

University of Groningen

Supervisory powers and bank risk taking

Shehzad, Choudry Tanveer; De Haan, Jakob

Published in:
Journal of International Financial Markets, Institutions & Money

DOI:
[10.1016/j.intfin.2015.05.004](https://doi.org/10.1016/j.intfin.2015.05.004)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2015

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):
Shehzad, C. T., & De Haan, J. (2015). Supervisory powers and bank risk taking. *Journal of International Financial Markets, Institutions & Money*, 39, 15-24. <https://doi.org/10.1016/j.intfin.2015.05.004>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.



Contents lists available at ScienceDirect

Journal of International Financial Markets, Institutions & Money

journal homepage: www.elsevier.com/locate/intfin

Supervisory powers and bank risk taking

Choudhry Tanveer Shehzad^{a,d,*}, Jakob De Haan^{a,b,c}^a University of Groningen, Groningen, The Netherlands^b De Nederlandsche Bank, Amsterdam, The Netherlands^c CESifo, Munich, Germany^d SDSB, Lahore University of Management Sciences, Lahore, Pakistan

ARTICLE INFO

Article history:

Received 3 August 2014

Accepted 14 May 2015

Available online 11 June 2015

Keywords:

Bank supervision

Bank regulation

Financial soundness

Financial fragility

ABSTRACT

We examine the effect of different types of bank supervisory powers in place *before* the crisis on bank risk-taking *during* the crisis. We employ data of more than 8000 banks from high-income OECD countries for the 2007–2011 period and impaired loans to gross loans ratio as proxy for bank risk-taking. Our Hausman–Taylor estimates indicate that the powers of bank supervisors to shake up the organizational structure of banks are more effective than powers to issue monetary penalties. Our results also suggest that supervisory powers do not affect risk-taking behavior of systemically important banks.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

The recent global financial crisis highlighted the importance of sound bank regulation and supervision for maintaining financial stability. Several authors argue that lax regulation led banks to take excessive risks that caused large losses during the crisis. For instance, according to Stiglitz (2010, p. 12), “it was deficiencies in regulation and regulatory enforcement that failed to prevent the banks from imposing costs on the rest of society.” However, as will be explained in more detail in Section 2, the empirical evidence on the impact of bank regulation on bank risk-taking is mixed at best.

The impact of regulation and supervision on banking risk is not only determined by the rules in place, but also by the powers of the supervisory authorities. An important question that has hardly been researched is which powers should be assigned to supervisory agencies. Only a few papers have touched upon this question and most work on this topic is theoretical. For instance, Prescott (1997, 1999) and Kupiec and O’Brien (1995) argue that supervisors’ powers to impose fines and penalties on banks may reduce moral hazard problems in banking.

We examine the impact of different types of bank supervisory powers in place *before* the crisis on bank risk-taking *during* the crisis, proxied by the impaired loans to gross loans ratio, for more than 8000 banks in high-income OECD countries for the period 2007–2011. In 2007 the crisis started with New Century Financial Corporation filing for Chapter 11 bankruptcy and Bear Stearns liquidating some of its hedge funds. As our sample includes many European banks and the euro crisis affected these banks seriously (cf. Fiordelisi et al., 2014), we consider all years since 2007 until the end of our sample as crisis period¹.

* Corresponding author at: Suleman Dawood School of Business, Lahore University of Management Sciences, Phase 5, DHA, Lahore, Pakistan. Tel.: +92 331 440 1708; fax: +92 042 3572 2591.

E-mail address: tanveer.shehzad@lums.edu.pk (C.T. Shehzad).

¹ Although the crisis was already showing signs of reversal in 2009 with extensive US and European bailouts packages, Shehzad and de Haan (2013) show that in 2010/2011 investors’ confidence in banking firms was still very low in high-income OECD countries.

Our data on supervisory powers are from the survey by [Barth et al. \(2008\)](#) which refers to the situation at the end of 2005. Time-varying regulation data is not available to the best of the authors' knowledge. However, as pointed out by [Barth et al. \(2004\)](#) and [Beck et al. \(2006\)](#), the change in bank regulation and supervision variables is usually very small. Additionally, using data that refer to 2005 also helps us to avoid any endogeneity which may arise because of changes in regulatory policies during the crisis.

While a number of indicators can be used as a proxy for bank risk-taking, such as distance to default, Z-score, and earnings volatility, we follow [Boyd et al. \(2010\)](#) and focus on the impaired loans to gross loans ratio. We see three advantages of using this ratio as a proxy for bank risk-taking. First, it is widely used by international organizations, such as the IMF, the World Bank and the BIS, to gauge the health of banking institutions. Second, using alternative measures, such as distance-to-default, would restrict the sample to listed banks only. Third, it is a direct indicator of the quality of credit extended by a bank. If a bank does not extend high-quality loans, its impaired loans to gross loans ratio will increase which will also affect its capital adequacy.

A related study is by [Beck et al. \(2006\)](#) who examine the effect of supervisory powers on corruption in bank lending. Using data of 2500 firms from 37 countries, they find that assigning more powers to supervisory agencies does not help improve the integrity of lending. Although we follow [Beck et al. \(2006\)](#) in constructing our indicators of supervisory powers, our paper differs significantly from theirs as we focus on supervisory agencies and banks instead of supervisory agencies and firms to whom bank lending is made. Another related paper is [Beltratti and Stulz \(2012\)](#). One of their explanatory variables for bank performance is an index of the power of the supervisory agency including elements, such as the rights of the supervisor to meet with and demand information from auditors, to force a bank to change the internal organizational structure, to supersede the rights of shareholders, and to intervene in a bank. Our paper differs, as we do not lump several supervisory powers together and use a much larger sample of banks over a longer time span.

We find that giving more powers to supervisory bodies to hire and fire bank managers and to change banks' organizational setup reduce bank riskiness. In contrast, powers to levy monetary penalties and fines are, if anything, counter-productive.

The paper is structured as follows: Section 2 gives a brief overview of related literature, Section 3 discusses the model and data used and Section 4 presents the empirical results. Section 5 offers a sensitivity analysis, while Section 6 offers the conclusions.

2. Literature review, contribution and hypothesis

Moral hazard problems in banks provides the rationale for assigning regulatory powers to bank supervisors ([Dewatripout and Tirole, 1994](#)). Several studies examine the effectiveness of bank regulation and supervision ([Barth et al., 2004](#); [Caprio et al., 2007](#); [Demirgüç-Kunt et al., 2008](#); [González, 2005](#); [Fonseca and González, 2010](#); [Demirgüç-Kunt and Detragiache, 2011](#); [Beltratti and Stulz, 2012](#); [Klomp and de Haan, 2012, 2014](#)). [Klomp and de Haan \(2012\)](#) provide an extensive discussion of this literature.

The empirical evidence on the relationship between (types of) regulation and supervision and financial stability is mixed. [Barth et al. \(2004\)](#) analyze the effect of different dimensions of bank supervision on bank stability. Using an earlier version of the survey dataset that we also use, their findings suggest that policies that induce accurate information disclosure and (incentives for) private sector corporate control of banks work best to promote stability at the country level. [Demirgüç-Kunt et al. \(2008\)](#), who focus on bank-level indicators for 203 banks from 39 countries, report a positive correlation between bank soundness (proxied by the Z-score) and the overall index of Basel Core Principles (BCP) compliance².

However, using several indicators of regulation, [Beltratti and Stulz \(2012\)](#) find no convincing evidence that tighter regulation in general was associated with better bank performance in their sample of 164 large banks (assets in excess of 50 billion \$ in 2006) from 32 countries during the crisis or with less risky banks before the crisis. Similar findings are reported by [Demirgüç-Kunt and Detragiache \(2011\)](#). Employing data of 3000 banks from 86 countries, they do not find support for the hypothesis that better regulation and supervision result in sounder banks. [González \(2005\)](#) even reports a negative relation between regulatory restrictions and stability of the banking system.

However, there is also some evidence suggesting that better regulation reduces bank riskiness. Using data of almost 200 banks from OECD countries for the period of 2002 to 2008, [Klomp and de Haan \(2012\)](#) show that while bank regulation has little impact on risk taking by low-risk banks, it significantly alters the behavior of high-risk banks. Similar results are reported by [Klomp and de Haan \(2014\)](#) for a sample of emerging and developing countries.

Previous studies do not provide an in depth analysis of the question of which powers should be assigned to supervisory agencies in order to reduce bank riskiness, although some studies consider some measure for supervisory powers. For instance, [Beltratti and Stulz \(2012\)](#) include as one of their explanatory variables an index of the power of the supervisory agency. They find that this variable is generally not significant in models for bank stock returns and bank riskiness. Likewise, one of the seven dimensions of bank regulation and supervision examined by [Klomp and de Haan \(2012, 2014\)](#) is supervisory control. They find that it is not related to banking risk.

² Also some older papers have used information on BCP compliance (which is not publicly available) to study bank performance. See [Klomp and de Haan \(2012\)](#) for a discussion of these studies.

We identify different types of powers assigned to supervisory agencies before the recent financial crisis and examine to what extent these powers are related to riskiness of banks in high-income OECD countries during the crisis. To be more specific, we follow Beck et al. (2006) in their definition of bank regulatory powers and further distinguish powers related to organizational restructuring and powers related to imposing monetary penalties³. We argue that both types of powers may have a different impact on bank risk-taking. The motivation comes from a vast stream of literature on banking (see e.g. Boyd et al., 1998) analyzing the consequences of the fact that banks' equity is much smaller than their liabilities. We hypothesize that one of the consequences is that the major brunt of monetary penalties imposed by supervisors will (indirectly) be borne by depositors and holders of subordinated debt and that therefore they are less effective in influencing bank managers' risk-taking than supervisors' powers related to organizational restructuring. First, there may be collusion between managers and owners to expropriate depositors' wealth as suggested by Boyd et al. (1998). In this line of reasoning, regulations reducing possible monetary benefits for bank managers and owners will lead to more risk-taking by banks. Second, monetary penalties may lead to reduced effort by management in deciding on the selection of loans given the lower monetary incentives. In contrast, supervisory powers to introduce organizational changes put the managers' jobs and the owners' profits at risk and can thereby induce more discipline.

3. Model and data description

We take impaired loans to gross loans ratio as our dependent variable. This is a commonly used proxy for bank risk-taking (Boyd et al., 2010; Shehzad et al., 2010). If a bank extended many high-risk loans before the crisis, its impaired loans to gross loans ratio will arguably be higher during the crisis. Our data on impaired loans to gross loans ratio comes from Bureau van Dijk's BankScope.

We examine whether the impaired loans to gross loans ratio (Ω_{ijt}) of bank i in country j at time t (i.e. the crisis years 2007–2011) depends on the supervisor's power in country j vis-à-vis banks before the crisis (i.e. in 2005), differentiating between power with regard to enforcing organizational changes (Δ_j) and power with regard to imposing monetary penalties (Ψ_j). In addition, we include the following variables: supervisory powers with respect to auditors (henceforth referred to as *auditory requirements* Φ_j), bank regulations concerning information disclosure to the market (henceforth referred to as *private monitoring* Λ_j), forbearance powers of supervisory agencies (henceforth referred to as *forbearance* Υ_j), a dummy for the presence of a deposit insurance scheme (Θ_j), a matrix of k bank-specific characteristics of bank i at time t (BSC_{it}), and a matrix of l macroeconomic control variables in country j at time t ($Macro_{jt}$). All variables are explained in detail below. So our model can be written as:

$$\Omega_{ijt} = \alpha_i + \beta * \Delta_j + \vartheta * \Psi_j + \kappa * \Phi_j + \eta * \Lambda_j + \varpi * \Upsilon_j + \pi * \Theta_j + \sum_{k=1}^n \gamma_k * BSC_{it} + \sum_{l=1}^m \delta_l * Macro_{jt} + \varepsilon_{it} \quad (1)$$

where α_i is an unobserved panel-level random effect with zero mean and finite variance independently and identically distributed (i.i.d) over panels, while ε_{it} is an idiosyncratic error with zero mean and finite variance i.i.d. over all observations.

Our data on the main variables of interest, i.e. supervisory powers related to organizational restructuring and imposing monetary penalties, are from the survey by Barth et al. (2008) which refers to the situation at the end of 2005. These data have been meticulously collected using the answers on questions related to bank supervision and governance by principal contacts in each country. Moreover, as mentioned by Barth et al. (2008), the compilation of the survey involved going back and forth with authorities for clarification of inconsistencies. Several papers have used data from this survey to construct measure for bank regulation and supervision (for a discussion, we refer to Klomp and de Haan, 2012, 2014). As pointed out by Barth et al. (2004) and Beck et al. (2006), the change in bank regulation and supervision variables is usually very small⁴. Additionally, using data that refer to 2005 also helps us to avoid any endogeneity which may arise because of changes in regulatory policies during the crisis.

In selecting the survey questions to construct our indicators of supervisory power related to banks we follow Beck et al. (2006). We group all questions that refer to supervisory powers included by Beck et al. (2006) into powers related to organizational restructuring and powers related to imposing monetary penalties. Questions referring to supervisory powers related to auditors are used to construct a separate variable, as these supervisory powers do not refer to banks. Still, as powers related to auditors may play an important role in reducing information asymmetry (Beck et al., 2006), we construct a separate variable for supervisory powers related to auditors (auditory requirements Φ_j). Table A1 in Appendix provides details of these and other variables.

The motivation for the other regulatory variables is as follows. Several studies (cf. Ostberg, 2006; Chen and Hasan, 2006; Beck et al., 2006) find that regulations concerning information disclosure to the general public (Λ_j) affect a bank's impaired

³ Beck et al. (2006) do not examine the impact of supervisory powers on bank risk-taking but analyze the effect of supervisory powers on corruption in bank lending.

⁴ Čihák et al. (2012) show that in response to the crisis, regulation has changed. However, these authors also conclude (p. 3) that "overall regulatory response to the crisis has been slow, although we find evidence of a number of significant changes. In particular, capital ratios increased, deposit insurance schemes became more generous, and reforms were introduced pertaining to bank governance and bank resolution. Some of these changes occurred in the latter part of our sample period. As supervisory powers remained fairly constant, we do not think that these changes will affect our main conclusion.

Table 1
Summary statistics.

Variables	Mean	Standard deviation	5th Percentile	95th Percentile	Observations
Impaired loans/gross loans	2.41	3.37	0.00	9.40	33,963.00
Z-score	4.00	7.48	−1.28	14.08	37,193.00
Real GDP growth	0.68	2.31	−2.44	3.10	38,361.00
GDP/capita	47.57	7.93	40.48	57.04	38,361.00
Listed	0.04	0.19	0.00	0.00	38,361.00
Fee income/total assets	0.01	0.02	0.00	0.02	24,011.00
Cost/income	75.96	31.83	44.87	125.61	38,175.00
Bank size	12.45	1.75	10.17	16.07	38,361.00
Deposit insurance	1.00	0.05	1.00	1.00	38,342.00
Bank concentration	40.46	16.66	31.60	85.69	38,335.00
Auditory requirements	2.43	0.95	2.00	5.00	38,262.00
Private monitoring	5.16	0.56	5.00	7.00	37,377.00
Forbearance	2.95	0.30	2.00	3.00	36,924.00
Supervision—organizational powers	5.67	0.87	3.00	6.00	38,109.00
Supervision—monetary penalty powers	3.66	0.91	1.00	4.00	38,029.00

loans ratio. [Boot and Thakor \(1993\)](#) and [Acharya \(1996\)](#) argue that giving forbearance powers to supervisory agencies can lead to excessive forbearance, which may in turn affect the moral hazard problems of a bank. So we also add a variable related to forbearance powers of supervisory agencies in our model. The variable used (Υ_j) measures lack of forbearance powers; it is constructed using the information provided by [Barth et al. \(2008\)](#). It is based on four questions that largely relate to the imposition of penalties based on breaching automatic thresholds. A higher value of this indicator represents that supervisory actions are automatic and there is less potential of forbearance by the supervisory agency.

We also include a dummy for the presence of a deposit insurance scheme (*source*: [Barth et al., 2008](#)). The reason for including this variable (Θ_j) is that the presence of explicit deposit insurance can cause moral hazard ([Demirgüç-Kunt and Detragiache, 2002](#)). Finally, we follow [Beltratti and Stulz \(2012\)](#) and include concentration of the banking system measured as the assets of the top-three commercial banks as a ratio of total banking assets. [Beltratti and Stulz \(2012\)](#) argue that concentration can be regarded as a proxy for the value of bank franchises because a more concentrated banking system enables banks to earn monopoly rents.

Our bank-specific control variables (BSC_{ij}) include: (i) A dummy variable reflecting whether a bank is listed on a stock exchange or not, following [Laeven and Levine \(2009\)](#). The reason for including this variable is that listed banks may exhibit different corporate governance structures, information dissemination patterns and board architecture and processes than non-listed banks ([Loderer and Waelchli, 2010](#)). (ii) Bank size measured as the logarithm of bank assets following [Beck et al. \(2006\)](#). The reason for including this variable is that large and small banks may have different risk taking behavior as discussed in Section 2. (iii) Cost-to-income ratio as a proxy for managerial efficiency. A low cost-to-income ratio indicates that the bank concerned is efficient ([Caprio et al., 2007](#)). (iv) Fee income to total asset as a proxy for the diversity of a bank's asset portfolio. [DeYoung and Rice \(2003\)](#) indicate that a marginal increase in noninterest income leads to a poor risk-return trade-off.

Our macroeconomic control variables ($Macro_j$) include real GDP growth and GDP/capita, following [Beck et al. \(2006\)](#) and [Laeven and Levine \(2009\)](#). While GDP growth has been used a proxy for business cycles, GDP/capita indicates the level of development of the country concerned.

Most of our bank-specific data are drawn from Bureau van Dijk's BankScope, while the macroeconomic control variables are taken from the IMF's World Economic Outlook.

Our data pertain to 2007–2011 for banks in high-income OECD countries. We only use data for commercial and savings banks. Investment banks are not included. Banks which had negative assets or equity were dropped from our sample. Similarly, banks which were in the process of liquidation, bankruptcy, or which were dissolved or delisted in the sample period, approximately 1338 banks, were dropped. However, banks that were not active (a little more than 300 banks) for other reasons⁵ were kept in our sample. After these filters, our sample consists of more than 8000 banks. We winsorized all bank-specific variables at the top and bottom 1 percentiles.

[Table A1](#) in Appendix gives precise definitions and sources of the variables used, while [Table 1](#) provides summary statistics.

Bank regulatory powers may be endogenous. [Demirgüç-Kunt et al. \(2008\)](#) point out that countries with sound banks may face less opposition in enacting more rigorous regulation and supervision than countries with distressed banks. However, it can also be argued that countries that have experienced episodes of distress, and whose banks are still weak, may have the strongest incentives to upgrade their supervisory capacity. So, in principle, the potential endogeneity of regulatory powers may bias the relationship with soundness in either direction. Consequently, in Eq. (1) Δ_j and Ψ_j may be correlated with α_i rendering random effect estimators inconsistent. Fixed effects within estimators remove α_i and also Δ_j and Ψ_j by mean-differencing so that β and ϑ cannot be estimated.

⁵ This includes banks which were merged with other banks or which went into receivership. It also includes those banks for which BankScope does not have any further information.

Table 2
Estimation results for Eq. (1).

	Model I	Model II	Model III
Real GDP growth	0.082***	−0.02	0.085***
	0.005	0.051	0.005
GDP/capita	−0.079**	−0.039	−0.084***
	0.008	0.031	0.009
Fee income/total assets	5.573	−7.658	11.586**
	5.426	16.778	5.647
Cost/income	0.018***	0.008	0.018***
	0.001	0.007	0.001
Bank size	−0.135**	−0.148	−0.140**
	0.064	0.231	0.069
Bank concentration	−0.382***	0.002	−0.405***
	0.014	0.072	0.014
Listed	0.361	−0.743	0.444
	0.426	0.862	0.67
Deposit insurance	1.356	0.583	0.013
	2.386	1.938	3.42
Auditory requirements	5.260***	−1.954	6.030***
	0.461	1.419	0.49
Private monitoring	1.131***	2.058***	0.556
	0.334	0.691	0.389
Forbearance	1.819***	−1.138	0.837
	0.556	0.964	0.721
Supervisory organizational powers	−12.120***	−0.08	−11.811***
	0.805	1.749	0.955
Supervisory monetary penalties	6.961***	−1.376	7.140***
powers	0.773	1.081	0.913
Constant	41.319***	10.452	45.376***
	3.971	8.973	4.775
Observations	18,561	415	18,146
Banks	8352	155	8197
Panel standard error	6.168	2.978	6.612
Wald chi-squared	1605.203	31.588	1680.504

All models have been estimated by Hausman–Taylor regressions for the period 2007–2011. Model I refers to our main estimation results for all banks. Models II and III are restricted to widely held banks and other banks only, respectively. Widely held banks are banks where no shareholder has more than 24.99 percent of the shares. The dependent variable is impaired loans to gross loans ratio winsorized at top and bottom 1 percentile. The explanatory variables are explained in Table A1. Bank-specific explanatory variables have been winsorized at top and bottom one percent level.

*** Represents significance at 1 percent level while ** and * represent the same at 5 and 10 percent level.

We therefore use Hausman–Taylor (1981) regressions which can estimate β and ϑ consistently. This technique has been used extensively in the banking literature to control for endogeneity problems (cf. Degryse et al., 2012; de Haas and van Lelyveld, 2006). Under this approach, first within estimations are performed. These within estimates are consistent for $\sum_{k=1}^n \gamma_k$

and $\sum_{l=1}^m \delta_l$. From these within estimates, we can get within residuals \hat{u} . By regressing within residuals \hat{u} on $\Delta_j, \Psi_j, \Phi_j, \Lambda_j, \Upsilon_j, \Omega_j, \Theta_j$ using time invariant exogenous variables, bank-specific and macroeconomic control variables as instruments, we can get intermediate yet consistent estimates of $\beta, \vartheta, \kappa, \eta, \varpi$. The within estimates of $\sum_{k=1}^n \gamma_k$ and $\sum_{l=1}^m \delta_l$ and intermediate

estimates of $\beta, \vartheta, \kappa, \eta, \varpi$ are used to obtain within and overall residuals. Next, residual variances are used to obtain Feasible Generalized Least Squares (FGLS) weights and perform GLS transformations for all variables. Finally, weighted instrumental variable estimators are used to obtain coefficients by instrumental variable regression. The order condition requires that the correlation between instruments and time-invariant endogenous variables is sufficiently high and the number of instruments should be greater than 2 in our case.

4. Results

This section presents the estimation results of Eq. (1), focusing on the sign and significance of β and ϑ . Model I in Table 2 presents our estimation results for all banks using Hausman and Taylor (1981) regressions. The coefficients of most control variables are significant and have the expected sign. Real GDP growth and GDP/capita show up with a positive, respectively a negative sign. The cost-to-income ratio comes up with a significant positive sign, indicating that banks with poor managerial quality have more impaired loans on their balance sheet. The coefficient of bank size is negative, indicating that big banks performed better compared to small banks in terms of impaired loans. Concentration has a significant negative effect. In line

with previous studies, the dummy indicating the presence of a deposit insurance scheme comes up with a positive sign, but it is not significant. The same holds for fee income.

We find that $\eta > 0$ and $\kappa > 0$ and that both parameters are significant, suggesting that private monitoring and auditory requirements result in adverse bank loan portfolio selection. Financial systems score high on private monitoring if they follow more stringent accounting and disclosure practices. According to [Hyytinen and Takalo \(2002\)](#), regulations on auditory requirements reduce future bank profits by increasing direct and indirect costs of information production, which in turn leads to lower bank franchise value and thereby increasing risk-taking incentives. As far as the effect of supervisory forbearance is concerned, we do not find any evidence supporting the views of [Boot and Thakor \(1993\)](#) and [Acharya \(1996\)](#).

Finally, we examine the effect of our main variables of interest which are supervisory powers related to organizational changes of banks and powers to impose monetary penalties on them. Our results show that $\beta < 0$ and that $\vartheta > 0$, suggesting that assigning powers to supervisory authorities aimed at organizational changes reduces the moral hazard problem, but assigning powers to impose monetary penalties is counter-productive and increases the moral hazard problem. These results provide support for our hypothesis. The next section offers some sensitivity tests to examine the robustness of this finding.

5. Sensitivity tests

[Laeven and Levine \(2009\)](#) and [Shehzad et al. \(2010\)](#) argue that banks with more widely held ownership structures differ from banks with large ownership blocks. While [Laeven and Levine \(2009\)](#) define widely held banks as banks where none of the owners has more than 10 percent of the shares, [Shehzad et al. \(2010\)](#) use a threshold of 24.99 percent. We estimate Eq. (1) for widely held banks – defined as banks in which no shareholder owns more than 24.99 percent of the shares – and for other banks. We follow the definition from [Shehzad et al. \(2010\)](#), as banking industry ownership is highly concentrated. Even using this threshold of 24.99 percent, our sample of widely held banks is less than 2 percent of the total sample. The results are presented in Models II and III of [Table 2](#), respectively. In line with our previous findings, the proxy for supervisory organizational powers comes up with a significant negative sign and the proxy for supervisory powers to impose penalties comes up with a significant positive sign in the sample of banks which are not widely held. For widely held banks our results do not turn out to be significant which can be attributed to a significantly smaller sample size. However, comparing Models I and II in [Table 2](#), there is an interesting difference. The coefficient of private monitoring turns out to be significantly positive for widely held banks. This result is in line with the argument of [Laeven and Levine \(2009\)](#) and [Shehzad et al. \(2010\)](#) that owners of widely held banks may have weaker powers and incentives to monitor managers.

Next we restrict our analysis to the top 10,000 banks in the world in terms of asset size. Out of these top 10,000 banks, we have almost 4000 banks in our sample. Focusing on large banks only, does not affect our main results as shown in Model I in [Table 3](#). The coefficients of the proxies for organizational powers and monetary powers appear significant with a negative and a positive sign, respectively, suggesting that organizational powers reduce non-performing loans whereas monetary powers tend to increase non-performing loans.

In the next sensitivity test we only include banks for which we have data for the entire sample period. Model II in [Table 3](#) presents the results. Focusing on these banks only does not affect our main conclusions, although the marginal effects of organizational powers and powers related to organizational penalties are slightly lower.

In Models III and IV of [Table 3](#), we distinguish between large and other banks in our sample, using [Beltratti and Stulz's \(2012\)](#) definition of large banks (i.e. banks having assets exceeding US\$ 50 billion). As pointed out by [Boyd and Runkle \(1993\)](#), failure of a large bank is supposedly more feared by supervisors than failure of a small bank, since the former is more likely to result in macroeconomic externalities⁶. Our main results do not change for non-large banks (Model III of [Table 3](#)). However, our results for large banks are different (Model IV of [Table 3](#)), as none of the supervisory power proxies appear significant. These results suggest that supervisory powers do not affect risk-taking behavior of systemically important banks. A possible reason for this result can be their belief that governments will have to bail them out eventually and that they are therefore not affected by supervisory threats of changes in organizational structure or imposition of monetary penalties.

In Model V we do not drop banks which ended in abnormalities like bankruptcy or liquidation as mentioned above. If we include such banks in our analysis, they may cause problems as they may be outliers. On the other hand, dropping such banks may cause a survivorship bias. Consequently, we include them as a sensitivity test. As is evident from the results shown in Model V in [Table 3](#), including such banks does not affect our conclusions. Finally, we have used the Z-score as dependent variable, which measures distance to default. As Model VI shows, our main conclusion holds in this specification although the coefficient of supervisors' organizational powers is only significant at the ten percent level.

⁶ Several studies have examined the relationship between size and riskiness of banks and there is some evidence for the 'too big to fail' point of view (see [Poghosyan and de Haan, 2012](#); [de Haan and Poghosyan, 2012](#) and references cited therein). However, some recent studies have pointed out that banks may also be 'too big to be rescued'. If governments are fiscally constrained, they may have insufficient means to bail out a failing large bank. [Demirgüç-Kunt and Huizinga \(2010\)](#) find evidence for this as the governments' fiscal position affects banks' CDS spreads during times of financial upheaval.

Table 3
Sensitivity tests.

	Model I	Model II	Model III	Model IV	Model V	Model VI
Real GDP growth	0.084*** 0.009	0.081*** 0.005	0.088*** 0.005	-0.246*** 0.03	0.078*** 0.005	0.079*** 0.012
GDP/capita	-0.090*** 0.009	-0.067*** 0.008	-0.076*** 0.009	-0.057*** 0.021	-0.083*** 0.008	0.003 0.011
Fee income/total assets	3.078 6.445	6.763 5.105	17.908*** 5.899	-3.578 9.051	8.132 5.767	-25.606*** 4.956
Cost/income	0.021*** 0.001	0.015*** 0.001	0.018*** 0.001	0.001 0.004	0.018*** 0.001	-0.045*** 0.002
Bank size	-0.815*** 0.102	0.049 0.057	-0.022 0.068	-1.93 2.164	-0.174*** 0.067	-0.042 0.073
Bank concentration	-0.337*** 0.019	-0.357*** 0.014	-0.413*** 0.014	-0.057* 0.032	-0.365*** 0.014	0.096*** 0.026
Listed	0.948** 0.462	0.880** 0.39	1.198* 0.476	0.162 0.75	0.446 0.426	-2.230*** 0.546
Deposit insurance	3.949 [†] 2.199	2.839 2.165	0.179 2.954	1.922 2.356	1.209 2.225	6.418** 2.708
Auditory requirements	4.963*** 0.517	6.458*** 0.42	5.709*** 0.511	0.453 0.901	4.778*** 0.487	0.265 0.628
Private monitoring	0.845*** 0.291	-0.136 0.29	1.315*** 0.432	0.213 0.394	1.343*** 0.36	0.768*** 0.248
Forbearance	1.582*** 0.473	-0.704 0.475	1.055 0.735	0.586 0.744	1.855*** 0.548	-0.148 0.302
Supervisory organizational powers	-9.046*** 0.785	-8.221*** 0.716	-11.710*** 0.951	-1.001 0.913	-12.498*** 0.821	1.080 [†] 0.636
Supervisory monetary penalties powers	5.358*** 0.822	6.932*** 0.718	6.585*** 0.813	0.527 1.308	7.118*** 0.762	0.835 0.901
Constant	38.205*** 3.837	24.500*** 3.416	41.408*** 4.358	41.104 42.987	42.969*** 4.151	-16.317*** 5.025
Observations	9207	18,304	18,261	300	19,094	21,327
Banks	3967	8171	8260	105	8691	9337
Panel standard error	4.871	5.672	6.789	2.772	6.193	5.589
Wald chi-squared	835.277	1366.367	1720.377	109.596	1510.065	1398.513

All models have been estimated by Hausman–Taylor regressions. Model I refers to big banks only where a big bank is a bank amongst the top-10,000 banks of the world according to assets size. In Model II, we only include only banks that were active during the period under consideration. In Models III and IV we limit our analysis to small banks and very big banks, respectively. Big banks have been defined as those banks which have assets greater than US\$ 50 billion in line with [Beltratti and Stulz \(2012\)](#). In Model V, we do not drop any banks because of bankruptcy, liquidation, being dissolved or delisted. The dependent variable is impaired loans to gross loans ratio winsorized at top and bottom 1 percentile in Models I–V. In Model VI, the dependent variable is Bank Z-score. Explanatory variables are explained in [Table A1](#). Bank-specific variables have been winsorized at top and bottom 1 percentile.

*** Represents significance at 1 percent level while ** and * represent the same at 5 and 10 percent level.

6. Conclusions

The impact of regulation and supervision is not only determined by the rules in place, but also by the powers of the supervisory authorities. We examine the effect of different types of bank supervisory powers in place *before* the crisis on bank risk-taking *during* the crisis. We employ data of more than 8000 banks from high-income OECD countries for the 2007–2011 period and impaired loans to gross loans ratio as proxy for bank risk-taking. Our Hausman–Taylor estimates indicate that powers of bank supervisors to shake up the organizational structure of banks are more effective than powers to issue monetary penalties. Several sensitivity tests show that our main results are very robust to different supervisory environments and for different types of banks. The only exception is that supervisory powers do not seem to affect risk-taking behavior of systemically important banks (defined as banks having assets exceeding US\$ 50 billion).

Our results have some policy implications. First, we suggest that supervisory agencies should focus more on the powers to shake and reorganize the management and board of the banks to reduce moral hazard problem. It will result in better alignment of the interests of bank management and deposit-holders, thereby reducing excessive risk-taking by banks. Second, as our results also suggest that risk-taking by large banks are not affected by supervisory powers, other instruments are needed to reduce risk-taking by these banks.

Acknowledgements

The views expressed do not necessarily reflect the views of De Nederlandsche Bank. Any errors are the sole responsibility of the authors. We thank an anonymous referee for very useful feedback on a previous version of the paper.

Appendix A.

[Tables A1 and A2.](#)

Table A1
Variable definitions and sources.

Variables	Definition and source
Impaired loans/gross loans Z-score	<p>Impaired loans/gross loans ratio winsorized at top and bottom 1 percentile Source: Bureau van Dijk BankScope</p> <p>Bank Z-score is a simplified distance to default measure and has been calculated as</p> $Z - \text{score}_{it} = \frac{ROA_{it} + (E/TA)_{it}}{\sigma_{ROA}}$ <p>where the return on assets (ROA) and the capitalization ratio (equity capital over total assets, E/TA) are observed annually, and σ_{ROA} is the standard deviation of ROA Source: Calculated from Bureau van Dijk BankScope</p>
Real GDP growth	<p>Real GDP growth Source: World Economic Outlook</p>
GDP/capita	<p>GDP/capita in thousands US\$ Source: World Economic Outlook</p>
Fee income/total assets	<p>Fee income and commissions as a ratio of total bank assets Source: Bureau van Dijk BankScope</p>
Listed	<p>A dummy which takes a value of one for listed banks and 0 otherwise Source: Bureau van Dijk BankScope</p>
Cost/income	<p>Cost/income ratio of a bank winsorized at top and bottom 1 percentile Source: Bureau van Dijk BankScope</p>
Bank concentration	<p>Assets of top-three commercial banks as a ratio of total banking assets Source: Čihák et al. (2012)</p>
Bank size	<p>Logarithm of bank assets winsorized at top and bottom 1 percentile Source: Bureau van Dijk BankScope</p>
Deposit insurance	<p>A dummy which takes a value of 1 if there is an explicit deposit insurance scheme and 0 otherwise Source: Barth et al. (2008)</p>
Auditory requirements	<p>A variable which assigns a value of 1 for each positive answer to the following questions: (i) Do supervisors get a copy of the auditor's report? (ii) Does the supervisory agency have the right to meet with external auditors to discuss their report without the approval of the bank? (iii) 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? (iv) Are external auditors legally required to report to the supervisory agency any other information discovered in an audit that could jeopardize the health of a bank? (v) Can supervisors take legal action against external auditors for negligence? Source: Barth et al. (2008)</p>
Private monitoring	<p>A variable which assigns a value of 1 for each positive answer to the following questions: (i) Are accounting practices for banks in accordance with International Accounting Standards (IAS)? (ii) Are accounting practices for banks in accordance with U.S. Generally Accepted Accounting Principles (GAAP)? (iii) Is an external audit a compulsory obligation for banks? (iv) Are auditing practices for banks in accordance with international auditing standards? (v) Is it required by the regulators that bank audits be publicly disclosed? (vi) Are specific requirements for the extent or nature of the audit spelled out? (vii) Are auditors licensed or certified? (viii) Are bank regulators/supervisors required to make public formal enforcement actions, which include cease and desist orders and written agreements between a bank regulatory/supervisory body and a banking organization? Source: Barth et al. (2008)</p>
Forbearance	<p>A variable which assigns a value of 1 for each positive answer to the following questions except for question (iii) where opposite holds: (i) Are there any mechanisms of cease and desist type orders, whose infraction leads to the automatic imposition of civil and penal sanctions on the banks directors and managers? (ii) Does the Banking Law establish predetermined levels of solvency (capital or net worth) deterioration which forces automatic actions (like intervention)? (iii) Can Supervisory Agency Forbear Prudential Regulation? (iv) If an infraction of any prudential regulation is found in the course of supervision, must it be reported? Source: Barth et al. (2008)</p>
Supervision: organizational powers	<p>A variable which assigns a value of 1 for each positive answer to the following questions: (i) Can the supervisory authority force a bank to change its internal organizational structure? (ii) Can supervisory agency legally declare—such that this declaration supersedes some of the rights of shareholders that a bank is insolvent? (iii) According to the Banking Law, does supervisory agency has authority to intervene that is, suspend some or all ownership rights a problem bank? (iv) Regarding bank restructuring and reorganization, can the supervisory agency supersede shareholder rights? (v) Regarding bank restructuring and reorganization, can the supervisory agency remove and replace management? (vi) Regarding bank restructuring and reorganization, can the supervisory agency remove and replace directors? Source: Barth et al. (2008)</p>
Supervision: monetary penalties powers	<p>A variable which assigns a value of 1 for each positive answer to the following questions: (i) Can the supervisory agency order the bank's directors or management to constitute provisions to cover actual or potential losses? (ii) Can the supervisory agency suspend the directors' decision to distribute bonuses? (iii) Can the supervisory agency suspend the directors' decision to distribute management fees? (iv) Can the supervisory agency suspend the directors' decision to distribute dividends? Source: Barth et al. (2008)</p>

Table A2
Number of banks per country in our sample.

Country	Number of banks
Australia	19
Austria	144
Belgium	33
Canada	41
Czech Republic	18
Denmark	75
Finland	8
France	148
Germany	610
Greece	16
Hungary	22
Iceland	9
Ireland	24
Italy	152
Japan	106
Rep. Of Korea	5
Luxembourg	72
Netherlands	28
New Zealand	10
Norway	117
Portugal	20
Slovakia	12
Spain	65
Sweden	82
Switzerland	337
United Kingdom	131
USA	7878
Total	10,182

References

- Acharya, S., 1996. Charter value, minimum bank capital requirement and deposit insurance pricing in equilibrium. *J. Banking Finance* 20, 351–375.
- Barth, J.R., Caprio Jr., G., Levine, R., 2004. Bank regulation and supervision: what works best? *J. Finan. Intermediation* 13, 205–248.
- Barth, J.R., Caprio Jr., G., Levine, R., 2008. Bank regulations are changing: for better or worse? In: *World Bank Policy Research Working Paper* 4646.
- Beck, T., Demirgüç-Kunt, A., Levine, R., 2006. Bank supervision and corruption in lending. *J. Monet. Econ.* 53, 2131–2163.
- Beltratti, A., Stulz, R.M., 2012. The credit crisis around the globe: why did some banks perform better during the credit crisis? *J. Finan. Econ.* 105, 1–17.
- Boot, A.W.A., Thakor, A.V., 1993. Self-interested bank regulator. *Am. Econ. Rev.* 83, 206–212.
- Boyd, J.H., Chang, C., Smith, B.D., 1998. Moral hazard under commercial and universal banking. *J. Money Credit Banking* 30, 426–468.
- Boyd, J.H., De Nicolò, G., Jalal, A., 2010. Bank competition, asset allocations and risk of failure: an empirical investigation. In: *CESifo Working Paper* 3198.
- Boyd, J.H., Runkle, D.E., 1993. Size and performance of banking firms: testing the predictions of theory. *J. Monet. Econ.* 31, 47–67.
- Caprio Jr., G., Laeven, L., Levine, R., 2007. Governance and bank valuation. *J. Finan. Intermediation* 16, 584–617.
- Chen, Y., Hasan, I., 2006. The transparency of the banking system and the efficiency of information-based bank runs. *J. Finan. Intermediation* 15, 308–332.
- Čihák, M., Demirgüç-Kunt, A., Soledad Martínez Pería, M., Mohseni-Cheraghlo, A., 2012. Bank regulation and supervision around the world. A crisis update. In: *World Bank Policy Research Working Paper* 6286.
- de Haan, J., Poghosyan, T., 2012. Size and earnings volatility of US bank holding companies. *J. Banking Finance* 36, 3008–3016.
- de Haas, R., van Lelyveld, I., 2006. Foreign banks and credit stability in Central and Eastern Europe. A panel data analysis. *J. Banking Finance* 30, 1927–1952.
- DeYoung, R., Rice, T., 2003. Noninterest income and Financial Performance at U.S. Commercial Banks. Supervision and Regulation Department Emerging Issues Series, Federal Reserve Bank of Chicago, Chicago, IL.
- Degryse, H., Havrylych, O., Jurzyk, E., Kozak, S., 2012. Foreign bank entry, credit allocation and lending rates in emerging markets: empirical evidence from Poland. *J. Banking Finance* 36, 2949–2959.
- Demirgüç-Kunt, A., Detragiache, E., 2002. Does deposit insurance increase banking system stability? An empirical investigation. *J. Monet. Econ.* 49, 1373–1406.
- Demirgüç-Kunt, A., Detragiache, E., 2011. Basel Core Principles and bank soundness: does compliance matter? *J. Finan. Stab.* 7, 179–190.
- Demirgüç-Kunt, A., Detragiache, E., Tresselt, T., 2008. Banking on the principles: compliance with Basel Core Principles and bank soundness. *J. Finan. Intermediation* 17, 511–542.
- Demirgüç-Kunt, A., Huizinga, H., 2010. Are banks too big to fail or too big to save? International evidence from equity prices and CDS spreads. In: *Center Discussion Paper*. Tilburg University, 2010-59.
- Dewatripont, M., Tirole, J., 1994. *The Prudential Regulation of Banks*. MIT Press, Cambridge, MA.
- Fiordelisi, F., Galloppo, G., Ricci, O., 2014. The effect of monetary policy interventions on interbank markets, equity indices and G-SIFIs during financial crisis. *J. Finan. Stab.* 11, 49–61.
- Fonseca, A.R., González, F., 2010. How bank capital buffers vary across countries: the influence of cost of deposits, market power and bank regulation. *J. Banking Finance* 34, 892–902.
- González, F., 2005. Bank regulation and risk-taking incentives: an international comparison of bank risk. *J. Banking Finance* 29, 1153–1184.
- Hausman, J.A., Taylor, W.E., 1981. Panel data and unobservable individual effects. *Econometrica* 49, 1377–1398.
- Hyytinen, A., Takalo, T., 2002. Enhancing bank transparency: a reassessment. *Eur. Finan. Rev.* 6, 429–445.
- Klomp, J., de Haan, J., 2012. Banking risk and regulation: does one size fit all? *J. Banking Finance* 36, 3197–3212.
- Klomp, J., de Haan, J., 2014. Bank regulation, the quality of institutions and banking risk in emerging and developing countries: an empirical analysis. *Emerg. Markets Finance Trade*.
- Kupiec, P.H., O'Brien, J.M., 1995. A Pre-commitment Approach to Capital Requirements for Market Risk. In: *Board of Governors of the Federal Reserve System (U.S.) Finance and Economics Discussion Series* 95–36.
- Laeven, L., Levine, R., 2009. Bank governance, regulation and risk taking. *J. Finan. Econ.* 93, 259–275.
- Loderer, C., Waelchli, U., 2010. Protecting minority shareholders: listed versus unlisted firms. *Finan. Manage.* 39, 33–57.

- Ostberg, P., 2006. [Market discipline, disclosure and moral hazard in banking](#). *J. Finan. Intermediation* 15, 333–362.
- Poghosyan, T., de Haan, J., 2012. [Bank size, market concentration, and bank earnings volatility in the US](#). *J. Int. Finan. Markets Inst. Money* 22, 35–54.
- Prescott, E.S., 1997. [The pre-commitment approach in a model of regulatory banking capital](#). *Fed. Reserve Bank Richmond Econ. Q.* 83, 23–50.
- Prescott, E.S., 1999. [A primer on moral-hazard models](#). *Fed. Reserve Bank Richmond Econ. Q.* 85, 47–78.
- Shehzad, C.T., de Haan, J., 2013. [Was the 2007 crisis really a global banking crisis?](#) *N. Am. J. Econ. Finance* 24, 113–124.
- Shehzad, C.T., de Haan, J., Scholtens, L.J.R., 2010. [The impact of bank ownership concentration on impaired loans and capital adequacy](#). *J. Banking Finance* 34, 399–408.
- Stiglitz, J.E., 2010. [Freefall: America, Free Markets, and the Sinking of the World Economy](#). W.W. Norton and Company, Inc, NY.