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Abstract

This study investigates whether regulations have an independent effect on bank risk-taking or whether their effect is channeled through the market power possessed by banks. Given a well-established set of theoretical priors, the regulations considered are capital requirements, restrictions on bank activities and official supervisory power. We use data from the Central and Eastern European banking sectors over the period 1998-2005. The empirical results suggest that banks with market power tend to take on lower credit risk and have a lower probability of default. Capital requirements reduce risk in general, but for banks with market power this effect significantly weakens. Higher activity restrictions in combination with more market power reduce both credit risk and the risk of default, while official supervisory power has only a direct impact on bank risk.

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1. Introduction

As we learn more about the dynamics of financial stability, three interrelated characteristics of the banking sector are receiving increasing attention by scholars and policy makers, namely regulations, competition, and risk-taking. The relationship between these three factors (RCR hereafter) is nurtured in an important paper by Keeley (1990), who argued that deregulation of the US banking sector in the 1970s and 1980s increased competition and, through the associated reduction in monopoly rents, led to a worsened equilibrium risk of failure. Keeley's paper triggered a lively debate on the possible RCR nexus both at the theoretical (see Hellmann et al., 2000; Cordella and Yeyati, 2002; Repullo, 2004; Niinimaki, 2004) and the empirical level (Salas and Saurina, 2003; Chen, 2007).[1] Yet, researchers have not examined empirically whether and how national regulations, such as restriction on activities, capital requirements, and supervisory power, interact with market power in shaping the risk-taking behavior of individual banks. This can have important policy implications as different types of regulation may have a direct or indirect (through market power) impact on bank risk-taking. It could also mean that the same regulations have different effects on bank risk taking depending on the comparative market power of the banks. In this paper, we attempt to extend our knowledge on the RCR nexus towards this direction and provide some additional insights in the dawn of the global financial crisis.

A first element worth noting is that the spotlight is placed on the transition countries of Central and Eastern Europe (CEE). Since the mid 1990s, the banking systems of CEE countries were extensively reformed through the abolition of administrative interventions and regulations, which seriously hampered their development. The reforms have been viewed as a means to reduce bank costs, particularly those associated with risk management and the evaluation of credit information. Institutional improvements, such as effective systems for taking collateral and repossessing assets in cases of default, played a fundamental role in the further development of the CEE banking sector. On the whole, and given the restructuring

[1] A rich literature also focuses on the relationship between competition and risk-taking, only. For instance, Stiglitz and Weiss (1981) focus on the impact of increases in interest rates or collateral requirements on the riskiness of banks' loan portfolio in the presence of excess demand. Allen and Gale (2004) focus on the trade-off between competition and stability, and show that it is complex and multi-faceted as such a trade-off does not necessarily exists in all cases. Boyd and De Nicolo (2005) review the literature and describe the existing evidence as mixed. They also derive a theoretical model which shows that as competition declines, banks earn more rents in the loan markets by charging higher loan rates, which however imply higher bankruptcy risk for borrowers. Then, within a moral hazard framework, borrowers optimally increase their own risk of failure, which naturally leads to financial instability.

and regulatory initiatives that took place in the last decade, the CEE region provides an excellent case for the study of the RCR nexus in banking.[2]

Moreover, as Haselmann and Wachtel (2007) point out, although research on banking in transition is voluminous the issues of risk-taking and risk management are not well-documented. At the same time, it is well-known that banks behave differently under different institutional settings (Berger et al., 2001; Berger and Udell, 2002; Haselmann and Wachtel, 2006), which implies that the results obtained for developed countries may not apply to the transition ones. In addition, the regulatory efforts undertaken in transition banking systems are quantitatively and qualitatively different from the analogous ones of developed banking systems. For example, deregulation in developed countries aims to increase competition and enhance efficiency, while in developing countries stability and risk reduction can be one of the main objectives. This has important implications in the way an empirical framework is built. For instance, Keeley (1990) uses dummy variables as proxies of regulatory relaxation in branching, interstate expansion and multibank holding company restrictions. Similarly, Salas and Saurina (2003) use dummies as proxies of changes in regulations, while Chen (2007) uses a dummy variable to note the completion of the second banking directive. In the present study, we rely on information from the World Bank (WB) database on bank regulations and supervision (Barth et al., 2001a, 2006, 2008) to construct indices that relate to capital requirements, official supervisory power and restrictions on bank activities. This is the first study that considers these indices, while examining the relationship between regulations, competition, and risk-taking.[3] These indices can be more informative than the dummy variables and allow us to consider a more harmonized measure that is of particular importance in a cross-country setting. We focus on these three regulatory policies because they are central in the agenda of policy makers and theory suggests that they can have both a direct impact on risk-taking but also an indirect effect through market power. Thus, we aim to provide an empirical assessment of whether and how they interact with banks' market power in shaping risk-taking.

The empirical analysis is carried out for 13 CEE banking systems over the period 1998-2005. In line with recent work on the measurement of bank competition (e.g. Jimenez et al., 2007), we develop extensive new non-structural indices of bank-level market power,

[2] For a detailed review of the reform process in the CEE countries' financial sectors see various issues of the EBRD Transition reports (e.g. Transition report 2006: Finance in transition).

[3] Beck et al. (2006a) and Schaeck et al. (2009) have also used these indices as control variables in their somehow related cross-country studies. However, these studies are at the country rather than the bank-level and they examine systemic crises rather than bank risk-taking. As Beck et al. (2006a) suggest research at the bank-level may be able to shed more light on the puzzling results of their study.

which are subsequently used to examine the RCR nexus. Also, to account for the fact that static econometric frameworks may be insufficient to capture the dynamics of the reform, we complement the static econometric framework with a dynamic one. Statistical robustness is further ensured by extensive misspecification tests and re-specifications of the empirical frameworks, the latter including the potential existence of a non-linear relationship between risk and competition as in Jimenez et al. (2007). The empirical results imply that banks with market power are associated with lower credit risk and a lower probability of default. Capital requirements reduce risk in general, but for banks with market power this effect significantly weakens. Higher activity restrictions in combination with more market power reduce both credit risk and the risk of default. Finally, official supervisory power has only a direct impact on bank risk.

The rest of the paper is organized as follows. Section 2 provides a theoretical discussion to back up our choice for the specific types of regulation considered. Section 3 presents the empirical model and discusses the data sources. Section 4 discusses the empirical results and Section 5 concludes the paper.

2. Background discussion

In the subsections that follow we provide a brief literature review of studies that relate bank regulation with competition and risk taking. This literature is initiated with the important contribution of Keeley (1990) who provided both a theoretical framework and empirical evidence that the deregulation of the US banking sector led to an erosion of bank market power and consequently of their equity capital. In turn, this increased banks' incentives to take on extra risk, thus also increasing the risk of failure. Below we explicitly comment on the studies that followed Keeley's analysis in terms of the three types of regulation considered in the present paper, namely capital requirements, restriction on activities and supervisory power. Note that most of the studies that examine whether the impact of regulations on risk-taking is channeled through market power are theoretical in nature, with empirical evidence being limited.

2.1. Capital requirements

Capital requirements can influence competition and risk-taking in various ways. First, high initial capital stringency requirements can impose entry barriers for newcomers. This would restrict competition and allow existing banks to accumulate power, resulting in a more prudent, less-risky behavior. Second, higher overall capital requirements are associated with

higher fixed costs of running the bank and, consequently, fewer banks will be able to afford these costs. Third, as Bolt and Tieman (2004) illustrate within a dynamic theoretical framework, more stringent capital adequacy requirements lead banks to set stricter acceptance criteria for granting new loans. In contrast to the latter argument, Hellmann et al. (2000) suggest that in addition to the capital-at-risk effect, there is an opposite effect that harms franchise value and encourages gabling. On the same line with Hellman et al. (2000), Matutes and Vives (2000) and Repullo (2004) conclude that capital requirements may not be enough and additional regulations such as deposit rate controls, deposit premiums or asset restrictions could be useful in reducing risk within a competitive environment. Niinimaki (2004) considers different market structures and suggests that if the bank is a monopoly or banks are competing only in the loan market, deposit insurance has no influence on risk-taking. However, when banks are competing for deposits the introduction of a deposit insurance scheme increases risk-taking, as banks with lower charter values tend to have lower solvency and higher credit risk.

2.2. Restrictions on bank activities

The theoretical model of Matutes and Vives (2000) suggests that asset restrictions can complement deposit insurance and capital requirements in limiting risk-taking when competition is intense. As discussed in Beck (2008), the activity and branching restrictions that were enforced after the financial crises of the 1930s aimed to restrict competition and enhance stability. Yet, the financial liberalization in the 1970s and 1980s resulted in "unchecked" competition and was considered as one of the determinants of banking fragility (Keeley, 1990). The empirical evidence may be better described as mixed. Claessens and Laeven (2004) find that lower restrictions on activity lead to more competition. In turn, this increase in competition could have a negative effect on profits and the charter value of banks, encouraging greater risk-taking. On the other hand, low restrictions could allow the creation of large financial conglomerates, reducing competition in the market. Beck et al. (2004) document such a positive correlation between concentration and restrictions on activities in the banking industry. Furthermore, evidence from studies that look at the diversification opportunities of banks across various market segments suggest that restrictions on bank activities will influence competition and bank behavior in other segments of the market. For example, Lepetit et al. (2008a) find that higher reliance on fee-based activities is associated with underpriced borrower default risk; and Lepetit et al. (2008b) show that expanding into non-interest income activities increases the risk of insolvency.

2.3. Official supervisory power

Levine (2003) discusses that, in general, powerful official supervisors could improve the governance of banks and promote competition. Indeed, we have established that as banks will experience an increase in competition they may take on additional risks. In this respect, a strong and independent supervisor would be able to prevent managers from engaging in an excessive risk-taking behavior. However this may not always be the case, especially in transition economies. For example, and under the political/regulatory capture view, powerful banks may confine politicians and induce supervisors to act in the interest of banks rather than the interest of the society (see e.g. Stigler, 1971). If this were the case, banks would retain and enhance their market power (see Delis and Pagoulatos the impact on risk-taking, 2008). Therefore, even though we do not have priors on how these opposing forces would affect risk-taking, we can come up with the following suggestions. On the one hand, higher charter values associated with decreased competition would provide incentives for more prudent investment decisions and lower risk-taking. On the other hand, if powerful banks will decide to increase their risk-taking it may be more difficult for politically connected supervisors to impose any restrictions.

3. Empirical specification and data

Given the considerations of the theoretical and empirical literature described above, we specify the following empirical model to study the relationship between bank risk-taking, competition and regulation (the latter in the form of capital requirements, activity restrictions and supervisory power):

$$r_{it} = b_0 + b_1 L_{it} + b_2 reg_{t-1} + b_3 L_{it} \times reg_{t-1} + b_4 x_{it} + b_4 m_t + u_{it} \quad (1)$$

In this specification, bank risk-taking r of bank i at year t is written as a function of bank market power, L; time-dependent indices of bank regulation, reg; a vector of bank-level variables reflecting the characteristics of each bank, x; variables that reflect the industry and macroeconomic conditions common to all banks, m; and the error term u.

We proxy the risk-taking behavior of banks by both the ratio of non-performing loans to total loans, and the Z-index, in alternative specifications. The first measure reflects the credit risk position of a bank. The CEE banks have inherited from the previous centrally-planned economies a considerable volume of nonperforming loans. In these countries banking laws were generally developed to promote sound banking practices among existing

and new market players, and to increase the efficiency of delivering intermediation services. Banks would therefore improve their performance by improving screening and monitoring of credit risk, with such policies involving the forecasting of future levels of risk. The Z-index, in turn, represents a more universal measure of bank risk-taking and is defined as $Z = (ROA + EA)/\sigma(ROA)$, where ROA is the rate of return on assets, EA is the ratio of equity to assets and $\sigma(ROA)$ is an estimate of the standard deviation of the rate of return on assets. This risk measure is monotonically associated with the probability of a bank's default and has been widely used in the empirical banking and finance literature (see e.g. Boyd et al., 2006). To calculate the standard deviation of ROA we use data on ROA from the two previous years and we verified that using three or four years produces very similar results.

3.1. Measuring bank market power

Claessens and Laeven (2004), Schaeck et al. (2009) and Yildirim and Philippatos (2007) derive country-specific Panzar and Rosse (1987) H-statistics, which they subsequently regress on a number of explanatory variables using cross-sectional estimation methods. However, some authors (see e.g. Shaffer, 2004) convincingly suggest that the H-statistic does not map into a range of oligopoly solution concepts as robustly as the Lerner index (i.e. the markup of output price over marginal cost) does, mainly owing to partial failure to incorporate long-run structural adjustments. For example, Angelini and Cetorelli (2003) recognize this and estimate Lerner indices for each year in the sample period, which are also regressed on a number of explanatory variables in a second stage of analysis, again using cross-sectional methods.

Here we opt for a bank-level Lerner index and to this end we obtain an estimate of the marginal cost at the country level and we use this marginal cost to obtain the Lerner index from the formula

$$L_{it} = (p_{it}^{q} - mc_{t})/\, p_{it}^{q} \tag{2}$$

where p_{it}^{q} is the price of bank output (calculated as the ratio of interest income to total earning assets). The marginal cost (mc) is estimated on the basis of the following translog cost function:

$$\begin{aligned} \ln C_{it} = {} & b_0 + b_1\overline{\ln q_{it}} + \frac{1}{2}b_2(\overline{\ln q_{it}})^2 + b_3\overline{\ln d_{it}} + \frac{1}{2}b_4(\overline{\ln d_{it}})^2 + b_5\overline{\ln w_{it}} + \frac{1}{2}b_6(\overline{\ln w_{it}})^2 + \\ & b_7(\overline{\ln q_{it}})(\overline{\ln w_{it}}) + b_8(\overline{\ln q_{it}})(\overline{\ln d_{it}}) + b_9(\overline{\ln d_{it}})(\overline{\ln w_{it}}) + e_{it} \end{aligned} \tag{3}$$

where C is the total cost of bank i at time t, q is bank output (measured by total earning assets), d is the value of bank deposits, w are the prices of inputs and e is a stochastic disturbance. Variables with bars represent deviations from their means, specified in this way to reduce multicollinearity (see Uchida and Tsutsui, 2005; Brissimis et al., 2008). Within this framework, in the special case of Cournot competition L is simply the output share of the ith bank at each point in time. In the case of perfect competition, $L = 0$; under pure monopoly, $L = 1$; and, finally, $L < 0$, implies pricing below marginal cost and could result, for example, from a non-optimizing behavior of banks. The merit of this approach is that it provides bank-level estimates of market power to be used in the subsequent analysis.

Data for the variables are obtained from BankScope. C is proxied by total expenses, q by total earning assets and d by total deposits and short-term funding. w represents three input prices, i.e. the price of funds (measured by the ratio of interest expenses to total deposits), the price of labor (measured by the ratio of personnel expenses to total assets[4]) and the price of physical capital (measured by the ratio of depreciation and other capital expenses to total fixed assets). Table 1 contains these variables, along with some descriptive statistics.

[Insert Table 1 about here]

[Insert Table 2 about here]

Estimation of Eq. (3) is carried out for each country separately using the method of maximum likelihood and average results of L on a country and time basis are presented in Table 2.[5] The picture presented by the estimates is mixed, with some countries reflecting fairly competitive practices (e.g. Bulgaria and Romania), other reflecting anticompetitive behavior (Lithuania and Slovenia), and most lying in between. Changing patterns over time are also different on a country by country basis. For example, Latvian banks move towards more anticompetitive behavior on average, while Slovakian banks move towards the opposite direction. An interesting pattern is observed in the more developed countries of the group (Czech Republic, Poland, Slovenia), where higher values are observed in the middle of the

[4] We define the price of labor as total personnel expenses divided by total assets because BankScope does not include comprehensive information on bank staff members for the countries considered. Many other studies have followed a similar approach (see e.g. Altunbas et al., 2001).

[5] We used the method of maximum likelihood to be in line with the majority of banking papers on cost efficiency/market power. Several robustness checks were performed; however, the results remained unchanged at the 10% level of significance. In particular, we used two-stage least squares instead of maximum likelihood, we included risk and ownership variables (public vs. private, foreign vs. domestic) among bank inputs in the cost and revenue equations and we trimmed the 5% of the samples to reduce the potential impact of outliers. All these results are available upon request.

examined period. This may suggest that market power has been the result of networking, owing to the weak institutional environment; however, penetration of foreign-owned banks and institutional advances before the accession of these countries in the EU may be responsible for the decreasing values in the last years of our sample. Finally, it is worth noting that in some of the less developed countries (e.g. Serbia and Romania in the first few years) banks are not behaving as optimizing firms on average.

3.2. Regulatory variables

The principal focus of this study is to examine whether the regulatory tools discussed in Section 2 (i.e. capital requirements, activity restrictions on banks and official supervisory power) have an impact on bank risk-taking through the level of market power of banks. To quantify the three classes of regulation we use the approach followed by Barth et al. (2001b, 2006, 2008).[6] Specifically, regulatory indices are constructed that relate to capital requirements (*caprq*), official supervisory power (*spower*) and restrictions on activities (*actrs*). We briefly discuss these indices below, while additional information can be found in Appendix A.

The first index *(caprq)* shows the extent of both initial and overall capital stringency. Initial capital stringency refers to whether the sources of funds counted as regulatory capital can include assets other than cash or government securities and borrowed funds, as well as whether the regulatory or supervisory authorities verify these sources. Overall capital stringency indicates whether risk elements and value losses are considered while calculating the regulatory capital. Theoretically, *caprq* can take values between 0 and 8, with higher values of indicating more stringent capital requirements. In our case, it ranges between 2 (e.g. Latvia-1999) and 8 (e.g. Slovenia-2002). The second index (*spower*) reveals the power of the supervisory agencies to take specific actions in relation to their authority against bank management and directors, shareholders, and bank auditors. In the present paper, the index ranges between 6 (e.g. Serbia) and 14 (e.g. Hungary) with higher values indicating more powerful supervisors. The last index (*actrs*) is determined by considering whether securities,

[6] This approach has been also followed by Fernandez and Gonzalez (2005), Pasiouras et al. (2006) and Buch and DeLong (2008) among others. An alternative would be to use principal component analysis as in Beck et al. (2006b). Barth et al. (2004) have followed both approaches, mentioning that on the one hand the drawback of using the summation for the construction of the index is that it assigns equal weight to each of the questions, whereas on the other hand the disadvantage of the first principal component is that it is less obvious how a change in the response to a question modifies the index. While they only report the empirical results on the basis of the latter approach, they mention (p. 218) that "*we have confirmed all this paper's conclusions using both methods*".

insurance, real estate activities, and ownership of non-financial firms are unrestricted, permitted, restricted, or prohibited. Theoretically, this index can range between 1 and 4 and as in the case of *caprq* and *spower*, higher values indicate higher restrictions. In the present study, *actrs* takes values between 1.25 (e.g. Estonia- 2002) and 3.25 (e.g. Romania-1999).

We should note here that new regulatory initiatives are unlikely to affect the risk-taking behavior of banks in the immediate term, especially through changes in market power. If regulations affect risk-taking, then it is expected that there are lags between establishing new banking laws or taking new policy initiatives (that will be reflected in the corresponding indices) and the time that these laws or initiatives are translated into more sound banking practices. Therefore, to the very best, the regulatory practices of the previous period are expected to impact the contemporaneous level of bank risk-taking. In fact, in the estimations below, we will be using both the first and the second lags of the regulation variables.

3.3. Other controls

A number of bank- and industry-level control variables are employed to improve the fit of our model. The former variables include the cost to income ratio and a proxy for bank size. The cost to income ratio (non-interest operating costs to total bank revenue) is used to control for differences in technical efficiency (see also Boyd et al., 2006), while the natural logarithm of real total assets (*lnta*) is used as a scaling variable. The industry-level controls include exogenous determinants of risk common to all banks. Specifically, we include the rate of GDP growth (*gdpg*) as a proxy for the fluctuations in economic activity, and a short-term interest rate (*ir*), which serves as an indicator of the monetary environment. In addition to the macroeconomic variables, we also use foreign (*for*) and public (*pub*) ownership as potential determinants of bank competition. *for* is defined as the per cent of foreign owned banks in terms of total industry assets and *pub* as the per cent of publicly owned banks in terms of total industry assets (for descriptive statistics, see Table 1). As a final control, we employ an index of market discipline (*mdisc*), which reflects the degree to which banks are forced to disclose accurate information to the public (e.g. disclosure of off-balance sheet items, risk management procedures, etc.) and whether there are incentives to increase market discipline such as subordinated debt and an absence of deposit insurance schemes.[7] In

[7] Demirgüç-Kunt and Detragiache (2002) show that several countries have established a system of national deposit insurance over the last 25 years, this being viewed as a way of avoiding bank runs. However, when deposit insurance is in effect, depositors may have no incentives to monitor banks, which may result in a decrease in market discipline (see e.g. Dermirguc-Kunt and Huizinga, 2004). See Calomiris (1999), Evanoff

accordance with the discussion of the rest of the regulatory indices above, this index enters the estimated equations lagged once.

3.3. Data sources

Our sample consists of 546 banks operating in the 13 CEE countries shown in Tables 1 and 2 over the period 1998-2005. We collect our data from a number of sources. Individual bank data are taken from BankScope. Data for *caprq*, *spower*, *mdisc*, and *actrs*, are obtained from the World Bank database on "Bank Regulation and Supervision" developed by Barth et al. (2001a) and updated by Barth et al. (2006, 2008). Since this database is available at only three points in time we use information from Version I for bank observations over the period 1998-2000, from Version II for bank observations over the period 2001-2003, and from Version III for bank observations for 2004-2005.[8] Data for the market structure (*for, pub*) and macroeconomic conditions (*ir, invgdp, gdpg*) are collected from the EBRD's Transition Reports and the World Bank's World Development Indicators (WDI).

4. Estimation and results

In this section, we investigate whether regulations and competition affect the degree of bank risk-taking separately or whether the effect of regulations is channeled through bank market power. We opt for both static and dynamic specifications of the empirical model specified above. The static specification is the norm in the literature and refers to the estimation of Eq. (1). Yet, Berger et al. (2000), among others, have shown that even a developed banking industry, such as that of the US, is subject to impediments that yield various forms of persistence in bank-level rents. One of these impediments refers to the interrelationship between bank risk-taking and impediments to competition. If for example a banking industry is characterized by informational opacity owing to networking, it is likely that the bonds that created the networking are strong and thus persistent. Two other arguments can be made in favor of a dynamic formulation. First, the potential impact of stock variables on flow variables (such as non-performing loans) may be better approximated by a

and Wall (2000), DeYoung et al. (2001), Bliss (2001), Jagtiani et al. (2000), Berger et al. (2000) among others for the role of subordinated debt in promoting discipline in banking.

[8] Version I was released in 2001 and contain information for 117 countries (Barth et al., 2001a). For most of the countries, information corresponds to 1999, while for others information is either from 1998 or 2000. Version II describes the regulatory environment at the end of 2002 in 152 countries (Barth et al., 2006) and Version III describes the regulatory environment in 142 countries in 2005/06 (Barth et al., 2008). Many other studies that have used this database across a number of years followed a similar approach (e.g. Demirgüç-Kunt and Detragiache, 2002; Fernandez and Gonzalez, 2005).

dynamic formulation (see Laeven and Majnoni, 2003). And second, Allen and Gale (2000, 2004) in considering a variety of different theoretical models of the risk-regulation nexus showed that regulations can have a negative effect on risk taking within a static model and a positive effect within a dynamic model.

Given the above, we augment the static model of Eq. (1) with a lagged dependent variable as follows:

$$r_{it} = b_0' + \delta r_{it-1} + b_1'\theta_t + b_2' reg_{t-1} + b_3'\theta_{it} \times reg_{t-1} + b_4' x_{it} + b_5' m_t + \varepsilon_{it}' \quad (4)$$

A value of δ between 0 and 1 implies that the dependent variables of the above equations persist, but they will eventually return to their normal (average) level. Values close to 0 mean that the speed of adjustment is high, while values close to 1 imply very slow adjustment.[9]

The choice of the estimation procedure rests on the special features of each empirical model. Estimation of Eq. (1) is carried out using panel data instrumental variables regression. There are two main reasons for this choice. First, it may be possible that after deregulation of the CEE banking systems started, and taking into account the huge transformation of the economy and the society of these countries within a small period, credit risk increased significantly. This led to increased financial instability (note the crises in the CEE banking sectors during the late 1990s[10]) and in an effort to smooth the turmoil the supervisory authorities reacted by setting new rules and taking new initiatives that are reflected in the regulatory indices. Therefore, it is likely that reverse causality prevails between bank risk taking and each of competition and regulation.[11] To prevent our model from capturing this adverse causality, we instrument against all risk and macroeconomic variables, their first lags and country dummies, in Eq. (1).[12]

As regards Eq. (4), we use the system GMM estimator proposed by Blundell and Bond (1998). Besides accounting for the specified dynamics, this estimator has two additional virtues. First, it does not break down in the presence of unit roots (for a proof see Binder et al., 2003) and second it accommodates the possible endogeneity between the risk,

[9] The coefficients on the lagged values take implausible values (e.g. negative or very small) for panels with a very small time dimension and are highly dependent on the robustness of the estimation method (see Nerlove, 2002).

[10] For details on these crises, see Laeven and Valencia (2008).

[11] Note that it may also be the case that as bank failures increase, the resulting higher degree of concentration in the industry does not necessarily imply more market power for surviving banks. Banks that do not fail are usually the more efficient bank, which effectively have lower costs in producing the same outputs (Beck et al., 2006). Using bank-level markups instead of a concentration ratio to measure market power safeguards our empirical analysis from capturing such a misleading relationship (we thank an anonymous referee for raising this point).

[12] This is a random effects panel IV regression. The validity of random effects against fixed effects has been verified by a Hausman test.

market power and regulation variables by means of appropriate instruments.[13] The instruments used are the same with the IV regressions and the validity of the instruments is verified by a Sargan test. A final practical issue in estimating Eq. (4) is that the interaction terms are highly collinear with their components. An easy way to reduce multicollinearity is by "centering" the variables. We do this by subtracting the mean from each observation and we observe that correlation of all independent variables is now below 40 per cent.

Table 3 reports the empirical results when *npl is* the dependent variable. We find a negative and significant association between market power and non-performing loans that is robust across all specifications (whether static or dynamic). Capital requirements appear to be an effective tool in reducing credit risk on average, a finding consistent with Barth et al. (2004) and Kopecky and VanHoose (2006). Also, consistent with the expectations of the supervisory power hypothesis, *spower* has a negative and independent effect on credit risk. Notably, in the regressions that include the interaction between market power and these two supervisory tools, only the interaction between market power and *caprq* enters with a positive and significant coefficient. This holds regardless of whether the level of *caprq* is included in the estimated equation. This shows that *caprq* has an independent effect on risk, but this effect decreases for banks with higher market power. In other words, this finding suggests that the stabilizing effects of capital regulations diminish when the banks have sufficient power to increase their credit risk.

The impact of *actrs* is insignificant, indicating that there is no direct effect of activity restrictions on credit risk. However, its interaction with market power enters negatively and significant (see columns 4 to 7), which implies that activity restrictions increase the credit risk-taking of banks with low market power. One potential explanation for this finding is that as the integration of financial services is restricted, banks focus on the loan market in order to replace the forgone non-interest income. However, due to the increased competition, banks with low market power in lending may view the financing of risky borrowers as the only way to attract customers and increase their market share.

[Insert Table 3 about here]

[13] To guarantee robustness we control for country heterogeneity and temporal variation in the above specifications through the appropriate use of dummy variables (see Baltagi, 2001). These dummy variables have been found jointly statistically significant in virtually all equations, but they are not reported to save space.

The results in Table 4 present the estimations when we use the Z-index as an overall measure of insolvency risk. Differences between static and dynamic models are negligible, however the coefficient on the lagged dependent variable is highly significant indicating a considerable level of persistence in bank risk. On the same line with the results in Table 3, lower competition and higher supervisory power result in lower bank risk. As before the interaction between competition and supervisory power does not influence risk. However, we observe some differences in the direct effects of *actrs* and *caprq*. As Claessens (2003) points out, the integration of financial services is a debated topic, especially for emerging markets. While, theoretically, lowering the restrictions on bank activities increases the possibilities of risk diversification, it also provides more opportunities to increase and shift risk. Furthermore, it will be more difficult for supervisors to monitor complex banks that offer a variety of services, and this problem can become even more severe in emerging countries where supervision can be weak and enforcement will tend to be lower. Another problem highlighted in Claessens (2003) is that due to reduced transparency and complicated structures of ownership and control, financial conglomerate groups can experience important corporate governance problems, which are generally already large in emerging markets. This would be expected to have an adverse effect in the monitoring and control of risk-taking by managers. Our results support these arguments in showing that stricter restrictions on bank activities are effective in reducing insolvency risk, a finding that it is consistent with the empirical results of Fernandez and Gonzalez (2005). This result is also consistent with the findings of Lepetit et al. (2008a,b) who show that the involvement in various activities that generate non-interest income results in higher risk-taking. This risk generated from the involvement in non-interest income related activities could also explain why *actrs* has a direct impact on overall risk, but not on credit risk. Turning to the capital requirements we find that they do not directly influence overall insolvency risk, a finding consistent with Barth et al. (2004).

[Insert Table 4 about here]

Consistent with the results in Table 3, *L*caprq* and *L*actrs*, enter in the relevant specifications (columns 4-7) with a significant coefficient. In particular, capital requirements have an effect on risk via and combined with the level of market power (since they appear statistically significant whether the *caprq* variable is included in the estimated equation or not). When a bank has high market power, capital requirements increase insolvency risk.

This result contradicts prior expectations as for the efficiency of capital requirements to avoid moral hazard problems. In more detail, the underlying idea of this argument is that with higher capital requirements banks will hold higher amounts of capital, implying higher losses for shareholders in the case of default and therefore lower incentives for risk-taking through more prudent investments. However, Hellman et al. (2000) argue that this traditional view does not consider the dynamic effect of capital requirements on the bank's franchise value. They argue that, in a dynamic scenario, an increase in the amount of capital has not only the positive *capital risk effect* but also a *franchise value effect* that moves in the opposite direction due to lower profits. However, lower franchise values imply stronger incentives for risk-taking. Thus, our results support the franchise-value-effect hypothesis, with risk-taking being conditional on the market power of the banks. In contract, the positive sign of *L*actrs* shows that activity restrictions limit the risk-taking of banks with high market power, thus enhancing bank soundness. Overall, it seems that ignoring the interactions between regulations and market power will lead to erroneous inferences about the impact of regulations on both credit risk and overall risk.

Turning to the control variables, we observe that consistent with the private monitoring hypothesis, regulatory proposals (e.g. European Shadow Financial Regulatory Committee, 1999, 2000) and past studies (e.g. Calomiris, 1999; Barth et al., 2004; Fernandez and Gonzalez, 2005; Demirgüç-Kunt et al., 2008) financial disclosures and other incentives that enhance market discipline can be an effective tool in decreasing risk. Bank ownership appears to be another important parameter, with a higher presence of foreign (state-owned) banks in the market resulting in lower (higher) risk-taking which are consistent with the literature that suggests a number of benefits from the entry of foreign banks in emerging markets,[14] as well as the negative impact of state-owned banks on the banking sector (see La Porta et al., 2002; Demirgüç-Kunt and Serven, 2009, for discussions). Consistent with our expectations, higher GDP growth lowers credit risk and increases bank soundness. However, the nominal interest rate does not have a significant impact on bank risk in most regressions. Turning to the bank-specific control variables, we find that as in Jimenez et al. (2007) among

[14] For example, as discussed in Bonin et al. (2005), until recently the information technology in transition countries was only basic, while the human capital necessary to make even prudent lending decisions and to price risk properly was sparse or non-existent. However, these conditions were obviously improved since enhancement of quality and availability of financial services, adoption of modern banking skills and technology, and increase in the quality of human capital, either by importing high skilled bank managers to work in their branches or by training the local employees are among the major benefits of foreign banks entry in emerging markets (Levine, 1996; Lensink and Hermes, 2004).

others, size has a negative impact on non-performing loan to total loan ratios which can be associated to better credit quality systems and corporate governance in larger banks. Finally, more efficient control of expenses (i.e. lower non-interest expenses to total revenue) contributes to bank soundness, although it does not appear to influence credit risk.

5. Conclusions

In this paper we analyzed the relationship between bank risk-taking, market power and regulations. On the basis of theoretical arguments we restrict our analysis to regulations related to capital requirements, restrictions on activities, and official supervisory power. The focus of the empirical tests is placed on whether these regulations have an independent effect on risk, whether their effect is transmitted via the level of bank market power or whether regulations and market power have a combined effect on bank risk.

We find that market power lowers both the non-performing loans and the overall insolvency risk. Capital requirements and supervisory power have a direct impact on credit risk by reducing non-performing loans. However, the stabilizing effects of capital regulations diminish when the banks have sufficient market power to increase their credit risk. Restrictions on activities do not have a direct effect on credit risk; however, there appears to be an indirect impact through market power. Supervisory power is also effective in reducing insolvency risk but as in the case of credit risk, this effect is independent of market power. In contrast, capital requirements do not influence directly the overall insolvency risk; however, they have an indirect effect that is channeled through market power. Finally, restrictions on activities have now both a direct and indirect effect by reducing insolvency risk, which however depends on the market power of banks. Overall, it appears that ignoring the interactions between regulations and market power leads to erroneous inferences about the impact of regulations on both credit risk and overall risk.

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Table 1
Descriptive statistics

	Albania	Bulgaria	Croatia	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Serbia	Slovakia	Slovenia
C	69,154	88,883	99,019	182,144	39,124	52,561	26,866	50,841	37,575	181,908	52,033	57,204	78,993
q	1,250,249	570,526	801,410	2,176,524	299,970	592,536	401,117	464,642	372,176	999,085	709,106	513,303	707,699
d	739,089	594,317	755,746	1,396,645	266,024	497,314	262,829	409,320	304,216	728,355	613,683	463,144	609,897
w_1	0.047	0.068	0.065	0.088	0.071	0.078	0.047	0.07	0.058	0.082	0.053	0.058	0.064
w_2	0.009	0.011	0.015	0.017	0.012	0.013	0.014	0.012	0.018	0.010	0.011	0.015	0.022
w_3	0.601	0.503	0.515	0.388	0.620	0.410	0.437	0.508	0.405	0.519	0.725	0.428	0.370
p^q	0.127	0.178	0.158	0.147	0.189	0.145	0.112	0.15	0.152	0.142	0.142	0.156	0.139
cr	0.077	0.039	0.021	0.032	0.046	0.015	0.037	0.023	0.037	0.028	0.043	0.034	0.05
Z	37.10	43.12	48.15	44.22	43.81	41.12	45.18	47.89	43.74	39.67	38.85	42.59	47.90
caprq	4.00	6.57	3.86	4.86	4.43	6.00	5.00	3.57	4.57	4.86	5.00	5.00	6.57
actrs	2.32	2.39	1.96	2.86	1.68	2.68	1.89	2.36	1.96	2.93	2.00	2.57	2.57
mdisc	5.00	6.00	6.00	6.14	6.43	6.29	6.86	6.00	6.00	4.86	5.00	5.29	6.86
spower	11.71	11.14	11.14	9.57	13.14	14.00	11.29	12.00	9.29	9.86	6.00	13.14	12.71
ci	0.456	0.477	0.443	0.385	0.670	0.532	0.458	0.510	0.486	0.498	0.582	0.441	0.362
ta	1,316,947	699,003	913,947	2,769,430	329,704	661,711	435,659	513,691	410,206	1,745,472	810,592	584,891	778,997
gdpg	6.45	2.175	4.441	2.8	6.275	3.85	4.475	5.85	4.516	4.05	2.791	3.6	4.45
ir	1.439	26.85	6.083	7.425	7.43	16.05	8.958	8.583	1.556	9.325	3.190	28.275	10.85
pub	65.58	31.54	23.19	35.11	50.08	16.45	29.16	54.54	40.85	32.325	53.73	68.79	32.625
for	48.48	67.16	49	52.475	66.65	60.525	55.29	59.38	44.78	11.51	43.74	15.4	57.52

Note: C: total expenses; q: total earning assets; d: total deposits and short-term funding; w1: price of funds (interest expenses/total deposits and short-term funding); w2: price of labor (personnel expenses/total assets); w3: price of physical capital (total depreciation and other capital expenses/total fixed assets); p^q: total revenue to total earning assets; cr: non-performing loans/total loans; Z: Z-index of bank risk; caprq: capital requirements index; actrs: restrictions on banks activities index; mdisc: market discipline index; spower: official disciplinary power index; ci: total operating costs/total income; ta: total assets; *gdpg*: annual % GDP growth rate; ir: short-term interest rate; pub: % of publicly owned banks in terms of total industry assets; for: % of foreign owned banks in terms of total industry assets. Figures other than ratios and indices are in thousand euros.

Table 2
Evolution of competitive conditions in the CEE banking systems (L)

	Albania	Bulgaria	Croatia	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Serbia	Slovakia	Slovenia
1998	0.395	0.234	0.662	0.630	0.749	0.347	0.555	0.919	0.714	0.104	0.028	0.436	0.965
1999	0.361	0.221	0.635	0.582	0.807	0.382	0.677	0.925	0.723	0.127	0.082	0.468	0.915
2000	0.479	0.273	0.610	0.520	0.860	0.420	0.661	0.946	0.732	0.230	0.059	0.406	0.908
2001	0.581	0.319	0.590	0.438	0.885	0.385	0.711	0.924	0.742	0.195	-0.146	0.372	0.866
2002	0.672	0.358	0.582	0.457	0.927	0.361	0.754	0.918	0.771	0.141	-0.053	0.297	0.816
2003	0.608	0.410	0.625	0.429	0.914	0.358	0.782	0.929	0.800	0.186	-0.014	0.236	0.794
2004	0.540	0.404	0.640	0.436	0.856	0.387	0.821	0.905	0.675	0.248	-0.089	0.205	0.748
2005	0.514	0.424	0.637	0.410	0.813	0.346	0.863	0.893	0.636	0.295	0.020	0.171	0.745

Note: The table presents average estimates of competition (L) for 13 CEE countries over the period 1998-2005. Lower values suggest increased competition and higher values increased market power.

Table 3
Reform, competition and risk-taking in the CEE banking system (dependent variable: non-performing loans/total loans)

	1	2	3	4	5	6	7
r_{t-1}		0.614	0.618		0.605		0.626
		(9.18)***	(9.31)***		(8.92)***		(9.33)***
L	-0.428	-0.386	-0.389	-0.345	-0.351	-0.327	-0.361
	(-3.95)***	(-3.12)***	(-3.21)***	(-2.91)***	(-3.09)***	(-2.72)**	(-3.06)***
L^2			0.042				
			(1.27)				
caprq	-0.062	-0.057	-0.056			-0.042	-0.031
	(-3.57)***	(-3.11)***	(-3.03)***			(-2.05)**	(-1.79)*
actrs	-0.012	-0.025	-0.026			-0.017	-0.024
	(-0.61)	(-1.40)	(-1.48)			(-0.68)	(-1.17)
spower	-0.031	-0.047	-0.046			-0.028	-0.039
	(-2.11)**	(-2.81)***	(-2.77)***			(-2.03)**	(-2.55)**
ci	0.025	0.027	0.027	0.024	0.031	0.026	0.030
	(1.48)	(1.55)	(1.54)	(1.42)	(1.68)	(1.51)	(1.64)
lnta	-0.455	-0.431	-0.433	-0.457	-0.434	-0.462	-0.436
	(-2.07)**	(-1.83)*	(-1.88)*	(-2.11)**	(-1.93)**	(-2.23)**	(-1.96)**
gdpg	-0.108	-0.117	-0.118	-0.106	-0.115	-0.110	-0.101
	(-6.43)***	(-7.06)***	(-7.15)***	(-6.31)***	(-6.98)***	(-6.50)***	(-6.12)***
ir	-0.042	-0.036	-0.036	-0.044	-0.039	-0.043	-0.039
	(-1.80)*	(-1.66)	(-1.65)	(-1.87)*	(-1.73)	(-1.86)*	(-1.73)
for	-0.020	-0.021	-0.021	-0.019	-0.022	-0.020	-0.023
	(-2.24)**	(-2.32)**	(-2.32)**	(-2.10)**	(-2.35)**	(-2.26)**	(-2.39)**
pub	0.031	0.030	0.030	0.030	0.031	0.029	0.032
	(2.80)***	(2.67)**	(2.65)**	(2.68)**	(2.77)**	(2.60)**	(2.81)***
mdisc	-0.027	-0.025	-0.024	-0.026	-0.025	-0.027	-0.0.24
	(-2.48)**	(-2.21)**	(2.16)**	(-2.45)**	(-2.25)**	(-2.50)**	(2.18)**
L*caprq				1.856	1.877	1.783	1.827
				(2.12)**	(2.23)**	(2.00)**	(2.14)**
L*actrs				-2.162	-2.094	-2.097	-2.131
				(-2.77)***	(-2.59)**	(-2.66)**	(-2.71)**
L*spower				0.643	0.702	0.607	0.712
				(0.70)	(0.91)	(0.63)	(0.98)
Number of countries	13	13	13	13	13	13	13
Observations	3499	3052	3052	3499	3052	3499	3052
Wald (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.338			0.323		0.295	
AR(1) (p-value)		0.047	0.040		0.033		0.048
AR(2) (p-value)		0.340	0.388		0.607		0.585
Sargan (p-value)		0.347	0.495		0.781		0.609

Note: Specifications 1 and 4 and 6 correspond to static panel data IV regressions and the rest to dynamic panel data models. r_{t-1} is the lagged dependent variable in the dynamic models. L is the bank-level estimate of market power obtained form Eqs. (2) and (3) of the main text. caprq, actrs and spower are indices of capital requirements, activity restrictions and supervisory power, respectively (defined comprehensively in the Appendix). ci is the ratio of non-interest expenses to total revenue and represents the level of technical efficiency. lnta is the natural logarithm of total assets and serves as a measure of bank size. gdpg is the country-specific GDP growth rate and ir is a nominal interest rate. for is the % of foreign-owned banks in terms of total industry assets. pub is the % of publicly-owned banks in terms of total industry assets. mdisc is an index reflecting market discipline (defined comprehensively in the Appendix). Wald is a test indicating goodness of fit of the regression, AR(1) and AR(2) are the first and second order Arrelano-Bond tests for serial correlation and Sargan is a test for overidentifying restrictions. t-statistics are reported in parentheses, with *, **, *** representing significance at the 10, 5 and 1%, respectively. All models include country dummy variables.

Table 4
Reform, competition and risk-taking in the CEE banking system (dependent variable: Z-index)

	1	2	3	4	5	6	7
r_{t-1}		0.584	0.601		(0.619)		0.604
		(6.21)***	(6.48)***		(6.88)***		(6.52)***
L	0.317	0.295	0.290	0.248	0.277	0.331	0.275
	(2.97)***	(2.61)**	(2.52)**	(2.03)**	(2.38)**	(3.16)***	(2.35)**
L^2			-0.041				
			(-1.62)				
caprq	0.138	0.107	0.114			0.144	0.118
	(1.61)	(1.12)	(1.21)			(1.65)	(1.29)
actrs	0.337	0.342	0.347			0.198	0.214
	(2.65)**	(2.80)***	(2.89)***			(1.71)	(1.84)*
spower	0.346	0.338	0.342			0.331	0.351
	(2.97)***	(2.85)***	(2.90)***			(2.72)**	(3.04)***
ci	-0.072	-0.084	-0.082	-0.081	-0.089	-0.083	-0.090
	(-2.10)**	(-2.25)**	(-2.20)**	(-2.15)**	(-2.49)**	(-2.23)**	(-2.52)**
lnta	0.047	0.036	0.038	0.041	0.047	0.043	0.049
	(0.97)	(0.80)	(0.87)	(0.82)	(0.98)	(0.87)	(1.04)
gdpg	0.352	0.310	0.312	0.350	0.324	0.349	0.317
	(5.52)***	(4.48)***	(4.47)***	(5.37)***	(4.72)***	(5.46)***	(4.57)***
ir	0.019	0.015	0.016	0.018	0.014	0.020	0.015
	(1.49)	(1.16)	(1.19)	(1.45)	(1.08)	(1.54)	(1.23)
for	0.458	0.447	0.451	0.460	0.428	0.455	0.426
	(3.25)***	(3.12)***	(3.19)***	(3.31)***	(3.02)***	(3.27)***	(2.96)***
pub	-0.208	-0.194	-0.197	-0.210	-0.194	-0.212	-0.197
	(-1.91)**	(-1.80)*	(-1.83)*	(-1.93)**	(-1.80)*	(-1.99)**	(-1.84)*
mdisc	0.268	0.326	0.331	0.273	0.338	0.327	0.344
	(2.26)**	(3.02)***	(3.15)***	(2.39)**	(3.27)***	(2.35)**	(3.50)***
L*caprq				-2.014	-2.007	-2.149	-2.011
				(-2.61)**	(-2.50)**	(-2.89)***	(-2.54)**
L*actrs				1.987	2.023	1.990	2.031
				(2.10)**	(2.34)**	(2.14)**	(2.49)**
L*spower				-0.322	-0.121	-0.312	-0.125
				(0.42)	(0.18)	(0.38)	(0.22)
Number of countries	13	13	13	13	13	13	13
Observations	2055	1727	1727	2055	1727	2055	1727
Wald (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.289			0.301		0.286	
AR(1) (p-value)		0.034	0.041		0.037		0.022
AR(2) (p-value)		0.488	0.456		0.514		0.381
Sargan (p-value)		0.617	0.597		0.409		0.420

Note: Specifications 1 and 4 and 6 correspond to static panel data IV regressions and the rest to dynamic panel data models. r_{t-1} is the lagged dependent variable in the dynamic models. L is the bank-level estimate of market power obtained form Eqs. (2) and (3) of the main text. caprq, actrs and spower are indices of capital requirements, activity restrictions and supervisory power, respectively (defined comprehensively in the Appendix). ci is the ratio of non-interest expenses to total revenue and represents the level of technical efficiency. lnta is the natural logarithm of total assets and serves as a measure of bank size. gdpg is the country-specific GDP growth rate and ir is a nominal interest rate. for is the % of foreign-owned banks in terms of total industry assets. pub is the % of publicly-owned banks in terms of total industry assets. mdisc is an index reflecting market discipline (defined comprehensively in the Appendix). Wald is a test indicating goodness of fit of the regression, AR(1) and AR(2) are the first and second order Arrelano-Bond tests for serial correlation and Sargan is a test for overidentifying restrictions. t-statistics are reported in parentheses, with *, **, *** representing significance at the 10, 5 and 1%, respectively. All models include country dummy variables.

Appendix. Information on regulatory variables

Variable	Category	Description
caprq	Capital requirements	This variable is determined by adding 1 if the answer is yes to questions 1-6 and 0 otherwise, while the opposite occurs in the case of questions 7 and 8 (i.e. yes=0, no =1). (1) Is the minimum required capital asset ratio risk-weighted in line with Basle guidelines? (2) Does the ratio vary with market risk? (3-5) Before minimum capital adequacy is determined, which of the following are deducted from the book value of capital: (a) market value of loan losses not realized in accounting books? (b) unrealized losses in securities portfolios? (c) unrealized foreign exchange losses? (6) Are the sources of funds to be used as capital verified by the regulatory/supervisory authorities? (7) Can the initial or subsequent injections of capital be done with assets other than cash or government securities? (8) Can initial disbursement of capital be done with borrowed funds?
mdisc	Market discipline	This variable is determined by adding 1 if the answer is yes to questions 1-7 and 0 otherwise, while the opposite occurs in the case of questions 8 and 9 (i.e. yes=0, no =1). (1) Is subordinated debt allowable (or required) as part of capital? (2) Are financial institutions required to produce consolidated accounts covering all bank and any non-bank financial subsidiaries? (3) Are off-balance sheet items disclosed to public? (4) Must banks disclose their risk management procedures to public? (5) Are directors legally liable for erroneous/misleading information? (6) Do regulations require credit ratings for commercial banks? (7) Is an external audit by certified/licensed auditor a compulsory obligation for banks? (8) Does accrued, though unpaid interest/principal enter the income statement while loan is non-performing? (9) Is there an explicit deposit insurance protection system?
spower	Official disciplinary power	This variable is determined by adding 1 if the answer is yes and 0 otherwise, for each one of the following fourteen questions: (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 illicit activities, fraud, or insider abuse? (3) Can supervisors take legal action against external auditors for negligence? (4) Can the supervisory authorities 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 director's decision to distribute dividends? (8) Can the supervisory agency suspend director's decision to distribute bonuses? (9) Can the supervisory agency suspend director's decision to distribute management fees? (10) Can the supervisory agency supersede bank shareholder rights and declare bank insolvent? (11) Does banking law allow supervisory agency or any other government agency (other than court) to suspend some or all ownership rights of a problem bank? (12) Regarding bank restructuring and reorganization, can the supervisory agency or any other government agency (other than court) supersede shareholder rights? (13) Regarding bank restructuring & reorganization, can supervisory agency or any other government agency (other than court) remove and replace management? (14) Regarding bank restructuring & reorganization, can supervisory agency or any other government agency (other than court) remove and replace directors?
actrs	Restrictions on banks activities	The score for this variable is determined on the basis of the level of regulatory restrictiveness for bank participation in: (1) securities activities (2) insurance activities (3) real estate activities (4) bank ownership of non-financial firms. These activities can be unrestricted, permitted, restricted or prohibited that are assigned the values of 1, 2, 3 or 4 respectively. We use an overall index by calculating the average value over the four categories.

Note: The individual questions and answers were obtained from the World Bank database developed by Barth et al. (2001a, 2006, 2008).