



BANK OF ENGLAND

Staff Working Paper No. 820

Supervisory governance, capture and non-performing loans

Nicolò Fraccaroli

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Nicolò Fraccaroli⁽¹⁾

Abstract

Scholars have long believed the governance of banking supervision to affect financial stability. Although the literature has identified at length the pros and cons of having either a central bank or a separate agency responsible for microprudential banking supervision, the advantages of having this task shared by both institutions (shared supervision) have received considerably less attention. This paper fills this void by comparing the impact of three supervisory governance models — supervision by the central bank, by an agency or by both of them — on bank non-performing loans. Using a new database on supervisory governance in 116 countries from 1970 to 2016, it finds that supervisory governance per se does not significantly affect non-performing loans. However, it also finds that, where the risk of capture is high, shared supervision is associated with a significant reduction in non-performing loans. This is in line with the supervisory capture theory, whereby it is more costly to capture two supervisors rather than one. Overall, these results provide new evidence in support of the relevance of supervisory governance in hampering supervisory capture from the banking sector.

Key words: Banking supervision, supervisory governance, supervisory capture, non-performing loans.

JEL classification: D73, E58, G18, G38, P16.

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1 Introduction

Following the Great Financial Crisis, a number of reforms in banking supervision across countries reignited the debate on the allocation of supervisory responsibilities and its impact on the stability of the banking system. These reforms were supported by a large literature that established a link between supervisory governance and financial stability (for a recent review of these works, see [Ampudia et al., 2019](#)). The main concern regards the delegation of microprudential banking supervision to either a central bank or a separated agency. On the one hand, due to its monetary policy responsibilities, a central bank may face a conflict of objectives when conducting supervision. 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 also benefits in terms of financial stability. Providing the central bank with full information on the health of the banking sector would allow it to promptly distinguish between illiquid and insolvent banks when acting as lender of last resort during crises ([Goodhart and Schoenmaker, 1995](#)). This would not only enable prompter actions during crises times, but also disincentivise banks' moral hazard behaviour in normal times: knowing that the lender of last resort holds full information on their status in the event of a crisis, banks would engage in less risky activities *ex ante*.¹

As the aforementioned theories provide contrasting arguments, the impact of governance on financial stability remains an open question to be tested empirically. Existing evidence, however, is mixed and provides no clear-cut answer on this relationship. This led some researchers to cast doubt on the presence of a link between supervisory governance and financial stability ([Goodhart and Schoenmaker, 1995](#); [Koetter et al., 2014](#)). Nevertheless, most empirical works focused 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 Germany, China and Japan,² have been categorised as either central bank's or agency's supervision, depending on the criteria chosen by the scholars. This approach has two main drawbacks. First, it omits hybrid arrangements, which should be analysed as an alternative to either central bank or agency supervision. Secondly, and most importantly, this binary operationalisation prevents any clear policy prescription as to the allocation of supervisory responsibilities. Hence, by introducing the new category of shared supervision, the present paper provides a contribution not only in terms the current understanding of the governance of banking supervision, but also for what concerns real-world policy choices and prescriptions.

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

²The United States represents a special case, as the Federal Reserve, the Office of the Comptroller of the Currency and the Federal Deposit Insurance Corporation, supervise different sets of banks. This special case will be discussed in Section 3.

An additional limitation of existing works is that they analyse the allocation of supervisory responsibilities as an isolated phenomenon. However, the political economy literature shows how the effectiveness of governance arrangements depends on the institutional quality of the country in which they are established. This argument applies also to reforms in central bank governance: [Acemoglu et al. \(2008\)](#) find that reforms in central bank independence are effective in reducing inflation only in countries with strong institutions. These results lead them to the conclusion that, if reforms fail to be fully effective, ‘it must be at least partly because of the constraints imposed by existing political economy factors’ ([Acemoglu et al., 2008](#), p. 404). The governance of banking supervision is not immune from such institutional constraints. In line with this, [Beck et al. \(2006\)](#) find that increasing the powers of banking supervisors worsens the quality of bank lending in countries with high corruption. This is because in countries with poor institutions supervisors can be captured by politicians and banks to divert credit flows for political or private interests. The more powerful the supervisor in these countries, the more attractive it becomes for supervisory capture. Although the institutional context may hence affect the effectiveness of supervisory governance, so far the interaction between the allocation of supervisory responsibilities and institutions has remained unexplored.

Theoretical works suggest that the quality of institutions is relevant for the effectiveness of supervisory governance as well. This is particularly true for the case of shared supervision in countries with high corruption. Adapting the theoretical model of [Laffont and Martimort \(1999\)](#) to banking supervision, [Boyer and Ponce \(2012\)](#) argued that shared supervision could be beneficial for financial stability when supervisory capture is a concern. Assigning supervisory responsibilities to two institutions rather than one, reduces the risk of supervisory capture, hence lowering 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. While these arguments have been proposed theoretically, the relationship between the allocation of supervisory responsibilities and supervisory capture has not been tested empirically.

This paper aims to fill these gaps in the literature providing empirical evidence on (1) the relationship between supervisory governance -including shared supervision- and financial stability and (2) on the inhibiting effect of shared supervision on supervisory capture. In doing so, it restricts the analysis of financial stability to nonperforming loans as a share of total loans (hereafter, NPLs). 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, as argued by [Koetter et al. \(2014\)](#). Moreover, NPLs is a measure that is more directly affected by supervision ([Delis and Staikouras, 2011](#); [Hirtle et al., 2019](#)) 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.

Using a new database on the governance of microprudential banking supervision in 116 countries during the years from 1970 to 2016, it finds that shared supervision is the only supervisory arrangement negatively and significantly correlated with nonperforming loans a share of total loans (hereafter, NPLs). On the other hand, NPLs tend to be higher when supervision is conducted by the central bank as a single supervisor, whereas no significant relationship is found with supervision by an agency. 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 a relevant 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. These findings are robust after controlling for country and year fixed effects, as well as for a number of macroeconomic and institutional variables. Overall, these results suggest that supervisory governance matters for financial stability when related to the socio-economic structure in which supervision is conducted, which in this case is captured by the degree of corruption of a country.

The remainder of the paper is organised as follows. Section 2 reviews the literature on the link between supervisory governance and financial stability, highlighting the limitation of existing works. Section 3 presents the hypotheses tested in this paper and the empirical model adopted to this purpose. Section 4 describes the new database of supervisory governance introduced in this paper as well as the other data included in the model as control variables. The empirical results and the robustness checks are reported and discussed in Section 5, whereas Section 6 concludes.

2 Related literature

The literature provides mixed evidence on the impact of supervisory governance on financial stability.³ Goodhart and Schoenmaker (1995) show 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) find that systemic banking crises are less likely, the higher the degree of cooperation between supervisory authorities. Their definition of cooperation could however be misleading, as those cases in which the central bank is the only supervisor are considered

³While 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.

‘full cooperation’.⁴ 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, which may be the central bank or an agency. Evidence is mixed also concerning other financial stability indicators: [Hasan and Mester \(2008\)](#) find no significant relationship between central bank supervision and the volume of problem loans over total loans, whereas [Dincer and Eichengreen \(2013\)](#) show 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 most puzzling set of results. While [Delis and Staikouras \(2011\)](#) and [Hirtle et al. \(2019\)](#) provide evidence that effective and frequent banking supervision can reduce NPLs, studies on the impact of supervisory governance on NPLs report mixed evidence. [Barth et al. \(2002\)](#) find that banks hold more NPLs when the central bank is the sole supervisor. [Dincer and Eichengreen \(2013\)](#) present similar results, but show that this relationship does not hold when controlling for the degree of independence of the supervisor. In contrast with both studies, [Koetter et al. \(2014\)](#) find no effect of a number of central bank supervision (as well as of a number of other central bank’s institutional traits) on NPLs, suggesting that the policy discussion on the allocation of supervision might be misguided.

Three complementary factors can be identified to explain these contrasting findings. First of all, these works rely on different definitions of supervisory governance. A first set of works examine 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 rely on survey-responses from supervisors on which institution is responsible for banking supervision ([Barth et al., 2002](#); [Koetter et al., 2014](#)), whereas a third strand of the literature define supervisory governance based on the degree of cooperation between supervisors ([Rutkowski and Schnabel, 2016](#)).⁵ While it is clear how the third set differs from the first two, also the first and second sets can lead to different outcomes. The definition adopted in the first set, for example, clusters together those cases where the central bank supervises alone or with another agency, as it focuses on the involvement of the central bank in supervision. This may not always coincide with the definition of the second set, which identifies which agency is responsible for supervision, and not necessarily involved in it. In some cases, in fact, supervisory responsibilities can be given to a single agency, which however supervises together with the central bank.⁶

⁴Their focus is in fact more on the ownership of supervisory information rather than interinstitutional cooperation.

⁵It is worth mentioning a fourth set of papers which distinguish supervisory governance based on the degree of concentration of supervisory authorities ([Melecky and Podpiera, 2013](#) and [Masciandaro and Romelli, 2018](#)); these works, however, explore the determinants of supervisory governance, rather than its impact, and extend the analysis also to the supervision of insurances and securities, and not only of the banking sector.

⁶The World Bank’s [Bank Regulation and Supervision Survey \(BSSR\)](#), which surveyed regulatory and supervisory agencies, provides relevant examples to support this argument. This is particularly visible for those

Secondly, most works focus on a binary choice between central bank supervision or supervision by an agency, excluding therefore the possibility of shared supervision.⁷ This approach may be problematic for two reasons. First of all, it excludes shared supervision, a governance model that might be of relevance. 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.⁸ [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. [Barth et al. \(2002\)](#) find that countries with multiple bank supervisors tend to have lower bank capital ratios and higher liquidity risks; in contrast, [Koetter et al. \(2014\)](#) identify no significant relationship between multiple supervisors and NPLs before and after the crisis of 2007. Both works, however, rely on cross-sectional data collected during 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).

Thirdly, the impact of supervisory governance may differ according to the institutional environment in which it operates. The literature on institutional quality has highlighted the relevance of good institutions for the effectiveness of a policy, including the implementation of a specific governance model. [Dollar and Svensson \(2000\)](#) showed that World Bank programs are successful depending on whether they have a democratic government and on how long the government has been in power. [Burnside and Dollar \(2000\)](#) found that international aid benefits growth only in those countries with good institutions. Institutional quality plays a relevant role also for the governance of central banks and supervisors, although evidence in this field is scarcer. [Acemoglu et al. \(2008\)](#) showed that increasing central bank independence reduces inflation only in countries with strong institutions, i.e. where the executive is subject to constitutional constraints. 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.

Institutional quality can play an important role also for the effectiveness of supervisory governance. The theoretical literature suggests that, in the presence of weak institutions,

cases in which the central bank is supervising together with another agency, like in the United States. For example, to the question ‘What body/agency supervises banks?’, in 1999 the United States replied the Office of the Comptroller of the Currency (OCC). In 2003, however, they included the OCC alongside the Federal Reserve and the Federal Deposit Insurance Corporation (FDIC) and state banking agencies. The different reply was not the result of a reform that changed the supervisory architecture in the United States, but just of a different interpretation by the respondent. Another interesting case is Germany, where the respondents in 2003 reported the federal supervisor, the BaFin, as the agency responsible of banking supervision, but ‘assisted by the Deutsche Bundesbank’ (Question 12.1 of the BSSR survey of 2003).

⁷In practice, this consisted in the creation of a dummy that equals 1 when the central bank supervises, and 0 otherwise.

⁸For 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).

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 responsibilities represents an organisational improvement. Under shared supervision, in fact, each supervisor would face higher informational asymmetries and limit her 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). Such 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 for financial stability. It follows that, where institutions are weak and the risk of supervisory capture is higher, shared supervision should have the benefit of preventing from such risk. While this argument has been supported from a theoretical standpoint, it has never been tested empirically. This is exactly what this paper sets out to do.

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. As was mentioned, the definition of financial stability is restricted to NPLs as the percentage share of total gross loans. NPLs are a useful proxy for financial stability, as higher portions of nonperforming loans over total loans can lead to higher credit losses for the bank. Moreover, they are comparable across countries for a relatively long time series and are considered by both academics and policymakers a key indicator of excessive credit risk taken by the banking system ([Koetter et al., 2014](#); [Fredriksson and Frykström, 2019](#)). An additional benefit is that, while other variables could serve as potential proxies for financial stability ([Gadanecz and Jayaram, 2009](#)), NPLs are more directly affected by supervision and the quality of institutions than others such as, for example, the occurrence of systemic bank crises. For this reason, NPLs have been used in a number of works to study the effect of supervision on financial stability ([Sundararajan et al., 2001](#); [Barth et al., 2004](#); [Delis and Staikouras, 2011](#); [Dincer and Eichengreen, 2013](#); [Koetter et al., 2014](#); [Hirtle et al., 2019](#)).

Data on NPLs are collected by the International Monetary Fund (IMF) and are publicly available on the World Bank online database, which describes bank NPLs 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”. The description also specifies that, according to international guidelines, loans are generally classified as nonperforming when payments of principal and interest are 90 days or more past due or

when future payments are not expected to be received in full.⁹ Data are submitted by national authorities to the IMF, following the Financial Soundness Indicators (FSI) Compilation Guide.¹⁰ These data cover 103 of the 116 countries in the sample and the years from 1998 to 2016.

I measure supervisory governance in the following way. I create three dummies, each representing one of the three models of supervisory governance. Each dummy 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. which has no monetary policy function) and (3) supervision shared between the central bank and an agency. This operationalisation overcomes the shortcomings of the literature, which understood supervisory governance either as being conducted by the central bank or an agency, excluding mixed arrangements (e.g. in [Dincer and Eichengreen, 2013](#); [Di Noia and Di Giorgio, 1999](#); [Goodhart and Schoenmaker, 1995](#)). The rationale for this approach is to avoid 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.

The categorisation 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, I 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 France¹¹ and that I therefore consider as a case of central bank supervision. For the special case of the European Single Supervisory Mechanism (SSM), I look at the composition of the Supervisory Board. In the Supervisory Board some countries are represented by one member of their national central banks (e.g. the Bank of Italy for Italy), others by their supervising agencies (e.g. the Finanssivalvonta for Finland) and others by both of them (e.g. the BaFin and the Bundesbank for Germany).¹² I consider shared supervision those cases in which national supervisor which shares supervision with the

⁹While international standards are not necessarily binding, [Barisitz \(2011, 2013\)](#) found that this definition is the most common among supervisors in Western and Eastern Europe.

¹⁰For further details, see the full description at this link: <https://data.worldbank.org/indicator/FB.AST.NPER.ZS>.

¹¹The 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). On the case of the Commission Bancaire, Edmond Malinvaud, in the discussion of the paper [Grilli et al. \(1991, p. 378\)](#) on central bank independence, supported this choice arguing that ‘everybody in France considers this commission, chaired by the governor, as belonging to Banque de France where it has its quarters’.

¹²Since 2019, each national agency is accompanied by a representative from the national central bank.

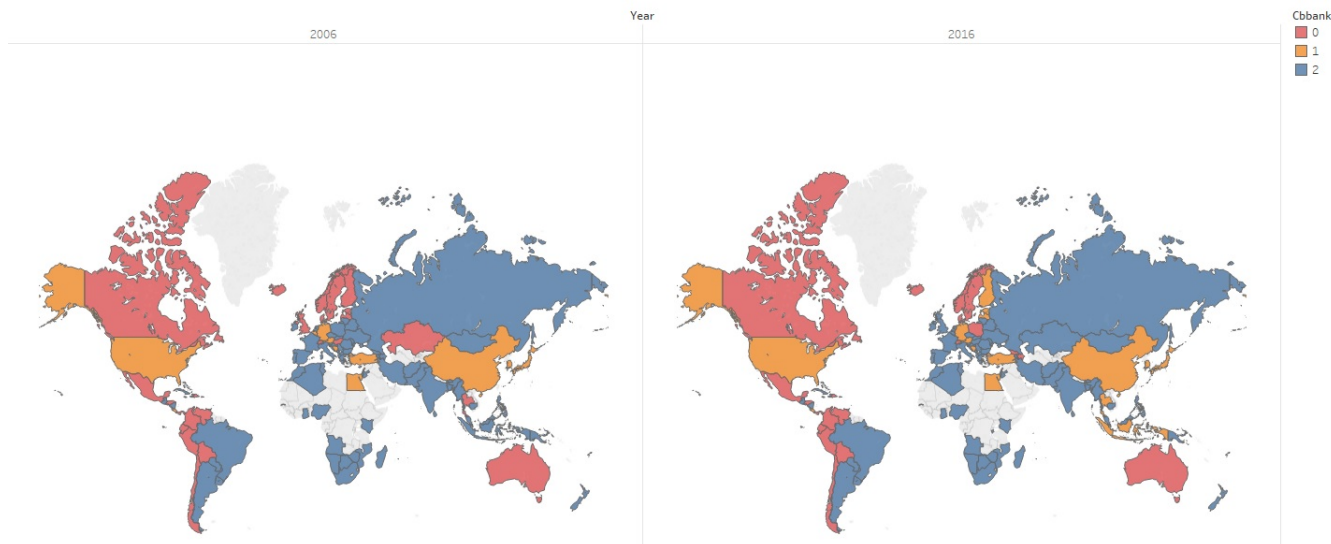
European Central Bank is an agency or both a central bank and an agency. A full list of the cases of shared supervision is provided in the Appendix (Table 9). This strict categorisation based on the statutory provisions of the supervisor is meant to overcome potential subjective bias in defining an arrangement as shared or non-shared. Previous works in fact included the case of shared supervision adopted based on survey responses which were however prone to the subjective interpretation of the respondents.¹³

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% of the countries in the sample had a central bank as the only supervisor, 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.¹⁴

¹³Barth 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 (see footnote 5 for an example). 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.

¹⁴While 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, Europe, Asia 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.

While previous works provided some explanations for the drivers of this heterogeneity (Melecky and Podpiera, 2013; Masciandaro and Romelli, 2018), the aim of this work is to study the relationship between these three supervisory models and NPLs. As described, most works focus on the impact of having either a central bank or an agency on financial stability. However, the presence of both pros and cons for each model and the mixed empirical evidence, led some to conclude that ‘there are no overwhelming arguments for either model’ (Goodhart and Schoenmaker, 1995, p. 556) and that the ‘policy discussions on whether prudential supervision should be shared or concentrated at the central bank may be somewhat misguided’ (Koetter et al., 2014, p. 64).

Nevertheless, existing estimates of the impact of supervisory governance on financial stability may be inaccurate for two (complementary) reasons, which will be tested empirically in this paper. The first is that what matters for supervisory governance to be effective may not be whether the supervisor is a central bank or an agency, but whether only one of them supervises or both. The second is that the effectiveness of supervisory governance may depend on the institutional environment in which it operates.

Concerning the first hypothesis, having two supervisors rather than one may be beneficial for financial stability. Splitting regulatory tasks to more than one agency has the advantage of increasing the costs of collusive activities, acting as a deterrent for regulatory capture, as

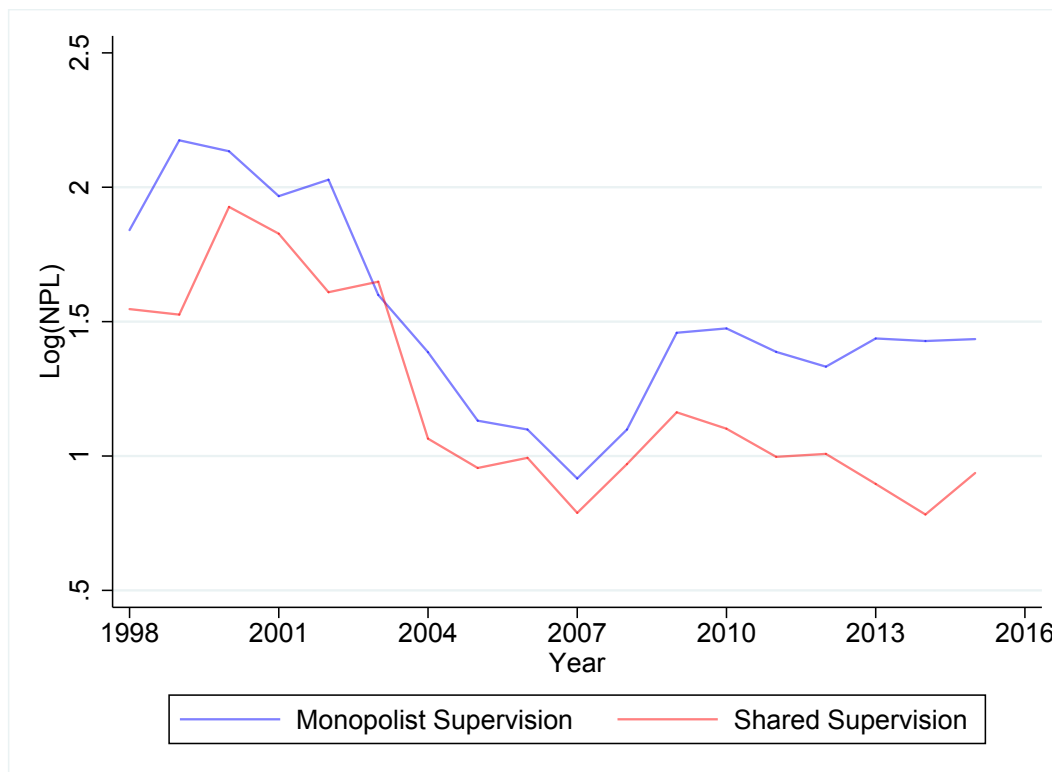
theorised by [Laffont and Martimort \(1999\)](#). Under this arrangement, firms would in fact need to capture two regulators, and therefore pay two bribes, rather than a single one. Moreover, shared supervision would reduce the information that each supervisor can obtain, hence reducing the stake for capture. [Boyer and Ponce \(2012\)](#) apply the theoretical model of [Laffont and Martimort \(1999\)](#) to the case of banking supervision, reaching the conclusion that concentration of supervisory powers in a single institution makes capture more likely. As supervisory capture is more costly, banks are less likely to obtain a lax supervision that allows them to engage in higher risk. Therefore, according to this view, NPLs should therefore be lower under shared supervision than under non-shared supervision.

The main disadvantage of shared supervision highlighted by the literature on regulatory agencies is the risk of regulatory arbitrage. The risk lies on the possibility that banks may choose the more lenient supervisor, leading to a race to the bottom in terms of supervisory laxity between the central bank and the agency ([White, 2011](#)). Previous works on the case of the United States, where supervision is shared between the Federal Reserve and other agencies, provided evidence in support of this phenomenon ([Rezende, 2014](#); [White, 2011](#)). According to this perspective, NPLs may be higher under shared supervision. However, regulatory/supervisory arbitrage could be arguably considered a phenomenon specific to the case of the United States,¹⁵ where banks can switch from state to national charters and viceversa, with the result of falling under different supervisors. In other countries where supervision is shared, as for example in Germany, banks cannot choose their preferred supervisor, but are actually supervised by both agencies. This is the case for all the cases of shared supervision included in the database of this paper with the exception of the United States. For this reason, regulatory arbitrage is unlikely to affect our result.

In line with this claim, descriptive evidence suggests that shared supervision perform better than the arrangements with a single supervisor. As [Fig. 2](#) shows, median NPLs tend to be lower when supervision is shared rather than when it is not. This provides further motivation to explore shared supervision more in depth.

¹⁵All the works that studied directly or indirectly the phenomenon of regulatory arbitrage focused on the case of the United States only, including [Agarwal et al. \(2014\)](#), [Rezende \(2014\)](#), [White \(2011\)](#) and [Rosen \(2003\)](#).

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



I will hence formulate the first hypothesis as follows:

Hypothesis 1: NPLs are lower when supervision is shared.

To test Hypothesis 1, I need to compare the relationship between NPLs and each supervisory governance model. In doing so, it is important to include country-level fixed effects to account for unobserved heterogeneity between countries. As pointed out by [Goodhart and Schoenmaker \(1995\)](#), in fact, the effectiveness of governance arrangements may depend on the particular banking structure of a country. Moreover, country fixed effects allow me to account for the potential cross-country differences in accounting standards used to identify loans as non-performing highlighted by [Bholat et al. \(2016\)](#) and [Baudino et al. \(2018\)](#). I also include year fixed effects to account for changes in NPLs dependent on specific years. This allows me to control for sudden changes in the ratio of NPLs, which could be driven, for example, by the presence of a financial crisis ([Laeven and Valencia, 2012](#)) or by a change in international accounting standards. Formally, I 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 loans¹⁶ for country i in year t . $SGOV$ is one of the three dummies corresponding to each model of supervisory 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, I intend to analyse how its sign and significance vary across different supervisory governance models. α_i controls for country-specific characteristics, μ_t is a controls for year-specific effects, and ϵ_{it} is the error term.

The second hypothesis bridges the theoretical arguments of [Laffont and Martimort \(1999\)](#) and [Boyer and Ponce \(2012\)](#) with the literature on institutions. The latter has highlighted the relevance of good institutions for the effectiveness of a policy, including the implementation of a specific governance model (as in [Beck et al., 2006](#) and [Acemoglu et al., 2008](#)). Institutional quality plays a relevant role also for the effectiveness of shared supervision, which depends in fact on the presence of the risk of supervisory capture. As argued in the theoretical model by [Boyer and Ponce \(2012\)](#), if supervisors were benevolent, then the allocation of supervisory responsibilities would be of no consequence. In these cases, shared supervision may have no effect on banks' risk, and therefore no significant relationship with NPLs may be established. On the contrary, in countries where the risk of supervisory capture is high, shared supervision should represent an effective institutional device to lower such risk and reduce therefore banks' risk-taking behaviour. Therefore, while previous works on institutions stressed the importance of a country's institutional quality to guarantee the effectiveness of a policy, in the case of shared supervision the opposite holds true. In other words, shared supervision is more effective where institutions are 'worse', i.e. the risk of corruption is higher. Following these considerations, I formulate a second hypothesis:

Hypothesis 2: When supervision is shared, its negative effect on NPLs should be stronger in countries where the risk of supervisory capture is higher.

This hypothesis requires to provide an indicator to account for the risk of supervisory capture. To this purpose, I use the inverse of the variable 'control of corruption' from the Worldwide Governance Indicators (WGI) database compiled by [Kaufmann et al. \(2010\)](#). This variable is a good proxy for the risk of supervisory capture as, following its description, it encompasses "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](#), p. 3).¹⁷

¹⁶In an alternative specification, I replace the dependent variable NPLs with the log differences in order to enhance cross-country comparability, following [Beck et al. \(2015\)](#).

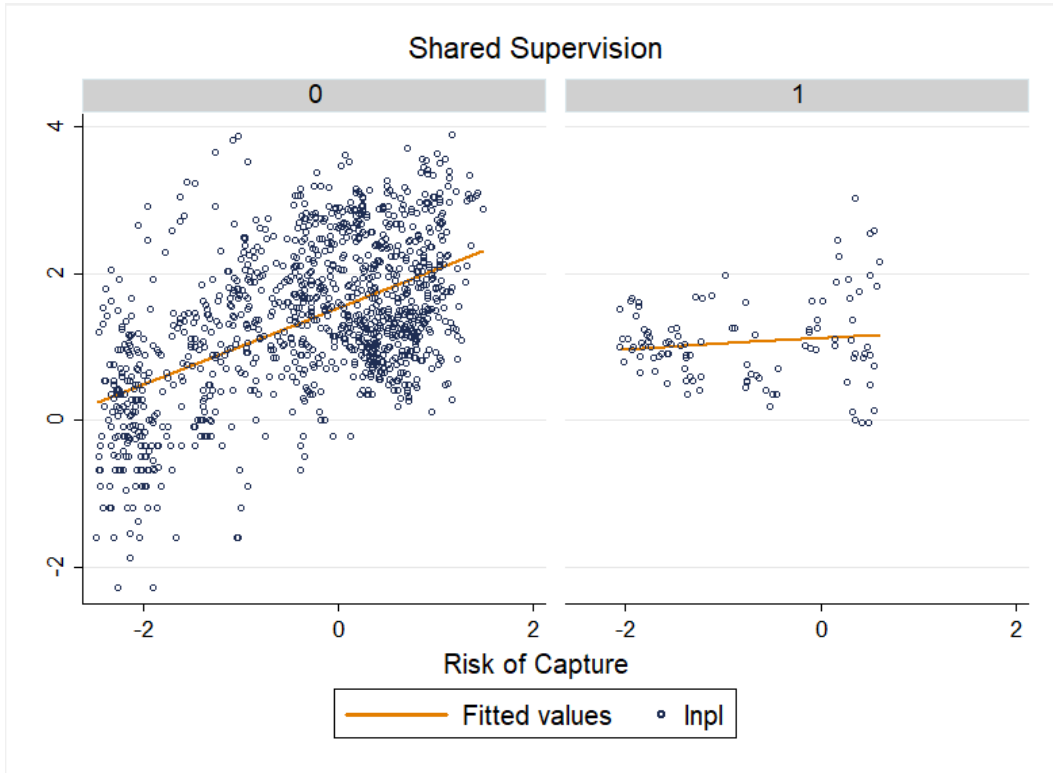
¹⁷More details on the construction of the variable are provided at this <http://info.worldbank.org/governance/wgi/pdf/cc.pdf>

I define the variable *RiskofCapture* in two ways, to control for potential problems related to the construction of the corruption indicator. As argued in [Apaza \(2009\)](#) and [Arndt and Oman \(2006\)](#), comparing the values of the control of corruption variable across countries might be problematic due to different underlying sources. To overcome this problem, in the first specification *RiskofCapture* is defined as a dummy that equals 1 when such risk is above the median risk of year t , and 0 otherwise. The dummy variable splits the sample between countries within the broader categories of ‘high’ (dummy equals 1) and ‘low’ risk of capture.¹⁸ The main advantage of this approach is that it avoids ranking countries on continuous estimates which may suffer from a potential aggregation bias. This comes however at the cost of not exploiting the variability of this index. For this reason, in the second specification, *RiskofCapture* is simply the inverse of the control of corruption indicator constructed by the WGI database. The higher the values, the higher the risk of capture (or the lower the control of corruption).

[Fig. 3](#) provides descriptive evidence in favour of Hypothesis 2. The figure displays the relationship between NPLs (y-axis) and risk of capture (x-axis) in two different samples. The sample on the left panel comprehends those countries where the supervisor is only one, either a central bank or an agency (the shared supervision dummy equals 0), whereas the sample on the right includes those countries where supervision is shared between the two institutions (the shared supervision dummy equals 1). While the positively-sloped fitting line of the left panel clearly displays a positive relationship between risk of capture and NPLs, this relationship is much weaker for countries where supervision is shared, where the fitting line is almost horizontal. While being merely descriptive, this evidence seems to be in line with the hypothesis advanced in the theoretical literature, for which shared supervision would act as an inhibitor to the link between capture and risk-taking.

¹⁸A similar solution was applied by [Acemoglu et al. \(2008\)](#) to indices of central bank independence.

Figure 3: Shared supervision and risk of capture



Note: The figure plots log NPLs (y-axis) against risk of capture (x-axis) in countries with non-shared (left-panel) and shared (right-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 Hypothesis 2, I look at the interaction between shared supervision and the risk of supervisory capture, which I analyse under its two specifications. Formally, I 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 Hypothesis 2 is not disproven, I 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 section introduces the new database on supervisory governance covering 116 countries for the period 1970-2016 used in this analysis. 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](#)).¹⁹ As the sample of countries in this survey varies from one round to another, it does not allow for 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 Assessments²⁰ 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, which provides a full updated list of each country's current supervising institution.²¹ 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 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](#).

¹⁹In particular, Section 12 of the survey which looks at supervision (the number of the section refers to the latest round of the survey and may vary across rounds). The starting point of the database was based on the replies by supervisory authorities to question 12.1: "What body/agency supervises commercial banks for prudential purposes?".

²⁰The full list of FSSAs by country and year can be found at this [link](#).

²¹The full list can be consulted at this [link](#). The list is however regularly updated.

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

	Number of countries	Years	Period
<i>Present work</i>	<i>116</i>	<i>46</i>	<i>1970-2016</i>
Rutkowski and Schnabel (2016)	34 (OECD)	43	1970-2013
Masciandaro and Romelli (2018)	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 empirical model 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. 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: a number of works in fact identified a negative relationship between economic activity and NPLs (Nkusu, 2011; Beck et al., 2015; Balgova et al., 2016). Using data from the World Bank database, I include as regressors domestic credit to the private sector as a percentage to GDP, GDP per capita annual growth and inflation. 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 and 0 otherwise.

Moreover, bank-related variables from a number of sources are added to the model. 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 the fragility of a country’s banking sector, I use an aggregated index, called z-score, which captures the probability of default of a country’s commercial banking system (see for example Demirgüç-Kunt et al., 2008), and which displays higher values for low-risk countries.²² I use the measure of z-score taken from Bankscope and Orbis Bank Focus - Bureau van Dijk (BvD), defined 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 by taking the log of the values and adding 1 to allow for transformation in the presence of zeroes: $\log(1 + z)$. 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

²²If 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.

impact on credit in countries where income is low, where they have a limited market share, where enforcing contracts is costly and where credit information is limited, and in countries that are distant from their home country. 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 2013,²³ 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 2015.²⁴ 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 line with this hypothesis, [Klomp and de Haan \(2009\)](#) found a positive relationship between central bank independence and financial stability. It is hence necessary to control for independence as it might be negatively associated to NPLs. In addition, I use the index of *supervisory power* constructed by the 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. I include this variable as the power held by a supervisor is believed to affect the fragility of the banking system: stronger banking supervisors can in fact improve the corporate governance of banks, with positive effects on supervision ([Stigler, 1971](#)). However, using the same index, [Beck et al. \(2006\)](#) found that a higher degree of supervisory power was not necessarily associated with lower corruption in bank lending, even in countries with highly developed institutions. They argued that this was further evidence in support of the regulatory capture view, for which concentrating too much power in supervisors may not necessarily result in better supervision in countries where the risk of capture is high. As the available estimates are the results of four rounds of survey, and are therefore fragmented over time, I interpolate

²³Data 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.”

²⁴Bodea 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.

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, I regress NPLs against the three models of supervisory governance separately and including country fixed effects. Table 2 displays the results.²⁵ From these preliminary estimates, 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 central bank supervision 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.²⁶

²⁵The low within variability of the supervisory governance dummies might suggest the inclusion of random effects rather than fixed effects. However, the random effect model lies on the assumption that the residuals are independent of the covariates. This would equate with assuming that country effects and supervisory governance are orthogonal, i.e. that $E(\alpha_i|SGOV_{it}) = E(\alpha_i) = 0$, which may not hold in our case. In addition, the Hausman test supports the use of 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. I therefore infer that between effects are not significantly biasing estimates of the within effects. Moreover, I 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 ($F(16, 93) = 9.84, Prob > F = 0.000$).

²⁶Similar results are obtained when the dependent variable, NPLs, is transformed in log form (see Tab. 10 in Appendix).

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

NPL	(1) Shared Sup.	(2) Central Bank	(3) Sup. Agency
Supervisory Governance	-7.437** (2.875)	4.767** (1.847)	-0.503 (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

However, the significance for central bank supervision is lost once I control for year fixed effects, as shown in Tab. 3. While shared supervision still remains negatively correlated with NPLs, its significance is weaker once I control for time fixed effects. This result is likely driven by the prominence of the crisis in the time span of analysis, which is reduced to the period 1998-2016 due to limited data on NPLs. A straightforward interpretation is that the significance is absorbed by year-specific dummies due to the sudden peaks in NPLs that followed the crisis years. A complementary explanation is that the policy environment has changed through time (potentially as a consequence of the crisis), leading to different solutions targeted at reducing the share of bank NPLs. Overall, these results supports Hypothesis 1, as they highlight a negative relationship between shared supervision and NPLs. On the other hand, they also show that this relationship is weakened once year dummies are included, suggesting that other factors may play a more relevant role. 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

NPL	(1) Shared Sup.	(2) Central Bank	(3) Sup. Agency
Supervisory Governance	-5.186* (2.976)	2.615 (1.870)	0.287 (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

In the second hypothesis, the variable of interest is the interaction between shared supervision and the risk of capture. Using the interaction allows me to verify whether the negative effect of shared supervision on NPLs is stronger where the risk of supervisory capture is higher.

I 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 including both country and time fixed effects, but without adding any regressor (Tab. 4, Col. 1). The three combinations deriving from the interaction report different results. In the first case, when there is no shared supervision and the risk of capture is high (0×1), 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). In the second case, when supervision is shared, but the risk of capture is absent or low (1×0), 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 correlated with 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 in place in countries with high risk of capture (both dummies equal 1, i.e. 1×1). 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 is 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. In fact, it might well be that the relevant governance aspect for financial stability is not allocation of supervisory powers, but rather the independence of the supervisor or the powers it holds. The coefficient of the interaction between shared supervision and risk of capture 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. According to them, more powerful supervisors are more likely to be captured, as they represent an useful resource for lobbies and politicians 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 I 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 expected. The significance of the interaction's coefficient holds also once I control for other institutional variables from the World Governance Indicator database (Tab. 4, Col. 6), providing further evidence in support of Hypothesis 2. When I substitute the dummy *RiskofCapture* with the continuous variable the results do not change overall, and the interaction even gains more significance, as displayed in Tab. 5.

Table 4: Regression with Risk of Capture as dummy variable

NPL	(1)	(2)	(3)	(4)	(5)	(6)
Shared sup. \times Risk of capture						
0 \times 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 \times 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 \times 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*** (0.746)	-5.378*** (1.246)	-5.293*** (1.146)	-4.829*** (1.482)	-4.875*** (1.510)	-4.836*** (1.535)
Shared	-6.798*** (1.234)	-5.471*** (1.646)	-5.476*** (1.500)	-4.905** (2.129)	-4.773** (2.204)	-4.723** (2.257)
Risk of Capture	5.908*** (1.740)	2.897 (1.781)	2.564 (1.720)	2.290 (1.686)	2.275 (1.655)	2.261 (1.843)
Crisis		4.924*** (0.979)	4.183*** (0.874)	4.109*** (0.854)	3.787*** (0.856)	3.692*** (0.854)
Credit		0.0414** (0.0169)	0.0282** (0.0137)	0.0307** (0.0134)	0.0256* (0.0136)	0.0248* (0.0140)
Inflation			0.0360 (0.0302)	0.0341 (0.0296)	0.0350 (0.0301)	0.0359 (0.0304)
GDP per capita			-0.285** (0.110)	-0.288*** (0.108)	-0.281** (0.110)	-0.278** (0.111)
CB Independence				-4.316 (4.194)	-4.438 (4.735)	-4.360 (4.873)
Sup. Power				-0.365* (0.209)	-0.285 (0.220)	-0.275 (0.213)
Bank Concentration					0.0403 (0.0256)	0.0396 (0.0265)
Bank z-score					-1.722** (0.835)	-1.728** (0.837)
Foreign banks (%)					0.0108 (0.0364)	0.0118 (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

5.3 Robustness Checks

While the results of the previous section hold significant after controlling for a number of factors that could potentially affect NPLs, this section further assesses the robustness of these findings by testing Hypothesis 2 under alternative specifications.

The first alternative specification is related to the potential criticism related to cross-country comparisons of NPLs data aggregated at country level. Before gradually converging to a commonly accepted definition, countries had different standards to consider a loan as nonperforming. In the most common definition, which is also the one provided in the IMF database used in this work, NPLs are those loans for which the payments of interest and principal are past due by 90 days or more.²⁷ However, as noted by Beck et al. (2015), some countries include among NPLs those loans which are 31 or 61 days overdue, whereas other countries do not comply with the international standards. While country fixed effects allow us to control for these between-country differences, as an additional check I estimate the model by replacing the ratios of NPLs over total gross loans with the same variable in logarithmic differences, in order to avoid measurement errors, following Beck et al. (2015). Tables 6 and 7 show that, under both definitions of supervisory capture, results do not change significantly once I replace the dependent variable with the logarithmic differences of NPLs.

In the second alternative specification, the dependent variable, NPLs, is replaced with bank regulatory capital.²⁸ This test aims to assess whether the positive correlation between shared supervision in high-corruption environments and banks' stability is limited to NPLs. It may in fact be that, while keeping NPLs low, banks are still able to capture the supervisor and hence to engage in more risky activities, as they would face more lenient scrutiny. This would be signalled by lower capital adequacy ratios: if this was the case, I would then expect shared supervision and high risk of capture to be negatively and significantly correlated with bank regulatory capital. To test this hypothesis, I run the same fixed effects panel data regression, substituting the dependent variable with bank capital. Results, which are reported in Table 8 (estimates for the interaction with the continuous variable are reported in Table 12 in the Appendix), reject this hypothesis. Bank regulatory capital is in fact positively and significantly correlated with the interaction between shared supervision and risk of capture under all specifications but the last one, where the coefficient loses significance but remains positive. These results show that in countries with high risk of capture, shared supervision is associated not only with lower NPLs, but also with higher bank regulatory capital, and hence with a more stable banking system overall.

²⁷Basel Committee on Banking Supervision, [Part 2: The First Pillar: Minimum Capital Requirements](#), par. 452.

²⁸Bank regulatory capital is defined as "The capital adequacy of deposit takers. It is a ratio of total regulatory capital to its assets held, weighted according to risk of those assets" (World Bank codebook).

Table 6: Regression with Risk of Capture as dummy variable and log(NPL) as dependent variable

log(NPL)	(1)	(2)	(3)	(4)	(5)	(6)
Shared \times Risk of capture						
0 \times 1	0.261** (0.129)	0.0803 (0.128)	0.0430 (0.124)	0.00650 (0.125)	-0.0152 (0.128)	-0.0728 (0.132)
1 \times 0	-0.327 (0.264)	-0.150 (0.211)	-0.156 (0.217)	-0.138 (0.199)	-0.126 (0.190)	-0.125 (0.183)
1 \times 1	-0.691** (0.266)	-0.461* (0.256)	-0.479* (0.267)	-0.452* (0.254)	-0.475* (0.258)	-0.555** (0.266)
Crisis		0.702*** (0.151)	0.606*** (0.139)	0.596*** (0.136)	0.561*** (0.133)	0.490*** (0.130)
Credit		0.00424 (0.00262)	0.00241 (0.00227)	0.00271 (0.00226)	0.00194 (0.00231)	0.00212 (0.00223)
Inflation			0.000328 (0.00229)	8.17e-05 (0.00252)	0.000779 (0.00225)	0.00139 (0.00249)
GDP per capita			-0.0436*** (0.0128)	-0.0439*** (0.0127)	-0.0434*** (0.0127)	-0.0418*** (0.0125)
CB Independence				-0.506 (0.414)	-0.457 (0.460)	-0.380 (0.445)
Sup. Power				-0.0382 (0.0345)	-0.0288 (0.0359)	-0.0259 (0.0353)
Bank concentration					0.000248 (0.00282)	0.000325 (0.00292)
Bank Z-score					-0.208** (0.101)	-0.206** (0.0996)
Foreign banks (%)					-0.000197 (0.00525)	0.00239 (0.00586)
Rule of Law						0.146 (0.305)
Reg. Quality						-0.108 (0.219)
Gov. Effectiveness						-0.435** (0.193)
Observations	1,337	884	874	874	846	846
R-squared	0.194	0.377	0.420	0.425	0.435	0.442
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 7: Regression with Risk of Capture as continuous variable and log(NPL) as dependent variable

log(NPL)	(1)	(2)	(3)	(4)	(5)	(6)
Shared × Risk of capture	-0.394** (0.193)	-0.423*** (0.159)	-0.367** (0.161)	-0.326* (0.169)	-0.330* (0.171)	-0.320* (0.166)
Shared	-0.864*** (0.191)	-0.610*** (0.106)	-0.535*** (0.129)	-0.495*** (0.147)	-0.476*** (0.151)	-0.438*** (0.163)
Risk of capture	0.684*** (0.203)	0.445** (0.202)	0.397** (0.198)	0.371* (0.191)	0.366* (0.212)	0.307 (0.220)
Crisis		0.695*** (0.139)	0.611*** (0.131)	0.606*** (0.128)	0.576*** (0.124)	0.518*** (0.123)
Credit		0.00354 (0.00237)	0.00183 (0.00205)	0.00199 (0.00206)	0.00151 (0.00209)	0.00144 (0.00205)
Inflation			-0.000478 (0.00262)	-0.000646 (0.00283)	-0.000180 (0.00273)	0.000309 (0.00287)
GDP per capita			-0.0414*** (0.0110)	-0.0420*** (0.0109)	-0.0412*** (0.0108)	-0.0396*** (0.0107)
CB Independence				-0.370 (0.429)	-0.353 (0.472)	-0.283 (0.451)
Sup. Power				-0.0429 (0.0341)	-0.0339 (0.0357)	-0.0283 (0.0350)
Bank concentration					0.00123 (0.00304)	0.000837 (0.00307)
Bank Z-score					-0.180* (0.0999)	-0.183* (0.0966)
Foreign banks (%)					0.000825 (0.00497)	0.00245 (0.00524)
Rule of Law						0.319 (0.282)
Reg. Quality						-0.124 (0.203)
Gov. Effectiveness						-0.391* (0.199)
Observations	1,467	977	956	953	922	922
R-squared	0.222	0.399	0.437	0.441	0.449	0.455
Number of id	103	101	100	99	95	95
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 8: Regression 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 (0.763)	0.568 (0.956)	0.615 (0.932)	0.444 (0.997)	-0.0657 (1.049)	-0.522 (1.162)
1 × 0	0.394 (0.737)	0.322 (0.947)	0.295 (0.968)	0.502 (0.942)	0.373 (0.984)	0.168 (1.032)
1 × 1	2.082*** (0.781)	3.881*** (1.154)	3.832*** (1.208)	4.307*** (1.018)	3.148*** (1.071)	2.290 (1.524)
Crisis		0.635 (0.656)	0.549 (0.683)	0.533 (0.679)	0.537 (0.710)	0.290 (0.693)
Credit		-0.0235* (0.0131)	-0.0241* (0.0130)	-0.0225* (0.0132)	-0.0167 (0.0103)	-0.0114 (0.0103)
Inflation			0.00264 (0.0189)	0.00297 (0.0185)	-0.00290 (0.0141)	-0.00581 (0.0128)
GDP per capita			0.00125 (0.0574)	0.00164 (0.0561)	-0.0555 (0.0479)	-0.0573 (0.0498)
CB Independence				-2.694 (2.942)	-2.405 (2.731)	-1.466 (2.410)
Sup. Power				-0.0197 (0.196)	-0.0358 (0.188)	-0.0397 (0.192)
Bank concentration					0.0276 (0.0190)	0.0284 (0.0184)
Bank Z-score					1.600** (0.644)	1.655*** (0.627)
Foreign banks (%)					-0.0862** (0.0363)	-0.0624** (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

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 both 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 comes at a time when shared supervision between central banks and agency is increasingly spreading, as with the establishment of the Single Supervisory Mechanism in the European Union, where the ECB supervises with a number of national agencies.

This paper has shown that this lack of attention might be unjustified. On the one hand, it found that analysing the impact of supervisory governance by looking solely 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 factors other than the nature of the institution. Therefore, the inclusion of shared supervision provides an explanation to the contrasting evidence provided in existing works on supervisory governance.

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 shared supervision is the only governance arrangement able to affect NPLs, but only if interacted with the risk of supervisory capture of a country. NPLs are in fact significantly lower in those countries where supervision is shared between the central bank and an agency, and where the risk of capture is high.

In conclusion, this paper suggests that reforms in supervisory governance could have an impact only depending on the institutional setting in which they are implemented. Institutional factors, such as the risk of capture in a country, are in fact able to influence the effectiveness of supervisory governance in keeping the banking system stable. If policy-makers want to address reforms in the governance of banking supervision, they should be aware that the success of their efforts will be conditional on the existing political economy setting in which the reform is undertaken.

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Appendix

Table 10: Regressions on three models of supervisory governance with country fixed effects; dependent variable: log(NPL)

	(1)	(2)	(3)
log(NPL)	Shared Sup.	Central Bank	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: 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, Financiële 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	Finantsinspeksioon
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

Notes: Years indicate the period in which the country had a shared supervision arrangement.

Table 11: Regression of three supervisory models on OECD and Non-OECD subsamples

NPL	OECD			Non-OECD		
	Shared	Central Bank	Sup. Agency	Shared	Central Bank	Sup. Agency
Supervisory Governance	-0.218 (1.164)	2.096 (2.123)	-1.582 (1.804)	-9.762*** (1.702)	4.608 (3.175)	4.016** (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 12: Using Risk of capture as continuous variable, dep. var. bank regulatory capital

Bank Reg. Capital to RWA	(1)	(2)	(3)	(4)	(5)
Shared \times Risk of Capture	0.480 (0.653)	0.931 (0.691)	0.765 (0.658)	1.214 (0.768)	1.209* (0.640)
Shared	0.846 (0.636)	2.038** (0.839)	1.834** (0.808)	2.538** (1.010)	2.260** (0.958)
Risk of Capture	2.282* (1.158)	2.362** (0.948)	2.793*** (0.849)	2.760*** (0.866)	2.194** (0.873)
Crisis		0.431 (0.660)	0.296 (0.685)	0.284 (0.682)	0.180 (0.691)
Credit		-0.0221* (0.0132)	-0.0225* (0.0131)	-0.0210 (0.0132)	-0.0173 (0.0108)
Inflation			0.00601 (0.0180)	0.00664 (0.0173)	0.00146 (0.0135)
GDP per capita			0.00547 (0.0570)	0.00635 (0.0557)	-0.0321 (0.0486)
CB Independence				-2.687 (2.875)	-2.270 (2.768)
Sup. Power				0.00338 (0.193)	-0.0313 (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 variable, dep. var. log(bank regulatory capital)

log(Bank Reg. Capital to RWA)	(1)	(2)	(3)	(4)	(5)
Shared × Risk of Capture	0.00650 (0.0486)	0.0296 (0.0453)	0.0205 (0.0439)	0.0590 (0.0485)	0.0596 (0.0437)
Shared	0.0338 (0.0474)	0.105* (0.0552)	0.0944* (0.0549)	0.154** (0.0666)	0.140** (0.0648)
Risk of Capture	0.128** (0.0639)	0.159** (0.0726)	0.189*** (0.0668)	0.185*** (0.0658)	0.162** (0.0695)
Crisis		-0.00972 (0.0567)	-0.0172 (0.0579)	-0.0184 (0.0580)	-0.0215 (0.0581)
Credit		-0.00104 (0.000840)	-0.00109 (0.000828)	-0.000957 (0.000832)	-0.000816 (0.000734)
Inflation			-6.88e-05 (0.00108)	-1.81e-05 (0.00104)	-9.41e-05 (0.000823)
GDP per capita			0.000114 (0.00314)	0.000160 (0.00310)	-0.00156 (0.00277)
CB Independence				-0.228 (0.169)	-0.199 (0.163)
Sup. Power				-0.00130 (0.0101)	-0.00355 (0.0104)
Bank Concentration					0.000435 (0.00103)
Bank Z-score					0.00365 (0.00340)
Foreign banks (%)					-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

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

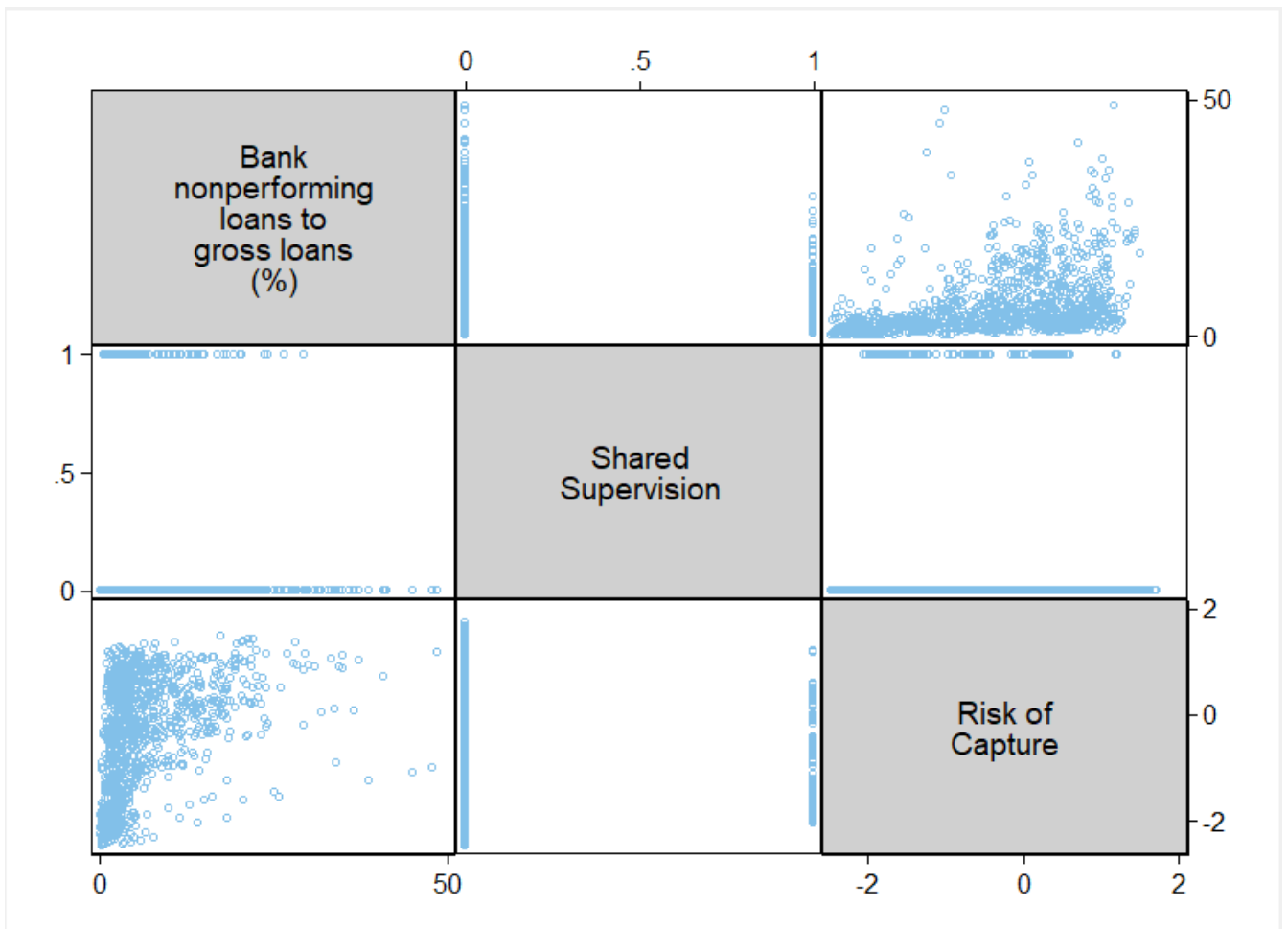


Table 14: Correlation table

	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

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