Supervisory Governance, Capture and Non-Performing Loans

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Abstract

Supervisory governance is believed to affect financial stability. The literature has identified pros and cons of having a central bank or a separate agency responsible for microprudential banking supervision, overlooking the benefits of having this task shared by both institutions. *Shared supervision* is considered beneficial for the stability of the banking system as it increases the costs of supervisory capture: capturing a single supervisor, be it the central bank or an agency, has in fact lower costs than capturing two. However, while this argument has been proposed theoretically and through anecdotal evidence, it has never been tested empirically. This paper fills this gap introducing a new dataset on the supervisory governance of 116 countries from 1970 to 2016. It finds that, while supervisory governance per se has no significant impact on nonperforming loans overall, nonperforming loans are significantly lower when supervision is shared in countries where the risk of capture is high. This last result is robust to a number of controls, providing new evidence in support of the detrimental impact of shared supervision to supervisory capture.

Keywords: banking supervision; supervisory capture; NPLs.
JEL codes: G18, G38, E58, P16, D73.

1 Introduction

Does supervisory governance affect financial stability? Following the Great Financial Crisis, a number of reforms in banking supervision across countries have reignited the debate on how

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supervisory responsibilities should be allocated among institutions to guarantee the stability of the banking system. The main concern regards the allocation of microprudential banking supervision to the central bank rather than a separated agency. On the one hand, a central bank may face a conflict of objectives when conducting supervision due to its monetary policy functions. Notably, when it tightens its monetary policy, it might become less strict in supervision than an agency with no monetary policy functions (Ioannidou, 2005). On the other hand, involving the central bank in supervision has the advantage of providing it with full and timely access to essential information on the health of the banking sector (Peek et al., 1999). This would benefit financial stability as it would allow the central bank to promptly distinguish between illiquid and insolvent banks when acting as lender of last resort during crises (Goodhart and Schoenmaker, 1995). Moreover, this setting would likely hamper banks' moral hazard behaviour: knowing that the lender of last resort will have full information on their status in the event of a crisis, banks would engage in less risky activities ex ante.[1]

As theories provide different insights, the question of allocating supervision to a central bank or an agency is an empirical one. Nevertheless, current evidence is mixed, making it impossible to draw any clearcut answer on the impact of supervisory governance on financial stability. While previous analyses contributed to raise doubts on the validity of the debate on supervisory governance, most of them focussed on the binary choice between a central bank or a separate agency as supervisor. As a result, shared arrangements, where both the central bank and an agency supervise, as, for example, in the United States, Germany, China and Japan, have been overlooked.

Shared supervision might however have *per se* some implications for financial stability. Theoretically, splitting supervisory responsibility inhibits against the risk of supervisory capture, hence reducing banks' risk-taking behaviour. Under shared supervision each supervisor faces higher informational asymmetries and holds only partial information on the banking system, making it less profitable for supervised banks to capture them. On the contrary, having a single banking supervisor makes capture more likely, allowing banks to take over more risk, with negative implications for financial stability. Although some works in the banking literature have provided empirical evidence on the effects of supervisory capture and on its link to supervisory governance, the relationship between supervisory governance and supervisory capture has never been tested empirically.

This paper aims to fill these gaps in the literature providing empirical evidence on (1) the relationship between supervisory governance and nonperforming loans and (2) on the inhibiting effect of shared supervision on supervisory capture. Using a new database on the governance of microprudential banking for 116 countries in the years from 1970 to 2016, it finds that

[1] Another advantage of the involvement of central banks in banking supervision regards monetary policy. Peek et al. (1999) found that supervisory information improves the central bank's forecast, with positive spillovers on its monetary policy decisions.

shared supervision is the only supervisory arrangement negatively and significantly correlated with nonperforming loans a share of total loans (NPLs, henceforth). NPLs are higher when supervision is conducted by the central bank, whereas they are not significantly correlated with supervision by an agency alone. However, once time fixed effects are included in the model, the coefficient of central bank supervision is no longer significant, whereas the one of shared supervision is only weakly significant. This suggests that supervisory governance alone might not have an impact on NPLs. Secondly, this paper finds that NPLs are significantly lower in countries where supervision is shared and the risk of supervisory capture is higher. The results are robust after controlling for country and year fixed effects, as well as for a number of macroeconomic and institutional variables.

2 Related literature

The literature provided mixed evidence on the impact of supervisory governance on financial stability.[2] Goodhart and Schoenmaker (1995) showed that bank crises occur less frequently when the supervisor is the central bank. However, as they argue, this should not be necessarily an argument in favour of central bank supervision. A lower number of bank crises, in fact, might also signal a less efficient supervisory regime. The relationship between central bank supervision and crises is however less clear when analysed at systemic level: Rutkowski and Schnabel (2016) found that systemic banking crises are less likely the higher the degree of cooperation between supervisory authorities. The definition of cooperation between supervisors adopted in their paper can nevertheless be misleading cases in which the central bank is the only supervisor are considered 'full cooperation'.[3] It hence remains unclear whether the results on cooperation are driven by actual cooperation between agencies or rather by the monopoly of supervisory information in the hands of a single supervisor. Evidence is mixed also concerning other financial stability indicators: Hasan and Mester (2008) found no significant relationship between central bank supervision and the volume of problem loans over total loans, whereas Dincer and Eichengreen (2013) showed that, when supervision is in the hands of an independent central bank, capital ratios are higher and bank credit to the economy is lower. NPLs arguably represented the more contentious as well as puzzling set of results. Barth et al. (2002) found that banks hold more non-performing loans when the central bank is the sole supervisor. While Dincer and Eichengreen (2013) found similar results, they showed that this relationship does not hold when controlling for the degree of independence of the supervisor. In contrast with both studies, Koetter et al. (2014) found no effect of a number of central bank supervision (as well as of a number of other central bank's institutional traits)

[2] While a wider literature studies the effects of central bank supervision on inflation, this section will review only those works relate to financial stability, which is the focus of this paper.

[3] Their focus is in fact more on the ownership of supervisory information rather than interinstitutional cooperation.

on NPLs.

There can be three complementary explanations for these contrasting findings. The first is that these works rely on different definitions of supervisory governance. A first set of works examined whether supervision is within the central bank or separated from it (Goodhart and Schoenmaker, 1995; Di Noia and Di Giorgio, 1999; Hasan and Mester, 2008; Dincer and Eichengreen, 2013), a second set of works relied on survey-responses from supervisors on which institution is responsible for banking supervision (Barth et al., 2002; Koetter et al., 2014), whereas a third paper defined supervisory governance based on the degree of cooperation between supervisors (Rutkowski and Schnabel, 2016).[4]

Secondly, most works focussed on a binary choice between central bank supervision or supervision by an agency, excluding therefore the possibility of shared supervision.[5] This approach may be problematic for two reasons. First of all, it excludes shared supervision, a governance model that might be of relevance, as highlighted in the literature. Moreover, for those cases where supervision is shared, it requires to make a subjective judgement on the allocation of supervision to one of the two categories.[6] Barth et al. (2002) and Koetter et al. (2014) represent an exception, as they both include a dummy that captures the presence of multiple supervisors. The first of these works found that countries with multiple bank supervisors tend to have lower bank capital ratios and higher liquidity risks; in contrast, the second one found that multiple supervisors cannot explain credit risks, proxied by nonperforming loans, both before and after the crisis. Both works however relied on cross-sectional data collected during two different points in time: Barth et al. (2002) combine survey responses collected between 1996 and 1999, whereas Koetter et al. (2014) combine responses collected between 2004 and 2006 (see Frisell et al., 2008 for more details).

A third explanation is that the impact of supervisory governance may differ according to the institutional environment in which it operates. Acemoglu et al. (2008) provided evidence in support of this thesis, showing that higher degrees of central bank independence lead to lower levels of inflation only in countries with strong institutions, whereas such effect is absent where institutions are weak. This concept can apply to supervisory governance too. The theoretical literature suggests that, in the presence of weak institutions, shared supervision might be beneficial for financial stability, as it reduces the risk of supervisory capture. The idea is grounded on the work by Laffont and Martimort (1999), who analysed the risk of capture of public agencies. They argued that, where such risk is higher, splitting supervisory

[4]It is worth mentioning a fourth paper which distinguishes supervisory governance based on the degree of concentration of supervisory authorities (Masciandaro and Romelli, 2018); this work is however exploring governance's determinants, rather than its impact, and extending the analysis also to the supervision of insurances and securities, and not only of the banking sector.

[5]In practice, this consisted in the creation of a dummy that equals 1 when the central bank supervises, and 0 otherwise.

[6]For example, Dincer and Eichengreen (2013) clarified that "where responsibility is shared, this requires making a decision about who is the lead or principal supervisor" (p. 313).

responsibilities represents an organisational improvement. Under shared supervision, in fact, each supervisor would face higher informational asymmetries and limit their discretionary power to engage in socially wasteful activities. This increases the transaction costs of collusive activities, making capture less attractive to the supervised entities (banks, in our case). This theoretical framework was then adapted to the case of banking supervision by Boyer and Ponce (2012), who maintained that having a single banking supervisor makes capture more likely, allowing banks to take over more risk, with negative implications on financial stability. It follows that, where institutions are weak and the risk of supervisory capture is higher, shared supervision has the benefit of preventing from such risk. Preventing supervisory capture would allow the smooth conduct of supervision, hence reducing the likelihood of banks' risk-taking behaviour (Boyer and Ponce, 2012).

While this thesis has never been tested empirically, previous empirical works highlighted the link between capture and governance. Using firm-level data across 37 countries, Beck et al. (2006) found that, while entrusting supervisors with more powers is generally associated with more corruption in lending due to a capture effect, this effect vanishes in countries with highly developed institutions. Focussing on the case of the United States, Agarwal et al. (2014) showed that state supervisors tend to be more lenient than federal ones, and even more with larger banks, suggesting that state supervisors may be subject to supervisory capture.

3 Research Design and Empirical Model

In order to assess the impact of supervisory governance on financial stability, it is necessary to first define both concepts. Our definition of financial stability is restricted to NPLs, computed as the shares of bank NPLs over total gross loans.[7] While there can be many indicators accounting for financial stability, NPLs have the advantage of being comparable across countries for a relatively long time series and of being considered by both academics and policymakers a key indicator of (excessive) credit risk taken by the banking system of a country (Koetter et al., 2014). Moreover, NPLs is a measure that is more directly affected by supervision and the quality of institutions in a country (Aiyar et al., 2015) than other proxies for financial stability, such as the occurrence of systemic banking crises which might have an exogenous source. Our definition of supervisory governance is built across three categories, each represented by a dummy that equals one when a specific country in a specific year presented the institutional arrangement corresponding to the dummy. The three groups are the following: (1) supervision by the central bank alone, (2) supervision by an agency which is not a central bank (i.e.

[7] Data are taken from the World Bank, which describes the variable as follows: "Bank nonperforming loans to total gross loans are the value of nonperforming loans divided by the total value of the loan portfolio (including nonperforming loans before the deduction of specific loan-loss provisions). The loan amount recorded as nonperforming should be the gross value of the loan as recorded on the balance sheet, not just the amount that is overdue".

which has no monetary policy function) and (3) supervision shared between the central bank and an agency. This definition differs from most of previous works that restricted supervisory governance to a binary choice where supervision is conducted by either the central bank or an agency (e.g. in Dincer and Eichengreen, 2013; Di Noia and Di Giorgio, 1999; Goodhart and Schoenmaker, 1995). The reason for this approach is that it avoids subjective judgements on which institution should be considered the principal supervisor for those cases in which both are involved in supervision, which are inevitable when such variable is constructed as binary. On the other hand, a minority of other works that included the case of shared supervision adopted different definitions.[8] The distinction adopted in this paper is based on a careful study of the dynamics concerning the distribution of supervisory information across institutions, rather than on the mere presence of a shared institutional arrangement. For example, when the central bank is supervising together with another agency, but the agency is chaired by the governor of the central bank, we do not consider such cases as shared supervision, but as central bank supervision. This is the case of the French Autorité de contrôle prudentiel et de résolution (ACPR), which is chaired by the governor of the Banque de France[9] and that we therefore consider as a case of central bank supervision. A full list of the cases of shared supervision is provided in the Appendix (Table 7). Following this categorisation, central bank supervision historically stands out as the most frequent arrangement, followed by supervision by an agency, and then shared supervision, which represents the minority of the cases. In 2016, the last year in our database, 66% countries in the sample had a central bank as the only supevisor, 21% an agency and the remaining 13% shared supervision. As the map of Fig. 1 displays, overall institutional arrangements have been heterogeneously distributed across countries both before and after the crisis.[10]

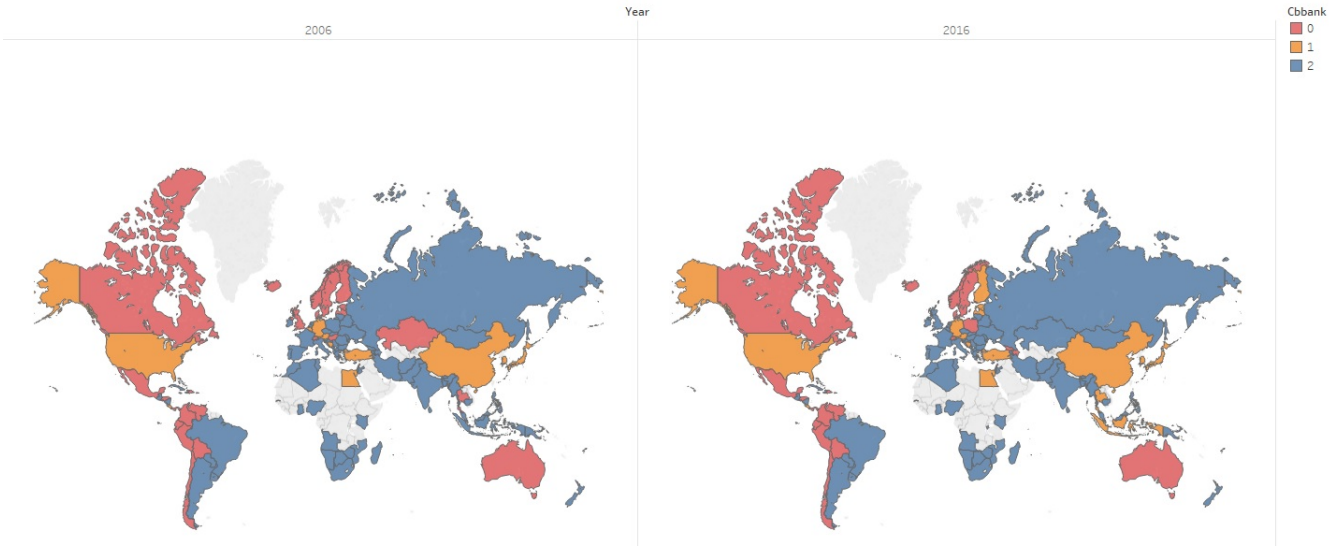
Insert Fig. 1 about here

[8] Barth et al. (2002) and Koetter et al. (2014) look at the presence of multiple supervisors based on supervisors' survey responses. This could be however problematic, as some respondents may interpret differently the same question. Moreover, while in the latter the survey corresponds to a single year, in the former the four rounds of surveys present different sample sizes, as some supervising authorities did not respond in certain years, not allowing to capture the time variation. Other examples are Rutkowski and Schnabel (2016), who focus on the degree of cooperation between supervisors, considering full integration when the supervisor is only one, and Masciandaro and Romelli (2018), who construct an Herfindhal-Hirschman index to compute the concentration of banking, insurances and securities supervisors in a specific country.

[9] The same reasoning applies to the Commission Bancaire, which preceded the ACPR as banking supervisor from 1984 (following the Loi Bancaire) to 2010. The ACPR, created on 21 January 2010, was the result of the merge of the Commission Bancaire with the insurance and investment firms supervisors (respectively the CEA and the CECEI).

[10] While common patterns of reforms in supervisory governance can be found in Scandinavia and in many Latin American countries, where supervision tended to be assigned to a supervising agency, both Europe and Latin America are quite heterogeneous.

Figure 1: Geographical distribution of the three types of supervisory governance before (2006) and after (2016) the Great Recession



Note: Countries in red have a supervising agency as sole supervisor, countries in blue have a central bank as sole supervisor, and countries in orange have shared supervision.

The literature has generally overlooked the impact of shared supervision on financial fragility. However, descriptive evidence suggests that shared supervision may be associated with lower NPLs than with monopolist supervision: as Fig 2 shows, median NPLs tend to be lower when supervision is shared rather than when it is not. We will hence formulate the first hypothesis as follows:

Insert Fig. 2 about here

Hypothesis 1: Supervisory governance affects the share of NPLs in the banking sector.

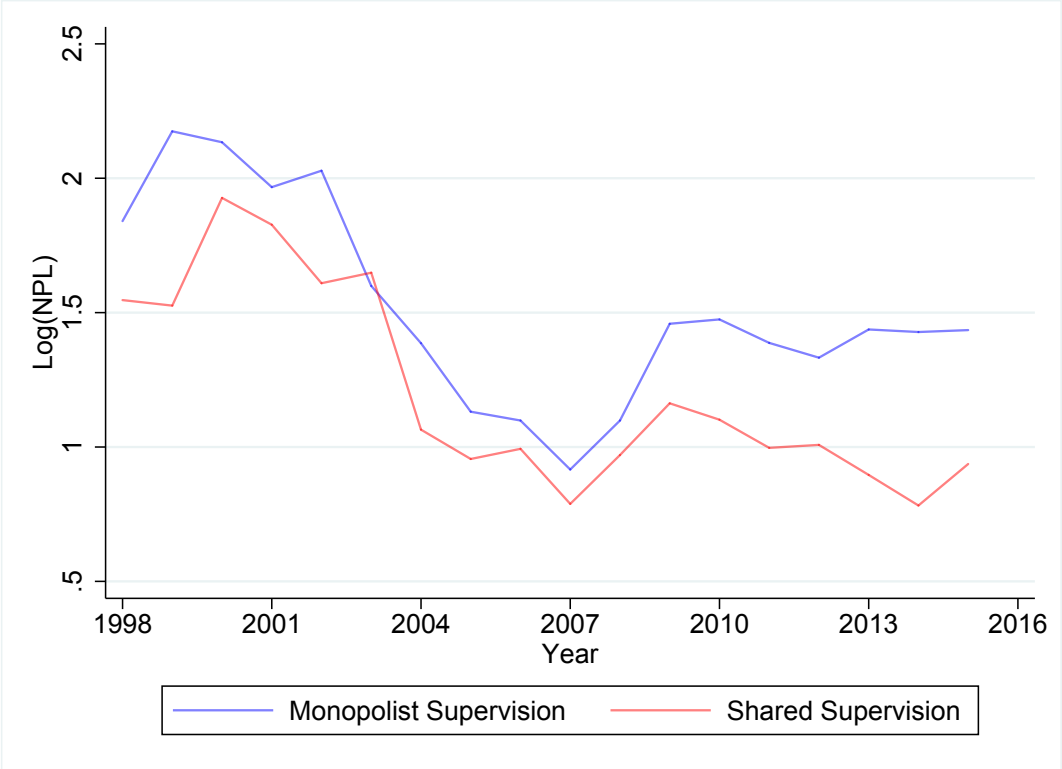
To test H1, we need to compare the relationship between NPLs and each supervisory governance model. Formally, we run the following panel data regression with country and time fixed effects:

$$NPL_{it} = \beta_0 + \beta_1 SGOV_{it} + \alpha_i + \mu_t + \epsilon_{it}$$

where the dependent variable, NPL, is the share of NPLs over total loans[11] for country i in year t. $SGOV$ is one of the three dummies corresponding to each model of supervisory

[11] In an alternative specification, I replace the dependent variable NPLs with the log differences in order to enhance cross-country comparability, following Beck et al. (2015).

Figure 2: Median NPLs under shared supervision and under non-shared ('monopolist') supervision (i.e. supervision by the central bank or an agency only).



governance, namely supervision by (1) the central bank only, (2) a supervisory agency only and (3) shared supervision. The coefficient of interest is β_1: in particular, we intend to analyse how its sign and significance varies across different supervisory governance.

As described in the previous section, the expected negative effect of shared supervision on NPLs is motivated by the disincentive that such institutional setting creates to supervisory capture, as outlined theoretically by Laffont and Martimort (1999) and Boyer and Ponce (2012). If this was the case, we would then expect shared supervision to be even more effective in countries where the risk of supervisory capture is higher. On the contrary, establishing a shared supervisory arrangement in countries where such risk is low might have no effect on NPLs. Following these considerations, we formulate a second hypothesis:

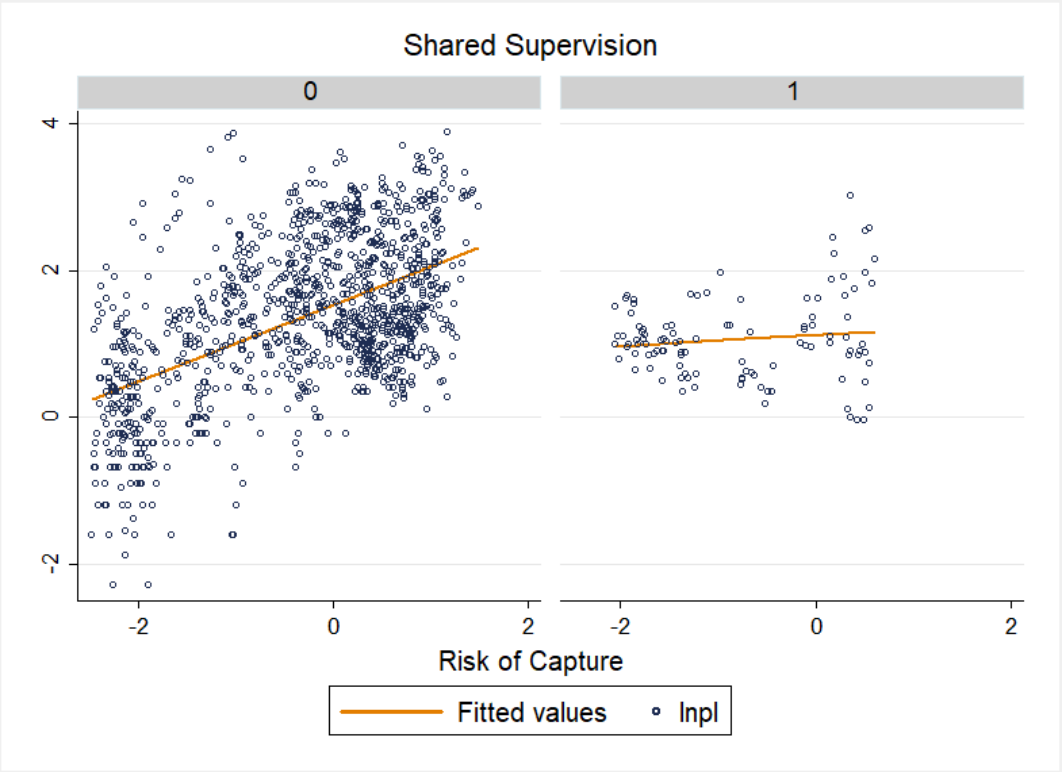
Hypothesis 2: the negative relationship between shared supervision and NPLs is stronger and more significant in countries where the risk of supervisory capture is higher.

Fig. 3 seems to confirm H2. By splitting the sample in countries with low and high risk of capture, it shows that the negative effect of shared supervision on NPLs holds only for the latters. The fitting line linking NPLs in countries with non-shared supervision and countries

with shared supervision is in fact horizontal in countries with low risk of capture, whereas it is negatively sloped in countries with high risk, meaning that NPLs tend to be lower when the dummy for shared supervision equals 1.

Insert Figure 3 about here

Figure 3: Shared supervision and risk of capture



Note: The figure plots NPLs (y-axis) against risk of capture (x-axis) in countries with non-shared (right-panel) and shared (left-panel) supervision. The fitting lines show that, as the risk of capture increases, the level of NPLs is higher in countries where supervision is not shared (positively sloped fitting line); on the other hand, when supervision is shared, the risk of capture does not affect the share of NPLs (horizontal fitting line).

In order to test H2, we adopt a different specification, where the variable of interest is the interaction between shared supervision and the risk of supervisory capture. To proxy for the risk of supervisory capture, we use the inverse of the variable 'control of corruption' from the Worldwide Governance Indicators (WGI) compiled by Kaufmann et al. (2010). This variable is a good proxy for the risk of supervisory capture as, following its description, it captures "perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests" (Kaufmann et al., 2010: 3).[12] We define the variable $RiskofCapture$ in two ways,

[12]More details on the construction of the variable are provided at this link.

to control for potential problems related to the construction of the indicator.[13] In the first specifcation, $RiskofCapture$ is a dummy variable that equals 1 when such risk is above the median risk of year t, and 0 otherwise. In the second specification, $RiskofCapture$ is a continuous variable which is simply the inverse of the control of corruption indicator. Formally, we test the following model:

$$NPL_{it} = \beta_0 + \beta_1 SharedSup_{it} \times RiskofCapture_{it} + \beta_2 SharedSup_{it} + \beta_3 RiskofCapture_{it} + \beta_4 X_{it} + \alpha_i + \mu_t + \epsilon_{it}$$

Where X is a vector of institutional, macroeconomic and financial controls which are likely to affect NPLs. If H2 is true, we would then expect β_1 to be negative and significant under the case in which both $SharedSup$ and $RiskofCapture$ equal 1, i.e. when a country with high risk of capture has a shared supervision arrangement.

4 Data

4.1 Supervisory Governance Data

This paper introduces a new database on supervisory governance covering 116 countries for the period 1970-2016. The initial data source for bank supervision was the information in the four rounds of World Bank's *Bank Regulation and Supervision* surveys conducted for the years 1999, 2003, 2007 and 2008-2010 (for a review of the surveys see Barth et al., 2013). As the sample of countries in these surveys varies from one round to another, it does not provide the possibility to analyse the evolution through time for all cases. To account for changes in supervisory architecture I integrated the database with information from the Bank for International Settlements (BIS) *Central Bank Governance* database, a legal database providing all the statutes of central banks and supervising agencies and their amendments, and from the International Monetary Fund (IMF) *Central Bank Legislation* database, another legal database which allows to filter central bank laws by section, and which provides details on the timeline of amendments for most of the section. Then, I cross-checked the material collected with the country-specific IMF's Financial System Stability Assessments[14] and with three reports conducted by the ECB on the supervisory reforms in EU and acceding countries (ECB, 2003; 2006; 2010). Data for year 2016 were collected in the same year from the website of the BIS,

[13] The rationale for using a dummy rather than exploiting the variability of this indicator lies on the problems related to its aggregation. As argued in Apaza (2009) and Arndt and Oman (2006), comparing the values of the corruption indicator across countries might be problematic due to different underlying sources. On the other hand, using a dummy variable has the advantage of not incorporating this information, but at the cost of not exploiting the variability of these indexes. A similar solution has been proposed by Acemoglu et al. (2008) to indexes of central bank independence. Estimates for the interaction between shared supervision and risk of capture as a continuous variable are provided in the Appendix, showing that the results are not subject to change in this different specification.

[14] The full list of FSSAs by country and year can be found at this link.

which provides a full updated list of each country's current supervising institution.[15] Historical changes have been integrated with information from academic papers and websites of central banks and supervising authorities. Moreover, to further verify the presence of reforms in the law of central banks since the 1970s, I have consulted the information contained in the dataset on central bank independence by Bodea and Hicks (2015) and Garriga (2016) which, once combined, cover the period 1970-2015. The IMF *Financial Reforms* database, covering the period 1973-2005 for 91 countries provided an additional source of verification (see Abiad et al., 2013 for details).

Based on this information, I have created three dummy variables that account for the three models of supervisory governance described in the previous section. The database is inevitably unbalanced for historical reasons, as many jurisdiction, like post-Soviet countries and many former colonies, did not have an independent national central bank nor a banking system in the 1970s-1980s. Compared to previous works on the effect of supervisory governance, the new data employed in this work provide a wider overview, as shown in Tab 1.

Table 1: Comparison of data covered in recent panel data studies

	Number of countries	**Years**	**Period**
Present work	**116**	**46**	**1970-2016**
Rutkowski and Schnabel (2016)	34 (OECD)	43	1970-2013
Masciandaro and Romelli (2017)	105	17	1996-2013
Chortareas et al. (2016)	35 (OECD)	11	1999-2010
Dincer and Eichengreen (2012)	89	12	1998-2010

Note: Each study presents a different measure of supervisory governance according to its research focus.

4.2 Control variables

The database is complemented with a number of variables to control for unobserved effects. Changes in NPLs can in fact be driven by a number of macroeconomic variables. Using World Bank data, I include as regressors domestic credit to the private sector as a percentage to GDP, GDP per capita annual growth and inflation. NPLs are in fact generally anticipated by credit expansions, encouraged by the easing of credit standards (Keeton, 1999 and Jiménez and Saurina, 2006). Growth can also play a role, as a number of works identified a negative relationship between NPLs and output (Nkusu, 2011; Beck et al., 2015; Balgova et al., 2016). In addition, as banking crises tend to generate peaks in NPLs (Laeven and Valencia, 2012; Kaminsky and Reinhart, 1999), I include a dummy variable constructed by Laeven and Valencia (2012) that equals 1 when a systemic banking crisis occurs, 0 otherwise.

[15]The full list can be consulted at this link. The list is however regularly updated.

Moreover, I include bank-related variables using a number of sources. In particular, I control for bank concentration as, according to Laffont and Tirole (1991), capture is more likely to occur when the group of regulated entities is more concentrated. To control for a banking sector's risk, I add the z-score aggregated at country level. This variable captures the probability of default of a country's commercial banking system (see for example Demirgüç-Kunt et al., 2008), displaying higher values for low-risk countries.[16] I use the measure of z-score taken from Bankscope and Orbis Bank Focus, Bureau van Dijk (BvD), which defined it as follows: $z = (k+\mu)/\sigma$, where k is equity capital over assets, μ is return over assets and σ is the standard deviation of return over assets (a proxy for return volatility). Following Demirgüç-Kunt et al. (2008) and Laeven and Levine (2009), I transform z-scores as follows: $log(1+z)$. Another variable that could potentially affect financial stability is the share of foreign banks in a country: as found by Claessens and Van Horen (2014), foreign banks have a negative impact on credit in low-income countries, in countries where they have a limited market share, where enforcing contracts is costly and where credit information is limited available, and when they come from distant home countries. Moreover, the presence of cross-border activities are believed to distort the incentives structure of domestic supervisors, as highlighted by Beck et al. (2014). I therefore include data on the percentage of foreign banks by Claessens and Van Horen (2014), covering the years from 1995 to 2013,[17] among the controls.

The allocation of supervisory responsibilities may not be the only governance trait affecting financial stability. Institutional factors, such as the degree of independence of the central bank and the powers held by the supervisor may affect the degree of NPLs. I therefore combine data of the widespread indexes of central bank independence built by Cukierman et al. (1992) and updated by Bodea and Hicks (2015) and Garriga (2016) to obtain a time series of the index from 1970 to 2015.[18] Such index proxies for the degree of political independence enjoyed by central banks on the basis of their statutory provisions. If the central bank is responsible for supervision and its independence is low, its capture would be easier and banks would engage in excessive risk-taking, as documented by Quintyn and Taylor (2002) and Quintyn et al. (2007). In this sense, it is necessary to control for independence as it might be negatively associated to NPLs. In addition, we use the index of *supervisory power* constructed by the

[16] If a bank displays a high z-score it means that, for the bank to become insolvent, a large number of standard deviations of its asset return have to drop.

[17] Data were downloaded from the World Bank Global Financial Development Database, updated on July 2018. The variable captures the percentage of the number of foreign owned banks to the number of the total banks in an economy. A foreign bank is defined as "a bank where 50 percent or more of its shares are owned by foreigners."

[18] Bodea and Hicks updated the index for the period 1972-2015 (even after the publication of their paper in 2014), whereas Garriga for 1970-2012, with slight differences between the movements of the two indexes. Based on the low probability of central banks reforms, I therefore took Garriga's data as basis and kept the same value of 2012 as constant for the years 2013-2015 when no changes were reported by Bodea and Hicks for that period. The only change I found for my dataset was Croatia, which reformed in 2013 as a consequence of its access to the EU in the same year. Data on central banks independence are available at this link for Bodea and Hicks, and at this link for Garriga. The index used in the estimation is the weighted version.

World Bank survey on Bank Regulation and Supervision and covering 143 jurisdictions from 1999 to 2010 (Cihák et al., 2012). This index includes the legal power of supervisors to intervene in banks, replace managers, force provisioning, acquire information and so on. We include this variable as the power held by a supervisor is believed to affect the fragility of the banking system. According to Stigler (1971), stronger banking supervisors can improve the corporate governance of banks, with positive effects on supervision. However, Beck et al. (2006) found that supervisory power did not lower corruption in bank lending, even in countries with highly developed institutions, in confirmation of the regulatory capture view. As the available estimates are the results of four rounds of survey, and are therefore fragmented over time, I interpolate the data to correct for the missing values, imposing the minimum and maximum values of the index as lower- and upper-bounds.

5 Results

5.1 Results on Hypothesis 1

As a first test, we regress NPLs against the three models of supervisory governance including country fixed effects. Table 2 displays the results.[19] From these preliminary results, it is clear that, for the case of NPLs, focusing on whether the supervisor should be the central bank or a supervising agency is not exhaustive. Although central bank supervision is positively and significantly associated with NPLs (in line with previous findings in Barth et al., 2002 and Dincer and Eichengreen, 2013), supervision by the agency is not significantly associated with NPLs. On the other hand, the results display a negative and significant association between shared supervision and NPLs. This preliminary analysis suggests that the impact of governance on NPLs might not be determined by having a central bank as supervisor or not, as the presence of the central bank *per se* is significantly associated with NPLs both positively (as sole supervisor) and negatively (as sharing supervision). On the contrary, the determining factor seems rather to depend on whether supervision is shared or not.[20]

However, the significance for central bank supervision is lost once we control for year fixed effects, as shown in Tab. 3. While shared supervision still remains negatively correlated with

[19] The low within variability of the supervisory governance dummies might suggest the inclusion of random effects rather than fixed effects. The Hausman test for the specification with the interaction (without standard errors clustered by country and time dummies) produces the following results: $\chi^2 = 16.23$ and $Prob > \chi^2 = 0.001$ for the raw test, $\chi^2 = 15.90$ and $Prob > \chi^2 = 0.0012$ for the test with the covariance matrices based on the estimated disturbance variance from the efficient estimator, and $\chi^2 = 16.05$ and $Prob > \chi^2 = 0.0011$ for the test with covariance matrices based on the estimated disturbance variance from the consistent estimator. We therefore infer that between effects are not significantly biasing estimates of the within effects. Moreover, we include time fixed effects, as the joint test on year dummies significantly rejects the null hypothesis that the coefficients for all years are jointly equal to zero ($F(16, 93) = 9.84, Prob > F = 0.000$).

[20] Similar results are obtained when the dependent variable, NPLs, is transformed in log form (see Tab. 8 in Appendix) and when all regressors are lagged by one period (see Tab. 9 in Appendix).

Table 2: Regressions on three models of supervisory governance with country fixed effects

	(1)	(2)	(3)
NPL	Shared Sup.	Central Bank	Sup. Agency
Supervisory	-7.437**	4.767**	-0.503
Governance	(2.875)	(1.847)	(1.881)
Observations	1,509	1,509	1,509
R-squared	0.022	0.016	0.000
Number of id	101	101	101
Country FE	Yes	Yes	Yes
Year FE	No	No	No

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

NPLs, its significance is weaker once we control for time fixed effects. These results suggest that, while the role of shared supervision should not be overlooked, supervisory governance may not have a direct effect on NPLs, confuting hence the first hypothesis stated in this paper. It may therefore be the case that supervisory governance has an impact on NPLs only when analysed together with the degree of supervisory capture in a country, as suggested in Hypothesis 2.

Table 3: Regressions on three models of supervisory governance with country and time fixed effects

	(1)	(2)	(3)
NPL	Shared Sup.	Central Bank	Sup. Agency
Supervisory	-5.186*	2.615	0.287
Governance	(2.976)	(1.870)	(1.779)
Observations	1,509	1,509	1,509
R-squared	0.183	0.177	0.172
Number of id	101	101	101
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

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

5.2 Results on Hypothesis 2

We first regress NPLs on the interaction between shared supervision and the risk of capture defined as dummy variable (Table 4). First, NPLs are regressed on the interaction without any regressor and including both country and time fixed effects (Tab. 4, Col. 1). The three combinations deriving from the interaction report different results. When the risk of capture is high and there is no shared supervision, NPLs tend to be higher, as the coefficient is positive and significant, even if weakly. Intuitively, this suggests that NPLs tend to be higher in an environment with high risk of capture (or low control of corruption). When supervision is shared, but the risk of capture is absent or low, then NPLs tend to be lower, but not significantly. This is in line with the results of the previous section, according to which shared supervision is negatively related to NPLs, but weakly, as supervisory governance alone does not seem to directly affect NPLs regardless of the risk of capture in a country. The third combination represents those cases in which shared supervision is established in countries with high risk of capture. According to the theory, this is the case where allocating supervision to two authorities would be effective, leading to lower NPLs. The results of the regression are in line with this thesis: when supervision is shared in countries with high risk of capture, the sign of the coefficient turns negative and displays higher significance than when supervision is not shared. This relationship remains robust after controlling for the occurrence of a crisis and for credit growth (Tab. 4, Col. 2), which are both positively and significantly correlated with NPLs, as suggested by the literature, and for GDP per capita and inflation (Tab. 4, Col. 3), the first being negatively and significantly correlated with NPLs in line with previous works. Tab. 4, Col. 4 adds governance variables to the model, to test whether other institutional traits, such as the degree of political independence of the central bank and the powers of the supervisor, absorb the significance of shared supervision. The coefficient of the interaction remains however significant, whereas only supervisory power is significantly and negatively correlated with NPLs, indicating that NPLs tend to be lower when the supervisor has less powers. While this result may seem counterintuitive, it is in line with the findings of Beck et al. (2006), who use the same index. They argue in fact that more powerful supervisors are more likely to be captured, as they represent an opportunity to shape the allocation of bank credit, due to their ability to influence the distribution of bank loans. The interaction between shared supervision and risk of capture remains significant once we control for indicators related to the health of the banking sector (Tab. 4, Col. 5). While supervisory power loses its significance, bank concentration is positively and significantly associated to NPLs, whereas the relationship with z-scores is negative, as we might expect. The significance of the interaction's coefficient holds also once we control for other institutional variables from the World Governance Indicator database (Tab. 4, Col. 6), providing further evidence in support of Hypothesis 2. Substituting the dummy $RiskofCapture$ with the continuous variable does not change the results, as the

interaction is even more significant, as displayed in Tab. 5.

5.3 Robustness Checks

There are many factors which potentially affect the presence of NPLs. The effect of a number of determinants is taken into consideration in the previous regressions through the addition of a number of controls. However, one relevant as well as problematic determinant, that is not captured by previous results, lies in the nature of NPLs data. It is in fact the supervisor that determines whether a loan would turn non-performing. This means that, if the supervisor is captured, it might be encouraged by banks to engage in a more lenient behaviour regarding their loans. If this is the case, it might well be that lower NPLs under shared supervision and high risk of caspture might be driven by the fact that supervisors in these countries are actually more controlled by banks than under different arrangements, and therefore incentivised to register a lower number of loans as non-performing. If this was the case, then the results displayed in the previous models would signal the opposite mechanism described in this paper: under shared supervision, the risk of capture is higher. NPLs may in fact tend to be lower exactly because the supervisor has been captured. In line with this hypothesis, Agarwal et al. (2014) found that, when the supervisor is less lenient, banks tend to report higher NPLs.

To verify if this is the case, it would be necessary to further test whether banks engage in more risky activities under shared supervision and high risk of capture. We therefore replace the dependent variable with banks' capital adequacy ratio, which is the share of capital held by banks as a ratio of their risk-weighted assets (also known as CRAR). We employ data from the International Monetary Fund's Financial Soundness Indicators Database, which provides data on capital adequacy as reported by IMF staff. Therefore, in order to test whether banks actually report lower NPLs in countries where supervision is shared and risk of capture is high, we test whether capital adequacy ratio is lower under the same conditions. If this is the case, it would mean that higher NPLs are not the result of a more lenient behaviour in supervisors' activity but, on the contrary, of a more stringent behaviour, which is reflected in the higher capital held by banks. The assumption underlying these considerations is that banks that manage to capture their supervisor would then engage in more risky activities, as they would face more lenient scrutiny, reporting lower capital adequacy ratios. To test this hypothesis, we run the same fixed effects panel data regression, substituting the dependent variable with bank capital. If this hypothesis was true, we would then expect shared supervision and high risk of capture to be negatively and significantly related to bank capital.

Results, which are reported in Table 6, reject this hypothesis. Bank regulatory capital is in fact positively and significantly correlated with NPLs under all specifications but the last one, where the coefficient remains however significant. These results show that in countries with high risk of capture, shared supervision is associated not only with lower NPLs, but also

Table 4: Regression with interaction - Risk of capture as dummy variable

NPL	(1)	(2)	(3)	(4)	(5)	(6)
Shared sup. × Risk of capture						
0×1	2.323*	0.180	-0.111	-0.496	-1.032	-1.264
	(1.321)	(1.097)	(1.051)	(1.099)	(1.194)	(1.211)
1×0	-1.445	-0.664	-0.458	-0.269	-0.00495	-0.0396
	(2.153)	(2.010)	(1.875)	(1.791)	(1.697)	(1.630)
1×1	-5.081**	-4.526*	-5.175**	-4.895*	-5.411**	-5.846**
	(2.081)	(2.546)	(2.410)	(2.623)	(2.668)	(2.734)
Crisis		5.301***	4.483***	4.377***	4.010***	3.724***
		(1.039)	(0.904)	(0.894)	(0.897)	(0.852)
Credit		0.0387**	0.0250*	0.0282**	0.0228*	0.0239*
		(0.0172)	(0.0139)	(0.0135)	(0.0135)	(0.0140)
Inflation			0.0414	0.0388	0.0402	0.0431
			(0.0336)	(0.0322)	(0.0326)	(0.0326)
GDP per capita			-0.304***	-0.307***	-0.307***	-0.301***
			(0.113)	(0.111)	(0.114)	(0.113)
CB Independence				-5.302	-5.381	-5.113
				(3.915)	(4.368)	(4.474)
Sup. Power				-0.408*	-0.316	-0.312
				(0.210)	(0.226)	(0.214)
Bank concentration					0.0425*	0.0438*
					(0.0249)	(0.0259)
Bank Z-score					-1.827**	-1.802**
					(0.823)	(0.835)
Foreign Banks (%)					-0.00684	0.00429
					(0.0379)	(0.0428)
Rule of Law						-0.0334
						(2.359)
Reg. Quality						-0.0491
						(1.862)
Government Effectiveness						-1.815
						(1.387)
Observations	1,337	884	874	874	846	846
R-squared	0.155	0.342	0.387	0.397	0.415	0.417
Number of id	94	92	92	92	88	88
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

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

Table 5: Regression with Risk of Capture as continuous variable

NPL	(1)	(2)	(3)	(4)	(5)	(6)
Shared × Risk of Capture	-5.110***	-5.378***	-5.293***	-4.829***	-4.875***	-4.836***
	(0.746)	(1.246)	(1.146)	(1.482)	(1.510)	(1.535)
Shared	-6.798***	-5.471***	-5.476***	-4.905**	-4.773**	-4.723**
	(1.234)	(1.646)	(1.500)	(2.129)	(2.204)	(2.257)
Risk of Capture	5.908***	2.897	2.564	2.290	2.275	2.261
	(1.740)	(1.781)	(1.720)	(1.686)	(1.655)	(1.843)
Crisis		4.924***	4.183***	4.109***	3.787***	3.692***
		(0.979)	(0.874)	(0.854)	(0.856)	(0.854)
Credit		0.0414**	0.0282**	0.0307**	0.0256*	0.0248*
		(0.0169)	(0.0137)	(0.0134)	(0.0136)	(0.0140)
Inflation			0.0360	0.0341	0.0350	0.0359
			(0.0302)	(0.0296)	(0.0301)	(0.0304)
GDP per capita			-0.285**	-0.288***	-0.281**	-0.278**
			(0.110)	(0.108)	(0.110)	(0.111)
CB Independence				-4.316	-4.438	-4.360
				(4.194)	(4.735)	(4.873)
Sup. Power				-0.365*	-0.285	-0.275
				(0.209)	(0.220)	(0.213)
Bank Concentration					0.0403	0.0396
					(0.0256)	(0.0265)
Bank z-score					-1.722**	-1.728**
					(0.835)	(0.837)
Foreign banks (%)					0.0108	0.0118
					(0.0364)	(0.0416)
Rule of Law						0.701
						(2.282)
Reg. Quality						0.0329
						(1.895)
Government Effectiveness						-0.817
						(1.338)
Observations	1,344	888	878	878	850	850
R-squared	0.183	0.354	0.394	0.402	0.418	0.418
Number of id	94	92	92	92	88	88
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

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

Table 6: Interaction with Bank Regulatory Capital as dependent variable and Risk of Capture as dummy variable

Bank Reg. Capital	(1)	(2)	(3)	(4)	(5)	(6)
Shared sup. × Risk of capture						
0 × 1	1.149	0.568	0.615	0.444	-0.0657	-0.522
	(0.763)	(0.956)	(0.932)	(0.997)	(1.049)	(1.162)
1 × 0	0.394	0.322	0.295	0.502	0.373	0.168
	(0.737)	(0.947)	(0.968)	(0.942)	(0.984)	(1.032)
1 × 1	2.082***	3.881***	3.832***	4.307***	3.148***	2.290
	(0.781)	(1.154)	(1.208)	(1.018)	(1.071)	(1.524)
Crisis		0.635	0.549	0.533	0.537	0.290
		(0.656)	(0.683)	(0.679)	(0.710)	(0.693)
Credit		-0.0235*	-0.0241*	-0.0225*	-0.0167	-0.0114
		(0.0131)	(0.0130)	(0.0132)	(0.0103)	(0.0103)
Inflation			0.00264	0.00297	-0.00290	-0.00581
			(0.0189)	(0.0185)	(0.0141)	(0.0128)
GDP per capita			0.00125	0.00164	-0.0555	-0.0573
			(0.0574)	(0.0561)	(0.0479)	(0.0498)
CB Independence				-2.694	-2.405	-1.466
				(2.942)	(2.731)	(2.410)
Sup. Power				-0.0197	-0.0358	-0.0397
				(0.196)	(0.188)	(0.192)
Bank concentration					0.0276	0.0284
					(0.0190)	(0.0184)
Bank Z-score					1.600**	1.655***
					(0.644)	(0.627)
Foreign banks (%)					-0.0862**	-0.0624**
					(0.0363)	(0.0305)
Rule of Law						-0.475
						(1.670)
Reg. Quality						-2.656*
						(1.524)
Government Effectiveness						-0.176
						(1.108)
Observations	1,354	895	884	884	856	856
R-squared	0.091	0.066	0.070	0.074	0.138	0.164
Number of id	94	92	92	92	88	88
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

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

with higher bank regulatory capital, and hence with a generally more stable banking system.

6 Conclusions

The institutional setting of microprudential banking supervision has acquired new relevance in light of the recent financial crisis and the reforms that followed it. While the literature provided a number of theoretical arguments in favour and against the allocation of such responsibility to central banks, little attention has been paid to the institutional environment in which supervision is conducted. This paper has shown that this lack of attention has been misplaced. On the one hand, it showed that analysing the impact of supervisory governance by looking at the distinction between central banks and supervising agencies may be misleading. Central bank supervision and shared supervision are the only models of supervisory governance significantly correlated with NPLs, suggesting that the effectiveness of governance may depend from other factors than the nature of the institution. Nevertheless, when controlling for year fixed effects, the significance of central bank supervision vanishes, leaving shared supervision as the only (weakly) significant governance model. On the other hand, it showed that supervisory capture is the only governance arrangement able to affect NPLs, but only if related to the risk of supervisory capture of a country. The main takeaway we can derive from the findings of this paper is that reforms in supervisory governance have no impact on NPLs without taking into consideration the institutional setting. Factors, such as the risk of capture in a country, are in fact able to influence the effectiveness of supervisory governance.

References

Abiad, A. D., Detragiache, E., and Tressel, T. (2013). A new database of financial reforms. *IMF Working Paper*, 18733.

Acemoglu, D., Robinson, J. A., Querubín, P., and Johnson, S. (2008). When does policy reform work? the case of central bank independence. *Brookings Papers on Economic Activity*, 1:351–429.

Agarwal, S., Lucca, D., Seru, A., and Trebbi, F. (2014). Inconsistent Regulators: Evidence from Banking. *The Quarterly Journal of Economics*, 129(2):889–938.

Aiyar, S., Bergthaler, W., Garrido, J. M., Ilyina, A., Jobst, A., Kang, K. H., Kovtun, D., Liu, Y., Monaghan, D., and Moretti, M. (2015). A strategy for resolving europe's problem loans. *IMF Staff Discussion Note*, 15(19).

Apaza, C. R. (2009). Measuring governance and corruption through the worldwide governance indicators: Critiques, responses, and ongoing scholarly discussion. *PS: Political Science and Politics*, 42(1):139–143.

Arndt, C. and Oman, C. (2006). Uses and abuses of governance indicators. *Development Centre Studies*.

Balgova, M., Nies, M., and Plekhanov, A. (2016). Reducing non-performing loans: Stylized facts and economic impact. *EBRD Working Paper*, 193.

Barth, J. R., Caprio, G., and Levine, R. (2013). Bank regulation and supervision in 180 countries from 1999 to 2011. *NBER Working Paper*, 18733.

Barth, J. R., Dopico, L. G., Nolle, D. E., and Wilcox, J. (2002). Bank safety and soundness and the structure of bank supervision: A cross-country analysis. *International Review of Finance*, 3(3/4):163–188.

Beck, R., Jakubik, P., and Piloiu, A. (2015). Key Determinants of Non-performing Loans: New evidence from a global sample. *Open Economies Review*, 26(3):525–550.

Beck, T., Demirgüç-Kunt, A., and Levine, R. (2006). Bank supervision and corruption in lending. *Journal of Monetary Econoimcs*, 53(8):2131–2163.

Beck, T., Todorov, R., and Wagner, W. (2014). Supervising cross-border banks: theory, evidence and policy. *Economic Policy*, 28(73):5–44.

Bodea, C. and Hicks, R. (2015). Price stability and central bank independence: Discipline, credibility, and democratic institutions. *International Organization*, 69(1):35–61.

Boyer, P. C. and Ponce, J. (2012). Regulatory capture and banking supervision reform. *Journal of Financial Stability*, 8(3):206–217.

Cihák, M., Demirgüç-Kunt, A., Pería, M. S. M., and Mohseni-Cheraghlou, A. (2012). Bank regulation and supervision around the world : A crisis update. *World Bank Policy Research Working Paper*, 46.

Claessens, S. and Van Horen, N. (2014). Foreign banks: Trends and impact. *Journal of Money, Credit and Banking*, 46(s1):295–326.

Cukierman, A., Webb, S. B., and Neyapti, B. (1992). Measuring the independence of central banks and its effect on policy outcomes. *World Bank Economic Review*, 6(3):353–398.

Demirgüç-Kunt, A., Detragiache, E., and Tressel, T. (2008). Banking on the principles: Compliance with Basel Core Principles and bank soundness. *Journal of Financial Intermediation*, 17(4):511 – 542.

Di Noia, C. and Di Giorgio, G. (1999). Should banking supervision and monetary policy tasks be given to different agencies? *International Finance*, 2(3):361–378.

Dincer, N. and Eichengreen, B. (2013). The architecture and governance of financial supervision: Sources and implications. *International Finance*, 15(3):309–325.

ECB (2003). Development in national supervisory structures. *ECB Report*.

ECB (2006). Recent developments in supervisory structures in EU and acceding countries. *ECB Report*.

ECB (2010). Recent developments in supervisory structures in the EU member states (2007-10). *ECB Report*.

Frisell, L., Roszbach, K., and Spagnolo, G. (2008). Governing the governors: A clinical study of central banks. *Sveriges Riskbank Working Paper Series*, 221:1–47.

Garriga, A. C. (2016). Central bank independence in the world: A new data set. *International Interactions*, 42(5):849–868.

Goodhart, C. A. E. and Schoenmaker, D. (1995). Should the functions of monetary policy and banking supervision be separated? *Oxford Economic Papers*, 47(4):539–560.

Hasan, I. and Mester, L. J. (2008). Central bank institutional structure and effective central banking: Cross-country empirical evidence. *Comparative Economic Studies*, 50(4):620–645.

Ioannidou, V. (2005). Does monetary policy affect the central bank's role in bank supervision? *Journal of Financial Intermediation*, 14(1):58–85.

Jiménez, G. and Saurina, J. (2006). Credit cycles, credit risk, and prudential regulation. *International Journal of Central Banking*, 2(2):65–98.

Kaminsky, G. L. and Reinhart, C. M. (1999). The twin crises: The causes of banking and balance-of-payments problems. *American Economic Review*, 89(3):473–500.

Kaufmann, D., Kraay, A., and Mastruzzi, M. (2010). The worldwide governance indicators: Methodology and analytical issues. *Draft Policy Research Working Paper*.

Keeton, W. R. (1999). Does faster loan growth lead to higher loan losses? *Federal Reserve Bank of Kansas City Economic Review*.

Koetter, M., Roszbach, K., and Spagnolo, G. (2014). Financial stability and central bank governance. *International Journal of Central Banking*, 10(4):31–67.

Laeven, L. and Levine, R. (2009). Bank governance, regulation and risk taking. *Journal of Financial Economics*, 93(2):259 – 275.

Laeven, L. and Valencia, F. (2012). Systemic banking crises database: An update. *IMF Working Paper*, 12(163).

Laffont, J.-J. and Martimort, D. (1999). Separation of regulators against collusive behavior. *The RAND Journal of Economics*, 30(2):232–262.

Laffont, J.-J. and Tirole, J. (1991). The Politics of Government Decision-Making: A Theory of Regulatory Capture*. *The Quarterly Journal of Economics*, 106(4):1089–1127.

Masciandaro, D. and Romelli, D. (2018). Central bankers as supervisors: Do crises matter? *European Journal of Political Economy*, 52:120 – 140.

Nkusu, M. (2011). Nonperforming Loans and macrofinancial vulnerabilities in advanced economies. *IMF Working Paper*, 161.

Peek, J., Rosengren, E. S., and Tootell, G. M. B. (1999). Is bank supervision central to central banking? *The Quarterly Journal of Economics*, 114(2):629–653.

Quintyn, M., Ramirez, S., and Taylor, M. W. (2007). The fear of freedom: Politicians and the independence and accountability of financial sector supervisors. *IMF Working Paper*, 25.

Quintyn, M. and Taylor, M. W. (2002). Regulatory and supervisory independence and financial stability. *IMF Working Paper*, 46.

Rutkowski, F. and Schnabel, I. (2016). Should banking supervision and monetary policy be separated? *Paper presented at the 32nd SUERF Colloquium and Deutsche Bundesbank/Foundation Geld und Währung Conference.*

Stigler, G. (1971). The economic theory of regulation. *Bell Journal of Economics*, 2:3–21.

7 Appendix

Figure 4: Scatterplot matrix of NPLs, shared supervision and risk of capture

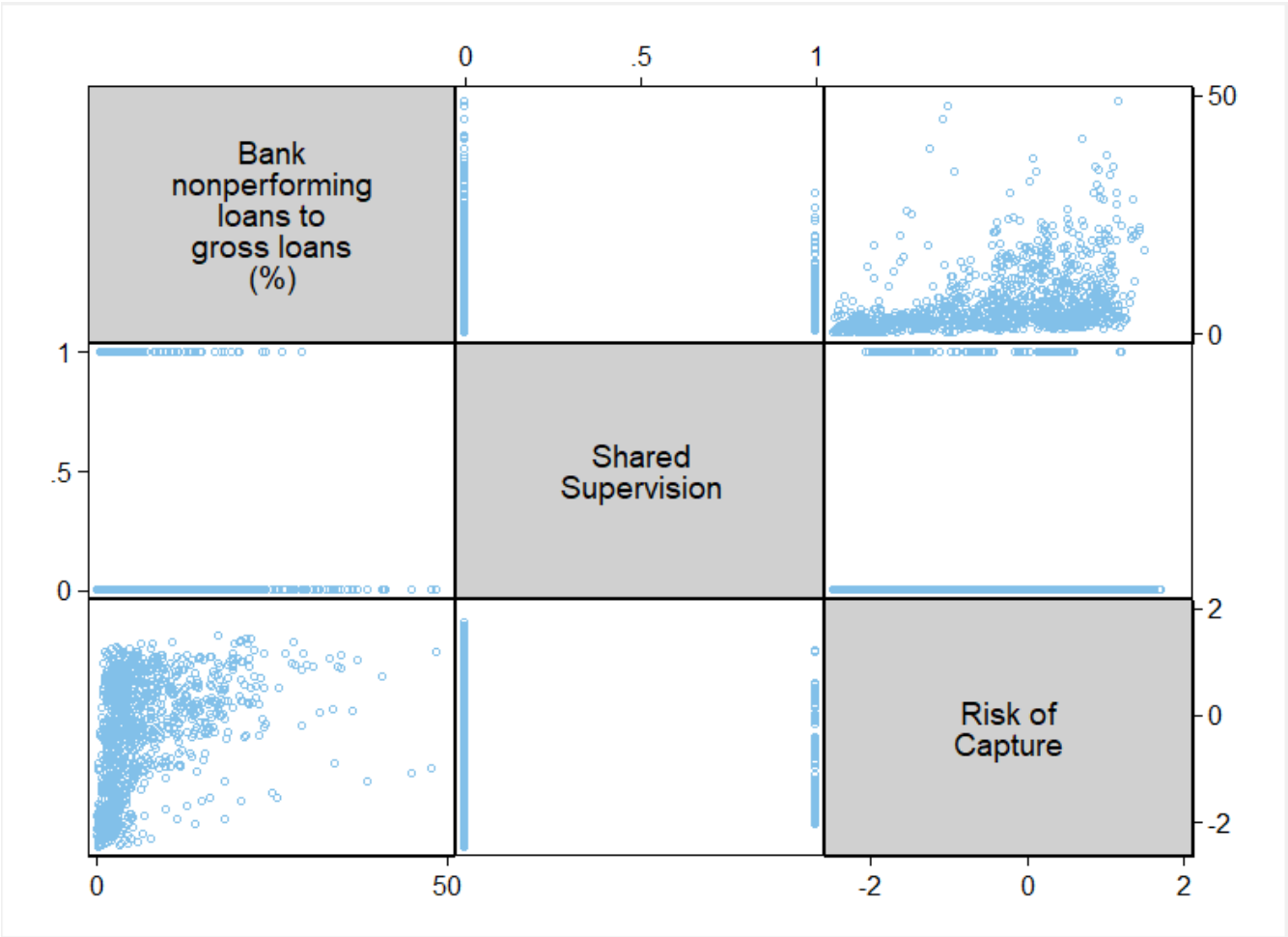


Table 7: List of countries with shared supervision

Country	Years	Central Bank	Supervising Agency
Austria	2002-2016	OeNB, ECB	Financial Market Authority (FMA)
Belgium	2004-2010	National Bank of Belgium, ECB	Commission Bancaire, FinanciÃšre et des Assurances (CBFA)
Bosnia-Herzegovina	1997-2016	CB of Bosnia and Herzegovina	Banking Agency of the Federation of BH (FBA)
China	2003-2016	People's Bank of China	China Banking Regulatory Commission (CBRC)
Costa Rica	1995-2016	Banco Central de Costa Rica	Superintendencia General de Entidades Financieras (SUGEF)
Egypt	1990-2016	Central Bank of Egypt	Financial Regulatory Authority (FRA)
Estonia	2015-2016	Eesti Pank, ECB	Finantsinspektsioon
Finland	2015-2016	Suomen Pankki, ECB	Finansinspektionen
Germany	1970-2016	Deutsche Bundesbank, ECB	BaFin
Hungary	1992-1999	Magyar Nemzeti Bank	State Banking Supervision
Indonesia	2014-2016	Bank Indonesia	OJK
Japan	1998-2016	Bank of Japan	Financial Supervisory Agency (FSA)
Korea, Republic of	1999-2016	Bank of Korea	Financial Supervisory Service (FSS)
Latvia	2015-2016	Latvijas Banka, ECB	Finance and Capital Market Commission (FKTK)
Luxembourg	2015-2016	Banque centrale du Luxembourg, ECB	Commission de surveillance du secteur financier (CSSF)
Malta	2015-2016	Central Bank of Malta, ECB	Malta Financial Services Authority (MFSA)
Nigeria	1988-2006	Central Bank of Nigeria	Nigeria Deposit Insurance Corporation (NDIC)
Pakistan	1974-1996	State Bank of Pakistan	Pakistan Banking Council (PBC)
Spain	1970	Banco de España	Ministry of Finance
Thailand	2008-2016	Bank of Thailand	Ministry of Finance
Turkey	1970-2016	Central Bank of the Republic of Turkey	Banking Regulation and Supervision Agency
United States	1970-2016	Federal Reserve Banks	OCC, FDIC
Zimbabwe	1999	Reserve Bank of Zimbabwe	Ministry of Finance

Table 8: Regressions on three models of supervisory governance with country fixed effects; dependent variable: log(NPL)

log(NPL)	(1) Shared Sup.	(2) Central Bank	(3) Sup. Agency
Supervisory Governance	-0.932*** (0.302)	0.697*** (0.183)	-0.150 (0.231)
Observations	1,509	1,509	1,509
R-squared	0.022	0.022	0.001
Number of id	101	101	101
Country FE	Yes	Yes	Yes
Year	No	No	No

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

Table 9: Regressions on three models of one-period lagged supervisory governance with country fixed effects

	(1) Shared Sup.	(2) Central Bank	(3) Sup. Agency
Lagged Sup. Governance	-6.313** (2.686)	3.787* (1.939)	0.0194 (1.301)
Observations	1,504	1,504	1,504
R-squared	0.019	0.011	0.000
Number of id	101	101	101
Country FE	Yes	Yes	Yes
Year	No	No	No

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

Table 10: Regression of three supervisory models on OECD and Non-OECD subsamples

	OECD			Non-OECD		
NPL	Shared	Central Bank	Sup. Agency	Shared	Central Bank	Sup. Agency
Supervisory	-0.218	2.096	-1.582	-9.762***	4.608	4.016**
Governance	(1.164)	(2.123)	(1.804)	(1.702)	(3.175)	(1.625)
Observations	628	628	628	982	982	982
R-squared	0.115	0.124	0.121	0.329	0.310	0.309
Number of id	35	35	35	68	68	68
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

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

Table 11: Regression with risk of capture as continuous variable and log(NPL) as dependent variable

log(NPL)	(1)	(2)	(3)	(4)	(5)
Shared × Risk of Capture	-0.574***	-0.586***	-0.546***	-0.502***	-0.505***
	(0.135)	(0.0975)	(0.0887)	(0.104)	(0.105)
Shared	-0.919***	-0.646***	-0.618***	-0.562***	-0.556***
	(0.162)	(0.0758)	(0.0728)	(0.114)	(0.117)
Risk of Capture	0.717***	0.383*	0.334	0.309	0.309
	(0.222)	(0.216)	(0.210)	(0.200)	(0.220)
Crisis		0.654***	0.567***	0.560***	0.553***
		(0.150)	(0.139)	(0.137)	(0.136)
Credit		0.00449*	0.00270	0.00293	0.00258
		(0.00257)	(0.00223)	(0.00224)	(0.00235)
Inflation			-7.73e-05	-0.000263	0.000248
			(0.00242)	(0.00263)	(0.00255)
GDP per capita			-0.0416***	-0.0418***	-0.0427***
			(0.0125)	(0.0124)	(0.0127)
CB Independence				-0.420	-0.424
				(0.435)	(0.476)
Sup. Power				-0.0330	-0.0264
				(0.0339)	(0.0378)
Bank concentration					0.000559
					(0.00291)
Bank z-score					-0.00604
					(0.00590)
Foreign banks (%)					0.00169
					(0.00562)
Observations	1,243	886	876	876	848
R-squared	0.226	0.388	0.428	0.431	0.438
Number of id	92	92	92	92	88
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

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

Table 12: Using Risk of capture as continuous variable, dep. var. bank regulatory capital

Bank Reg. Capital to RWA	(1)	(2)	(3)	(4)	(5)
Shared × Risk of Capture	0.480	0.931	0.765	1.214	1.209*
	(0.653)	(0.691)	(0.658)	(0.768)	(0.640)
Shared	0.846	2.038**	1.834**	2.538**	2.260**
	(0.636)	(0.839)	(0.808)	(1.010)	(0.958)
Risk of Capture	2.282*	2.362**	2.793***	2.760***	2.194**
	(1.158)	(0.948)	(0.849)	(0.866)	(0.873)
Crisis		0.431	0.296	0.284	0.180
		(0.660)	(0.685)	(0.682)	(0.691)
Credit		-0.0221*	-0.0225*	-0.0210	-0.0173
		(0.0132)	(0.0131)	(0.0132)	(0.0108)
Inflation			0.00601	0.00664	0.00146
			(0.0180)	(0.0173)	(0.0135)
GDP per capita			0.00547	0.00635	-0.0321
			(0.0570)	(0.0557)	(0.0486)
CB Independence				-2.687	-2.270
				(2.875)	(2.768)
Sup. Power				0.00338	-0.0313
				(0.193)	(0.187)
Bank concentration					0.0270
					(0.0190)
Bank z-score					0.0711
					(0.0542)
Foreign banks (%)					-0.0805**
					(0.0353)
Observations	1,259	897	886	886	858
R-squared	0.087	0.073	0.083	0.086	0.137
Number of id	92	92	92	92	88
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

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

Table 13: Using Risk of capture continuous varable, dep. var. log(bank regulatory capital)

log(Bank Reg. Capital to RWA)	(1)	(2)	(3)	(4)	(5)
Shared × Risk of Capture	0.00650	0.0296	0.0205	0.0590	0.0596
	(0.0486)	(0.0453)	(0.0439)	(0.0485)	(0.0437)
Shared	0.0338	0.105*	0.0944*	0.154**	0.140**
	(0.0474)	(0.0552)	(0.0549)	(0.0666)	(0.0648)
Risk of Capture	0.128**	0.159**	0.189***	0.185***	0.162**
	(0.0639)	(0.0726)	(0.0668)	(0.0658)	(0.0695)
Crisis		-0.00972	-0.0172	-0.0184	-0.0215
		(0.0567)	(0.0579)	(0.0580)	(0.0581)
Credit		-0.00104	-0.00109	-0.000957	-0.000816
		(0.000840)	(0.000828)	(0.000832)	(0.000734)
inflation			-6.88e-05	-1.81e-05	-9.41e-05
			(0.00108)	(0.00104)	(0.000823)
gdp_pc			0.000114	0.000160	-0.00156
			(0.00314)	(0.00310)	(0.00277)
CBIu				-0.228	-0.199
				(0.169)	(0.163)
suppower				-0.00130	-0.00355
				(0.0101)	(0.0104)
bankconcentration					0.000435
					(0.00103)
bankzscore					0.00365
					(0.00340)
foreignbanksamongtotalbanks					-0.00352*
					(0.00192)
Observations	1,259	897	886	886	858
R-squared	0.119	0.073	0.085	0.091	0.109
Number of id	92	92	92	92	88
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

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

Table 14: Correlation table

	NPL	Shared Sup.	Central Bank	Sup. Agency	Risk of capture	Crisis	Credit	Inflation	GDP per capita
NPL	1								
Shared Sup.	-0.0939***	1							
Central Bank	0.311***	-0.413***	1						
Sup. Agency	-0.267***	-0.174***	-0.822***	1					
Risk of capture	0.352***	-0.130***	0.323***	-0.264***	1				
Crisis	0.181***	0.0470**	-0.0586***	0.0345*	-0.117***	1			
Credit	-0.199***	0.191***	-0.269***	0.169***	-0.656***	0.119***	1		
Inflation	0.164***	-0.0167	0.00399	0.00625	0.0440	0.0334	-0.0556***	1	
GDP per capita	-0.114***	0.0209	0.0262	-0.0419**	0.138***	-0.192***	-0.0733***	-0.119***	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 15: Interaction with capture dummies by quartile

VARIABLES	(1) IQR 1	(2) IQR 2	(3) IQR 3	(4) IQR 4
Shared × Capture				
0 × 1	-2.995	0.0391	0.867	0.376
	(2.036)	(1.528)	(0.963)	(0.843)
1 × 0	-8.291***	-4.376*	-1.828	-4.386*
	(1.478)	(2.615)	(2.456)	(2.582)
1 × 1	-1.809	-5.019**	-6.094***	0
	(2.389)	(2.251)	(2.224)	(0)
Observations	1,243	1,243	1,243	1,243
R-squared	0.166	0.151	0.157	0.151
Number of id	92	92	92	92
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

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