Bank competition and financial (in)stability in Europe: A sensitivity analysis

Samantas, Ioannis

University of Athens

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Ioannis Samantas[1]

Abstract

This studyexamines the effect of market structure variables on stability subject to regulation and supervision variables. The Extreme Bound Analysis (EBA) is employed over a sample of banks operating within the enlarged European Union during the period 2002-2010. The results show an inverse U-shaped association between market power and bank soundness and stabilizing tendency in markets of less concentration, where policies lean towards limited restrictions on non-interest bearing activities, official intervention to bank management and book transparency. However, in markets with higher share of foreign owned assets, the pattern is inverted. The significant impact of regulatory variables contributes to the ongoing reform as a stability channel of bank competition.

Key Words: Market power; financial stability; regulation; extreme bound analysis
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[1] Center of Financial Studies, University of Athens, E-mail: isamantas@econ.uoa.gr

1. Introduction

The deregulation process paves the way towards the intensification of competitive conditions, amid which financial institutions struggle to survive posing a threat to the potential incidence of financial crises. Systemic risk is large especially for incumbent whose market share and large enough to imply negative externalities to national economies in cases where cross-border activity is significant.

The ongoing restructuring towards aggregate concentration for income diversification and risk management purposes has rendered financial regulation an imperative building upon the failing premises of Basel II. In the light of the present financial crisis, capital regulation has been deficient falling short of taking account of systemic effects, market discipline ineffective due to too-big-to-fail policies, risk evaluations deficient once we consider the operation of credit ratings agencies while supervision exhausted its jurisdiction to non-shadow banking system. In line with the ingoing debate on the dynamics of competition and financial stability taking into consideration contemporary institutional reforms we shed light on the dynamics of competition in associating with the evergreen topic of financial stability.

The contribution of the underlying paper is threefold: first, it contributes to thelimitedliterature[2] focusing exclusively on Europe although some studies in theirinternational samples includethe European region(Schaeck and Cihak, 2008; Boyd et al., 2009; De Nikolo and Loukoianova, 2007; Berger et al., 2009; Laeven and Levine, 2009). Second, the U-shaped relationship of competition and financial stability is investigated empirically since no one but Berger et al. (2009) and Beck et al. (2012) allowed for it. Third, it is challenging to see if the effects of concentration and market power are insensitive to the variation of differentinformational sets. In the light of new data on regulation and supervision by the World Bank, this study for the first time utilises them[3] following a new methodology known only in the cross-country growth literature.

[2] Cipollini and Fiordelisi (2009), Uhde and Heimeshoff (2009) and Agoraki et al. (2009) for the Southestern region.
[3] See appendix for detailed description (Barth et al., 2013).

2. Theory

The analysis[4] of the underlying relationship stems from the seminal contribution of Keeley (1990) following those of Marcus (1984) and Chan et al. (1986), who proposed the 'franchise (charter) value' paradigm, that is if the diminishing market power of banks,in line with the emergence of great competitive pressures, squeezes profit margins, banks in order to recoup increased returns take refuge in risky projects. Bank failures are likely to occur when adverse selection and moral hazard problems indicate that banks are getting more reluctant to monitor borrowers and thereby falling short of exploiting the benefits of relationship banking (Boot and Greenbaum, 1993). Thus, loan portfolios tend to comprise marginal applicants and potentially exacerbate the risk exposure (Allen and Gale, 2000). In contrast, monopolistic banking markets promote the prudent conduct of banks in engaging in less risky projects amid conditions of more profit-making opportunities and capital cushions (Beck, 2008).

However, another severe source of instability is traced at the liability side; thanks to the ongoing deregulation of financial markets, interest rates have slumped on the sly ever since the endeavour of removing entry barriers and expanding restrictions flourished. In such a situation, banks strive to curb low franchise value and profitability engaging in riskier asset allocation given that in hard times of insolvency and banks runs, deposit insurance schemes are stand by to intervene. Hence, it is deemed to be essential for the authorities to impose restrictions on deposit competition to discourage 'gambling for resurrection' (Cole et al., 1995).

On the top of that, Matutes and Vives (1996) consider the self-fulfilling expectations of depositors to endogenously affect the quality – or the failure probability - of a bank. In other words, the bank withhigh depositors' trust will enjoy higher margins and greater market share as perceived to be diversified and hence safer in their eyes. In addition, they examine the welfare implications of deposit insurance equilibria: notwithstanding the positive impact of insurance in preventing crises, mitigating transport costs and extending the market, deposit insurance guarantee that all banks are credible. Hence, in the absence of no expected diversification gains to

[4] See Carletti and Hartman (2003), Beck (2008) and Vanhoose (2010) for a comprehensive theoretical and empirical review.

exploit, all banks are discounted at the same rate and the resulting higher competition hits high failure probabilities. If decisive regulatory authorities allow for takeovers of the failed banks, banks' assets remain put contributing further to financial stability (Perotti and Suarez, 2000). However, the assumption that concentration is conducive for lower competition is erroneous but, at least, possible to bring about financial stability if the preservation of long-term relationships can exploit the private and exclusive information about the way liquidity needs are probabilistically distributed (Smith, 1984).

Even it is the case that anticompetitive conductis not an inherent feature of large banks, a relative market structure may induce stability effects in the presence of well-diversified portfolios and economies of scale (Diamond, 1984; Williamson, 1986). The size, therefore, does matter in concentrated markets and recent economic history advocates fewer episodes of bank insolvency and runs occurred in Canada than in U.S. (Allen and Gale, 2000). Capie (1995) show less competitive market structures in UK to be stable during the period 1840 and 1940 and sustainably profitable in the past few decades as compared to the variable performance of German banks. The argument here is in favour of large banks and concentrated markets, upon which supervisory authorities can bear the burden of monitoring and regulating.

The other strand of literature contending the competition-stability nexus emanates from Stiglitz and Weiss (1981), who showed that monopolistic market structures are to be blamed for great charges on loans and thereby upcoming defaults. Safe borrowers are repelled by high borrowing costs and information asymmetries render a significant part of loans nonperforming and hence constituent of financial instability. Boyd and De Nikolo (2005) employed the loan market channel in their analysis to conclude that the positive relationship between risk and competition is fragile. As monopolistic structures increase loan rates, borrowers surrender to riskier projects. Thus, the probability of default rates is conditional on banks' pricing conduct in the loan markets.

That is not the case for the model of mean shifting investment technologies by Koskela and Stenbacka (2000), since higher competition diminishes the loan rates without necessarily triggering default risk in equilibrium out of the increased demanded volume of investments. Caminal and Matutes (2002) found that monopolistic markets, bearing the costs of monitoring, tend to be more susceptible to risky loans and thereby subsequent failures. Thus, failing credit rationing, bank

willingness to loan out places the bank course in jeopardy. On the other hand, De Nikolo and Luchetta (2009) proved out of a general equilibrium framework that efficiency, optimal portfolio quality and diversification rents best feature competitive markets, though non-perfect competition constitutes second-best alternative.

On the other hand, Allen and Gale (2004) put forward a number of theoretical models of competition and financial stability trying to shed light on the multifaceted underlying relationship. They include aspects like spatial and Schumpeterian competition, agency costs, financial intermediaries and contagion to highlight the efficient levels of potential trade-off between competition and stability. It is Pareto optimal, though socially undesirable, to have instability in cases of a) perfect competition and complete markets, b) present agency problems due to the incentive to acquire greater market share and 'last bank standing effect' (Perotti and Suarez, 2002)[5] and c) many banks occupying the same locations and lacking innovation (Schumpeterian competition). Contagion might well be an outcome triggered by the systemic risk of an aggregate shock on liquidity only where competitive interbank market leaves price takers off to liquidate their assets.

Under the perspective of supervision and precautionary regulation, interesting arguments have been articulated in the literature. The assertion that it is easier to monitor few and large banks rather than much more and smaller banks, does not cohere with operating complexity of large entities. Under conditions of expanding restructurings, universal banks and conglomerates provide the whole spectrum (or part of) of financial services - e.g. consulting (M&As), instrument and proprietary trading (derivatives included), stock broking, investment management, insurance – which have been previously offered by more specialized banks, such as commercial, investment, and merchant banks. The subject is apparently multifarious for supervisory authorities to inspect and timely intervene rendering financial instability a presumptive reality. On the contrary, the mandate of having concentrated markets at the convenience of authorities, policies are likely to lean towards the provision of large subsidies and bail-outs in an attempt to eschew from impawning the viability of too-big-to-fail banks. Under the auspices of such tutelar policies, bank managers have

[5] Supporting the competition-stability literature, it concedes the prudent bank behavior as precipitated by the probability of the other market players be hit by random solvency shock. In the end, duopolies turn out to produce great monopoly rents.

an incentive to take risks potentially exacerbating the contagion risk of large and insolvent banks (Mishkin, 1999).

Without constraining ourselves to surrender to any side of contending hypotheses, it could be the case that there exists a matching point. Martinez-Miera and Repullo (2010) concur that there exists a U-shaped relationship between competition and bank failure risk. In particular, monopolistic markets experience the risk-shifting effect, that is more competition with low loan rates stabilizes banks as they run less risk of default whereas the margin effect – lower revenues of total non-defaulting loans may jeopardize banks in view of potential entries – occurs usually in competitive markets.

3. Methodology

The decision upon which variables are theoretically and empirically grounded to constitute the crux of deterministic group is not that apparent. The underlying literature has proposed different econometric modelling – (e.g) GMM methodology, panel, probit, logit models and duration analysis, etc. – and various determinants of bank risk of failure. Such unwieldy bulk of variables amounts to almost 50 variables that end up with mixed results depending each time on the econometric specification and the independent set of the regression model. On those grounds, this paper considers interesting the prospect of analysing the statistical power of key effects (market power, concentration) of bank risk conditioned to the variation of every single subset of variables. In other words, utilising Extreme Bound Analysis (EBA) as set out by Leamer (1983; 1985) and Leamer and Leonard (1983), the partial correlations of dependent and independent variables are examined to endorse whether such relationships are fragile or robust at standard confidence levels.

Hence, the employed methodology is a sensitivity analysis of linear modelling regarding multiple regressions of bank risks on explicit groups of variables. We embark upon the group of interest that comprises the effects of market power and concentration along with their quadratic terms to allow for non-linearities. Along the lines, both centrifugal strands of literature can be verified without precluding the significant power of the other. The following steps of analysis include reasonable

subsets of cautiously pooled variables that one can identify as statistically significant in the literature. Schematically,

Financial stability (lnZ) = f [Market structure variables (L_{t-1}, CONC), institutional (I), macroeconomic (M), bank-specific factors (B_{t-1})] + ε (1)

In this model, the variables of interest are market power and, secondarily, concentration. The Lerner index (*L*)isappropriate to capture the pricing conduct of banksafter extrapolating marginal costs through the standard stochastic modelling of equation (3) along with the estimation of the partial derivative of total costs with respect to total assets (equation 4). Concentration is proxied by Herfindahl-Hirschman ratio (*HHI*) since it is deemed in the literature to delineate real market conditions in antitrust policies and represent the stepping-stone of SCP paradigm. The selection of both measures that have drawn attention in the empirical analysis is cautious of the fact that they have been overwhelmingly applied in the literature interchangeably to explain market conditions[6]; in the following analysis, I opt to plug them both in regressions to compare the accruing evidence.

All variables allowed to have variation at the bank level, namely competition and several other controls that encompass the banks' business model, are lagged one period to avoid reverse causality among them. In other words, the endogeneity of market power may reflect the impact of insolvency on market structure and pricing conduct of banks subsequently. The fact that country-level factors remain free to interact concurrently provides a prima facie insight of the potential drivers of heterogeneity. In addition, the fact that the some countries (specially Germany) are highly represented in the sample, the analysis employs the inverse of the number of banks operating within each market in a way to avoid any such bias and guarantee error clustering at the country level.

The bound analysis kicks off at the point where the baseline model regresses financial stability on the variables of interest (*L*, *CONC*) after controlling for other bank-specific specificities (*B*) and adverse macroeconomic conditions (*M*) across the region to deduct as much a possible the error effects and convey real depiction in levels and significance of the underlying coefficients. Various bank-specific factors

[6] See Schaeck (2009) for a thorough review on measures of concentration, market power and financial stability in the literature.

are also employed to encompass different aspects of banks' balance sheet, income structure, corporate governance and general strategic planning investigating. As a next step thereafter, institutional factors that allow for different legal systems, regulatory schemes and market discipline mandates (*I*) are plugged in to construct the bounds of the market structure coefficients.

Thus, the extreme upper and low bounds of the coefficient values are constructed by allowing for all possible combinations of *I*-effects expanding the analysis up to 10 regressions for each model. The degree, to which partial correlations between market structure and financial stability are robust or fragile,is defined by the persistence of the sign and the statistical significance in-between the range of the bound. Otherwise, the variables of interest should be treated with less confidence as far as their causal effect on risk is concerned since the fragility in the underlying relationships in terms of sign and statistical inference is contingent on the employed information set. However, the analysis does not aim to come up with a single model that breaks down the competition-(in)stability nexus, rather to assess the interconnections in between considering what has been proposed in the empirical literature and always on the mandate of ever-afresh institutional reform.

My endeavour is to resolve the adverse results on the relationship between competition and concentration through the employment of the quadratic term of Lerner index to verify whether it is the case of U-shaped relationship. The underlying addition comes ad hoc, only in the models that construct the extreme bounds of competition and concentration so as to estimate the infection point; that is, the value of competition above which the relationship of soundness-competition alters; otherwise, the use of it in all model combinations would blur the effective bounds. In case of no significance in the coefficient of the Lerner index that constructs the extreme bounds, I opt to utilise a different information set of the same size.

Moreover, the aim of gauging the impact of country-level variables on risk seems to be insufficient, if not inappropriate due to the possibility that the underlying effect may not be expressed in levels but also in slopes (model 2). Hence, the model includes interaction terms between country-level factors and the Lerner index along with lagged bank-specific controls. However, the only drawback with this approach is that interaction terms may bring about multicollinearity problems that are partially counterbalanced by more degrees of freedom due to the regression analysis conducted on a whole sample. Such problems are depicted in inflated standard errors and,

consequently, in higher coefficients revealing thereby a potential weak-data problem; the latter consists in the little variation of a specific independent factor to determine cross-sectional differentials(Levine and Renelt, 1992). The model is schematically the following:

$$\ln(Z) = f(L_{t-1}, CONC * L_{t-1}, I * L_{t-1}, M * L_{t-1}, B_{t-1}) + \varepsilon \qquad (2)$$

The variable of interest is the Lerner index (*L*)alogside concentration (*CONC*), both included in the analysis simultaneously since they tend to reflect different features of bank competitiveness. Second, I utilise all possible combinations of two and three I-variable sets in order to juxtapose the results comprisingfive bank-specific variables, three country-level variables, a procedure that comes along the lines of Kormendi and Meguire (1985) and Barro (1991).

4. The model

We should first estimate the price mark-up over marginal cost (Lerner index) combining the estimation of average prices and marginal costs at the bank level. The average prices are estimated over total assets (TA) along the lines of Shaffer (1993) and Berg and Kim (1994), instead of other earning assets in an attempt to expand as much as possible the observations of the sample since 2002. First, we have to estimate marginal costs by means of running a translog cost function, similar to the version of Turk Ariss (2010) that excludes the use of price of borrowed funds as input price on the grounds that it presumably captures some degree of monopoly power of incumbent banks in the deposit market. The employed model takes the following form:

$$\begin{aligned}\ln TC = {} & a + \beta_1 \ln Q + \frac{1}{2}\beta_2 \ln Q^2 + \sum_{k=1}^{2}\gamma_k \ln W + \sum_{k=1}^{2}\theta_k \ln Z + \frac{1}{2}\sum_{k,j=1}^{2}\kappa_{k,j} \ln W^2 + \\ & + \frac{1}{2}\sum_{k,j=1}^{2}\mu_{k,j} \ln Z^2 + \frac{1}{2}\sum_{k=1}^{2}\xi_k \ln Q \ln W + \frac{1}{2}\sum_{k=1}^{2}\pi_k \ln Q \ln Z + \frac{1}{2}\sum_{k,j=1}^{2}\varphi_{k,j} \ln W \ln Z + \\ & + \psi T + \frac{1}{2}\psi T^2 + \frac{1}{2}\psi T \ln Q + \frac{1}{2}\sum_{k=1}^{2}\psi_k T \ln W + \frac{1}{2}\sum_{k=1}^{2}\psi_k T \ln Z + \varepsilon\end{aligned} \qquad (3)$$

where TC: total costs (total operating costs (interest expenses, personnel and other costs), Q: total bank output or total assets, W1: price of labour (personnel expenses over total assets), W2: price of physical capital (other operating expenses over fixed assets), Z1: fixed assets deflated by total equity, Z2: Off-balance sheet activities deflated by total equity and T: time trend. Fixed effects modeling accounts for different bank specificities and the estimation of model (3) separately for each banking market seems to reflect different technologies in the region. Time dummies also interact with the deterministic kernel in order to capture time-varying and non-neutral technological progress in the banking sector. Homogeneity of degree one in input prices ($\Sigma\gamma k=1$) and symmetry conditions in all quadratic terms are imposed in model (3).

When it comes to the estimation of the Lerner index, the extrapolation of the marginal costs by running the following model, which is schematically the partial derivative of total costs with respect to total assets (see Berger et al. 2009; Turk Ariss, 2010):

$$MC = \frac{TC}{Q}\left[\beta_1 + \beta_2 \ln Q + \sum^{2} \xi_k \ln W + \sum^{2} \pi_k \ln Z + \psi T\right] \qquad (4)$$

We are then able to construct the Lerner index (L) with respect to specific bank activities before delving into the analysis of competition determinants. According to the following structural model,

$$L_{i,t} = \frac{AR_{i,t} - MC_{i,t}}{AR_{i,t}} \qquad (5)$$

AR denotes the average revenue of banks estimated by total income over total assets and MC the marginal cost derived through model (4). Their subscripts signify the use of Lerner index as the only proxy of market power at the bank level over time. I then estimate the natural logarithm of Z-score, which have been widely accepted in the

literature as the most reliable proxy of distance from a situation of insolvency. I compute it in the form of the following expression,

$$Z_{i,t} = \frac{ROA_{i,t} + (E/TA)_{i,t}}{\sigma(ROA_{i,t})} \qquad (6)$$

where ROA: returns on assets, EQ/TA: total equity to total assets, σ(ROA): standard deviation of returns on assets, all expressed at for bank *i* at time *t*. It is interpreted as the number of standard deviations by which ROA should fall under the mean so as to extinguish the equity of a bank (Boyd and Runkle, 1993). To avoid time invariance of the denominator, a three-year rolling window is implemented so as to potentially attribute the variation of the Z-score not only to the variation of profitability and capital, but also to the volatility of bank profitability. When it comes to set it as a dependent variable, the natural logarithm of Z-score normalises its extreme values due to high skewness. In the literature, any possible negative values are alleviated by transforming them through truncation at zero point [ln(1+Z-score)] or winsorising at 1% level and then taking logs. Since the latter produces non-negative values, I opt for it.

5. Determinants of stability

5.1. Bank-specific variables

Asset size has been used in the literature (e.g. Liu et al., 2012) in an attempt to see whether financial stability comes from managers attitude to exploit scale economies or by the perception that too-big-to-fail policies will constitute the facility of last resort in the form of governmental subsidies, among others.***Capital ratio*** is the value of total equity deflated by a bank's total assets. We employ it to account for differentials in risk preference behaviour of bank managers along the lines of Schaeck and Cihak (2008) and Berger et al. (2009). ***Cost efficiency*** turns out to be the most widely employed accounting variable that proxy for cost efficiency as contemporary efficiency modelling may produce bias due to certain methodological and econometric assumptions. A negative effect on stability is expected since inefficient

banks tend to engage in risky behaviour to make up for insufficient performance (Uhde and Heimeshoff, 2009).

Liquidity is controlled for by the ratio of liquid assets over customer deposits and short-term funding. It measures what percentage of deposits and funding can be served in case there is a suddenly bank run. The higher this ratio is the less vulnerable a bank is vis-à-vis a deposit run-off case. We see similar proxies in the literature, such as liquid assets over liquid liabilities or over total assets (Laeven and Levine, 2009; Olivero et al., 2010), with no substantial difference in practice. ***Diversification*** indicates the ability of a bank to expand its operations to off-balance sheet activities, namely to insurance, real estate and securities activities; thus, a standard proxy is the total non-interest operating income over total. I expect a negative association between diversification and risk but it also might be the case that banks with high-income diversification are exposed to greater risks in their attempt to accomplish economies of scope (Stiroh, 2004).

5.2. Macroeconomic variables

GDP growth rate has been employed by the studies of Bonfirm and Dai (2009), Jimenez et al. (2013) and Olivero et al. (2010) in order to control for different stages of economic development. As for its expected effect, higher customer demand after the adoption of Euro may resulted in better managerial efficiency in terms of a relatively superior utilisation of production factors (Conrad et al., 2009). Economic prosperity reduced the probability of a potential bank crisis, which usually comes along with loan risk during economic recessions. On the other hand, loan losses can occur during economic booms if high growth GDP rates promote optimistic evaluations over borrowers' creditworthiness leading to less stringent policies, and when competitive structures make managers more willing to risk-taking activities (Jimenez and Saurina, 2006).

Boyd et al. (2004) underscore ***inflation*** as another key determinant of bank failure. When the nominal rate of interest (inflation) is below a certain threshold, a relatively higher probability of bank failure is present in monopolies on the grounds that the incentive of loaning out cash reserves dominates that of paying low rates on deposit accounts. Secondly, asset loss is greater in competitive structures in times of a

crisis, as monopolies tend to make profits upon the liquidation of assets (e.g. deposits) except cash, for they are able to provide inter-temporally much lower deposit insurance.***Stock market turnover*** is defined as the total value of trended shares over the average stock market capitalisation. I employ the degree of liquidity in stock markets in order to take account of alternative funding means of firms, which may be related to greater dissemination of credit information and, thus, to greater bank soundness (Beck et al., 2012).

5.3. Regulatory environment

Capital regulatory index measures the degree of regulation on bank capital that should be set aside as a buffer for potential market and credit risks. In particular, it is about the initial capital stringency, that is which type - and to what extent - of regulatory funds other than cash, governmental securities or borrowed funds, is appropriate and verifiable by the official regulatory authorities. It is also about the overall capital stringency, according to which the regulatory capital is estimated accounting for risks and value losses. Thus, we quantify it by ascribing values of 0 or 1 to every single one of the nine questions included in the appendix, with the observations ranging between 0 (no stringency) and 9 (high stringency). After the advent of Euro, the necessity to build upon the inefficient or inadequate regulatory directives as set out by the Accord of the Basel Committee (Basel I, Basel II and III) constitute the product of sedulous research. Empirical studies are split between the invigorating effects of capital requirements on less loan losses and the detrimental implications on risk-taking. Required reserves of capital may constitute sufficient buffers in view of potential liquidity shocks notwithstanding the case of banks embarking on gambling behaviour in order to make up either for the utility loss of powerful bank owners (Laeven and Levine, 2009), or for the diminishing franchise values (Hellman et al., 2000).

Official supervisory power measures the degree of supervisory power exercised by the official authorities and their 'intervention' to the decisions of bank managers. It takes values from 0 to 10 ascribing 0 and 1 to negative and positive responses, respectively. From a theoretical perspective, strong supervision tends to demoralise managers to engage in excessive risk-taking - especially in countries with

low accounting requirements (Fernandez and Gonzalez, 2005) - whereas it may be associated with corruption in lending transactions, and obstruction of bank operations (Barth et al., 2004).

Private monitoring index is indicating the degree of information released to the public and officials relative to requirements of auditing authorities and credit rating agencies. It takes values between 0 and 10 after taking into account the 'no' and 'yes' responses of 10 questions, respectively. Hence, higher values highlight greater private insight over the economic performance of banks. It has been overlooked in the literature and only recently has been utilised by Schaeck et al. (2009), who argue about the insignificant concentration due to the common practice of investors, regulatory authorities and credit agencies to inspect large entities closely.

Activity restrictions is an interesting variable commensurate with the extent to which bank activities like securities, insurance and real estate activities are under constraint. In particular, it takes the responses of 'prohibited', 'restricted', 'permitted' or 'unrestricted' and we quantify them by assigning the values of 4, 3, 2 and 1, respectively. We, finally, get the average value of the overall index and draw remarks over the degree of activity restriction. In the literature, there are two strands of reasoning in favour or against their effect on bank soundness. In cases when such restrictions forbid banks to engage in more risky projects, financial stability is evident (Uhde and Heimeshoff, 2009). However, if banks are restricted to diversify their portfolio to non-interest bearing products, the concomitant utility loss induces powerful bank owners to riskier conduct (Laeven and Levine, 2009).

Foreign ownershiphas been employed (e.g. Yeyati and Micco, 2007) is calculated as the total assets of banks, which are owned by foreigners with more than 50% stake, as a percentage to the total assets of the banking system they operate within. The issues related to penetration of foreign banks in a national market are the screening costs of local customers that tend to attenuate through acquired experience, and the guarantees of the parent bank that constitute a safety net in times of insolvency and liquidity shocks (De Nikolo and Loukoianova, 2007; Claessens et al. 2001). There is also the option to pick up national banks of monopolisic markets (dodging competition hypothesis), higher operational efficiency (cream skimming hypothesis), or large market shares through branches and subsidiaries (quest for market power hypothesis).

6. Data

The sample includes financial data of at most 2450 banks headquartering in the enlarged European Union (27-EU). The data are from consolidated accounts of the Bankscope database, and when that is not possible, the use of unconsolidated accounts is the second-best solution. The data amount to 12118observations for the period 2003-2010 and pertain to EU-15 and EU-12 subgroups of the European Union[7]. The decision to analyse a period after the crack of the financial meltdown emanates from the latest update of supervision and regulatory variables[8] in the World Bank. To avoid losing observations-outliers in an already limited sample, I winsorize at 1% level of the distribution of the Lerner index and the Z-score to smooth out their impact and come up with robust standard errors. The sample alsoincludes the whole spectrum of productive specialisation[9] in European banking after careful elimination of double counting for every single case.

[Insert table 1 here]

Table 1 contains summary statistics of the key bank-specific and regulation variables employed throughout the main econometric part. Each column exhibits the mean values per country as well as the average of the developed and developing region[10]. In particular, EU-15 is far more stable throughout the period 2003-2010; Germany and Spain stand out as the best performers in contrast with Finland and Greece, which are below the average of EU-12. In the latter case, Slovenia, Bulgaria and Poland enjoy greater bank soundness whereas Cyprus, Estonia and Latvia lie below the lowest score of EU-15 countries. Furthermore, harsher monopolistic

[7] EU-15: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Netherlands, Portugal, Spain, Sweden and UK. EU-12: Cyprus, Czech R., Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, Bulgaria and Romania.

[8] In particular, through the use of questionnaires disseminated in many financial institutions, the methodology followed to construct the *I*-variables is explicitly encompassed in the appendix as retrieved from Barth et al. (2013).

[9] Bank holding and holding companies, Clearing institutions and custody, Commercial banks, Cooperative banks, Finance companies (Credit card, Factoring and Leasing), Group finance companies, Investment and Trust corporations, Investment banks, Islamic banks, Micro-financing institutions, Other non-banking credit institutions, Private banking and Asset management companies, Real estate and mortgage banks, Saving banks, Securities firms and Specialised governmental credit institutions.

[10] Bulgaria and Romania is included in the EU-10 as they constitute the enlarged Southeastern part of European Union.

conditions occur in UK (80.3%) and, especially in Lithuania (76.4%) and Malta (63.9%). In contrast, Finland, Ireland and Cyrus have negative values of the Lerner index, indicating an irrational behaviour or predatory pricingon banking products. The rest variables provide a clear snapshot of the special characteristics of each banking market and the country-level conditions of the economy, regulation and supervision.

[Insert table 2 here]

Table 2 contains information on pair wise correlations of the country-specific variables employed in the analysis. As we can see, correlation is significant at 5% level between the variables of regulation and supervision. In particular, countries with high inflation experience higher market concentration andgrowth rates of GDP, which come in line with transaction activity in the stock market. Moreover, the decisive intervention of supervisory authorities to the decisions of bank managers is correlated with more regulation on bank capital and markets of more foreign-owned banks while it appears as a substitute mechanism to correct imprudent practices through less bank information required by public authorities. However, such transparency in a market of incumbent banks also appears as a policy complement to restrictions imposed on non-traditional banking activity.

7. Main results

Table 3 displays the results of the sensitivity analysis conducted to see whether and to what extent factors of regulation and supervision have an independent impact on bank soundness. The baseline model in the first column excludes everything but the macroeconomic and bank-specific controls while the rest comprises the results we add one key variable at a time in order to see the variables of market structure. The coefficient of Lerner remains significant with a negative effect except in the last two columns, where it loses significance; in contrast, the underlying effect turns positive when the model allows for capital regulation.Concentration in the banking market enters with negative bearing on bank soundness persistently at 1% significance level.

There is an explicit significance of regulatory variables when they are assessed individually notwithstanding official supervision enters with no explanatory power. Once we plug them all in the model their compound effect turns out to be significant at 1% level. Significance of activity restrictions[11] denotes that managers are restricted to enter other non-traditional business lines for diversification purposes, taking on more risks and exacerbating thereby their portfolio risk exposure. On the contrary, capital regulation enters significant at 1% level fostering stability to the banking sector. Hence, more capitalization makes banks immune to liquidity shocks although the opportunity cost of such a 'tax burden' in cases of powerful owners, constitute a considerable motive for risk taking by means of monopolistic conduct (Laeven and Levine, 2009). Similarly, foreign ownership is related to bank stability meaning that the openness to foreign institutions leads to competition and profit margins due to the adoption of better practices that enhance further operational performance. Bank soundness peters out as official supervision becomes more stringent on the grounds that some degree of corruption in lending activities undermines systemic efficiency (Beck et al., 2006b). Last, private monitoring is highly significant with a negative bearing on banking system stability despite the fact that too-big-to-fail banks have been subject to close monitoring and inspection due to their potential systemic repercussions. Hence, there is a motive for excessive risk-taking among incumbent banks without hampering the effect of concentration.

Once the whole set of I-variables enters the model, the same pattern holds for regulation variables with no credit at least for the stand-alone explanatory power of foreign ownership. Considering possible policies, an increase in ACT, CAP, OFF, PRIV by one standard deviation leads to a Z-score change of -2.9%, 11.4%, -15.9% and -11.7%[12], respectively.In fact, there are many possible scenarios of regulatory reforming, combining the above effects towards a more rationalised too-big-to-fail banking system.

Furthermore, times of high market demand as expressed by GDP growth make banks utilize production factors in a more efficient way of diminishing average costs (Conrad et al., 2009), while the combination of policies altogether are able to boost

[11] The stabilizing effect of activity restrictions is found by Berger et al. (2009) and Beck et al. (2012) unlike Beck et al. (2006a), Laeven and Levine (2009) and Uhde and Heimeshoff (2009) advocating to the contrary.

[12] The estimation emanates from the respective coefficients multiplied by their standard deviation [ACT: 2.069, CAP: 1.462, OFF: 2.314, PRIV: 1.382].

further the impact of the business cycle towards more stabilising practices. In contrast to the persistent positive effect of GDP growth, the stand-alone impact of inflation on bank stability is significantly negative highlighting possibly the incentive of loaning out cash reserves rather than paying low deposit rates. More liquidity in stock markets has considerable bearing on financial fragility, which is not expected. That may reflect the risk-shifting tendency of banks towards non-traditional activities, herding behaviour, among others.

A significantly positiverelationship is also evident between asset size and bank soundness coupled with a fragile effect of cost inefficiency. Hence, I conclude that the exploitation of economies of scale is below par insofar as government subsidies and other 'too-big-to-fail' policies operate as last resort mechanisms for managers with excessive risk-taking tendency. That also is in line with Schaeck and Cihak (2013), who consider efficiency as a significant channel of stability through competition. Furthermore,the equity ratiodemonstrates, though not persistently, its positive bearing at 1% significance level as it constitutes a buffer that insulates a bank from low profitability or profit volatility commensurate with the degree of managers' risk aversion. Moreover, portfolio diversification is explicitly significant in jeopardizing bank stability as banks on their way to accomplish economies of scope engage in excessive risk-taking (Stiroh, 2004). The same destabilizing pattern lies in the coefficient of liquidity ratio implying excessive opportunity cost that is potentially compensated by risky portfolio allocations.

[Insert table 3 here]

Then EBAthroughany possible combination of regulatory variables attempts to verify whether there exists a persistent effect of market power and concentration in sign and significance. Hence, the coefficient of Lerner index takes significant values at 1% level ranging between -0.368 and 0.096 when I include [ACT, OFF] and [CAP, PRIV] in the model, respectively. Hence, an increase of one standard deviation in the Lerner index drives to a relative change of the Z-score ranging from -8% to +2.1%. Concentration reports no switch in impact sign and proves to be stable in its relationship with bank soundness across all possible regressions. It takes values from -0.009 when [OFF, PRIV] come into play, to -0.008 with [ACT, CAP, PRIV] variables.

In the next two arrows below the grey ones, the models that constructonly the extreme bounds of Lerner and concentration comprise the quadratic term of market power to verify whether, and to what extent, it is the case of non-linear relationship between Lerner index and Z-score. The linear effect of market power takes values between the range [0.785, 0.585] and the narrower one [0.608, 0.760] for the extreme bounds of the Lerner index and HHI, respectively. The former bounds indicate fragility in the underlying relationship as opposed to the significance at 1% level in the latter. On the other hand, the respective bounds for the quadratic term are [-1.071, -0.603] and [-0.875, -1.213] while t-values show persistent explanatory power. It is therefore concluded that the U-shaped relationship between competition and risk does exist and sign change occurs at the infection points [0.733, 0.970] and [0.695, 0.627], where concentration and market power get close to their limits. In another perspective of Lerner (concentration) EBA, profits have to fall before equity is fully depleted by 17.4%-12.9% (13.5%-16.9%) more standard deviations if market power increases by one standard deviation. However, when market power takes values more than 0.733 (0.627), a reduction of market power by one standard deviation makes profits diminish by 23.8%-13.4% (19.4%-26.9%) more standard deviations before equity capital is totally depleted.

[Insert table 4 here]

In table 5, I replicate the procedure by allowing for the effect of country-level factors not only to take place in levels but also in the slope of the competition-stability nexus. The linear effect of Lerner index is quite stable in its positive sign and persistence in the sensitivity analysis of model 2. Market power drives to bank stability in markets of limited concentration where we see effective systems of less restrictions on bank activities, more capital requirements, less share of foreign-owned banks, limited intervention of supervisory authorities on a bank's decisions and less private monitoring. In the assessmentof the stand-alone impact of foreign ownership,I marginally reject its bearing on stability at 10% level while market power and its interaction with concentration are neutralised. Thus, foreign penetration and any policy conducive to it fail to explain the variation of the Z-score as long as they are seconded by supplementary initiatives. The expected effect of one-standard-deviation increase in ACT, CAP, FOR, OFF and PRIV on the market power-stability

correlation is -2.3%, +7.1%, -32.3%, -7.3% and -9.4%[13], respectively. Considering the negative sign as in the results of model 1, regulation policies tend to undermine financial stability, as monopolistic pricing can no longer keep up at the expense of potential systemic infection, undisciplined bank management and unreliable accounting information.

The last part of the table gives a prima facie impression of the role of the business cycle and the special characteristics of differently specialised banks. The intensity of GDP growth rate stabilise profits and concurrently minimise loan losses and profit variation while it owes its devastating impact to lower equity capital along the lines of the propensity of banks to increase their leverage profile, and follow securitisation strategies of poor quality. On the other hand, stock market funding tend to have a positive impact on profitability and a negative one on sROA and loan losses, although without sufficing to justify its negative sign in tables 1 and 2.

I also verify considerable significance in the independent effects of interaction terms between lagged competition and macroeconomic variables. I conclude that GDP growth bolsters the stabilizing bearing of market power across all cases. Furthermore, inflation pressures and stock market liquidity does notjeopardise the competition-stability nexus. However, in the last column we see clearly the fact that regulation policies tend to deprive stock market funding from non-linear correlations with bank soundness. As in table 1, the sign of bank-specific factors remains put but their statistical significance becomes evident in fewer cases. Looking at the full model, fragility is exacerbated by financial institutions with higher asset size, less capital buffers, lower cost efficiency and greater portfolio diversification. Only bank size has a persistent effect throughout the analysis of model 2, while once the model allows for the single interaction between activity restrictions and market power, cost efficiency and non-traditional income demonstrate their explanatory power accompanied by the destabilising effect of liquid assets.

[Insert table 5 here]

[13] The increase of one standard deviation in ACT, CAP, FOR, OFF, PRIV leads to a Lerner coefficient equal to 1.855, 2.033, 1.284, 1.760 and 1.710, respectively. Thus, the relative change is estimated considering the initial level (1.898).

In the grey rows, the extreme bounds of competition and concentration, emanated from two to three-variable sets, range in-between the values of [0.326, 2.775] and [-0.019, -0.005], respectively. For the former case, the model comprises [CAP, OFF] and [OFF, PRIV] for its lowestbound and highest bound, respectively; as for the interaction HHI*L the bounds are constructed by [OFF, PRIV] and [ACT, CAP, OFF] specifications. In addition, the partial correlation both at 5% and 1% significance level is fragile and it takes the replacement of one I-variable to change sign or lose significance, whereas concentration keeps its robust significance across all versions of model 2. Once I plug the squared term, the linear effect across all extreme bounds of the Lerner index and its interaction with HHI lies between the ranges [0.927. 3.394] and [3.394. 2.340], respectively. Similarly, the quadratic variable gets values in-between the bounds[-0.771, -0.809] and [-0.809, -1.316] with a persistent significance at 1% level across all specifications. Thus, an increase in the Lerner index of one standard deviation drives to higher levels of the Z-scoreby 7.2% (61.6%), which is further decomposed to a positive 23.8% (19.4%) change up to a point where higher levels of market power lead to a fall by 14.5 (17.8%).

[Insert table 6 here]

8. Is the effect of market structure variables altered by the interaction between ownership with regulation?

There exist some theories about the correlation between ownership and risk being variant along with different national regulatory policies (e.g. John et al. 2008). I therefore embark on a sensitivity analysis including interaction terms of regulatory variables with foreign ownership (*F*) to see whether prudential policies are crucially determined by certain governance structures. The employed model is the following:

$$\ln(Z) = f(L_{t-1}, CONC, I*F, B_{t-1}) + \varepsilon \qquad (7)$$

Table 7 confirms a negligible impact of market power on bank riskiness and the persistence of concentrated markets in risk-taking behaviour irrespectively of the

degree of collinearity amongst interaction terms.In the regressions containing one I-variable each time, there is considerable stand-alone effect of regulation and supervision on bank soundness that is materially contingent uponthe degree of foreign ownership. In particular, foreign ownership is positively associated with financial stability in markets where a) more restrictions are imposed on banks to engage in securities, insurance and real estate activities, b) less bank capital reserves are required, c) official authorities do intervene in bank managers' decisions and d) there is higher degree of monitoring from rating agencies and auditing authorities.

Admittedly, the results are in absolute contradistinction with the first two models implying that ownership structures may differentiate the impact of competition policies especially in (developing) markets where banking integration takes the form of M&As, branches and subsidiaries and provision of cross-border financial services. There is also significance at 10% level of market power in destabilising the financial system the more it is likely that banks under foreign control is subject to private scrutiny regarding the transparency of their books. Both capital stringency and capital requirements, when coupled with other regulatory policies, tend to exacerbate risk-taking behaviour inducing bank managers to make up for potential utility loss; especially when it is the case of foreign owner being sufficiently large (Laeven and Levine, 2009). As for the rest macroeconomic and bank-specific controls, everything is settled even under different information sets.

[Insert table 7 here]

9. Are the results robust to alternative measures of risk?

Last, the analysis tests alternative measures of market stability and to what degree the fully-fledged model (8) can predict their variation. I therefore employ all the components that build up the Z-score along with the logged nominator, the Z-score with the denominator being averaged over the whole period and credit risk as proxied by loan loss charges over average gross loans.

$$Risk = f\,[L, CONC, I, M, B) + \varepsilon \qquad (8)$$

Market power highly determines at 1% significance level the variation of bank profitability, non-performing loans and the Z-score with the denominator averaged over the whole period (table 8).Market concentration enters significantly positive in the prediction of Z-score and interestingly of loans losses, profit variability and the nominator, out of which no one constituent seems to be correlated with it.

Activity restrictions drive to higher bank profitssince any potential risk diversification in non-interest bearing activities is dominated by losses on assets. Fragility of the banking system on loan provisioning is crystallised by the efficacy of capital regulation. The results provides a clear-cut answer to which policy has a direct impact on non performing loans; that is, the more capital reserves are required to be set aside, the more managers are incentivised to take refuge in higher risk-return profiles. Thus, they are bound to extend their operation by granting more loans either to marginal applicants or to customers-defaulters at any level of informational asymmetry. Likewise, the share of foreign owned assets in a banking system does harm to stability to the extent that is associated with lower profitability, and loan losses. That might indicate fierce competition reminiscent of contestable markets, in which incumbent banks strive to survive potential market entries.

The degree of intervention of official authorities guarantees stability through greater quality of earning assets, the preservation of capital levels abiding by the Basel rules, and healthy loan portfolio devoid of excessive subordinate risks.Hence, the latter is not expected ex ante since stricter authorities tend to intervene in bank decisions through suspending dividends, superseding the rights of shareholders thereby demoralizing potential investors. Such burden on bank management that otherwisemight provoke corruption in lending activities is not the case in our analysis; however, authorities are failing to keep pace with bank business inspection as overall risk is underestimated therebyendangering bank solvency with sub par policies. Moreover, the fact that financial institutions are exposed to private sector surveillance appears beneficialfor banks to preserve high levels of equity capital and credit rationing.

We also observe GDP growth to predict significantly bank stability and profitability along with less credit risk and variation in profits. In contrast, inflationary pressures drive to diminishing asset returns at 1% significance level. Furthermore, stock market activity tends to stabilize the banking sector on the

grounds that the increase in profits outpaces the losses occurred in lending activities. Hence, in cases of higher elasticity of aggregate demand, more resources of market funding make banks engage in excessive risk taking and therefore provide less credible information to the public.

As for the bank-level controls, financial fragility is attributed to asset size, which tends to diminish equity capital at 1% significance level as expected by construction. The level of equity capital seems to increase returns on assetsat the expense of considerably higher profit volatility and loan losses. Cost efficient banks tend to enjoy profits and sufficient capital base, and those expanding their business to insurance, trading and real estate products exacerbate operational risk through profit volatility and credit risk. Last, liquid assets has a more negligent negative bearing in previous specification, although its destabilising tendency is partially offset by higher profitability and capital buffers.

[Insert table 8 here]

10. Concluding remarks

This study addresses whether the relationship between market structure and financial stability is significant under different specifications for the European Union since the advent of the common currency. In a nutshell, it endorses the concentration-fragility nexus, while the inverse U-shaped correlation between the Lerner index and Z-score comes along to reconcile mutually exclusive theories employing a) linear effects of regulatory and supervisory variables, b) interactions of I-variables with bank market power, d) interactions of I-variables with foreign ownership, and f) different dependent variables that encompass different aspects of bank risk.

The results show a fragile relationship between the Lerner index and Z-score both at 5% and 1% significance level, when utilising the effect of I-variables in levels (model 1). When interactions come into play, the Lerner index follows the same pattern taking account of different-sized information sets. We also trace this U-shaped relationship, according to which market power seems to empower bank solvency up to the level of 0.644, where monopolistic behaviour have devastating repercussions.

Concentrated markets are highly correlated with financial fragility across any specification and robustness check. However, fragility emanates from bank managers who engage in risk-taking in lending transactions and other non-interest income activities.

Besides, we come up with collateral issues that have been appealing in many studies in terms of the policy implications they put forward. In general, the majority of institutional variables are capable of affecting bank stability individually. When I assess their significance, more financial stability is traced in markets where we observe more capital regulation and foreign ownership while requirements of information dissemination, restrictions on non-traditional activities as well as supervisory intervention tend to destabilise the financial system. However, the pattern appears remarkably the opposite in markets with higher share of foreign-owned banks, where stability is fostered by restrictions on activities, management and information transparency alongside lower capital reserves.

Competition policy should promote the mandate of less concentration and take preemptive action towards less monopolistic pricing especially in times of high inflation and stock market activity, when banks tend to price 73.3% above their marginal cost. Higher capital buffers in Basel directives vis-à-vis potential losses on risky OBS allocations, although indispensable in the wake of the crisis, constitute the stabilising precondition of too-expensive-to-fail incumbent banks. Official intervention, book transparency and activity restrictions operate under a heterogeneous European framework that induce negative repercussions on bank soundness due to the per se monopolistic pricing of concentrated markets. Policy makers should evaluate the level of foreign penetration in a market, the change of market power over time and how institutional reforms have been evolving in order to identify how, to what extent, bank solvency is by all means preserved.

References

Agoraki, M-E, Delis, M.D. and Pasiouras, F., 2009. Regulations, competition and bank risk-taking in transition countries.Journal of Financial Stability.

Allen, F. and Gale, D., 2000. Comparing financial systems. Cambridge, MA: MIT Press.

Allen, F. and Gale, D., 2004. Competition and financial stability.Journal of Money, Credit and Banking 36, 453-480.

Barro, R.J., 1991. Economic growth in a cross section of countries. The Quarterly Journal of Economics 106, 407-443.

Barth, J.R., Caprio, Jr. and Levine, R., 2004. Bank regulation and supervision: what works best?.Journal of Financial intermediation13, 205-248.

Barth, J.R., Caprio, G. and Levine, R., 2005.Rethinking bank regulation: Till angels govern. Cambridge University Press.

Barth, J.R., Caprio, G. and Levine, R., 2008. Bank regulations are changing: For better or worse?.Comparative Economic Studies50, 537-563.

Barth, J., Caprio, G. and Levine, R., 2013. Bank Regulation and Supervision in 180 Countries from 1999 to 2011.Journal of Financial Economic Policy5, 2-2.

Beck, T., 2008. Bank Competition and Financial Stability: Friends or Foes?.World Bank Policy Research, Working Paper 4656, June.

Beck, T., De Jonghe, O. and Schepens, G., 2012. Bank competition and stability: cross-country heterogeneity.Journal of Financial Intermediation.

Beck, T., Demirguc-Kunt, A. and Levine, R., 2006a. Bank concentration, competition, and crises: first results.Journal of Banking and Finance 30, 1581–1603.

Beck, T., Demirgüç-Kunt, A. and Levine, R., 2006b. Bank supervision and corruption in lending.Journal of Monetary Economics53, 2131-2163.

Berg, S.A. and Kim, M., 1994. Oligopolistic interdependence and the structure of

production in banking: an empirical evaluation.Journal of Money, Credit and Banking 26, 309-322.

Berger, N.A., Klapper, F.L. and Turk-Ariss, R., 2009. Bank competition and financial stability.Journal of Financial Service research 35, 99-118.

Boyd, H.J., De Nicolò, G.and Jalal M.A., 2009. Bank competition, risk and asset allocations.IMF Working Paper, no. 09/143.

Boyd, J.H., De Nicoló, G. and Smith, B.D., 2004. Crises in competitive versus monopolistic banking systems.Journal of Money, Credit and Banking 36, 487–506.

Boyd. J. and De Nicoló, G., 2005. The theory of bank risk taking revisited.Journal of Finance 60, 1329–1343.

Boyd, J.H. and Runkle, D. E., 1993. Size and performance of banking firms: Testing the predictions of theory.Journal of Monetary Economics31, 47-67.

Boot, A.W. and Greenbaum, S., 1993. Bank regulation, reputation, and rents: Theory and policy implications. In: Mayer, C., and Vives, X., eds), Capital markets and financial intermediation. Cambridge, UK: Cambridge University Press, 292-318.

Caminal, R. and Matutes, C., 2002. Market power and banking failures.International Journal of Industrial Organization 20, 1341-61.

Capie, F., 1995. Prudent and stable but inefficient?: Commercial Banks in Britain, 1890-1940. In: Bordo, M.D., Sylla, R., Eds.), Anglo-American Financial Systems: Institutions and Markets in the Twentieth Century. Irwin, New York.

Carletti, E. and Hartmann, P., 2003. Competition and financial stability: what's special about banking? In: Mizen P (ed) Monetary history, exchange rates and financial markets: essays in honour of Charles Goodhart 2. Edward Elgar, Cheltenham, UK.

Chan, Y.S., Greenbaum, S. and Thakor, A., 1986. Information reusability, competition and bank asset quality.Journal of Banking and Finance 10, 243-53.

Cipollini, A. and Fiordelisi, F., 2009. The Impact of Bank Concentration on Financial Distress: The Case of the European Banking System (November 30, 2009.EMFI Working Paper No. 2.

Claessens, S., Klingebiel, D. and Laeven, L., 2001. Financial restructuring in banking and corporate sector crises: What policies to pursue? (No. 8386). National Bureau of Economic Research.

Cole, A.R., McKenzie, J. and White, J.L., 1995. Deregulation Gone Awry: Moral Hazard in the Savings and Loan Industry. Available at SSRN: http://ssrn.com/abstract=1293468

Conrad, A., Neuberger, D. and Trigo Gamarra, L., 2009.The impact of regional and demographic factors on the efficiency of German savings banks (No. 111). Thünen-series of applied economic theory.

De Nicolo G. and Loukoianova, E., 2007. Bank ownership, market structure, and risk.IMF Working Paper, Washington, D.C.

De Nicolo, G. and Lucchetta, M., 2009. Financial intermediation, competition, and risk: A general equilibrium exposition.IMF Working Papers 09/105.

Diamond, D.W., 1984. Financial intermediation and delegated monitoring.Review of Economic Studies 51, 393-414.

Fernandez, A.I. and Gonzalez, F., 2005. How accounting and auditing systems can counteract risk-shifting of safety-nets in banking: Some international evidence.Journal of Financial Stability1, 466-500.

Hellmann, T.F., Murdock, K. and Stiglitz, J., 2000. Liberalization, moral hazard in banking and prudential regulation: are capital requirements enough?.American Economic Review 90, 147–165.

Jiménez, G., Lopez, J.A. and Saurina, J., 2013. How does competition affect bank risk-taking?.Journal of Financial Stability.

Jimenez, G., Salas, V. and Saurina, J., 2006. Determinants of collateral. Journal of Financial Economics81, 255-281.

John, K., Litov, L. and Yeung, B., 2008. Corporate Governance and Risk-Taking.The Journal of Finance63, 1679-1728.

Keeley, M., 1990. Deposit insurance, risk and market power in banking. American Economic Review 80, 1183–1200.

Kormendi, R.C. and Meguire, P.G., 1985. Macroeconomic determinants of growth: cross-country evidence.Journal of Monetary economics16, 141-163.

Koskela, E. and Stenbacka, R., 2000. Is there a tradeoff between bank competition and financial fragility?.Journal of Banking and Finance 24, 1853–1873.

Laeven, L. and Levine, R., 2009. Bank governance, regulation and risk taking.Journal of Financial Economics 93, 259–275.

Leamer, H., 1983. Let's Take the Con Out of Econometrics. American Economic Review 73, 31-43.

Leamer, H., 1985. Sensitivity Analyses Would Help. American Economic Review 75, 308-13.

Leamer, H. and Leonard, H., 1983. Reporting the Fragility of Regression Estimates. Review of Economics and Statistics 65, 306-17.

Levine, R. and Renelt, D., 1992. A sensitivity analysis of cross-country growth regressions.The American Economic Review 82, 942-963.

Liu, H., Molyneux, P. and Wilson, J.O., 2012. Competition and stability in European banking: A regional analysis.The Manchester School 81, 176-201.

Marcus, A.J., 1984. Deregulation and bank financial policy.Journal of Banking and Finance 8, 557-565.

Martinez-Miera, D. and Repullo, R., 2010. Does competition reduce the risk of bank failure?. Review of Financial Studies 23, 3638-3664.

Matutes, C. and Vives, X., 1996. Competition for deposits, fragility, and insurance.Journal of Financial Intermediation 5, 184-216.

Mishkin, F.S., 1999. Financial consolidation: Dangers and opportunities.Journal of Banking and Finance 23, 675-91.

Olivero, M.P., Li, Y. and Jeon, B.N., 2011. Competition in banking and the lending channel: Evidence from bank-level data in Asia and Latin America.Journal of Banking and Finance35, 560-571.

Perotti, E. and Suarez, J., 2002. Last bank standing: What do I gain if you fail?.European Economic Review 46, 1599-622.

Schaeck, K., 2009. Bank market structure, competition and stability: Issues and concepts. In: M. Fratianni, A. Z., Alessandrini, P., Eds.), The Changing Geography of Banking. Springer, 133–153.

Schaeck, K. and Cihak, M., 2008. How does competition affect efficiency and soundness in banking? New empirical evidence. European Central Bank Working Paper 932.

Schaek, K., Cihak, M. and Wolfe, S., 2009. Are competitive banking systems more stable?.Journal of Money, Credit and Banking 41, 711-734.

Schaeck, K. and Cihák, M., 2013. Competition, efficiency, and stability in banking.Financial Management.

Shaffer, S., 1993. A Test of Competition in Canadian Banking.Journal of Money, Credit and Banking 25, 49-61.

Smith, B.D., 1984. Private information, deposit interest rates, and the ‘stability’ of the banking system.Journal of Monetary Economics 14, 293-317.

Stiglitz. J.E. and Weiss, A., 1981. Credit rationing in markets with imperfect information.American Economic Review 71, 393–410.

Stiroh, K.J., (2004. Do community banks benefit from diversification?. Journal of Financial Services Research 25, 135-160.

Turk Ariss, R., 2010. On the implications of market power in banking: Evidence from developing countries.Journal of Banking and Finance34, 765-775.

Uhde, A. and Heimeshoff, U., 2009. Consolidation in banking and financial stability in Europe: empirical evidence.Journal of Banking and Finance 33, 1299–1311.

VanHoose, D.D., 2010.The industrial organization of banking: bank behavior, market structure, and regulation. Springer.

Williamson, S.D., 1986. Costly monitoring, loan contracts and equilibrium credit rationing.Quarterly Journal of Economics 102, 135-46.

Yeyati, E.L. and Micco, A., 2007. Concentration and foreign penetration in Latin American banking sectors: Impact on competition and risk.Journal of Banking and Finance31, 1633-1647.

Table 1: Descriptive statistics

	Z-score	Lerner	TA	TC/TI	TNINTI/ TI	LIQ/DE PSTF	CONC	GDPGR	Inflation	Stock MT	Activity R.	Capital Reg.	Foreign Own	Official Sup.	Private Mon.
Austria	195.174	0.325	5873.057	0.659	0.203	0.365	0.265	0.023	0.020	0.350	6.333	5.666	0.144	11.666	5.666
Belgium	88.257	0.157	44573.660	0.652	0.295	0.417	0.796	0.020	0.023	0.678	7.333	5.000	0.210	9.666	6.333
Denmark	53.973	0.243	9384.117	0.602	0.211	0.360	0.591	0.014	0.020	0.634	9.666	5.333	0.139	9.666	7.666
Finland	41.317	-0.174	34316.880	0.657	0.386	0.498	0.922	0.031	0.016	1.064	8.000	5.666	0.317	7.333	7.000
France	155.072	0.150	36018.890	0.659	0.306	0.426	0.435	0.015	0.021	0.812	8.000	6.000	0.091	7.333	8.000
Germany	901.771	0.157	5417.424	0.718	0.180	0.230	0.345	0.014	0.019	0.453	7.000	6.666	0.151	10.000	6.666
Greece	47.408	0.152	18160.340	0.657	0.215	0.317	0.674	0.035	0.035	0.587	9.000	5.666	0.108	10.000	7.000
Ireland	67.648	-0.149	40898.670	0.395	0.037	0.871	0.476	0.039	0.031	0.524	7.000	4.000	0.140	9.333	8.333
Italy	253.199	0.156	6903.262	0.669	0.199	0.349	0.387	0.008	0.025	0.425	10.666	5.000	0.056	5.000	9.000
Luxemburg	80.982	0.291	7723.828	0.551	0.283	0.834	0.309	0.040	0.031	1.638	8.333	6.333	0.647	12.000	7.000
Netherlands	57.767	0.057	88215.220	0.664	0.159	0.657	0.838	0.020	0.021	0.922	6.000	6.000	0.067	6.666	7.333
Portugal	70.247	0.411	12145.250	0.746	0.201	0.484	0.720	0.009	0.028	0.396	10.000	6.000	0.185	13.666	7.333
Spain	336.367	0.102	22986.740	0.569	0.171	0.219	0.446	0.030	0.034	0.880	6.666	8.000	0.094	9.666	7.666
Sweden	66.267	0.515	12957.060	0.597	0.210	0.236	0.596	0.027	0.018	1.007	9.000	2.500		7.000	8.000
UK	176.974	0.803	52002.790	0.735	0.351	0.726	0.387	0.023	0.020	1.247	4.666	4.666	0.402	7.666	8.666
EU-15	**172.828**	**0.213**	**26505.146**	**0.635**	**0.227**	**0.466**	**0.546**	**0.023**	**0.024**	**0.774**	**7.844**	**5.500**	**0.197**	**9.111**	**7.444**
Cyprus	25.583	-0.008	5458.085	0.627	0.090	0.468	0.739	0.036	0.028	0.579	11.000	7.000	0.169	10.000	8.333
Czech R.	54.279	0.133	6219.384	0.670	0.303	0.291	0.605	0.047	0.024	0.283	12.000	5.500	0.872	9.500	8.500
Estonia	29.180	0.331	985.089	0.675	0.372	0.782	0.949	0.062	0.048	0.314	7.666	5.666	0.991	12.666	7.000
Hungary	52.143	0.317	2134.387	0.823	0.180	0.648	0.568	0.032	0.054	0.260	9.333	9.666	0.628	14.000	7.666
Latvia	28.784	0.600	1318.662	0.638	0.296	0.485	0.550	0.073	0.071	0.107	7.666	7.000	0.441	11.666	7.000
Lithuania	51.082	0.764	1844.011	0.692	0.254	0.295	0.745	0.075	0.034	0.224	9.333	5.333	0.849	12.000	7.000
Malta	61.043	0.639	1891.901	0.704	0.109	0.597	0.733	0.025	0.025	0.536	10.666	6.666	0.623	13.666	7.333
Poland	70.046	0.219	3406.975	0.674	0.248	0.337	0.594	0.046	0.024	0.286	9.666	4.666	0.529	9.333	7.333
Slovakia	84.259	0.065	4554.698	0.671	0.340	0.364	0.734	0.066	0.046	0.069	11.333	5.333	0.604	13.000	6.666
Slovenia	119.091	0.023	1428.511	0.709	0.201	0.250	0.591	0.045	0.045	0.310	9.666	7.333	0.303	13.333	7.333
Bulgaria	74.998	0.540	908.921	0.735	0.249	0.429	0.464	0.061	0.067	0.202	8.666	7.333	0.500	11.333	7.000
Romania	40.285	0.546	2253.744	0.797	0.258	0.506	0.624	0.064	0.112	0.170	9.333	5.333	0.272	10.000	5.333
EU-12	**57.564**	**0.347**	**2700.364**	**0.701**	**0.242**	**0.454**	**0.658**	**0.053**	**0.048**	**0.278**	**9.694**	**6.402**	**0.565**	**11.708**	**7.208**

Z-score: the unlogged version of Z-score before winsorizing it; Lerner: the Lerner index before winsorizing it, in order to draw remarks on its mean values across the European region; TA: total assets; TC/TI: total cost over total income; TNINTI/TI: total non-interest income over total income; LIQ/DEPSTF: liquid assets over total deposits and short-term funding; CONC: market concentration; GDPGR: the growth rate of GDP; Inflation: inflation rate; Stock MT: stock market turnover; Activity R.: activity restrictions; Capital Reg.: Capital regulation index; Foreign Own.: the share of foreign-owned assets in a banking industry; Official Sup.: official supervisory power; Fraction ED: fraction of entry denied; Private Mon.: Private monitoring index. EU-15: the average values of all variables deflated by the number of banks within a banking market; EU-12: the average values of all variables deflated by the number of banks within a banking market including Bulgaria and Romania of the enlarged European Union. Source: World Bank, Bankscope and own estimations.

Table 2: Correlation matrix between country-level variables

Variables	CONC	GDPGR	Inflation	Stock MT	Activity res	Capital Reg.	Foreign own.	Official Sup.	Private Mon.
CONC	1								
GDPGR	0.141*	1							
Inflation	0.222*	0.356*	1						
Stock MT	0.071*	0.252*	-0.027*	1					
Activity Res	0.135*	-0.041*	0.144*	-0.283*	1				
Capital Reg.	-0.055*	-0.042*	-0.061*	-0.101*	-0.087*	1			
Foreign Own	0.181*	0.277*	0.133*	0.328*	-0.099*	-0.027*	1		
Official Sup.	-0.077*	-0.011	-0.028*	-0.315*	0.009	0.334*	0.281*	1	
Private Mon.	0.030*	0.057*	0.033*	0.333*	0.306*	-0.095*	0.139*	-0.459*	1

Source: Bankscope database, World Bank.

Table 3: Regression output of model 1

Variables	**Baseline**	**Sensitivity analysis**					
Lerner	-0.158***	-0.350***	0.089**	-0.129***	-0.145***	-0.055	-0.088
	(0.000)	(0.038)	(0.037)	(0.040)	(0.037)	(0.036)	(0.054)
Concentration	-0.011***	-0.009***	-0.009***	-0.004***	-0.010***	-0.009***	-0.004***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Institutional variables (Regulation, supervision, governance)							
Activity restrictions		-0.082***					-0.014*
		(0.005)					(0.008)
Capital regulation			0.111***				0.078***
			(0.006)				(0.009)
Foreign ownership				0.133**			-0.034
				(0.053)			(0.075)
Official supervision					0.004		-0.069***
					(0.004)		(0.007)
Private monitoring						-0.111***	-0.085***
						(0.008)	(0.012)
Country-specific variables							
GDPGR	0.048***	0.026***	0.041***	0.039***	0.043***	0.032***	0.035***
	(0.005)	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.007)
Inflation	-0.078***	-0.039***	-0.093***	-0.097***	-0.076***	-0.081***	-0.062***
	(0.000)	(0.007)	(0.008)	(0.009)	(0.008)	(0.007)	(0.008)
Stock market turnover	-0.241***	-0.303***	-0.251***	-0.093***	-0.220***	-0.179***	-0.175***
	(0.000)	(0.026)	(0.025)	(0.028)	(0.025)	(0.024)	(0.032)
Bank-specific variables							
Q	-0.006	-0.010*	-0.015***	-0.028***	-0.011**	-0.006	-0.018***
	(0.005)	(0.006)	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)

E/TA	-0.079	0.404***	0.094	0.024	-0.070	0.121	0.516***
	(0.110)	(0.118)	(0.111)	(0.118)	(0.111)	(0.111)	(0.123)
Cost to income	-0.028	-0.155***	0.010	-0.072*	-0.030	-0.017	-0.114***
	(0.040)	(0.034)	(0.044)	(0.043)	(0.040)	(0.041)	(0.040)
TNINTINC/TI	-0.589***	-0.599***	-0.636***	-0.615***	-0.596***	-0.590***	-0.684***
	(0.050)	(0.053)	(0.052)	(0.054)	(0.051)	(0.051)	(0.055)
Liquidity	-0.011	-0.029**	-0.014	-0.024*	-0.010	-0.023*	-0.027*
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)
Time dummies	YES	YES	YES	YES	YES	YES	YES
Specialisation dummies	YES	YES	YES	YES	YES	YES	YES
R-squared	0.2188	0.2401	0.2417	0.235	0.2213	0.2329	0.2617
Obs	12118	9529	11956	11136	11956	11956	8709
Banks	2450	2432	2447	2361	2447	2447	2346
Countries	27	27	27	26	27	27	26

OLS model with standard errors clustered at the country level and adjusted by the number of banks operating within each market employing time dummies to capture time varying fixed effects. The first column reports the results of the baseline model totally devoid of any institutional controls. The table then includes one at a time interacting controls for regulation, supervision and governance with the Lerner index, in order to verify their stand-alone effect on bank stability as well as their compound explanatory power in the last column. Z-score is logged after 1% winsoring and all bank-specific variables are lagged one period to avoid the possibility of reverse causality. Standard errors are in parentheses while asterisks ***, **, * denote the significance level being at 1%, 5% and 10%, respectively.

Table 4: Extreme bounds of model 1

Variables	**Bounds**	**Coefficient**	**Std. error**	**t-value**	**I-variables**	**Significance (1%)**	**Significance (5%)**
Lerner	low	-0.368	0.039	-9.380	ACT, OFF	Fragile(0)	Fragile(0)
	base	-0.158	0.036	-4.410	-		
	high	0.096	0.037	2.550	CAP, PRIV		
Lerner	low	0.785	0.095	8.280	ACT, OFF	Infection points [0.733, 0.644, 0.97]	
	base	0.565	0.097	5.800	-		
	high	0.585	0.096	6.120	CAP, PRIV		
Lerner^2	low	-1.071	0.239	-4.490	ACT, OFF		
	base	-0.877	0.111	-7.860	-		
	high	-0.603	0.113	-5.330	CAP, PRIV		
CONC	low	-0.009	0.001	-12.710	OFF, PRIV	Robust	Robust
	base	-0.011	0.001	-15.400	-		
	high	-0.008	0.001	-12.130	ACT, CAP, PRIV		
Lerner	low	0.608	0.094	6.440	OFF, PRIV	Infection points [0.695, 0.644, 0.627]	
	base	0.565	0.097	5.800	-		
	high	0.760	0.096	7.940	ACT, CAP, PRIV		
Lerner^2	low	-0.875	0.111	-7.820	OFF, PRIV		
	base	-0.877	0.111	-7.860	-		
	high	-1.213	0.124	-9.780	ACT, CAP, PRIV		

Following model 1, the table reposts the extreme bounds of the Lerner index and concentration with the respective standard errors and t-values. The column 'I-variables' indicates the specific information set that constructs the underlying bound, and the last two underline the relationship between market structure and financial stability as fragile or robust at 1% and

5% significance level according to whether their sign and significance persistently remains stable over many specifications. The rows in grey report the extreme bounds of L and HHI utilizing two and three-variable I-sets while in the two rows below them, the L-squared term comes in ad hoc for every extreme bound case in order to check for non-linearities. Infection points refer to the levels in Lerner distribution where the respective coefficient switches its sign.

Table 5: Regression output of model 2

Variables	**Baseline**	**Sensitivity analysis**					
Lerner	1.413***	2.071***	0.326**	0.117	1.153***	2.071***	1.898***
	(0.143)	(0.154)	(0.156)	(0.164)	(0.146)	(0.213)	(0.397)
CONC*L	-0.024***	-0.017***	-0.018***	-0.000	-0.022***	-0.020***	0.015***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)
Institutional variables (Regulation, supervision, governance)							
Activity restrictions*L		-0.107***					-0.043**
		(0.014)					(0.018)
Capital regulation*L			0.146***				0.135***
			(0.015)				(0.029)
Foreign ownership*L				-0.181			-0.614***
				(0.128)			(0.190)
Official supervision*L					0.014*		-0.138***
					(0.008)		(0.024)
Private monitoring*L						-0.105***	-0.179***
						(0.018)	(0.035)
Country-specific variables							
GDPGR*L	0.037***	0.004	0.016*	0.041***	0.026***	0.022***	0.043***
	(0.007)	(0.008)	(0.008)	(0.010)	(0.008)	(0.008)	(0.010)
Inflation*L	-0.074***	-0.098***	-0.075***	-0.108***	-0.065***	-0.072***	-0.115***
	(0.012)	(0.013)	(0.012)	(0.014)	(0.012)	(0.012)	(0.014)
Stock market turnover*L	-0.528***	-0.892***	-0.360***	0.023	-0.448***	-0.407***	-0.046
	(0.062)	(0.070)	(0.061)	(0.075)	(0.061)	(0.061)	(0.087)
Bank-specific variables							
Q	-0.008	-0.044***	-0.011*	-0.032***	-0.014**	-0.012**	-0.019***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
E/TA	-0.180	0.080	-0.147	-0.087	-0.164	-0.138	0.360***
	(0.114)	(0.122)	(0.112)	(0.117)	(0.114)	(0.114)	(0.119)
Cost to income	-0.014	-0.177***	0.019	-0.060	-0.016	-0.003	-0.119**
	(0.047)	(0.043)	(0.049)	(0.046)	(0.047)	(0.048)	(0.048)
TNINTINC/TI	-0.590***	-0.991***	-0.613***	-0.604***	-0.597***	-0.606***	-0.691***
	(0.052)	(0.051)	(0.052)	(0.054)	(0.052)	(0.052)	(0.056)
Liquidity	-0.009	-0.053***	-0.011	-0.018	-0.009	-0.010	-0.022
	(0.013)	(0.015)	(0.013)	(0.013)	(0.013)	(0.013)	(0.143)
Time dummies	YES	YES	YES	YES	YES	YES	YES
Specialisation dummies	YES	YES	YES	YES	YES	YES	YES
R-squared	0.2074	0.1678	0.2177	0.2276	0.2118	0.2135	0.2412
Obs	12118	9529	11956	11136	11956	11956	8709
Banks	2450	2447	2408	2361	2447	2447	2346

Countries	27	27	27	27	27	27	26

OLS model with standard errors clustered at the country level and adjusted by the number of banks operating within each market employing time dummies to capture time varying fixed effects. The first column reports the results of the baseline model totally devoid of any institutional controls; however, the possibility of country-level factors affecting bank soundness in slopes through their interaction with bank competition is investigated. The table then includes one at a time interacting controls for regulation, supervision and governance with the Lerner index, in order to verify their stand-alone effect on bank stability as well as their compound explanatory power in the last column. Z-score is logged after 1% winsoring and all bank-specific variables are lagged one period to avoid the possibility of reverse causality. Standard errors are in parentheses while asterisks ***, **, * denote the significance level being at 1%, 5% and 10%, respectively.

Table 6: Extreme bounds of model 2

Variables	**Bounds**	**Coefficient**	**Std. error**	**t-value**	**B-variables**	**Significance (1%)**	**Significance (5%)**
Lerner	low	0.326	0.156	2.090	CAP, OFF	Fragile(0)	Fragile(0)
	base	1.414	0.143	9.860	-		
	high	2.775	0.323	8.580	OFF, PRIV		
Lerner	low	0.927	0.185	5.010	CAP, OFF	Fragile	
	base	1.986	0.165	12.050	-		
	high	3.394	0.350	9.690	OFF, PRIV		
Lerner^2	low	-0.771	0.125	-6.150	CAP, OFF	Robust	
	base	-0.847	0.118	-7.170	-		
	high	-0.809	0.119	-6.790	OFF, PRIV		
CONC*L	low	-0.019	0.002	8.73	OFF, PRIV	Robust	Robust
	base	-0.024	0.002	-11.480	-		
	high	-0.005	0.002	-2.050	ACT, CAP, OFF		
Lerner	low	3.394	0.350	9.690	OFF, PRIV	Fragile	
	base	1.986	0.165	12.050	-		
	high	2.340	0.225	10.420	ACT, CAP, OFF		
Lerner^2	low	-0.809	0.119	-6.790	OFF, PRIV	Robust	
	base	-0.847	0.118	-7.170	-		
	high	-1.316	0.134	-9.810	ACT, CAP, OFF		

Following model 2, the table reposts the extreme bounds of the Lerner index and the interaction term CONC*L with the respective standard errors and t-values. The column 'I-variables' indicates the specific information set that constructs the underlying bound, and the last two underline the relationship between market structure and financial stability as fragile or robust at 1% and 5% significance level according to whether their sign and significance persistently remains stable over many specifications. The rows in grey report the extreme bounds of L and CONC*L utilizing two and three-variable I-sets while in the two rows below them, the L-squared term comes in ad hoc for every extreme bound case in order to check for non-linearities. Infection points refer to the levels in Lerner distribution where the respective coefficient switches its sign.

Table 7: Sensitivity analysis

Variables	**Sensitivity analysis**				
Lerner	-0.035	-0.073	-0.051	-0.099*	-0.014
	(0.053)	(0.054)	(0.054)	(0.054)	(0.054)
Concentration	-0.006***	-0.005***	-0.005***	-0.004***	-0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Institutional variables (Regulation, supervision)					
Activity restrictions	-0.041***	-0.011	-0.014*	-0.012	-0.019**
	(0.009)	(0.008)	(0.008)	(0.008)	(0.010)
Capital regulation	0.073***	0.099***	0.071***	0.077***	0.099***
	(0.009)	(0.011)	(0.009)	(0.009)	(0.011)
Official supervision	-0.062***	-0.071***	-0.082***	-0.073***	-0.087***
	(0.007)	(0.007)	(0.008)	(0.007)	(0.009)
Private monitoring	-0.080***	-0.082***	-0.094***	-0.105***	-0.113***
	(0.012)	(0.013)	(0.013)	(0.014)	(0.016)
Foreign ownership (F)	-0.983***	0.507***	-1.025***	-0.850***	-1.736***
	(0.167)	(0.195)	(0.200)	(0.319)	(0.387)
Activity restrictions*F	0.114***				0.050**
	(0.017)				(0.022)
Capital regulation*F		-0.091***			-0.133***
		(0.032)			(0.031)
Official supervision*F			0.087***		0.099***
			(0.017)		(0.019)
Private monitoring*F				0.105***	0.122***
				(0.037)	(0.043)
Country-specific variables					
GDPGR	0.032***	0.030***	0.035***	0.036***	0.026***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
Inflation	-0.071***	-0.062***	-0.061***	-0.061***	-0.064***
	(0.009)	(0.008)	(0.008)	(0.008)	(0.009)
Stock market turnover	-0.161***	-0.175***	-0.130***	-0.175***	-0.116***
	(0.032)	(0.032)	(0.033)	(0.032)	(0.034)
Bank-specific variables					
Q	-0.016***	-0.019***	-0.016***	-0.017***	-0.015**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
E/TA	0.580***	0.501***	0.554***	0.539***	0.593***
	(0.123)	(0.123)	(0.123)	(0.125)	(0.123)
Cost to income	-0.094**	-0.115***	-0.096**	-0.115***	-0.087**
	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)
TNINTINC/TI	-0.685***	-0.691***	-0.694***	-0.675***	-0.694***
	(0.055)	(0.055)	(0.055)	(0.056)	(0.055)
Liquidity	-0.032**	-0.024*	-0.031**	-0.029**	-0.031**
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Time dummies	YES	YES	YES	YES	YES
Specialisation dummies	YES	YES	YES	YES	YES
R-squared	0.2644	0.2623	0.2638	0.2624	0.2669
Obs	8709	8709	8709	8709	8709
Banks	2346	2346	2346	2346	2346

Countries	26	26	26	26	26

OLS model with standard errors clustered at the country level and adjusted by the number of banks operating within each market employing time dummies to capture time varying fixed effects. The table includes interacting controls of regulation, supervision with foreign ownership. Standard errors are in parentheses while asterisks ***, **, * denote the significance level being at 1%, 5% and 10%, respectively.

Table 8: Alternative measures of stability

Variables	**ROA**	**E/TA**	**sROA**	**ln(ROA+E/TA)**	**Loan losses**	**lnZ**
Lerner	0.007***	-0.001	-0.000	0.009	0.006***	-0.337***
	(0.001)	(0.007)	(0.001)	(0.008)	(0.001)	(0.074)
Concentration	0.000	0.000	0.0001***	0.0002*	0.000**	-0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Other Governance indicators						
Activity restrictions	0.001***	0.000	-0.000	0.001	0.000	-0.025***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.009)
Capital regulation	0.000	0.001	-0.000	0.001	0.001***	0.072***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.012)
Foreign ownership	-0.004***	0.014	0.002	0.008	0.003*	-0.214**
	(0.001)	(0.009)	(0.001)	(0.010)	(0.002)	(0.094)
Official supervision	0.0004***	0.002**	-0.000	0.002***	-0.001***	-0.083***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.009)
Private monitor	0.000	0.009***	-0.000	0.009***	-0.002***	-0.064***
	(0.000)	(0.001)	(0.000)	(0.002)	(0.000)	(0.016)
Country-specific variables						
GDPGR	0.001***	-0.001**	-0.001***	-0.000	-0.001***	0.036***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.009)
Inflation	-0.000	-0.001	0.001***	-0.001	0.000	-0.074***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.012)
Stock market turnover	0.002***	-0.004	-0.001*	-0.004	-0.005***	-0.065
	(0.001)	(0.004)	(0.000)	(0.004)	(0.001)	(0.041)
Bank-specific variables						
Q	0.000	-0.017***	-0.000	-0.017***	0.000	-0.033***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.008)
E/TA	0.027***	-	0.035***	-	0.027***	1.076***
	(0.005)		(0.005)		(0.007)	(0.182)
Cost to income	-0.013***	-0.027***	0.002	-0.041***	0.001	-0.490***
	(0.002)	(0.008)	(0.002)	(0.010)	(0.002)	(0.055)
TNINTINC/TI	0.014***	0.098***	0.012***	0.110***	0.005**	-1.321***
	(0.002)	(0.011)	(0.002)	(0.012)	(0.002)	(0.084)
Liquidity	0.001*	0.050***	0.000	0.053***	-0.001	-0.039
	(0.000)	(0.005)	(0.001)	(0.005)	(0.001)	(0.024)
Time dummies	YES	YES	YES	YES	YES	YES
Specialisation dummies	YES	YES	YES	YES	YES	YES

R-squared	0.2735	0.3991	0.3063	0.4103	0.1064	0.3772
Obs	9568	9571	8785	9568	8984	9568
Banks	2374	2374	2348	2374	2247	2374
Countries	26	26	26	26	26	26

OLS model with standard errors clustered at the country level and adjusted by the number of banks operating within each market employing time dummies to capture time varying fixed effects. The first column reports the results of the baseline model, that is the regression of alternative measures of risk on the whole information set. Standard errors are in parentheses while asterisks ***, **, * denote the significance level being at 1%, 5% and 10%, respectively.

Appendix

Information on Bank Regulatory and Supervision Variables

Variable	Methodology of quantification	Source
Activity restrictions (ACT)	I assign values of 1, 2, 3, 4 if bank participation indicates 'unrestricted', 'permitted', 'restricted' or 'prohibited' responses to the following questions: What is the level of regulatory restrictiveness for a) bank participation in securities activities (the ability of banks to engage in the business of securities underwriting, brokering, dealing, and all aspects of the mutual fund industry), b) bank participation in insurance activities (the ability of banks to engage in insurance underwriting and selling)?, c) bank participation in real estate activities (the ability of banks to engage in real estate investment, development, and management)?, d) bank ownership of nonfinancial firms?	Barth et al. (2004; 2005; 2008; 2012)
(Capital regulation (CAP)	I assign '0' and '1' if the responses are 'no' and 'yes', respectively. The opposite holds for questions 8 and 9 (Yes:0, No:1) and we also assign '1' if 6 < 0.75. The questions are: 1) Is the minimum capital-asset ratio requirement risk weighted in line with the Basel guidelines?, 2) Does the minimum ratio vary as a function of market risk?, 3) Are market value of loan losses not realized in accounting books deducted? 4) Are unrealized losses in securities portfolios deducted, 5) Are unrealized foreign exchange losses deducted?, 6) What fraction of revaluation gains is allowed as part of capital?, 7) Are the sources of funds to be used as capital verified by the regulatory/supervisory authorities?, 8) Can the initial disbursement or subsequent injections of capital be done with assets other than cash or government securities?, 9) Can initial disbursement of capital be done with borrowed funds?	Barth et al. (2004; 2005; 2008; 2012)
Official Supervisory power (OFF)	I assign '0' and '1' if the responses are 'no' and 'yes' (respectively) and add them up. The questions are the following: 1) Does the supervisory agency have the right to meet with external auditors to discuss their report without the approval of the bank?, 2) Are auditors required by law to communicate directly to the supervisory agency any presumed involvement of bank directors or senior managers in elicit activities, fraud, or insider abuse?, 3) Can supervisors take legal action against external auditors for negligence?, 4) Can the supervisory authority force a bank to change its internal organizational structure?, 5) Are off-balance sheet items disclosed to supervisors?, 6) Can the supervisory agency order the bank's directors or management to constitute provisions to cover actual or potential losses?, 7) Can the supervisory agency suspend the directors' decision to distribute Dividends, 8) Bonuses, 9)Management fees?, 10) Can the supervisory agency legally declare-such that this declaration supersedes the rights of bank shareholders-that a bank is insolvent?, 11) Does the Banking Law give authority to the supervisory agency tointervene that is, suspend some or all ownership rights-a problem bank?, 12) Regarding bank restructuring and reorganization, can the supervisory agency or any other government agency supersede shareholder rights?, 13) remove and replace management?, 14) remove and replace directors?.	Barth et al. (2004; 2005; 2008; 2012)

Private monitoring index (PRIV)	I assign '0' and '1' if the responses are 'no' and 'yes', respectively. We construct the index through the formula: {(1*2)+[1 if 3 equals 100%; 0 otherwise]+[1 if 4 and 5 equals zero; 0 otherwise]+[(6-'1')*('-1')+7+8]+9+10+11}. The question are the following: 1) Is an external audit a compulsory obligation for banks? , 2) Are auditors licensed or certified?, 3) What percent of the top ten banks are rated by international credit rating agencies (e.g., Moody's, Standard and Poor)?, 4) Is there an explicit deposit insurance protection system?, 5) Were depositors wholly compensated (to the extent of legal protection) the last time a bank failed?, 6) Does accrued, though unpaid interest/principal enter the income statement while the loan is still non-performing?, 7) Are financial institutions required to produce consolidated accounts covering all bank and any non-bank financial subsidiaries?, 8) Are bank directors legally liable if information disclosed is erroneous or misleading?, 9) Are off-balance sheet items disclosed to the public?, 10) Must banks disclose their risk management procedures to the public?, 11) Is subordinated debt allowable (required) as part of capital?	Barth et al. (2004; 2005; 2008; 2012)
Foreign Ownership (FOR)	What fraction of the banking system's assets is in banks that are 50% or more foreign owned?	Barth et al. (2004; 2005; 2008; 2012)