G28, L51

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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 70s and early 80s. While the deregulation of branching and activity restrictions may have resulted in more intense competition among banks, with positive repercussions for financial depth and efficiency, it may as well have had the unintended consequence of increasing banking sector instability.[2] Similarly, the international process of banking liberalization seemingly has gone hand in hand with an increased occurrence of systemic banking crises in the last two decades of the twentieth century, 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 similar inconclusive debate as on the relationship between competition and stability has been led on the effect of the regulatory framework on banks' risk-taking incentives and ultimately bank stability. On the one hand, capital regulation and interest rate and activity restrictions are seen as fostering stability (Hellmann, Murdock, and Stiglitz (2000)); 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 (Demirguc-Kunt and Detragiache (2002)).

[1] See Group of Ten (2001), Bank for International Settlements (2001), International Monetary Fund (2001) and Indonesia and Banco de Mexico (2008) as well as Vives (2001) and Carletti and Vives (2009). For a recent on-line debate on this topic, see http://www.economist.com/debate/overview/205.

[2] See among others Keeley (1990) and Jayaratne and Strahan (1998)

The contribution of this paper originates in combining the two literatures and showing empirically 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, we find large cross-country variation in this relationship. We test the possible channels that may create cross-country variation in the competition-stability relationship and show that cross-country variation in market structure, the regulatory framework and the institutional environment in which banks operate affects cross-country heterogeneity in the competition-stability relationship. Specifically, our results suggest that an increase in competition will have a larger impact on banks' risk taking incentives in countries with stricter activity restrictions, more homogenous market structures, more generous deposit insurance and more effective systems of credit information sharing.

The effects of these structural country features on the competition-stability relationship are not only statistically, but also economically large and thus have important policy implications. For example, we conduct a ceteris paribus analysis that mimics a post 'great recession' scenario with generous deposit insurance schemes and stronger restrictions on bank activities and, hence, implying more herding. The relationship between market power and soundness is almost twice as strong 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 20%. In our fictitious post-crisis scenario, a similar loss in market power leads to a 38% reduction in the average Z-score. This effect of regulatory reform comes in addition to any direct effect (positive or negative) that such reforms might have on banks' stability.

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 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 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. This debate has been renewed after the recent crisis, with 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]

Our paper builds on a rich theoretical and empirical literature exploring the relationship between competition and stability in the banking system.[4] 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 Marcus (1984) and Keeley (1990), 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. However, 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 (Boot and Thakor (1993), Allen and Gale (2000), Allen and Gale (2004)). The competition-

[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, we only exploit the within country-year variation in bank market power and bank soundness. More detailed information is in the Methodology section.

[4] For an excellent overview of the existing (pre-2008) models and empirical evidence on competition and stability, see Carletti (2008) and Degryse and Ongena (2008).

stability hypothesis, on the other hand, argues that more competitive banking systems result in more rather than less stability. Specifically, Boyd and De Nicolo (2005) show that lower lending rates reduce the entrepreneurs' cost of borrowing and increase the success rate of entrepreneurs' investments. In addition, these firms will refrain from excessive risk-taking to protect their increased franchise value. 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 Boyd and De Nicolo (2005) model that allow for imperfect correlation in loan defaults (Martinez-Miera and Repullo (2010); Hakenes and Schnabel (2011)) 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. Wagner (2010) extends the Boyd and De Nicolo (2005) 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 Boyd and De Nicolo (2005) results.[5]

The standard response to conflicting theoretical predictions is to let the data speak. Numerous authors have used different samples, risk measures and competition proxies to discriminate between the competition-fragility and competition-stability view.[6] Empirical studies for specific countries – many if not 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 (Beck, Demirguc-Kunt, and Levine (2006); Schaeck, Cihak, and Wolfe (2009)). There seems also evidence that banks in more competitive banking systems hold more capital, thus compensating for potentially higher risk they are taking (Schaeck and Cihak (2011), Berger, Klapper, and Turk Ariss (2009)). A consequence of the recent

[5]Other authors have also shown that more intense competition may induce banks to (i) switch to more risky, opaque borrowers (Dell'Ariccia and Marquez (2004)), and (ii) acquire less information on borrowers (Hauswald and Marquez (2006)).

[6]For an overview, see Beck (2008).

theoretical extensions is that the predicted impact of competition on bank stability moved from a bipolar setting (good or bad per se) to a continuous approach (settings that are better or worse in relative terms). These models lead to new testable implications that exceed a mere assessment of the sign of the coefficient of bank market power. For example, by allowing loan defaults to be imperfectly correlated, the Martinez-Miera and Repullo (2010) model and the Hakenes and Schnabel (2011) model imply that the impact of competition on risk is affected by regulatory constraints on asset diversification, since the latter will affect the correlation structure of loan defaults.

Our paper also relates to the literature on bank regulation and stability. More effective credit information sharing cannot only help deepen and broaden financial systems, but also reduce fragility (Powell, Mylenko, Miller, and Majnoni (2004)). Capital requirements have often been advocated as tools to reduce bank fragility, though there is little empirical evidence that more stringent capital regulation helps reduce bank fragility (Barth, Caprio, and Levine (2006)). While activity restrictions have often been heralded as a way to reduce bank fragility, cross-country evidence has also shown a positive relationship between activity restrictions and the likelihood of a systemic crisis (Beck, Demirguc-Kunt, and Levine (2006)). The role of deposit insurance schemes has been especially controversial. A substantial body of empirical work has shown the negative effects that generous deposit insurance can have on bank stability by providing perverse incentives to take aggressive risks (see Demirguc-Kunt and Kane (2002), for an overview). The market structure can also have important repercussions for banking sector stability. Acharya and Yorulmazer (2007) and Brown and Dinc (2011) 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 many banks may fail together.

While this paper builds on the cross-country literature on the competition-stability relationship, it is the first - to our best knowledge - to explore the heterogeneity of this link 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 we want to exploit cross-country heterogeneity of the competition-stability relationship, we cannot use indicators of competition on 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. Third, this paper does not investigate the direct impact of regulation (Z) on competition (X) or risk (Y), questions that have been the topic of previous research. Rather, we focus on the impact of regulation (Z) on the competition-stability trade-off ($\frac{\partial Y}{\partial X}$). The former effects are controlled for by including time-varying country fixed effects, which imply that we only exploit the within-country year information. Finally, we try to control for biases stemming from reverse causation and simultaneity, but are careful to not infer causality from our analysis.

The remainder of the paper is structured as follows. Section 2 discusses different factors that might explain the variation in the competition-stability relationship. Section 3 introduces data and methodology. Section 4 presents results on the average cross-country relationship between bank competition and stability, while section 5 explores the cross-country heterogeneity in this relationship. Section 6 concludes with policy implications.

2 Competition-stability relationship - a conceptual framework

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, reg-

ulatory and institutional framework in which banks operate. Specifically, 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 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 empirical data favor one theory over the other. The relative strength 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.

To more formally conceptualize the framework for our hypothesis, let β denote the estimated effect of bank market power on stability. This point estimate is influenced by three factors: $\beta_{CF} > 0,\ \beta_{CS} < 0,\ p(CF) \in [0,1]$ where β_{CF} denotes the stability welfare gains of a unit increase in market power (competition-fragility hypothesis), β_{CS} denotes the stability loss as a result of a unit increase in market power (competition-stability hypothesis) and $p(CF)$ indicates how likely it is that one theory dominates over the other. β_{CF} and β_{CS} are the parameters one would obtain in an ideally designed laboratory setup that perfectly matches the assumptions of the underlying model. In the absence of such a setup, every estimate of the relationship between market power and bank soundness is a combination of these underlying 'deep' parameters. Our conjecture is that these theories do, however, provide information on how certain country characteristics affect $\beta_{CF},\ \beta_{CS}$ and $p(CF)$. More specifically, let x denote the specific feature under investigation and let $\beta = p(CF) * \beta_{CF} + (1 - p(CF)) * \beta_{CS}$. A change in x (or two samples with different x) can lead to a different estimated impact of market power on stability via three different channels.

It may affect β_{CF}, β_{CS}, as well as $p(CF)$. The joint impact on β is determined by:

$$\frac{\partial \beta}{\partial x} = \frac{\partial p(CF)}{\partial x} * \beta_{CF} - \frac{\partial p(CF)}{\partial x} * \beta_{CS} + p(CF) * \frac{\partial \beta_{CF}}{\partial x} + (1 - p(CF)) * \frac{\partial \beta_{CS}}{\partial x}$$

In the remainder of this section, we describe the theoretical predictions about the impact of country-specific features on the competition-risk taking relationship. These predictions are inferred from the assumptions underlying the models in the competition-stability as well regulation-stability literature. We combine the different predictions in three groups.

2.1 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 Boyd and De Nicolo (2005). First, we consider the **credit information sharing** framework. Credit registry institutions are public or private entities which collect information on the creditworthiness of borrowers. The existence of credit registers is expected to reduce both adverse selection and moral hazard problems that are inherent on being in the lending business (Pagano and Jappelli (1993) and Kallberg and Udell (2003)). As borrowers realize that it will be hard 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 (Padilla and Pagano (2000), Vercammen (1995)). Houston, Lin, Lin, and Ma (2010) show for a sample of nearly 2400 banks in 69 countries that greater information sharing leads to higher bank profits and lowers bank risk. 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, since better information sharing systems will lower the entrepreneurs' incentive to take more risk ($\frac{\partial \beta_{CS}}{\partial x} > 0$).

In addition, we consider financial structure and, more specifically, competition for banks coming from financial markets. 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 ($\frac{\partial \beta_{CS}}{\partial x} > 0$).

2.2 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 (Hellmann, Murdock, and Stiglitz (2000), Matutes and Vives (2000) and Repullo (2004)). Allen, Carletti, and Marquez (2011) show that borrowers prefer well capitalized banks, since these banks have a relatively higher incentive to monitor, which improves firm performance. This rise in bank value and the borrower preferences should induce a rise in bank charter value, thus lowering the banks' risk appetite. These effects allow us to hypothesize that more stringent (risk-based) **capital regulation** may limit the negative influence that competition may have on stability ($\frac{\partial \beta_{CF}}{\partial x} < 0$). Another, popular regulatory measure to increase the stability of banking systems is **deposit insurance**, as it reduces the risk of bank runs (Matutes and Vives (1996)). On the other hand, too generous deposit insurance schemes or inappropriately priced deposit insurance might increase moral hazard (see, e.g., Demirguc-Kunt and Kane (2002) and Demirguc-Kunt and Huizinga (2004)) since the safety net subsidy increases the liquidation value of the bank. Thus, a generous deposit insurance system will increase risk-taking incentives in more competitive environments, i.e. $\frac{\partial \beta_{CF}}{\partial x} > 0$.

In addition to regulation, such as capital requirements and deposit insurance, effective banking super-

vision can be important for several reasons. First, monitoring banks is both costly and difficult for both depositors and shareholders, which can lead to suboptimal bank risk behavior. Second, bank failures may be very costly, due to the crucial role banks play within the economic system. Taking these points into account, more effective supervision should provide incentives to limit bank risk taking and thus could soften the effect of competition on risk taking ($\frac{\partial \beta_{CF}}{\partial x} < 0$). Having **multiple supervisors** may lead to different supervisory approaches, which can generate useful information which would otherwise be neglected (Llewellyn (1999)). However, it might also lead to regulatory arbitrage, exacerbating the effect of competition on stability. Banking supervision may be supplemented by **external governance** which serves the same purpose. Having a wide range of private control mechanisms such as external audit and external ratings should also dampen the risk incentives of a bank. Increased level of disclosure makes it easier for depositors to determine a banks' risk position and will make funding costs more risk-sensitive, which gives banks an incentive to improve the quality of their asset portfolio.

2.3 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. 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. Acharya and Yorulmazer (2007) and Brown and Dinc (2011) 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 many banks may fail together. Hence, herding behavior may also affect banks' incentive to increase risk-taking in response to an increase in competition**. Activity restrictions** 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. Hence, all else equal, an increase in activity

restrictions will lead to more gambling behavior in response to more competition ($\frac{\partial \beta_{CF}}{\partial x} > 0$) as banks have limited outside options, and hence herd more (less heterogeneity), in such a setup. In addition, Martinez-Miera and Repullo (2010) and Hakenes and Schnabel (2011) show that a lower correlation of loan defaults makes it more likely that fiercer competition harms stability. A bank's potential to reduce the correlation of its loan portfolio and other revenues is clearly affected by restrictions on diversification. Let x be a proxy for restrictions on diversification, we then conjecture that $\frac{\partial p(CF)}{\partial x} < 0$. Moreover, 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. Hence, there will be a lack of bank business model diversification if they all venture in the same new, profitable business lines. Thus, we can hypothesize that competition will have a stronger impact on bank risk behavior in more **heterogeneous banking systems**, i.e. $\frac{\partial \beta_{CF}}{\partial x} < 0$.

We also look at herding in terms of risk taking behavior (**systemic risk**). A crucial assumption in Boyd and De Nicolo (2005) is that loan defaults are perfectly correlated. Martinez-Miera and Repullo (2010) show that if this restriction is relaxed, such that a bank's loan portfolio has both systematic and idiosyncratic risk, then Boyd and De Nicolo (2005)'s predictions can switch sign. When there is herding in risk-taking behavior, there will be fewer idiosyncratic defaults. In times of systemic distress, the stock price correlation of non-financial firms also increases and hence, the assumption of perfectly correlated loan defaults becomes more plausible. Therefore, if systemic risk is high, we expect to see a reduction in the probability that the competition-fragility view is favoured over the competition-stability model, implying that $\frac{\partial p(CF)}{\partial x} < 0$.

The expected effects can be 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. The third column describes the channel (theory) through which the variable may have an impact on the competition-stability relationship.

Variable	Expected Impact on β	Operates through
Institutional and financial development		
Information Sharing	$+$	β_{CS}
Stock Market Development	$+$	β_{CS}
Regulation and Supervision		
Capital Regulation	$-$	β_{CF}
Deposit Insurance	$+$	β_{CF}
Multiple Supervision	$+$ or $-$	β_{CF}
External Governance	$+$	β_{CF}
Herding		
Activity Restrictions	$+$ or $-$	β_{CF} (+) or $p(CF)$ (-)
Heterogeneous Banking System	$-$ or $+$	β_{CF} (-) and $p(CF)$ (+)
Systemic Risk	$+$ or $-$	β_{CF} (+) and $p(CF)$ (-)

3 Data and Methodology

In this section, we describe the data and methodology for our empirical analysis. First, we describe the sample composition and data sources. Next, we explain how we allow for country-level variation in the estimated impact of competition on stability. We also describe how we compute the bank-specific measures of soundness and market power.

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 Dijck that contains information on banks around the globe, based on publicly available data-sources. The period of analysis is $1994-2009$. 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. 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 and to enhance robustness of the standard errors. While most of the bank-specific variables are ratios, variables in levels (such as size) are expressed in 2007 US dollars.

The bank-specific data are linked to various country-level datasets 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 compiled by the World Bank (Barth, Caprio, and Levine (2008)). Additional information is obtained from the World Development Indicators and the Doing Business database. A detailed list of the 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 datasets yields a sample of banks from 79 countries. The sample consists of a mix of developed and developing countries (see Appendix B).

3.2 Empirical framework

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, proxies of market power at the bank- or country-level are related to bank soundness in a linear or quadratic specification. The sign of the coefficient(s) then indicates whether competition helps or harms stability (or whether there is a turning point at which there is a sign reversal). These studies provide insight into the average relationship between competition and stability for the set of countries under investigation (e.g.: developing countries as in Turk Ariss (2010), developed countries as in Berger, Klapper, and Turk Ariss (2009), the European Union as in Schaeck and Cihak (2010)), while controlling for other country-specific factors such as macro-economic conditions, regulation and supervision. However, single country studies (such as Keeley (1990), Salas and Saurina (2003), Jimenez, Lopez, and Saurina Salas (2010), Boyd, De Nicolo, and Jalal (2006)) document a large degree of variation in the competition-stability relationship. This indicates that these other country-specific factors may not only have a level effect but also a slope effect. Hence, it is not only important to control for the impact of these factors on risk but also on how they shape the competition-stability relationship. Put differently, these variables may also determine whether it is more likely to find support for the franchise value paradigm compared to the risk-shifting hypothesis or vice versa. This results in the following setup:

$$Risk_{i,j,t} = c + \beta_j \cdot Competition_{i,j,t-1} + \gamma_j \cdot X_{i,j,t-1} + \delta Z_{j,t} + \varepsilon_{i,j,t} \tag{1}$$

In this setup, the indices $i,\ j\ ,t$ stand respectively for bank, country and time. The impact of competition (as well as any other bank-specific variable, $X_{i,j,t}$) on risk is allowed to vary at the country level. This is denoted by giving the corresponding (vector of) coefficient(s) a j subscript. The vector of bank-specific variables, $X_{i,t-1}$, 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 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 control variables that determine bank soundness are presented in the upper part of Table 1. Furthermore, time-varying country-specific characteristics may also affect bank soundness and are therefore included in the vector $Z_{j,t}$.

<**Insert Table 1 around here**>

We hypothesize that β_j can be modelled as a function of (a subset of) these country-specific factors. To gain insight in the potential drivers of heterogeneity in β, we take a two-step approach. In a first step, we relate bank market power to a measure of bank soundness. This relationship is assessed at the country level. Specifically, for each country we regress bank stability on bank competition and a group of bank-specific control variables, while controlling for time-fixed effects and using five year rolling windows:

$$Risk_{i,t} = c + \beta \cdot Competition_{i,t-1} + \gamma X_{i,t-1} + v_t + \varepsilon_{i,t} \tag{2}$$

The retrieved conditional correlations are subsequently matched to country-specific variables measured at the first year of the five year window. Including time fixed effects and estimating this equation country by country over time has several advantages. First, we allow for the maximum extent of heterogeneity in the competition-stability trade-off across countries. Second, the time dummies differ in each country regression and hence indirectly capture the level effect of country-specific regulation or the business cycle on bank risk. In the second step, we explore which country-specific variables explain the heterogeneity in the estimated β_js. Specifically, we regress the estimated β_js on a set of country-level variables capturing the market, regulatory and institutional framework in which banks operate.

In an alternative specification, we combine the two stages into one. Specifically, we run the following regression:

$$Risk_{i,j,t} = c + (\beta_0 + \beta_1 Z_{j,t}) * Competition_{i,j,t-1} + \gamma X_{i,j,t-1} + v_{j,t} + \varepsilon_{i,j,t} \tag{3}$$

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, $\nu_{j,t}$. We do this for two main reasons. First, as mentioned in the introduction and throughout the paper, many other papers have documented that regulation, supervision and the business cycle may have an impact on competition and market 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 rule out this possibility by only exploiting the within country-year variation.[7] Second, time-varying country fixed effects eliminate the impact of omitted (e.g., stance of the business cycle or inflation) or unobservable (e.g., unexpected monetary policy) country-specific variables by capturing the maximum extent of unobserved time-varying country heterogeneity. Furthermore, we also cluster the error terms on the country-year level.

Both methods have their (dis)advantages. The two-step approach allows for heterogeneous coefficients for all variables (as Equation (2) is estimated for each country separately), compared to a pooled γ coefficient on the control variables $X_{i,j,t}$ in Equation (3). The two-step approach gives equal weight to each country, whereas the pooled approach gives more degrees of freedom. In the two step approach, the dependent variable is an estimated variable (which is accounted for), whereas the multicollinearity problem may be more severe for interaction variables in Equation (3). The combination of these two setups should provide reliable and robust evidence on the drivers of heterogeneity in the competition-stability relationship.

3.3 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

[7] In mathematical terms, an (un)observed country-specific variable $Z_{j,t}$ may affect $\overline{Risk}_{j,t}$ 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 $Z_{j,t}$.

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.

3.3.1 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. We prefer the Lerner index over market share as it is more closely linked to the theoretical models that hinge on banks' franchise value. 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 (Gan (2004)). 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 concentration measures.[8] Conditional on having an estimate of the marginal price and cost, we can construct the Lerner index for each bank and each year, as follows:

$$Lerner_{i,t} = \frac{P_{i,t} - MC_{i,t}}{P_{i,t}} \tag{4}$$

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 Berger, Klapper, and Turk Ariss (2009), we model the total operating cost of running the bank as a function of a single, aggregate

[8] 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, estimating a global cost function or using average cost rather than marginal cost lead to very similar results.

output proxy, $Q_{i,t}$, and three input prices, $w^j_{i,t}$, with $j \in \{1,2,3\}$. More specifically, we estimate:

$$\ln C_{i,t} = \alpha_0 + \alpha_1 \ln Q_{i,t} + \alpha_2 (\ln Q_{i,t})^2 + \sum_{j=1}^{3} \beta_j \ln w^j_{i,t} + \sum_{j=1}^{3}\sum_{k=1}^{3} \beta_{j,k} \ln w^j_{i,t} \ln w^k_{i,t} + \sum_{j=1}^{3} \gamma_j \ln w^j_{i,t} \ln Q_{i,t} + v_t + \varepsilon_{i,t} \tag{5}$$

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:

$$MC_{i,t} = \frac{\partial C_{i,t}}{\partial Q_{i,t}} = \frac{C_{i,t}}{Q_{i,t}} \left(\widehat{\alpha}_1 + 2\widehat{\alpha}_2 \ln Q_{i,t} + \sum_{j=1}^{2} \widehat{\gamma}_j \ln \frac{w^j_{i,t}}{w^3_{i,t}} \right) \tag{6}$$

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 capture the price of fixed assets, the price of labor and the price of borrowed funds. 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 Berger, Klapper, and Turk Ariss (2009), Equation (5) is estimated separately for each country in the sample to reflect potentially different technologies.

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.

In many other cross-country studies that examine the bank competition-stability relationship, authors have relied on country-specific 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 a correlation matrix between non-structural measures of market power and concentration, that are measured at the country-year level, 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. 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.[9]

<**Insert Table 2 around here**>

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-statistics 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 positively related to other competition proxies.

3.3.2 The Z-Score: measure of bank soundness

In our analysis, bank risk is measured using the natural logarithm of the Z-score (as in e.g. Houston, Lin, Lin, and Ma (2010), Demirguc-Kunt and Huizinga (2010), Laeven and Levine (2009) and many others). The Z-score measures the distance from insolvency (Roy (1952)) and is calculated as

$$Z_{i,t} = \frac{ROA_{i,t} + (E/A)_{i,t}}{\sigma(ROA)_{i,t}} \tag{7}$$

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. While in large parts of the literature the volatility of profits is computed over the full

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

sample period, we use a three-year rolling time window for 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 (Schaeck and Cihak (2010)). 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 (Boyd and Runkle (1993)). 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.[10] Table 1 shows that the average value of ln(Z-score) slightly exceeds four with a standard deviation of 1.31. It 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 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.

3.3.3 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

[10] 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.

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.

4 The cross-country relationship between market power and bank soundness

4.1 Main results

Regression-based evidence on the relationship between bank market power and bank soundness is reported in Table 3, 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 (3) and impose that $\beta_1 = 0$. This assumption will be relaxed in section 5.

The results in column 1 of Table 3 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., Berger, Klapper, and Turk Ariss (2009)). 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). Doing so, we control for the impact of time-varying country characteristics that may affect both the aggregate level of competition and stability in a country and could lead to a spurious relationship.

<Insert Table 3 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 0.127, leads to a drop in the Z-score of almost 25%. Put differently, the number of standard deviations profits have to fall before capital is depleted is reduced by 25% if market power is reduced by one standard deviation.

Table 3 also reports three robustness checks on the baseline equation. First, we verify whether or not the results are dominated by countries that constitute the lion's share of our sample.[11] We weigh each observation with the inverse of the number of banks in the corresponding country. These weights ascertain that each country's banking sector gets an equal weight in the estimation. We again find a positive and significant relationship between market power and bank stability, though with a slightly smaller coefficient (column 2). Second, we report the results for the pre-2007 sample (column 3). The period of analysis is thus 1994-2006, and is hence not contaminated by the exceptional events of the 2007-09 global financial crisis. In addition, it spans the period before Basel II was implemented. As such, the change in capital regulation does not affect our measure of risk. The impact of competition on stability in this shorter sample is almost identical to the results reported in column 1. 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

[11] 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.

possibility, the column 4 and 5 regressions control more directly for reverse causation and endogeneity biases. In column 4, we control for unobserved heterogeneity at the bank level, by controlling for bank fixed effects, rather than time-varying country fixed effects. Using within-bank variation over time, we confirm the positive relationship between banks' market power and stability. As a bank in a specific country faces a more competitive environment, it becomes more risky. In column 5, we present 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 indicate 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.[12]

While not the focus of the paper, we do find some other interesting and stable relationships between the control variables and bank soundness in the various specifications. Banks that have expanded into non-interest income activities are riskier. Furthermore, faster growing banks and banks with large provisions for loan defaults are also less sound.

4.2 Robustness tests

The Table 4 results show that the positive relationship between banks' market power and soundness is not driven by a specific component of the Z-score. The Z-score consists of three building blocks: bank profits, bank capital and profit volatility. In Table 4, we report in the first four columns the impact of the Lerner index on the Z-score (replicating column 1 of Table 3) as well as the impact of Lerner on each of the constituents of the Z-score. An increase in market power is associated with an increase in profits, a higher capital ratio and less volatile profits. The latter two results indicate that the relationship between the Lerner index and the Z-score is not spuriously created by regressing a price markup on a variable related to bank profitability.

[12] Next to cost efficiency and loan growth, we use lagged values of the Lerner index as instruments. Therefore the sample size reduces substantially. Estimating the baseline equation (as in column one) on this sample of 47488 observations yields a coefficient of 1.76 for Lerner.

The negative relationship between market power and bank risk (column 4) is in line with the lower panel of Figure 1.

<Insert Table 4 around here>

Next, we gauge the robustness of our findings to alternative measures of bank soundness. While in large parts of the literature the volatility of profits is computed over the full sample period, we follow Schaeck and Cihak (2010) and use a three-year rolling time window for the standard deviation of ROA to allow for variation in the denominator of the Z-score. This approach avoids that the Z-scores are exclusively driven by variation in the levels of capital and profitability (Schaeck and Cihak (2010)). Moreover, given the unbalanced nature of our panel dataset, it avoids that the denominator is computed over different window lengths for different banks. In the fifth column, we employ a Z-score where profit volatility is measured over 5 year rolling windows (instead of three years). Even though the measure is different and the sample size is reduced in column 5, we do not find that the relationship between competition and stability is significantly different from the baseline approach (column 1 of Table 4). In column 6, we use Non-Performing Loans (NPL) as an alternative risk measure.[13] We do not find a significant relationship between the Lerner index and the NPL ratio, which can be explained by several factors. First, the NPL ratio is an ex-post risk measure that does not necessarily reflect banks' voluntary choices. Second, non-performing loans reduce earnings and hence also the Lerner index. This reverse causality creates a bias in the estimated relationship, whereas the results in column 1-4 indicate that this is less of a concern for the Z-score. Finally, the NPL ratio is an indicator of credit risk which is only one aspect of total bank risk.

In the last three columns of Table 4, we confirm the pooled sample evidence on the positive impact of market power on stability by looking at alternative bank-level competition measures. In column 7, we simultaneously include the subcomponents of the Lerner index, which is a relative markup of price over

[13] In this specification, we do not include loan loss provisions as an independent variable.

marginal cost.[14] 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 banks' risk-taking significantly and indicate that a reduction in the mark-up (more competition) originated from prices, costs or both leads to less stability. In the last two columns, we include the loan market share and market share in total assets[15] instead of a pricing power index. While a large market share does not necessarily imply market power, we do find that banks with a larger market share behave more prudent.

In the remainder of the paper, we focus on a specific measure of bank competition, the Lerner index and a bank-level indicator of stability. The aforementioned robustness tests as well as the correlation table of the different competition and market structure measures provide an indication that the relationship between competition and stability is robust to using alternative setups. Nevertheless, it is important to stress that we, however, do not want to settle the debate on the exact measures to use in a study of competition-stability, but rather aim to 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. Even if the competition or risk measure would be flawed and a source of bias, it would only affect our results if the bias works disproportionately across countries and is related to our country-specific variables of interest.

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

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

[14] All results in the paper also hold when using average cost rather than marginal cost in the Lerner index. While average cost is theoretically inferior to marginal cost in the concept of the Lerner index, it has the advantages that it does not (i) require a choice of cost function, (ii) involve an additional estimation step and (iii) require the demarcation of the region/sample used in the estimation.

[15] 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.

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 (3)) 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 that 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 (1994) to less than one (1997). The time variation in the estimated relationship is much lower from 2000 onwards.

<**Insert Figure 3 around here**>

Figure 3 shows the unconditional and conditional correlation between banks' market power and soundness across countries, with a very similar finding[16]. The bar charts show that the unconditional and conditional correlations are positive in most countries. In the first panel of Figure 3, the height of the bars shows the magnitude of the unconditional correlation between the Z-score and the Lerner index. In the second panel of Figure 3, the height of the bars shows the magnitude of the coefficient of the Lerner index when estimating Equation (2) for each country separately. The correlations and coefficients that are significantly different from zero have a lighter shade. The average of the 79 estimated coefficients equals 1.64, which resembles the full sample coefficient from the weighted regression (1.46). Hence, on average, it seems that the franchise value paradigm dominates the risk-shifting hypothesis. However, there is a large amount of heterogeneity in the competition-stability relationship from a negative and significant relationship to a coefficient estimate of almost six. The standard deviation of the coefficient across the 79 countries is 1.42. A quick look at the country labels[17] on the X-axis also reveals that it is not just a developed versus developing countries story or that regions exhibit similar behavior.

[16] The correlation between the conditional and unconditional correlation is 0.77 and strongly significant.

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

In the remainder of this section, we will empirically explore what drives this large cross-country variation in the competition-stability relationship. In the following, we pick up on our conceptual framework of section 2 and discuss in more depth the different indicators that we use as proxies for the institutional environment, the regulatory framework and herding. Table 5 presents descriptive statistics for the different country-level variables, while Table 6 reports correlations. The definition and source of the variables are in Appendix A.

<**Insert Table 5 around here**>

<**Insert Table 6 around here**>

Subsequently, in section 5.2., we present the main results before discussing some robustness tests.

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

5.1.1 Institutional and financial development

We hypothesized that variables capturing the extent to which information on borrowers (and defaults) are shared may affect the risk-shifting incentives of entrepreneurs. We therefore use an indicator of the **Depth of Information Sharing**, which captures the difference in information content between the credit registries in different countries. Some of them only collect limited information on large borrowers, while others have extensive information on a whole range of borrowers and their characteristics (Miller (2003)). The index ranges between 0 and 6, with a higher value indicating that more information is available. Furthermore, we use **Stock Market Turnover**, i.e. the ratio of stocks traded to stocks 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. The correlation analysis shows that countries with more liquid stock exchanges also have more effective systems of credit information sharing.

5.1.2 Regulatory and supervisory framework

We consider several dimensions of the regulatory and supervisory framework that might impact on the relationship between banks' market power and soundness. First, we use a **Capital Stringency** index that indicates whether there are explicit requirements regarding the amount and source of capital that a bank should have. Specifically, 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. A higher index indicates greater stringency. Capital Stringency ranges from 2 to 10, with an average of 5.8. It is not correlated with any of the other country-level indicators. Second, **Deposit Insurance Coverage** is proxied by deposit insurance coverage relative to GDP per capita. This variable is taken from the Deposit Insurance Around the World database of the World Bank (Demirguc-Kunt, Karacaovali, and Laeven (2005)). Deposit insurance 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. Third, the degree of market discipline is captured by a dummy that equals one if there are **multiple supervisors** in a country and an **External Governance** index. 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. The **Multiple Supervisors** dummy gives more info on the structure of public supervision, with more regulators indicating the possibility of regulatory arbitrage, but also more information. 16% of our sample observations (country-years) have multiple bank supervisors. Interestingly, these four indicators of the regulatory and supervisory framework are not 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.

5.1.3 Herding and market structure

As discussed above, we use three proxies of herding and market structure. First, we look at whether overall activity restrictions limit the possibility of banks to diversify their activities. Therefore we include an **Activity Restrictions** index, taken from the World Bank's Bank Regulation and Supervision database (Barth, Caprio, and Levine (2008)), which measures the degree to which banks are permitted to engage in fee-based activities related to securities, insurance and real estate rather than more traditional interest spread-based activities. Lower values of the index indicate that no restrictions are placed on this type of diversification by banks and higher values indicate that such diversification is prohibited. The index ranges from 4 to 15, with an average of 9.5. Second, **Heterogeneity-Revenues** measures whether there are substantial revenue differences among financial institutions within a country. It is calculated as the within-country, within-year standard deviation of the non-interest income share. If all banks in a country have a similar business model (either voluntarily or forced by regulation), the indicator will be low. 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. A second indicator of the too-many-to-fail 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** - is a proxy of systemic risk. Lower values of the aggregate Z-score points to a lower aggregate level of banking sector soundness and larger scope for herding as the likelihood of joint failures is larger in unstable banking sectors. Systemic Stability ranges from 0.185 to 6.297, with an average of $3.60\dot{4}$. 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. We also find a positive and significant correlation between Heterogeneity-Revenues and the Depth of Information Sharing.

5.2 Main results

In a first approach, we regress the estimated coefficient from a country-by-country regression of bank soundness on bank market power on the different country-level variables discussed above. Specifically, for each country we regress our bank stability measure[18] (Z-score) on the Lerner index and a group of bank-specific control variables, while controlling for time-fixed effects and using five year rolling windows. Since our sample period is 1994-2009, and taking into account that we lag our independent variables with one period, we get a maximum of eleven country-specific conditional correlations and a total of 590 coefficient estimates for 73 countries. The retrieved conditional correlations are subsequently matched to country-specific variables measured at the first year of the five year window. In the first nine columns of Table 7 we regress the conditional correlation coefficient separately on each country specific characteristic. The tenth column shows the results when pooling all characteristics in a single regression.[19]

The results in Table 7 suggest that competition is more harmful for stability in countries where (i) there are more effective systems of credit information sharing, (ii) stock markets are more liquid, (iii) there is more stringent capital regulation, (iv) deposit insurance is more generous, (v) there are more restrictions on the permissible range of activities and (vi) banks herd more in terms of revenue structure. When including all nine country-specific indicators simultaneously, however, only the depth of credit information sharing, the strength of capital regulations, deposit insurance coverage and the heterogeneity of revenues continue to enter significantly, while stock market turnover and activity restrictions lose their significance. The latter is due to the correlation with other variables. Stock market turnover is significantly correlated with the depth of information sharing. Activity restrictions is negatively correlated with the heterogeneity of revenues.

[18] The reported results are based on the Z-score in which the 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.

[19] The number of countries and observations vary in each specification due to the availability and coverage of different country-specific characteristics. When repeating the regressions reported in columns 1-9 using a common sample (the sample used in column 10), we obtain similar results.

The signs of the significant relationships are in line with the theoretical predictions as explained in Section 2 (except for the coefficient of the capital stringency index). Systemic stability, external governance and multiple supervisors do not enter significantly in any regression.

<**Insert Table 7 around here**>

The results in Table 7 are not only statistically, but also economically large, as indicated by the last two columns. Specifically, we report the predicted β coefficient at the 10th and the 90th percentile of the respective country-specific characteristic. We note that in all cases, there is a positive relationship between banks' market power and soundness, with the magnitude of the relationship, however, varying significantly. Take the case of deposit insurance, where the magnitude of the market power-soundness relationship is more than twice as high at the 90th percentile of deposit insurance generosity as at the 10th percentile. The relationship between market power and soundness is more than 50% higher at the 90th percentile of the depth of credit information sharing and the strength of capital regulation than at the 10th percentile of the respective variable.

Finally, the four cases mentioned in the lower end of these columns show the impact of a change in competition corresponding with one of four different 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 - 1.642 - is very close to the average estimate reported in Table 3. Case 2 resembles a fictitious post-crisis scenario with generous deposit insurance schemes (two standard deviations increase) and more herding among banks (two standard deviation reduction in heterogeneity) and stronger restrictions on bank activities (a one 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 twice as strong, suggesting a very negative impact of competition on stability in this scenario. Case 3 (4), puts the country variables at the mean of the lowest (highest) five countries for each variable, where we redefine all variables to have a positive impact on the market power-soundness

relationship. Doing so, we find that the relationship between banks' market power and soundness is almost twice as high in countries with high values among the variables strengthening the market power-soundness relationship than in countries with low values for these variables.

Table 8 shows the robustness of our findings to using an alternative specification that combines the two stages into one, using regression equation (3). For ease of comparability of the economic significance, all country-specific variables have been normalized to have zero mean and unit variance. We include country-year fixed effects. We do this for two main reasons. First, as mentioned in the introduction and throughout the paper, many other papers have documented that regulation, supervision and the like have an impact on competition and market 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 rule out this possibility by only exploiting the within country-year variation. Second, time-varying country fixed effects eliminate the impact of omitted (e.g., stance of the business cycle or inflation) or unobservable (e.g., unexpected monetary policy) country-specific variables by capturing the maximum extent of unobserved time-varying country heterogeneity.

<**Insert Table 8 around here**>

The results in Table 8 indicate a positive relationship between banks' market power and soundness, a relationship that 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 more restrictions on the permissible range of activities, (v) banks herd more in terms of revenue structure and (iv) 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, more generous deposit insurance, more systemic stability and higher activity restrictions. While the coefficient on the interaction of Lerner index and Multiple Supervisors enters significantly and positively when included

by itself, it enters negatively and significantly when controlling for the interaction of the Lerner index with the other country-level variables. The capital stringency index, which sign in Table 7 conflicts with the theoretical predictions put forward in section 2, is no longer significant in the one-step approach results of Table 8.

Interestingly, the absolute value of the coefficients of the significant variables varies in magnitude (between 0.14 and 0.48). As we normalized the variables, there seems to be an important effect in economic terms, and the importance varies with the variable under consideration. The coefficient on the Lerner index without interaction is 1.55. A one standard deviation increase in one of these variables hence leads to a 10% to 30% change in the impact of competition on stability, a similarly large effect as found in Table 7. The dependent variable 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. Another unreported regression confirms the stability of the findings in the sample period 1994-2006, which does not include the unusual events of the Great Recession. Finally, the number of countries and observations vary in each specification due to the availability and coverage of different country-specific characteristics. When repeating the regressions reported in columns 1-9 using a common sample (the sample used in column 10), we obtain similar results.

5.3 Additional results exploiting bank-level variation

So far, we have exploited cross-country and time-series variation in the competition-stability relationship. However, banks' risk-taking incentives might be also 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. This subsection assesses whether such bank-level variation exists.

<**Insert Table 9 around here**>

Table 9 shows the impact of competition on bank stability while controlling for the potential impact of failing banks. The first column shows our baseline competition-stability regression. In the second and the third column, we interact the Lerner index with an exit dummy. In the second regression, the exit dummy equals one in the two years before the bank leaves the sample. These banks seem to react less intense when competition changes. However, notice that this dummy does not discriminate 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 when the bank had a negative return on assets in that period. In this way, we only capture the banks that actually where in distress before they leave the sample. The significant and positive interaction term between competition and the exit dummy indicates that these 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 fourth 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, multiple supervisors, high activity restrictions and higher systemic stability react stronger to a change in competition. This shows that our main results are not driven by distress situations.

<**Insert Table 10 around here**>

Table 10 shows the results for the baseline competition-stability regression while controlling for the impact of bank market share. The first column retakes our baseline results, while we include a squared term

of the Lerner index in the second column. Including the squared term does not affect the main results on the interaction variables as can be inferred from comparing column 1 and 2. The only variable that turns insignificant after including the squared Lerner variable is Multiple Supervisors (for which we did not find significance in Table 7 and conflicting results in Table 8). We still obtain that banks operating in a country with overall more effective systems of credit information sharing, generous deposit insurance, high 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 Martinez-Miera and Repullo (2010)'s theoretical predictions. However, the relationship does not turn negative until a value of 0.285 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. In the fourth 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. Finally, in columns 5 and 6, 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. The interaction enters significantly in neither case. Overall, we cannot find evidence that competition exacerbates the too-big-to-fail phenomenon.

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-sectional heterogeneity, with estimates ranging from significantly negative, over insignificant to mostly strong positive relationships between competition 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 market structures, more generous deposit insurance and more effective systems of credit information sharing. Our findings help in understanding 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 capital regulations, less homogenous market 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). Mim-

icking 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 20%. In our fictitious post-crisis scenario, a similar loss in market power leads to a 38% reduction in the average Z-score (which is the buffer of capital against losses expressed in terms of profit volatility).

Our results also show that more stringent capital regulation can have an exacerbating influence on the relationship between competition and stability, which puts the current debate on capital buffers somewhat in perspective. Finally, they show the trade-off in reducing information asymmetries by introducing or upgrading credit registries; while helping to deepen and broaden financial systems, they can also exacerbate the impact of competition on stability. Most importantly, 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.

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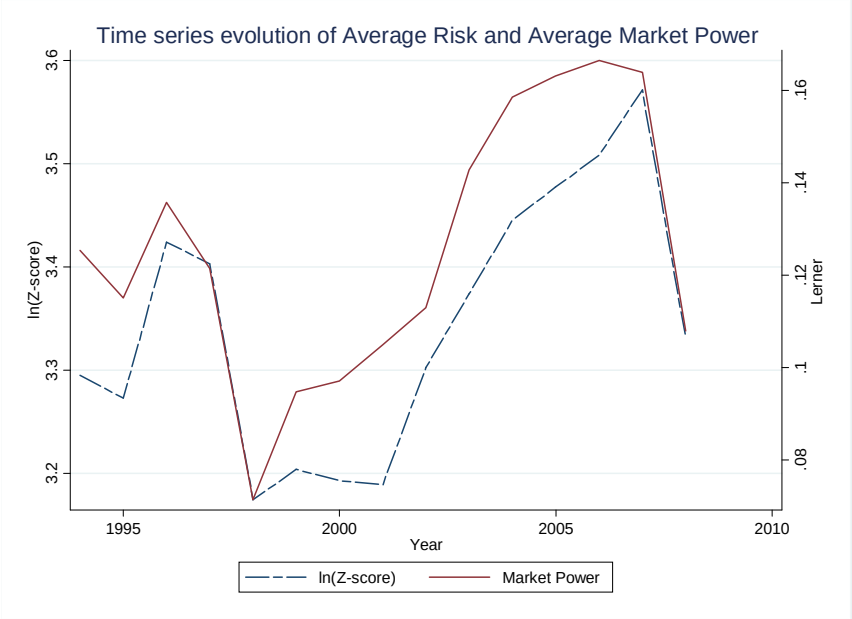
Figure 1: Evolution over Time of Market Power, Bank Stability and Profit Volatility

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 measured through 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 an 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.



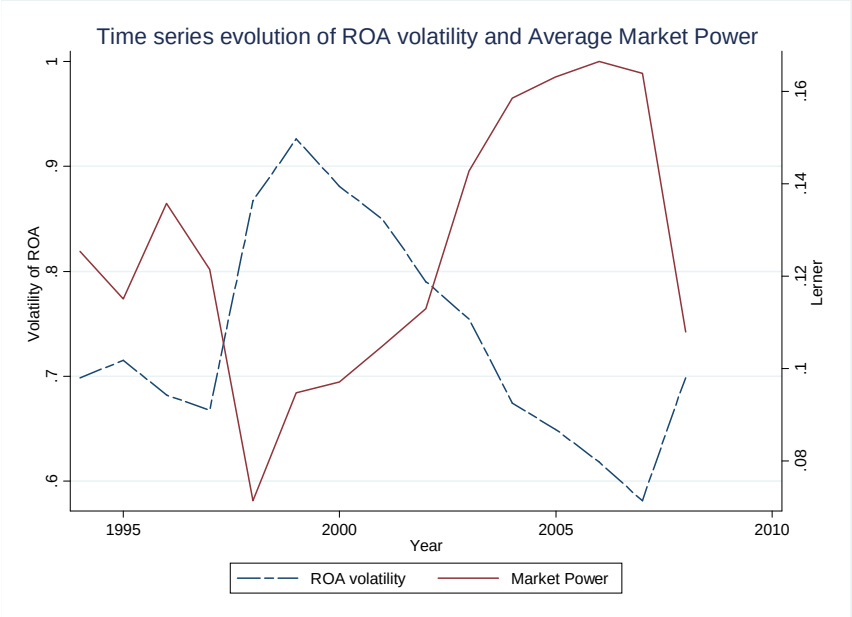


Figure 2: Evolution over Time of the Conditional Correlation between Bank Market Power and Stability

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.

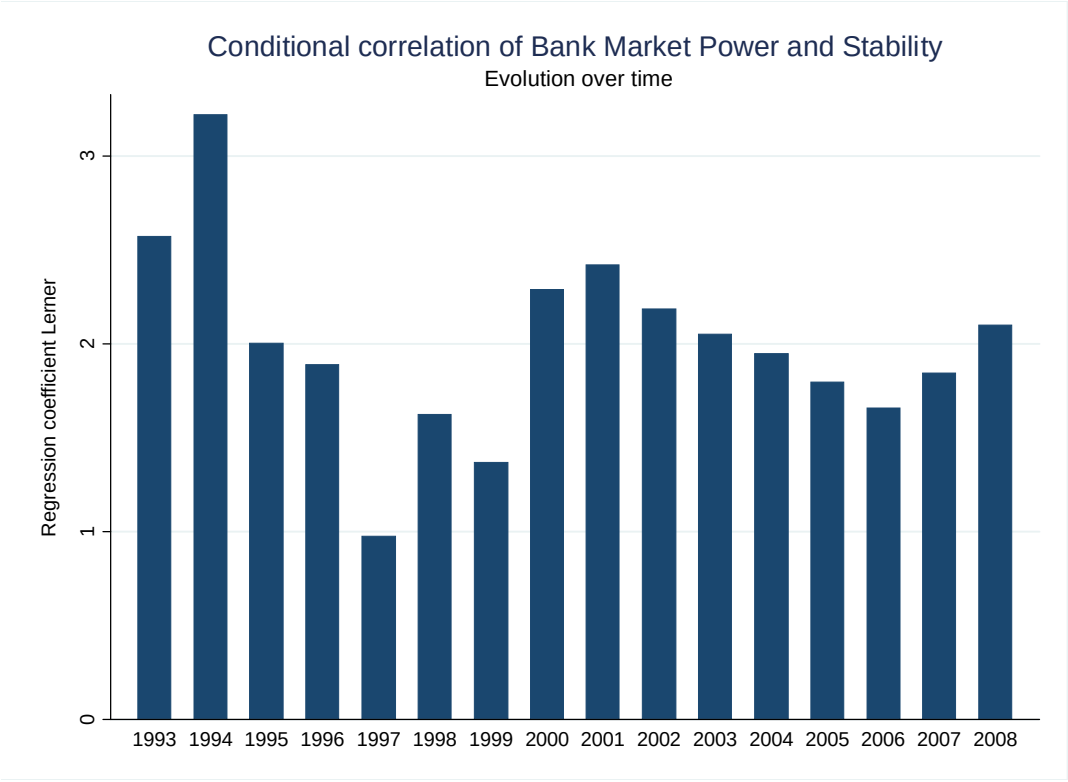
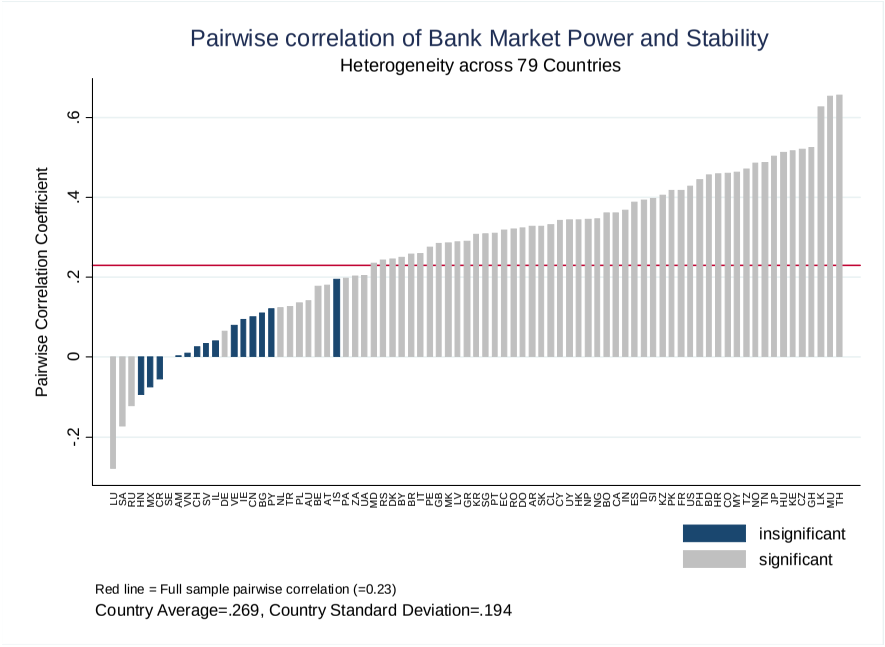


Figure 3: Correlation of Bank Market Power and Stability

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. 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. The set of countries is heterogeneous and they have different regulatory frameworks and institutional settings. We conjecture that this heterogeneity across countries may affect the competition-stability relationship at the country level. This requires that the competition-soundness relationship also exhibits variation at the country level. In the left hand side panel, the height of the bars shows the pairwise correlation between market power and bank soundness per country. The bars are sorted from low to high and the country labels are mentioned on the X-axis. The correlations that are significantly different from zero have a lighter shade. The full sample correlation is depicted by the black line and equals 0.23. The average pairwise correlation over the 79 countries ressembles the full sample correlation. However, there is a large amount of heterogeneity in the competition-stability relationship, with correlations ranging from below -0.2 to above 0.6. The standard deviation of the correlation across the 79 countries is 0.194. In the right hand side graph, the height of the bars shows the magnitude of the coefficient of the Lerner index when regressing the Z-score 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. The full black line crosses the Y-axis at the value of the estimated coefficient of the Lerner index retrieved by regressing stability on bank soundness and a set of control variables, similar to column two in table 3. The dotted lines indicate a 95 percent confidence interval. We conjecture that heterogeneity across countries may affect the competition-stability relationship at the country level. The average of the 79 estimated coefficients equals 1.64, which ressembles the full sample coefficient (1.46). However, there is a large amount of heterogeneity in the competition-stability relationship. The standard deviation of the coefficient across the 79 countries is 1.42. Appendix B contains information on the country names, abbreviations, average Lerner, average Z-sccore and the correlation between them.



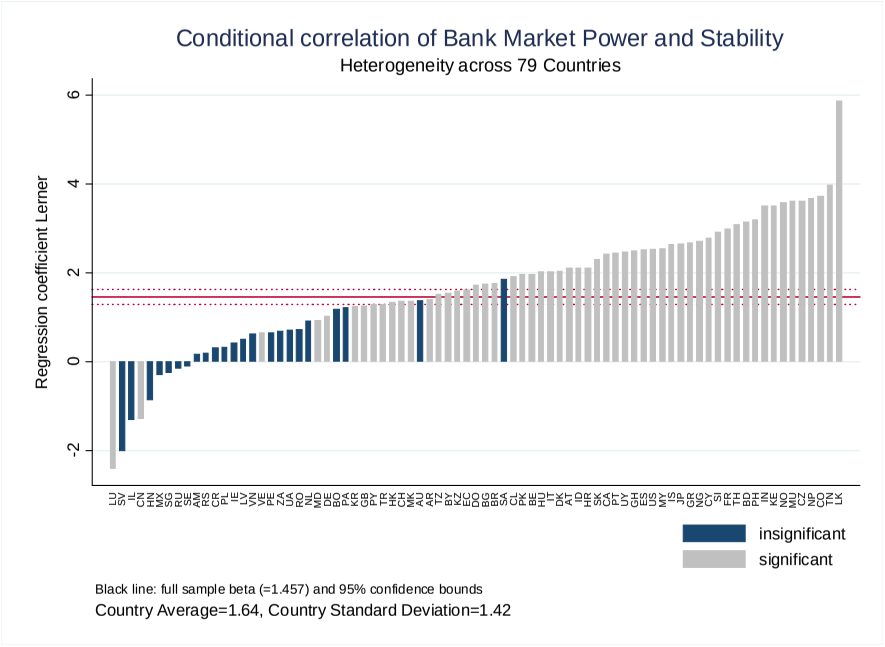


Table 1: Bank-specific Variables: Summary Statistics

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 80821 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 measured through 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	0.1348
Loans to Total Assets	0.5828	0.1884
Non-Interest Revenue Share	0.2635	0.1763
ln(Total Assets)	6.4456	1.8562
Loan Loss Provisions to Interest Income	0.1494	0.1925
Annual Growth in Total Assets	0.1025	0.2531
Commercial Bank dummy	0.5337	0.4989
Cooperative Bank dummy	0.2821	0.45
Savings Bank dummy	0.1842	0.3877
Translog Cost Function		
Total Operating Cost	280.2257	877.7694
Price of Fixed Assets	1.7439	3.2831
Price of Labor	0.0158	0.0097
Price of Funding	0.0411	0.0338
Average Price of bank activities	0.0769	0.042
Marginal Cost	0.0672	0.0386
Bank Soundness and Market Power		
ln(Z-score)	4.0057	1.3178
	Between Bank Variation	1.098
	Within Bank Variation	0.841
	Within Country-Year variation	1.143
	Between Country Variation	0.532
Lerner	0.1242	0.1427
	Between Bank Variation	0.139
	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-statistics, such that a higher value also indicates an increase in market power. p-values are in parentheses. The Lerner index is positively correlated with all other measures.

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: 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). The first four colums show the OLS estimates, whereas the fifth column are IV (2SLS) regression results. For each regression, 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. In the first three OLS regressions, 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 Lerner index and the Z-score. In the second column, we weigh each observation with the inverse of the number of banks in the country. Doing so, we control whether or not our results are driven by countries that may be overrepresented in our sample. In the third OLS regression,we limit our sample period to the period 1994-2006 to exclude the potential impact of the recent financial crisis on the competition-stability relationship. The fourth column shows OLS results when controlling for bank fixed effects instead of country-year fixed effects. In the last column, we take into account that market power may be endogenous and use an IV approach. The instruments are loan growth and lagged values of the Lerner index. [The Stock-Yogo weak ID test critical values at the 15 per cent level is 11.59 and at the 10 per cent level is 19.93.]

VARIABLES	OLS ln(Z-score)	OLS ln(Z-score)	OLS ln(Z-score)	OLS ln(Z-score)	IV ln(Z-score)
Lerner	1.927***	1.456***	1.939***	1.659***	2.303***
	(0.0994)	(0.0860)	(0.0987)	(0.130)	(0.135)
Share of Wholesale Funding	0.114	-0.0990	-0.0657	-0.0766	0.0637
	(0.134)	(0.0881)	(0.105)	(0.103)	(0.146)
Loans to Total Assets	-0.0495	0.148**	-0.0420	-0.106	0.0227
	(0.0712)	(0.0661)	(0.0714)	(0.118)	(0.0622)
Non-Interest Revenue Share	-1.046***	-0.577***	-1.101***	-0.495***	-1.113***
	(0.0826)	(0.0696)	(0.0824)	(0.102)	(0.0958)
ln(Total Assets)	0.0277***	0.00652	0.0503***	-0.0359	0.0270***
	(0.00942)	(0.00706)	(0.00671)	(0.0345)	(0.00953)
Loan Loss Provisions to Interest Income	-0.552***	-0.537***	-0.508***	-0.281***	-0.345***
	(0.0718)	(0.0531)	(0.0694)	(0.0576)	(0.0738)
Annual Growth in Total Assets	-0.461***	-0.286***	-0.499***	-0.108***	-0.283***
	(0.0426)	(0.0371)	(0.0458)	(0.0413)	(0.0402)
Constant	3.859***	3.332***	3.772***	4.281***	
	(0.0875)	(0.0688)	(0.0786)	(0.221)	
Observations	80821	80821	66440	80821	47488
R-squared	0.334	0.377	0.328	0.609	0.096
Type dummies	YES	YES	YES	NO	YES
Time x Country dummies	YES	YES	YES	NO	YES
Number of Countries	79	79	79	79	79
Country Weights		YES			
Pre 2007 sample			YES		
Bank Fixed Effects (and time dummies)				YES	
Instruments					lagged Lerner, Cost-Income ratio and Loan Growth
F-stat_IV					2071
J-stat					0.941
p-value					0.625

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

Table 4: Alternative Risk and Competition Measures

This table contains a test of the robustness of the results with respect to the bank market power and stability measure. In the baseline setup, market power is measured as the Lerner index and bank soundness is captured by the natural logarithm of the Z-score. The Lerner index is the relative markup of price over marginal cost. 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. The first column shows the results for our baseline regression, as also shown in column one of table 3. In regression two to six, we use five alternative bank soundness measures. In column two to four, we replace the Z-score by one of its constituents, being return on assets, equity over total assets and the volatility of returns. In column five, 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. The sixth column uses non-performing loans as an alternative stability indicator. In regressions seven to nine, we look at alternative market power measures. In column seven we replace the Lerner index with its two subcomponents, being the average price of bank activities and marginal cost. In column eight and nine, we use a market share indicator based on total loans or total assets as a proxy for bank market power. All regressions include bank specific control variables and country-year fixed effects. When using non-performing loans as a stability measure, we leave out the loan loss provisions over interest income ratio as a control variable, since both variables are strongly related to each other. Standard errors are robust and clustered at the country-year level.

VARIABLES	ln(Z-score3)	ROA	Equity/TA	$\sigma(ROA)$	ln(Z-score5)	NPL	ln(Z-score3)	ln(Z-score3)	ln(Z-score3)
Lerner	1.927***	3.560***	7.447***	-0.788***	1.824***	0.000962			
	(0.0994)	(0.138)	(0.451)	(0.0578)	(0.105)	(0.00960)			
Average Price of bank activities							7.716***		
							(0.820)		
Marginal Cost							-12.42***		
							(1.044)		
Market Share - Loans								0.463**	
								(0.230)	
Market Share - Total Assets									0.407*
									(0.235)
Constant	3.859***	0.316***	19.07***	0.777***	3.582***	0.630***	4.276***	4.286***	4.285***
	(0.0875)	(0.0615)	(0.593)	(0.0524)	(0.0985)	(0.0224)	(0.0911)	(0.0688)	(0.0690)
Observations	80821	80821	80821	80821	59512	80648	80821	80821	80821
R-squared	0.334	0.436	0.437	0.408	0.374	0.630	0.321	0.304	0.304
Bank Specific Control Variables	YES	YES	YES	YES	YES	YES	YES	YES	YES
Type dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Time x Country dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES

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

Table 5: 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 activity restrictions and two herding measures: 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 1074. Detailed information on the construction and data source of these country-specific variables are provided in Appendix A.

Variable	Observations	Mean	St. Dev.	Minimum	Maximum
Institutional and Financial development					
Depth of Information Sharing	932	3.867	1.965	0.000	6.000
Stock Market Turnover	927	0.544	0.819	0.000	16.781
Regulation and Supervision					
Capital Stringency	906	5.786	1.804	2.000	10.000
Deposit Insurance Coverage	1074	-0.534	1.489	-1.661	3.271
Multiple Supervisors	899	0.164	0.370	0.000	1.000
External Governance Index	898	12.686	2.059	6.000	16.500
Herding and Market Structure					
Activity Restrictions	876	9.471	2.332	4.000	15.000
Heterogeneity - Revenues	1073	0.180	0.059	0.031	0.340
Systemic Stability	989	3.604	1.141	0.185	6.297

Table 6: 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 measured at the country-year 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 (in italic). Detailed information on the construction of these variables can be found in Appendix A.

Variables	Depth of Information Sharing	Stock Market Turnover	Capital Stringency	Deposit Insurance Coverage	Multiple Supervisors	External Governance	Activity Restrictions	Heterogeneity-Revenues
Stock Market Turnover	0.240	1.000						
	(0.048)							
	68							
Capital Stringency	-0.150	0.036	1.000					
	(0.234)	(0.767)						
	65	*70*						
Deposit Insurance Coverage	0.267	0.227	-0.043	1.000				
	(0.024)	(0.049)	(0.722)					
	71	*76*	*72*					
Multiple Supervisors	0.150	0.358	-0.093	0.178	1.000			
	(0.234)	(0.002)	(0.438)	(0.135)				
	65	*70*	*72*	*72*				
External Governance	0.267	0.072	0.098	-0.096	0.054	1.000		
	(0.031)	(0.552)	(0.413)	(0.422)	(0.652)			
	65	*70*	*72*	*72*	*72*			
Activity Restrictions	0.046	-0.109	0.034	0.029	-0.064	0.181	1.000	
	(0.715)	(0.367)	(0.775)	(0.808)	(0.593)	(0.129)		
	65	*70*	*72*	*72*	*72*	*72*		
Heterogeneity-Revenues	0.270	0.101	0.146	0.121	0.047	0.145	-0.320	1.000
	(0.023)	(0.383)	(0.220)	(0.290)	(0.694)	(0.225)	(0.006)	
	71	*76*	*72*	*79*	*72*	*72*	*72*	
Systemic Stability	0.110	-0.037	0.039	-0.139	-0.186	0.094	-0.205	-0.096
	(0.362)	(0.749)	(0.747)	(0.222)	(0.117)	(0.432)	(0.084)	(0.401)
	71	*76*	*72*	*79*	*72*	*72*	*72*	*79*

Table 7: Drivers of Time-varying Conditional Correlation between Lerner and Z-score

This table explains the variation in the conditional (regression-based), time-varying correlation between bank stability and competition by regressing these correlation coefficients on country-specific characteristics. The time-varying correlation is retrieved by running country by country regressions over five year rolling windows as in Equation (2). More specifically, for each country we regress our bank stability measure (Z-score) on the Lerner index and a group of bank-specific control variables, while controlling for time fixed effects and using five year rolling windows. Since our sample period is 1994-2009, and taking into account that we lag our independent variables with one period, we get a maximum of eleven country-specific conditional correlations. The retrieved conditional correlation is subsequently matched to country-specific variables measured at the first year of the five year window. As our dependent variable is an estimated dependent variable, we require at least 50 observations over the five year estimation period to mitigate an errors in variables problem. In the first nine columns, we regress the conditional correlation coefficient separately on each country specific characteristic. The tenth column shows the results when pooling all characteristics in a single regression. The last two columns give an indication of the economic significance of the variables when pooling all country variables into one regression. We respectively look at the 10th and the 90th percentile when ranking them according to one of the country specific characteristics and calculate the impact of a change in market power for these two percentiles. The four cases mentioned in the lower end of these columns show the impact of a change in competition corresponding with one of the four different scenarios described in the text. Case 1 corresponds to the effect for a country that is average in each dimension. Case 2 ressembles a fictitious post global recession scenario with generous deposit insurance schemes (two standard deviations increase) and more herding/restrictions on bank activities; In case 3 (4), we put the country variables at the mean of the lowest (highest) 5 percent of countries. All country-specific variables are normalized (on the full sample) to facilitate comparing the economic magnitudes across specifications. All regressions include time fixed effects. Standard errors are robust and clustered at the the time level. Differences in the number of countries used in the regressions are due to differences in the data availability for the country-specific variables.

	Dependent variable: Time-varying estimated relationship between market power and bank soundness										Economic Significance	
VARIABLES	β	β	β	β	β	β	β	β	β	β	p10	p90
Depth of Information Sharing	0.133***									0.176**	1.285	1.823
	(0.0242)									(0.0562)		
Stock Market Turnover		0.111*								0.0607	1.589	1.706
		(0.0569)								(0.0603)		
Capital Stringency			0.249***							0.296***	1.306	1.971
			(0.0684)							(0.0523)		
Deposit Insurance Coverage				0.413***						0.551***	1.070	2.249
				(0.0881)						(0.130)		
Multiple Supervisors					0.0162					-0.0919	1.684	1.436
					(0.0628)					(0.0849)		
External Governance Index						-0.105				-0.124	1.792	1.487
						(0.0722)				(0.0691)		
Activity Restrictions							0.187***			0.0865	1.529	1.751
							(0.0320)			(0.0812)		
Heterogeneity - Revenues								-0.222***		-0.150*	1.799	1.494
								(0.0462)		(0.0792)		
Systemic Stability									-0.0583	-0.111	1.529	1.751
									(0.0518)	(0.0670)		
Constant	1.512***	1.729***	1.531***	1.462***	1.599***	1.484***	1.657***	1.624***	1.635***	2.238***		
	(0.00429)	(0.0127)	(0.00521)	(0.0337)	(0.00826)	(0.0459)	(0.0174)	(0.000839)	(0.00444)	(0.0844)	Case 1	1.642
											Case 2	2.965
Observations	536	568	505	590	499	502	495	590	574	437	Case 3	1.009
R-squared	0.009	0.006	0.022	0.048	0.002	0.004	0.014	0.016	0.005	0.123	Case 4	1.824
Year dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES		
Number of Countries	66	70	66	73	66	66	66	73	72	55		

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

Table 8: 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 3, 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. Doing so, we present a continuous extension to the analysis in table 7. In the last column, we show the result when we add all interaction terms simultaneously. 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.

VARIABLES	lnZscore3	lnZscore3	lnZscore3	lnZscore3	lnZscore3	lnZscore3	lnZscore3	lnZscore3	lnZscore3	lnZscore3
Lerner index	1.647***	1.704***	1.923***	1.901***	1.850***	1.939***	1.984***	1.896***	1.825***	1.553***
	(0.103)	(0.117)	(0.101)	(0.113)	(0.123)	(0.106)	(0.0828)	(0.0905)	(0.128)	(0.117)
Depth of Information Sharing	0.603***									0.354***
x Lerner	(0.109)									(0.134)
Stock Market Turnover		0.330***								0.0802
x Lerner		(0.0742)								(0.0810)
Capital Stringency			0.101							-0.0326
x Lerner			(0.101)							(0.0825)
Deposit Insurance Coverage				0.328***						0.391***
x Lerner				(0.111)						(0.0925)
Multiple Supervisors					0.207**					-0.142**
x Lerner					(0.0899)					(0.0670)
External Governance Index						0.143				-0.138
x Lerner						(0.148)				(0.137)
Activity Restrictions							0.642***			0.480***
x Lerner							(0.104)			(0.0965)
Heterogeneity - Revenues								-0.486***		0.00137
x Lerner								(0.114)		(0.125)
Systemic Stability									0.305***	0.366***
x Lerner									(0.0995)	(0.0867)
Constant	3.845***	3.838***	3.873***	3.863***	3.865***	3.873***	3.893***	3.839***	3.867***	3.872***
	(0.0870)	(0.0915)	(0.0867)	(0.0820)	(0.0894)	(0.0879)	(0.0921)	(0.0844)	(0.0867)	(0.0964)
Observations	79175	72975	77560	80849	77452	77508	76994	80848	79437	68465
R-squared	0.332	0.323	0.325	0.337	0.326	0.324	0.327	0.337	0.331	0.304
Control Variables	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Type dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year x Country dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Number of Countries	71	76	72	79	72	72	72	79	79	61

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

Table 9: Failing Banks

This table shows regression results for the competition-stability trade-off while controlling for the impact of distressed and failing banks. The first column replicates the results from column 10 in table 8, 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). For each regression, error terms are robust and clustered at the country-year level.

VARIABLES	Baseline	Exit	Distressed Exit	Not Distressed
Lerner index	1.553***	1.609***	1.368***	1.321***
	(0.117)	(0.111)	(0.120)	(0.127)
Depth of Information Sharing	0.354***	0.346***	0.335**	0.379***
x Lerner	(0.134)	(0.130)	(0.132)	(0.145)
Stock Market Turnover	0.0802	0.0943	0.0420	-0.0266
x Lerner	(0.0810)	(0.0826)	(0.0703)	(0.0854)
Capital Stringency	-0.0326	-0.0354	-0.0146	0.0459
x Lerner	(0.0825)	(0.0825)	(0.0807)	(0.0882)
Deposit Insurance Coverage	0.391***	0.378***	0.393***	0.493***
x Lerner	(0.0925)	(0.0913)	(0.0917)	(0.113)
Multiple Supervisors	-0.142**	-0.135**	-0.147**	-0.177**
x Lerner	(0.0670)	(0.0679)	(0.0631)	(0.0719)
External Governance Index	-0.138	-0.136	-0.131	-0.0924
x Lerner	(0.137)	(0.136)	(0.133)	(0.148)
Activity Restrictions	0.480***	0.493***	0.408***	0.481***
x Lerner	(0.0965)	(0.0962)	(0.0928)	(0.102)
Heterogeneity - Revenues	0.00137	0.00953	-0.0251	0.0209
x Lerner	(0.125)	(0.125)	(0.119)	(0.129)
Systemic Stability	0.366***	0.370***	0.374***	0.369***
x Lerner	(0.0867)	(0.0888)	(0.0776)	(0.0881)
Last Observation		-0.189**		
x Lerner		(0.0888)		
Last Observation Distressed			1.818***	
x Lerner			(0.189)	
Constant	3.872***	3.874***	3.917***	3.945***
	(0.0964)	(0.0961)	(0.0957)	(0.0959)
Observations	68465	68465	68465	67201
R-squared	0.304	0.304	0.306	0.280
Control Variables	YES	YES	YES	YES
Type dummies	YES	YES	YES	YES
Year x Country dummies	YES	YES	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 10: Robustness test - Market Share

This table shows regression results for the competition-stability trade-off while controlling for the potential impact of nonlinearities, a banks' market share and too big to fail status. The first column replicates the results from column 10 in table 8, 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 following columns, we expand this regression with extra interaction terms. In the second 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 competition effect. In regression three and four 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 3) or a dummy indicating whether the bank has a market share that is higher than 10 percent (column 4). In the last 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. For each regression, error terms are robust and clustered at the country-year level.

VARIABLES	Baseline	Lerner	Market Share	Large Market Share	TBTF10	TBTF25
Lerner index	1.553***	1.878***	1.900***	1.884***	1.888***	1.884***
	(0.117)	(0.109)	(0.121)	(0.113)	(0.112)	(0.110)
Depth of Information Sharing	0.354***	0.210*	0.203*	0.208*	0.207*	0.208*
x Lerner	(0.134)	(0.113)	(0.117)	(0.115)	(0.114)	(0.114)
Stock Market Turnover	0.0802	0.0761	0.0705	0.0742	0.0720	0.0730
x Lerner	(0.0810)	(0.0682)	(0.0685)	(0.0683)	(0.0682)	(0.0682)
Capital Stringency	-0.0326	-0.0709	-0.0760	-0.0724	-0.0746	-0.0751
x Lerner	(0.0825)	(0.0769)	(0.0765)	(0.0767)	(0.0767)	(0.0768)
Deposit Insurance Coverage	0.391***	0.240***	0.240***	0.240***	0.240***	0.241***
x Lerner	(0.0925)	(0.0769)	(0.0775)	(0.0771)	(0.0771)	(0.0769)
Multiple Supervisors	-0.142**	-0.0355	-0.0360	-0.0356	-0.0359	-0.0364
x Lerner	(0.0670)	(0.0614)	(0.0613)	(0.0614)	(0.0614)	(0.0615)
External Governance Index	-0.138	-0.117	-0.113	-0.116	-0.113	-0.113
x Lerner	(0.137)	(0.111)	(0.111)	(0.111)	(0.110)	(0.111)
Activity Restrictions	0.480***	0.382***	0.386***	0.383***	0.383***	0.381***
x Lerner	(0.0965)	(0.0835)	(0.0842)	(0.0837)	(0.0836)	(0.0835)
Heterogeneity - Revenues	0.00137	0.00699	0.00526	0.00610	0.00677	0.00771
x Lerner	(0.125)	(0.109)	(0.108)	(0.108)	(0.109)	(0.109)
Systemic Stability	0.366***	0.469***	0.464***	0.468***	0.469***	0.471***
x Lerner	(0.0867)	(0.0797)	(0.0801)	(0.0798)	(0.0796)	(0.0796)
Lerner		-3.298***	-3.294***	-3.296***	-3.294***	-3.294***
x Lerner		(0.235)	(0.236)	(0.235)	(0.235)	(0.235)
Market Share			-1.450			
x Lerner			(1.619)			
Dummy Large Market Share				-0.114		
x Lerner				(0.193)		
I(Size/GDP $>$ 10%)					-0.235	
x Lerner					(0.229)	
I(Size/GDP $>$ 25%)						-0.433
x Lerner						(0.279)
Constant	3.872***	4.008***	4.002***	4.006***	4.003***	4.003***
	(0.0964)	(0.0894)	(0.0926)	(0.0908)	(0.0917)	(0.0908)
Observations	68465	68465	68465	68465	68465	68465
R-squared	0.304	0.312	0.312	0.312	0.312	0.312
Control Variables	YES	YES	YES	YES	YES	YES
Type dummies	YES	YES	YES	YES	YES	YES
Year x Country dummies	YES	YES	YES	YES	YES	YES

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 Beck and Demirguc-Kunt (2009)	Ratio of the value of total shares traded to average real market capitalization
	Regulation and Supervision	
Capital Stringency	Bank regulation and supervision database Barth et al. (2000, 2003, 2008)	The strength of capital regulation in a country
Deposit Insurance coverage	Deposit insurance around the world database, Demirguc-Kunt et al. (2005)	Deposit insurance coverage relative to GDP per capita
Multiple supervisors	Bank regulation and supervision database Barth et al. (2000, 2003, 2008)	Dummy equal to one when there are multiple bank supervisors
External governance index	Bank regulation and supervision database Barth et al. (2000, 2003, 2008)	The strength of external auditors, financial statement transparancy, and the existence of an external rating
	Herding and Market Structure	
Activity restrictions	Bank regulation and supervision database Barth et al. (2000, 2003, 2008)	Degree to which banks can participate in various non-interest income activities.
Heterogeneity - 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

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.

Country	Country code	Lerner	ln(Zscore)	Cond. Corr.	Country	Country code	Lerner	ln(Zscore)	Cond. Corr.
Argentina	AR	0.082	2.576	1.398	Latvia	LV	0.176	2.917	0.506
Armenia	AM	0.199	3.326	0.174	Luxembourg	LU	0.098	3.746	-2.404
Australia	AU	0.117	3.665	1.379	Macedonia, FYR	MK	0.110	3.617	1.365
Austria	AT	0.114	3.929	2.105	Malaysia	MY	0.184	3.456	2.539
Bangladesh	BD	0.138	3.015	3.146	Mauritius	MU	0.168	3.323	3.613
Belarus	BY	0.172	3.086	1.547	Mexico	MX	0.003	2.577	-0.285
Belgium	BE	0.067	3.882	1.970	Moldova	MD	0.214	3.245	0.928
Bolivia	BO	0.030	2.919	1.185	Nepal	NP	0.164	3.489	3.677
Brazil	BR	0.161	2.814	1.756	Netherlands	NL	0.151	4.023	0.924
Bulgaria	BG	0.116	3.550	1.751	Nigeria	NG	0.165	2.894	2.717
Canada	CA	0.111	3.792	2.426	Norway	NO	0.186	3.737	3.585
Chile	CL	0.187	3.593	1.916	Pakistan	PK	0.078	3.144	1.961
China	CN	0.116	3.598	-1.272	Panama	PA	0.140	3.692	1.216
Colombia	CO	0.052	2.700	3.719	Paraguay	PY	0.188	2.933	1.292
Costa Rica	CR	0.067	3.819	0.310	Peru	PE	0.089	3.348	0.652
Croatia	HR	0.113	3.324	2.114	Philippines	PH	0.114	3.875	3.195
Cyprus	CY	0.106	2.709	2.786	Poland	PL	0.126	3.159	0.332
Czech Republic	CZ	0.102	3.151	3.614	Portugal	PT	0.078	3.612	2.442
Denmark	DK	0.191	3.578	2.032	Romania	RO	0.114	2.861	0.720
Dominican Republic	DO	0.000	3.156	1.722	Russian Federation	RU	0.117	3.296	-0.136
Ecuador	EC	0.081	3.129	1.620	Saudi Arabia	SA	0.303	3.860	1.863
El Salvador	SV	0.083	3.833	-1.996	Serbia	RS	-0.039	2.726	0.196
France	FR	0.091	3.935	2.991	Singapore	SG	0.240	3.868	-0.235
Germany	DE	0.083	4.682	1.032	Slovak Republic	SK	0.067	3.095	2.306
Ghana	GH	0.215	2.777	2.499	Slovenia	SI	0.135	3.561	2.919
Greece	GR	0.126	2.933	2.679	South Africa	ZA	0.114	3.363	0.690
Honduras	HN	0.169	3.847	-0.868	Spain	ES	0.144	4.204	2.520
Hong Kong SAR, China	HK	0.177	3.752	1.338	Sri Lanka	LK	0.180	3.092	5.867
Hungary	HU	0.125	3.180	2.023	Sweden	SE	0.232	3.673	-0.089
Iceland	IS	0.172	2.702	2.644	Switzerland	CH	0.177	4.969	1.362
India	IN	0.152	3.264	3.502	Tanzania	TZ	0.146	2.757	1.520
Indonesia	ID	0.065	3.089	2.110	Thailand	TH	-0.050	2.419	3.091
Ireland	IE	0.099	3.579	0.421	Tunisia	TN	0.111	3.267	3.984
Israel	IL	0.114	3.837	-1.296	Turkey	TR	0.174	2.722	1.292
Italy	IT	0.154	4.149	2.029	Ukraine	UA	0.110	2.983	0.712
Japan	JP	0.040	3.526	2.647	United Kingdom	GB	0.115	3.758	1.260
Kazakhstan	KZ	0.104	2.998	1.592	United States	US	0.167	4.092	2.469
Kenya	KE	0.144	3.430	3.503	Uruguay	UY	0.037	2.368	2.467
Korea, Rep.	KR	0.120	2.824	1.247	Venezuela, RB	VE	0.182	2.719	0.649
					Vietnam	VN	0.180	3.820	0.627