A Normative Analysis of Banking Supervision: Independence, Legal Protection and Accountability

Jorge Ponce
A Normative Analysis of Banking Supervision: Independence, Legal Protection and Accountability

Jorge Ponce

Banco Central del Uruguay, 777 Diagonal J.P. Fabini 11100 Montevideo, Uruguay

Abstract

This paper uses a formal model of a bank supervisor to derive policy implications on the optimal institutional arrangements for effective banking supervision. I find that bank supervisors should have political independence, and that independence should be complemented by legal protection and accountability arrangements for bank supervisors. I provide empirical evidence supporting these results.

JEL classification numbers: G21, G28.

Key words: Banking supervision, institutional organization, independence, legal protection, accountability, empirical evidence.

1. Introduction

The institutional organization of banking supervision has been attracting the interest of academics and policymakers in the last years. Goodhart

The views expressed herein are those of the author and do not necessarily represent the views of the institutions to which he is affiliated. A previous draft of this paper was written while the author was a graduate student at Toulouse School of Economics.

E-mail address: jponce@bcu.gub.uy

1I use the term “banking supervision” in a broad sense. It includes not only supervisory policies but also the institutional arrangements that are in charge of conducting them.

2According to Masciandaro and Quintyn (2007), structure, organization and governance of banking sector supervision was not a topic for an animated debate two decades ago. Financial systems around the world were heavily regulated (i.e., repressed); by whom and how they were supervised was not a topic that stirred great commotion. Since then, financial liberalization has profoundly altered the banking sector and the nature of its operations, triggering big challenges to bank supervisors. Moreover, a series of systemic

October 21, 2010
(1998), Lastra (1996) and Quintyn and Taylor (2003) were among the first scholars to stress the need for independent supervisory agencies. The Basel Committee on Banking Supervision (1997, 2006) has put the need for independent, accountable and legally protected bank supervisors in its Core Principles for Effective Banking Supervision. However, policy makers have been reluctant to give a substantial degree of effective independence to supervisory authorities and to enact appropriate accountability arrangements.\footnote{Quintyn et al. (2007) analyze recent changes in legal and institutional frameworks for supervision in 32 countries and find strong evidence that the endorsement of independence to bank supervisors remains half-hearted and overcompensated on the accountability side. I find that around 30 percent of the countries in the data set I use in Section 5 fail to enact adequate levels of independence and accountability to their supervisors (see Section 5.3 for details).}

Moreover, non-conclusive empirical evidence on the effects of different supervisory arrangements on the outcomes of the banking sector have been presented. On the one hand, Das et al. (2004) find that better supervisory governance (of which independence is a key component) tends to improve the solvency of banks and to reduce the ratio of non-performing loans. On the other hand, Barth et al. (2004, 2006) find that supervisory independence is not related to bank development or the level of non-performing loans.

Which are the characteristics that the institutional arrangements for banking sector supervision should have to effectively implement an efficient supervisory policy? This is the topic addressed in this paper. I provide a formal model of a bank supervisor that allows to derive policy implications on the optimal institutional arrangements for effective banking supervision.\footnote{In broad terms, banking supervision is “effective” when it is adequate to accomplish the purposes of improving banking stability and strengthening the banking sector. In this paper’s formal model, these purposes are accomplished when a banker abstains from taking excessive risks.}

I find that bank supervisors should have political independence, and that independence should be complemented by legal protection and accountability arrangements for bank supervisors. I provide empirical evidence supporting these theoretical findings: the existence of an independent, legally protected and accountable bank supervisor substantially reduces the average probability of banks’ loans default. Moreover, the existence of appropriate account-
ability arrangements and legal protection for bank supervisors are the most important elements to reduce the riskiness of banks.

In the model, banking supervision is necessary to avoid excessive risk taking by a banker. A supervisory policy characterized by closing excessively risky banks is effective. However, politicians, who seek to maximize social welfare, cannot credibly commit to this policy. As in Mailath and Mester (1994), politicians confront a dynamic commitment problem: they find optimal \textit{ex post} not to punish a banker that has taken excessive risks (i.e., to close the bank) even though it is optimal \textit{ex ante} to commit to this policy. In turn, the banker will take excessive risks. This provides a rationale for giving political independence to the bank supervisor.

Delegation of authority to a self-interested agent is not without its difficulties. First, the independent bank supervisor may prefer to shirk rather than to supervise banks. Second, bankers may "capture" the bank supervisor through side-contracts (e.g., monetary bribes, in-kind favors, presents and future job offers) as for the latter not to enforce a supervisory policy.\textsuperscript{5} Third, some characteristics of supervisory information (e.g., opaqueness, complexity and confidentiality) may imply that the terms of the contract between society (e.g., a constitutional framer or legislative body seeking to maximize social welfare) and the independent bank supervisor may not be properly enforced. The Parliament or a Court of Law may find it impossible to verify whether the bank supervisor has evaded his responsibilities when they have access only to public information about banks. However, the bank supervisor may be able, and should be willing, to show hard, verifiable information (e.g., audited bank’s balance sheets and technical reports on the riskiness of a bank).

I characterize the optimal contract between society and the independent bank supervisor: the contract that gives the latter incentives to effectively supervise the bank at the lowest cost to the former. The optimal contract can be implemented by Law: a Bank Supervisor’s Charter Law or Statute. In addition to set up a politically independent bank supervisor, this Law should protect the bank supervisor for the exercise of his duties in good faith and should specify accountability arrangements.

Legal protection is good for incentives. A bank closure may imply high costs to the banker. In turn, the banker may sue the bank supervisor. If the

\textsuperscript{5}I will use the expressions “capture” and “side-contract” interchangeably.
outcome of such a lawsuit implies punishment to the bank supervisor even though he shows hard evidence that the bank was indeed excessively risky, then his incentives to close the bank down will weaken and his incentives to accept a side-contract from the banker will strengthen. Thus, legal protection (i.e., that the bank supervisor cannot be punished if he proves that he has closed down an excessively risky bank) reduces the scope for capture. Legal protection also makes it easier to hire competent supervisors. Indeed, the lack of legal protection would have to be compensated by higher revenues accruing to the supervisor. Consequently, enacting legal protection reduces the pecuniary cost of appointing an independent bank supervisor.

Accountability is good for incentives. Accountability implies answerability and responsibility: the bank supervisor must be prepared to justify his actions (e.g., by showing hard information to a judge) and he is liable to be blamed for the outcome of his actions. Without an appropriately designed accountability arrangement, the bank supervisor will not have incentives to supervise banks. Moreover, he will have incentives to accept side-contracts from bankers, and even to blackmail them by using closure as a threat.

The design of accountability arrangements matters. First, rewards and penalties accruing to the bank supervisor have to be contingent on the information he provides and on the assessment of the actions he has taken. Second, tough accountability arrangements specifying high expected penalties are better for incentives but they discourage bank supervisors to participate. Consequently, the policy maker should trade these effects off.

The theoretical analysis has the following testable implication: the probability of banks’ loans default (i.e., a measure of the riskiness of the banking sector) would be lower when the institutional arrangement for banking supervision is characterized by independent, legally protected and accountable bank supervisors. I use data collected by the Financial Sector Assessment Program (FSAP) on 81 countries around the world for the period 1999-2009 to test that hypothesis. The results from the analysis of the data are consistent with predictions. Moreover, the estimates imply that the probability of bank’s loans default significantly reduces from 10 percent to 3 percent.

---

6The Financial Sector Assessment Program (http://www.imf.org/external/np/fsap/fsap.asp) is jointly conducted by the International Monetary Fund and the World Bank since 1999 with the aim, among others, of identifying the strengths and vulnerabilities of a country’s financial system by assessing its observance of relevant financial sector standards and codes.
(approximately) when the supervisory arrangement has the characteristics described before.

In addition to quantify the effect of supervisory arrangements on the riskiness of banks, the empirical part of this paper sheds some light on the relative importance of different components of the supervisory arrangement. Adequate accountability arrangements and legal protection for bank supervisors are key elements to reduce the riskiness of the banking sector.

Around 30 percent of the countries in the sample fail to enact appropriate independence and accountability arrangements, and more than 50 percent of the bank supervisors are not legally protected. Hence, the results in this paper imply that policy makers should be persuaded of the benefits of enacting arrangements for banking sector supervision along the lines suggested in this paper.

The theoretical literature on independence and, more broadly, governance of banking sector supervisors has built up on the formal models of the literature on central banks’ independence. Quintyn and Taylor (2003, 2007) argue that the independence of supervisory agencies matters for banking stability for many of the same reasons that the independence of central banks matters for monetary stability, and that accountability arrangements should complement independence arrangements in order to make banking supervision effective. Rochet (2008) concludes that banking crises are largely amplified by political interference and that the key to successful reform is independence and accountability of bank supervisors. This paper provides a model formalizing the optimal contract for a bank supervisor. Independence, accountability arrangements and legal protection for bank supervisors emerge as necessary conditions to implement the optimal contract.

So far, empirical work has obtained non-conclusive results. Das et al. (2004) use FSAP data to construct an index of regulatory governance and find that it has a significant positive effects on their index of financial system soundness. Barth et al. (2004, 2006) construct a data set via surveys to document the relationship between several supervisory practices and banking sector outcomes. They find that supervisory independence is not related to bank development or efficiency or the level of non-performing loans.

Differently from these papers, the theoretical analysis in this paper pro-
vides a framework to test the causal effect of supervisory arrangements on the riskiness of the banking sector. It also allows the quantification of this effect and the uncovering of the key components of a supervisory arrangement for effective banking supervision.

The next section describes the model and its benchmark. Section 3 analyzes the key elements on a bank supervisor’s contract. Section 4 characterizes the optimal contract for an independent bank supervisor and derives policy implications. Section 5 presents the empirical results and Section 6 concludes. Technical proofs and tables are in the Appendix.

2. The Model and Its Benchmark

2.1. Agents, Technologies and Preferences

This model describes the relationship between a banker, a bank supervisor and politicians in a risk neutral environment.

Banker. The banker collects (fully insured) retail deposits in amount $D$, and invests in risky loans. The banker is the residual claimant of the bank’s assets and is protected by limited liability. Deposits are paid the risk-free interest rate, which is normalized to zero. For simplicity, the size of the bank’s balance sheet is normalized to 1: $D = 1$.

The banker has access to a risky investment technology (i.e., bank loans). This technology yields a random, gross return $\tilde{R}$ at maturity or a deterministic, gross return $R_l < 1$ if it is liquidated before maturity. $\tilde{R}$ is contingent on the state of the world at maturity, which is perfectly verifiable. For simplicity, I assume that there are three states of the world (upper, middle and default) with corresponding returns $R^u > R^m > 1 > R^d = 0$. There is no time discounting.

The distribution of probabilities of the bank’s loans return, $\tilde{R}$, depends on the banker’s private behavior: she can take excessive risks, leading to a deterioration of the distribution of probabilities on the returns in the sense of second-order stochastic dominance (see Table 1). Third parties may observe the riskiness of the bank’s loans only through supervision. I assume that excessive risk-taking implies a mean-preserving spread on the distribution of probabilities of $\tilde{R}$. Hence, if $\pi$ denotes the expected net present value of the bank’s loans, we have: $\pi^{\text{benchmark}} = \theta^u R^u + \theta^m R^m - 1$, $\pi^{\text{risk-taking}} = (\theta^u + \alpha) R^u + (\theta^m - \alpha - \beta) R^m - 1$, and $\pi = \pi^{\text{benchmark}} = \pi^{\text{risk-taking}}$. Banking activities add to social welfare: $\pi > 0$. 6
Table 1: Effects of the banker’s behavior on the distribution of probabilities of $\tilde{R}$.

<table>
<thead>
<tr>
<th>Behavior</th>
<th>$\Pr (R^u)$</th>
<th>$\Pr (R^m)$</th>
<th>$\Pr (R^d)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark</td>
<td>$\theta^u$</td>
<td>$\theta^m$</td>
<td>$\theta^d$</td>
</tr>
<tr>
<td>Risk-taking</td>
<td>$\theta^u + \alpha$</td>
<td>$\theta^m - \alpha - \beta$</td>
<td>$\theta^d + \beta$</td>
</tr>
</tbody>
</table>

The banker maximizes her expected profit, denoted $B$. If the banker does not take excessive risks, then $B_{\text{benchmark}} = \theta^u (R^u - 1) + \theta^m (R^m - 1)$. These two terms are the expected residual values of the bank’s assets (i.e., the return on loans net of the reimbursement to depositors) when bank loans’ returns are $R^u$ and $R^m$ respectively. Limited liability implies that the banker gets zero when $\tilde{R} = R^d = 0$. Rearranging terms and using the definition of the expected net present value of the bank’s loans (i.e., $\pi = \theta^u R^u + \theta^m R^m - 1$),

$$B_{\text{benchmark}} = \pi + \theta^d.$$

The banker’s expected profit when she takes excessive risks can be computed in the same way:

$$B_{\text{risk-taking}} = \pi + \theta^d + \beta.$$

The banker prefers to take excessive risks. If she takes excessive risks, then the probability of the upper and the default states will increase. So, the banker will benefit more frequently from high returns but her bank will also fail with a higher probability. However, limited liability implies that the banker does not internalize the downside losses. Otherwise stated, limited liability provides the banker with an incentive to gamble with depositors’ money; excessive risk-taking reports an additional expected profit $B_{\text{risk-taking}} - B_{\text{benchmark}} = \beta$ to the banker.\(^8\)

\(^8\)By increasing the stake of bank shareholders, capital regulation would boost their incentives to ensure that the bank is not taking excessive risks (see Santos, 2001, for a review of the literature). However, Kashyap et al. (2008) discuss a series of factors that put limits to the alignment-of-incentives function of bank capital before the subprime crisis. Moreover, Rochet (1992) makes an extensive study of the consequences of capital regulations on the portfolio choices of commercial banks and concludes that “capital regulations (at least of the usual type) are a very poor instrument for controlling the risk of banks: they
Bank Supervisor. The bank supervisor has the authority to gather private information from the bank and to penalize the banker by closing her bank down; if the bank is closed, the banker receives nothing.

The bank supervisor has access to a supervisory technology which is characterized as follows. If he exerts some unobservable effort, he will gather hard, verifiable information about the riskiness of the bank’s loans with probability \( \mu \in (0, 1) \). He will get no information with probability \( 1 - \mu \). For example, he might conduct on-site inspections with the aim of certifying the bank’s loans quality, and he might process financial information with the aim of proving that the bank is indeed excessively risky. If the bank supervisor shirks, he will gather no information and he will get a private benefit \( B \). I assume that \( \mu \geq \frac{\beta}{\pi + \theta} \). Thus, if the bank supervisor commits to close the bank whenever he gets information certifying excessive risk-taking by the banker, the banker will abstain from taking excessive risks.\(^9\)

The bank supervisor is a self-interested agent and is protected by limited liability. He receives an incentive scheme from society:\(^10\) he gets a transfer \( w \) and is subject to monitoring. The transfer can be viewed as the budget of the bank supervisor. It can also be viewed as a proxy for his private benefits, his prestige, or the size of the staff that the supervisor gets when holding office. Monitoring works as follows: a judge (e.g., a legislature or a court of law) demands the bank supervisor to show hard information in support of his actions, and punishes him (e.g., the supervisor is fired and forbidden to work in the banking sector) with probability \( p \in [0, 1] \). This probability may be contingent on the information (if any) that is provided by the bank supervisor and on the assessment of the actions that he has taken. If punishment occurs, the bank supervisor will not receive the transfer \( w \);
he will suffer from an exogenous, non-pecuniary (e.g., reputational) cost $c$ instead. Thus, the bank supervisor’s utility function can be written as

$$S = w - p(w + c).$$

The parameters $w$ and $p$ are endogenous and will be optimally determined in Section 4.

*Politicians.* Politicians can be thought of as the executive branch of the government. They seek to maximize social welfare.

2.2. Capture

To keep her additional expected profit because of excessive risk-taking, $B_{\text{risk-taking}} - B_{\text{benchmark}} = \beta$, the banker may offer side contracts to the bank supervisor in order the latter does not close the bank (i.e., in order to capture the supervisor).\(^{11}\) Because of the illegal nature of capture, the side-contract between the banker and the bank supervisor is subject to transaction costs: transferring $\beta$ units of bribes to the bank supervisor only increases his utility by an amount $b < \beta$; $\beta - b$ represents the transaction costs of side-transferring.\(^{12}\) The bank supervisor has all the bargaining power at the capture stage, so that he can extract all the additional expected profit, $\beta$, from the banker. Thus, $b$ represents the increase in the bank supervisor’s utility when he is captured by the banker.

2.3. Legal Status of the Bank Supervisor

The bank supervisor has *political independence* when he can decide to close the bank without requiring approval from politicians. The bank supervisor is under *political control* when he cannot decide to close the bank. In this case, such a decision is made by politicians.

2.4. Systemic Effects of a Bank Failure

The failure of the bank, either when the bank supervisor closes the bank down or when he does not but the bank’s loans default (i.e., when $\tilde{R} = R^d = 0$), has systemic effects: it generates a social cost $f$. This cost

\(^{11}\)Making this assumption is an helpful modeling short-cut since these side contracts may take the form of various in-kind or implicit favors, presents or job offers.

\(^{12}\)See Tirole (1992) for a discussion of the origins of these costs.
comprises, for example, contagion effects, the break-up of valuable lender-borrower relationships, the disruption on the payment system and the costs associated to the reimbursement of insured depositors.

2.5. Timing

The timing unfolds as follows:

— *Investment*: the banker collects deposits, decides whether or not to take excessive risks, and invests.

— *Supervision 1 (information gathering)*: the bank supervisor decides whether or not to exert unobservable effort to gather private information from the bank.

— *Capture*: the bank supervisor decides whether or not to accept a side-contract from the banker.

— *Supervision 2 (closure decision)*: if the bank supervisor has political independence, he decides whether or not to close the bank down. Under political control, politicians make such a decision. If the bank is closed down, its assets are liquidated and depositors reimbursed.

— *Returns*: if the bank was not closed down before, its loans’ return realizes. Depositors are reimbursed. The banker receives her payoff.

— *Monitoring*: the monitoring technology is applied. The bank supervisor decides whether to show or to hide supervisory information (when he has got it).

2.6. Benchmark: the First-best Outcome

For future references, I derive the first-best outcome that would be implemented by a social planner who keeps full control on banking supervision (i.e., does not rely on the bank supervisor), and has the ability to commit to its supervisory policy before the banker makes her risk-taking decision.

Expected social welfare is given by

\[ W = \pi - (\theta^d + \mathbbm{1}_{\{\text{risk-taking}\}} \beta) f, \]

where \( \mathbbm{1}_{\{\text{risk-taking}\}} \) is equal to 1 if the banker takes excessive risks and equal to 0 otherwise, and \( f \) is the systemic effect of a bank failure. Expected social welfare is equal to the bank’s net present value, \( \pi \), net of the expected social cost of a bank failure. The latter is contingent on the banker’s risk-taking behavior because the probability of bank’s loans default, \( \Pr(R^d) \), will increase by \( \beta \) if excessive risks are taken. Thus, it is first-best optimal that the banker abstains from taking excessive risks.
To implement this outcome, the social planner has to commit to gather private information from the bank and to close it down when the banker has taken excessive risks. Indeed, this supervisory policy satisfies the participation and the incentive compatibility constraints for the banker. The banker’s participation constraint is $B^{\text{benchmark}} = \pi + \theta^d \geq 0$, which is satisfied because $\pi > 0$ and $\theta^d > 0$. The banker’s incentive compatibility constraint is $B^{\text{benchmark}} = \pi + \theta^d \geq (1 - \mu)(\pi + \theta^d + \beta) = (1 - \mu)B^{\text{risk-taking}}$ because the bank will never be closed down if the banker does not take excessive risks but it will be closed, and its banker will get zero, with probability $\mu$ (the probability of getting information about the riskiness of the bank’s loans) if the banker does take excessive risks. This incentive compatibility constraint is satisfied because $\mu \geq \frac{\beta}{\pi + \theta^d + \beta}$.

2.7. The Problem of the Social Planner

When the social planner does not keep full control on banking supervision, it has to give incentives to the bank supervisor in order he effectively supervises the bank; i.e., in order he gathers private information from the bank and closes it down when the banker takes excessive risks. I adopt a normative viewpoint. I will characterize the optimal contract to be offered to the bank supervisor: the contract that gives the bank supervisor incentives to effectively supervise the bank at the lowest cost to the social planner.

It is natural to assume that the loss in expected social welfare because of excessive risk-taking by the banker, $W^{\text{benchmark}} - W^{\text{risk-taking}} = \beta f$, is larger than the maximum contracting cost of appointing a bank supervisor. Thus, in this model, banking supervision is (second-best) socially optimal.

3. The Key Elements on the Bank Supervisor’s Contract

In this section, I analyze the elements that are essential on the bank supervisor’s contract for banking supervision to be effective: political independence, accountability arrangements and legal protection.

3.1. Political Independence

Assume first that the bank supervisor is under political control (i.e., politicians are the ones who decide whether the bank should be closed down or not), and that politicians have received hard evidence that the banker has taken excessive risks. At the closure stage, politicians should close the bank down. However, welfare-maximizer politicians always prefer to
keep the bank open: if they keep the bank open, expected social welfare is 
\[ W_{\text{risk-taking}} = \pi - (\theta d + \beta) f. \] If they close the bank down, expected social
welfare is 
\[ W_{\text{closure}} = R^l - 1 - f \] because the bank’s loans are liquidated for
an amount \( R^l \), depositors are reimbursed and society suffers from the sys-
temic costs imposed by the failure of the bank. 
\[ W_{\text{risk-taking}} - W_{\text{closure}} = \pi + (1 - \theta d - \beta) f + (1 - R^l) > 0 \]
because \( \pi > 0, 1 - \theta d - \beta > 0, \) and \( R^l < 1. \)\(^\text{13}\)

Welfare-maximizer politicians confront a dynamic commitment problem
that makes non-credible the threat of closing the bank down: they find optimal
\emph{ex post} not to close a bank whose banker has taken excessive risks even
though it is optimal \emph{ex ante} to commit to this policy. In turn, the banker will
engage in excessively risky investments. This provides a rationale for giving
political independence to the bank supervisor. The following Proposition
summarizes this result.

\textbf{Proposition 1.} The bank supervisor should have political independence. 
Without political independence, the threat of closing down an excessively risky bank
is not credible and the banker always takes excessive risks.

3.2. Accountability Arrangements

According to the Collins English Dictionary, “If you are accountable to
someone for something that you do, you are responsible for it and must be
prepared to justify your actions to that person.” Responsible is defined as
“legally or morally obliged to take care of something or to carry out a duty;
liable to be blamed for loss or failure.” In this model, the bank supervisor is
accountable when he must justify his actions (e.g., by showing hard evidence
to a judge) and when he is liable to be blamed for the outcome of his actions:
when he is punished with some probability \( p > 0. \)

Assume that the bank supervisor has political independence and that he
is not accountable: \( p = 0. \) Thus, he receives the monetary transfer \( w \) with
certainty: \( S|_{p=0} = w. \) In this setting, the bank supervisor does not have
incentives to gather private information from the bank. First, his payoff is
not contingent on being able to show hard information on the riskiness of
the bank’s loans. Second, the bank supervisor gets a private benefit \( B \) by

\(^{13}\)This result does not depend on the use of the closure policy. It is still valid under
other policies as, for example, recapitalization and fines because none of them reduce the
probability with which the bank fails given that the banker has taken excessive risks, nor
the associated expected welfare cost due to a bank failure, \((\theta f + \beta)f. \)
shirking rather than exerting effort to gather information from the bank. Moreover, the bank supervisor has strong incentives to offer a side-contract to the banker. Since he gets no punishment for letting open an excessively risky bank nor for closing down a non-excessively risky one, the bank supervisor have incentives to blackmail the banker using closure as a threat. Consequently, accountability arrangements are necessary to give the bank supervisor incentives to effectively supervise the bank.

The design of the accountability arrangements matters: the probability $p$ has to be contingent on the information that is provided by the bank supervisor and on the assessment of the actions that he has taken. Assume instead that $p$ is non-contingent. If $p > 0$, the bank supervisor gets a payoff $S = w - p(w + c)$, which is not contingent on the information he may be able to show nor in the actions he may have taken. As in the case in which $p = 0$, this non-contingent payoff does not give the bank supervisor incentives to gather private information from the bank but it does give him incentives to blackmail the banker.

3.3. Legal Protection

If the bank supervisor closes down an excessively risky bank, the banker may sue the bank supervisor for the losses she suffers from. Legal protection means that such a lawsuit will imply no punishment to the bank supervisor when he is able to show hard evidence proving that it was indeed an excessively risky bank (i.e., $p = 0$ in this case).

Assume that the bank supervisor has political independence, that he is accountable and that he gets hard information that the banker has taken excessive risks. The bank supervisor should close the bank down. Assume however that the bank supervisor is not protected: if he closes the bank and shows hard evidence, he is punished with probability $p_2 > p_1$ otherwise. In this setting, if the bank supervisor closes the bank down, he gets $S|_{p_1} = w - p_1(w + c)$. If the bank supervisor is captured by the banker, he gets $S|_{p_2} = w - p_2(w + c) + b$ (i.e., the sum of his expected payoff and of the benefits from being captured). Simple algebra shows that the bank supervisor prefers to be captured by the banker if $p_1 \geq p_2 - \frac{b}{w+c}$. Consequently, legal protection (i.e., $p_1 = 0$) reduces the scope for capture.
4. The Optimal Contract with an Independent Bank Supervisor

In the previous section, I show that the bank supervisor has to have political independence. Otherwise, the politicians’ dynamic commitment problem undermines the credibility of the bank closure policy and the banker takes excessive risks. In this section, I characterize the contract that the social planner should offer to an independent bank supervisor: the incentive scheme \( \{w^*, p^*\} \) that gives the bank supervisor incentives to effectively supervise the bank at the lowest cost to the social planner.

4.1. The Optimal Contract

The bank supervisor should be rewarded when he has made a right closure decision, i.e., when “the bank supervisor has closed down an excessively risky bank, or he has kept open a non-excessively risky bank” (I denote \( e_2 \) this event). However, the judge in charge of monitoring the supervisor will not be able to verify whether this event (i.e., \( e_2 \)) is satisfied or not if it does not get hard information on the riskiness of the bank’s loans from the bank supervisor (see Figure 1). Moreover, the bank supervisor may prefer not to give such information to the judge. First, if the supervisor gets hard evidence that the bank is excessively risky and is captured by the banker, he may prefer to hide such information to the judge. Second, if the supervisor shirks in the information gathering activity, he has no information to show. Hence, the judge should rely of the event “the bank supervisor shows hard evidence on the riskiness of the bank’s loans” (which I denote \( e_1 \)) to assess the actions taken by the bank supervisor. For the sake of brevity, denote \( e_1^c \) and \( e_2^c \) the complementary events to \( e_1 \) and \( e_2 \) respectively, and \( p(e_1, e_2) \), \( p(e_1, e_2^c) \) and \( p(e_1^c) \) the probabilities with which the bank supervisor is punished when \( e_1 \) and \( e_2 \) occur, when \( e_1 \) occurs and \( e_2 \) does not, and when \( e_1 \) does not occur, respectively.

The bank supervisor has to get incentives to gather private information from the bank, to show such information to the judge, and to abstain from offering a side-contract to the banker (i.e., to close an excessively risky bank

---

14 A judge cannot do better by using (public) information on the realized return of the bank’s loans because the returns \( R^u \), \( R^m \), \( R^d \) and \( R^l \) are non-contingent on the behavior of the banker.

15 The occurrence of this event implies that the bank supervisor has exerted effort gathering the information from the bank.
and to keep open a non-excessively risky one). A priori, seven incentive compatibility conditions have to be satisfied: three of them prevent deviations in only one direction, three others prevent deviations in two directions simultaneously, and the last one prevents the deviation in the three directions simultaneously.\footnote{There also are some technical conditions to be satisfied because $p$ is a probability.} However, some of them are redundant. Only two are relevant: the one stating that the bank supervisor does not have interest to offer a side-contract to the banker (i.e., he is not captured), and the one expressing that he has interest to exert effort to gather private information from the bank and simultaneously does not want to be captured. The bank supervisor should also accept the incentive scheme. The three relevant constraints (the two relevant incentive compatibility conditions and the participation constraint) can be written as:\footnote{I am presenting here an sketch of the proof of Proposition 2. See Appendix A for the complete proof.}

\begin{align*}
p(e_1, e_2) - p(e_1, e_2) &\geq \frac{b}{\mu(w + c)}, \quad \text{(IC-3)} \\
p(e_1^c) - p(e_1, e_2) &\geq \frac{B + b}{\mu(w + c)}, \quad \text{(IC-5)} \\
p(e_1^c) + \frac{\mu}{1 - \mu} p(e_1, e_2) &\leq \frac{w}{(1 - \mu)(w + c)}. \quad \text{(PC)}
\end{align*}
conditions (IC-3) and (IC-5). Indeed, the bank supervisor is more willing to participate and to effectively supervise the bank if he is rewarded with certainty for that (i.e., if he receives the transfer $w$ and is never penalized). Thus, it is optimal to set $p^*(e_1, e_2) = 0$.

To set $p(e_1, e_2)$ as large as possible is good for incentives: it relaxes (IC-3). Indeed, the fact that the bank supervisor does not close an excessively risky bank is a clear signal that he has been captured by the banker. To preserve incentives, the bank supervisor should be punished with probability one: $p^*(e_1, e_2) = 1$.

Two cases, depending on the value of the parameters, have to be considered to determine the optimal transfer, $w^*$, and the optimal probability of punishment, $p^*(e_1)$. In the first case, the private cost that the bank supervisor suffers from when he is punished, $c$, is lower than the sum of the benefits from shirking in the information gathering activity and from being captured by the banker: $c < B + b$. In this case, to punish the bank supervisor with probability one when he does not show hard information, $p^*(e_1^c) = 1$, is not enough to restore incentives. Moreover, the bank supervisor always participates (i.e., despite the transfer $w$ is zero) because he gets a private benefit $B + b - c > 0$ with certainty. The social planner has to offer a large enough transfer to the bank supervisor in order to restore incentives: $w^*$ has to satisfy $\mu w^* - (1 - \mu) c = B + b - c$, where the left-hand side is the bank supervisor’s expected payoff if he behaves and the right-hand side is his private benefit from deviating. Thus, $w^* = \frac{B + b}{\mu} - c$.

If $c \geq B + b$, the incentive compatibility conditions are less demanding than in the previous case: to set $p(e_1^c) = 1$ is not necessary to provide incentives. Moreover, it implies that the bank supervisor has to be compensated with a larger than necessary transfer, $w$, in order to ensure the participation of the bank supervisor. The optimal value for $p(e_1^c)$ is $p^*(e_1^c) = \frac{B + b}{(1 - \mu)(B + b) + \mu c} < 1$, and the optimal value for $w$ is $w^* = \frac{1 - \mu}{\mu} (B + b)$, which is lower than the transfer that is required when $p(e_1^c) = 1$: $w = \frac{B + b}{\mu} - c$.

The following Proposition summarizes these results.

---

18If the bank supervisor exerts effort to gather private information from the bank, he obtains it with probability $\mu$. Thus, if he exerts effort to gather information and he is not captured by the banker, he will get $w$ with probability $\mu$ (because $p^*(e_1, e_2) = 0$) and he will suffer from the cost $c$ with probability $1 - \mu$ (because $p^*(e_1^c) = 1$).
Proposition 2. The optimal contract to be offered to a politically independent bank supervisor in order that he effectively supervises the bank (i.e., he exerts effort to gather private information from the bank, he closes down an excessively risky bank and he keeps open a non-excessively risky one) is characterized by the following incentive scheme:

- a transfer to the bank supervisor if he is not punished:
  \[ w^* = \begin{cases} 
  B + b - c & \text{if } c < B + b \\
  \frac{1 - \mu}{\mu}(B + b) & \text{if } c \geq B + b 
  \end{cases} \]

- probabilities of punishment:
  \[ p^*(e_1, e_2) = 0, \]
  \[ p^*(e_1, e_2^c) = 1, \]
  \[ p^*(e_1^c) = \begin{cases} 
  1 & \text{if } c < B + b \\
  \frac{1}{(1-\mu)(B+b)+\mu c} & \text{if } c \geq B + b 
  \end{cases} \]

where \( e_1 \) stands for the event “the bank supervisor shows hard evidence on the riskiness of the bank’s loans”, \( e_2 \) stands for the event “the bank supervisor has closed down an excessively risky bank, or he has kept open a non-excessively risky bank”, and \( e_1^c \) and \( e_2^c \) stand for the complementary events to \( e_1 \) and \( e_2 \) respectively.

Proof. The proof is in Appendix A. ■

4.2. Policy Implications

In this section, I offer some reflections on the ways in which the optimal contract characterized in Proposition 2 can be implemented by an adequate institutional arrangement for banking supervision.

The optimal contract should be enacted by a Statute or Charter Law for the bank supervisor. To enact the contract by law has the following advantages: first, since a law can only be replaced by another law, and laws generally require long, costly and complex processes to be passed, then to enact the contract by law reduces the scope for renegotiation. Second, the natural way to enforce laws is through the judicial branch of the government, then the enforcement of the contract is strengthened. Otherwise stated, the
execution of the terms of the supervisor’s Charter Law will be not only subject to the surveillance of the legislature (who offers the contract), but also to judicial review.

The Charter Law should provide political independence for the bank supervisor. It should also give an adequate budget to him (i.e., he should be rewarded according to $w^*$). The optimal contract implies that the bank supervisor cannot be punished when he has effectively supervised the bank (i.e., the probability of punishment when the bank supervisor shows hard evidence that he has closed down an excessively risky bank is equal to zero: $p^*(e_1, e_2) = 0$). Thus, the Charter Law should provide legal protection for the bank supervisor. Finally, the optimal contract implies that $p^*(e_1, e_2) = 1$ and that $p^*(e_1) > 0$. The bank supervisor has to justify his decisions by showing hard evidence to the judge and he is responsible for the outcome of his actions. Thus, the Charter Law should specify accountability arrangements.$^{19}$

To summarize, the optimal contract characterized in Proposition 2 can be implemented by a Bank Supervisor’s Charter Law or Statute that:

- provides political independence for the bank supervisor and gives him an adequate budget;
- provides legal protection for the bank supervisor; and
- specifies accountability arrangements for the bank supervisor.

5. Empirical Evidence

In this section, I provide empirical evidence supporting the policy implications of the theoretical model.

5.1. Empirical Strategy

The optimal contract characterized in Proposition 2 gives the bank supervisor incentives to effectively supervise the bank. In turn, the banker

$^{19}$Hüpkes et al. (2005, 2006) give operational content to the concept of accountability. They also discuss specific arrangements that can best secure the objectives of bank supervisors’ accountability: regular and ad hoc reports to the legislative and the executive branches of the government, as well as to the public in general, judicial review, and supervisor’s liability for faulty supervision.
abstains from taking excessive risks. Thus, the theoretical model has the following testable implication: the probability of bank’s loans default, \( \Pr(R^d) \), would be lower when the bank supervisor is independent, legally protected and accountable.

To test this implication I use the following cross-country linear regression model:

\[
NPL_i = a_1 + a_2 \times CP1_i + \epsilon_i,
\]

(Model 1)

where \( NPL_i \) (the ratio of non-performing loans to total loans in the banking system of country \( i \)) is an estimation of the probability of default of banks’ loans in country \( i \) (i.e., \( \Pr(R^d_i) \equiv NPL_i - \epsilon_i \); \( \epsilon_i \) is the estimation error), \( CP1_i \) is the observed compliance of country \( i \) with the supervisory arrangement characterized in Section 4 (see Table B.1 in the Appendix for a precise definition), and \( a_1 \) and \( a_2 \) are parameters to be estimated. Under the assumptions that \( \epsilon \) is uncorrelated with \( CP1 \) and that the variance of \( CP1 \) is different from zero, the parameters in Model 1 are identified:

\[
\theta^f = a_1 + a_2, \quad \text{and} \quad \beta = -a_2.
\]

To test the individual contribution of independence, legal protection and accountability, I use the following cross-country linear regression models:

\[
NPL_i = a_1^j + a_2^j \times CP1_j^i + \epsilon_i,
\]

(Models 2-4)

where \( CP1_j^i \) is the observed compliance of country’s \( i \) supervisory arrangement with key element \( j \), \( j \in \{ \text{independence, legal protection, accountability} \} \), and \( a_1^j \) and \( a_2^j \) are parameters to be estimated. Under the assumptions that \( \epsilon \) is uncorrelated with \( CP1^j \) and that the variance of \( CP1^j \) is different from zero, these parameters are identified.

5.2. Data Set

The Financial Sector Assessment Program (FSAP) conducted since 1999 by the International Monetary Fund and the World Bank is the main source of data. Every time that a FSAP is conducted for an individual country, a Report on its Observation of Standards and Codes (ROSC) is published. In particular, ROSCs summarize the extent to which countries observe the Core Principles for Effective Banking Supervision (Core Principles thereafter), a framework of minimum standards for sound supervisory practices that are considered universally applicable (Basel Committee on Banking Supervision, 2006).
Table B.2 in the Appendix shows the FSAP’s data for the three key elements on Core Principle 1: (independence) “Each [authority involved in the supervision of banks] should possess operational independence, transparent processes, sound governance and adequate resources (...)”; (legal protection) “A suitable legal framework for banking supervision is also necessary, including legal protection for supervisors”; and (accountability) “Each such authority should (...) be accountable for the overall exercise of its duties.” These data allow the construction of a variable (named CP1) which accounts for the overall compliance of individual countries with these key elements.

The data set contains information for all countries for which the FSAP had reported at least one ROSC as for January 2010 (i.e., for the period 1999-2009): 81 countries in total. Many countries present missing values for some of the key elements of CP1 (see Table B.2 for details). For the analysis in the next two sections I consider countries with information for all key elements of CP1 (i.e., I assume that observations are missing at random). The robustness of the results is checked in Section 5.5. The ratio of non-performing loans to total loans (NPL), as well as other variables that are described in Table B.1 in the Appendix, are averages over the period 1999-2009.

5.3. Descriptive Analysis

Summary statistics are presented in Table B.4 in the Appendix. Around 30 percent of the countries in the sample fail to give adequate levels of independence to their bank supervisors and to enact appropriate accountability arrangements. Moreover, more than 50 percent of the countries in the sample

20Following the methodology proposed by the Basel Committee on Banking Supervision (1999), the assessment of compliance with each element of the Core Principles is done using a four point grading scale. The four grades reported on the ROSCs are: (0) non-compliant, implying no substantive implementation of the Principle; (1) materially non-compliant, if there are severe shortcomings, despite the existence of formal rules, regulations and procedures, and there is evidence that supervision has clearly not been effective; (2) largely compliant, whenever only minor shortcomings are observed which do not raise any concerns about the authority’s ability and clear intent to achieve full compliance; and (3) compliant, when all essential criteria are met without any significant deficiencies.

21There may be many ways of constructing CP1. I use the following: CP1i = 1 if country i is largely or fully compliant with each of the three key elements, otherwise CP1i = 0. Table B.1 in the Appendix shows alternative definitions for CP1, and Section 5.5 shows that the results are robust to changes in the definition of CP1.
do not provide legal protection to their bank supervisors.

The cross-correlation Table B.3 in the Appendix shows a negative relationship between the ratio of non-performing loans to total loans (NPL) and CP1. It also shows negative relationships between NPL and each of the key elements of CP1.

5.4. Regression Results

Table 2, column (1), shows the regression coefficients for $a_1$ and $a_2$ in Model 1 estimated by using ordinary least squares (OLS). Both coefficients are significant at the 1 percent level and have the expected sign: $\hat{a}_1 > 0$ and $\hat{a}_2 < 0$; thus, the estimates of the parameters of interest do not violate the theoretical restrictions imposed by the model.

Table 2: OLS Regressions. Dependent variable: non-performing loans to total loans (percentage)

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>CP1</td>
<td>Independence</td>
<td>Legal Protection</td>
<td>Accountability</td>
</tr>
<tr>
<td></td>
<td>-7.251***</td>
<td>-4.324*</td>
<td>-7.764***</td>
<td>-7.458***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.053)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>Constant</td>
<td>10.430***</td>
<td>11.749***</td>
<td>12.086***</td>
<td>12.456***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>N</td>
<td>44</td>
<td>75</td>
<td>63</td>
<td>52</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.351</td>
<td>0.047</td>
<td>0.273</td>
<td>0.196</td>
</tr>
</tbody>
</table>

Notes: p-values for $H_0$: the coefficient is equal to zero are in parentheses below the estimated coefficients. Each regression uses heteroskedasticity-consistent standard errors from an OLS model. * significant at the 0.10 level, ** significant at the 0.05 level, *** significant at the 0.01 level.

22 Each regression in Table 2 uses heteroskedasticity-consistent standard errors. Tests for heteroskedasticity (not reported) were conducted for all regressions. The null hypothesis of constant variance of the error term was always rejected.
The point estimation for $\beta$ is $\hat{\beta} = 7.251$, and the point estimation for $\theta^f$ is $\hat{\theta}^f = 3.179$. This means that the existence of an independent, legally protected and accountable bank supervisor reduces the average probability of banks' loans default from 10 percent to 3 percent approximately. This is the main empirical result.

Columns (2) to (4) in Table 2 attempt to analyze the individual contribution of the key elements of $CP1$ to the previous result (Models 2 to 4). The coefficient of independence is significant at the 5.3 percent level, and the coefficients of legal protection and accountability are significant at the 1 percent level. All estimated coefficients have the expected sign: compliance with the component parts of $CP1$ individually reduces the average probability of banks' loans default. The coefficients of legal protection and accountability are larger (in absolute value) than the coefficient of independence. Their explanatory power is also larger (the adjusted $R^2$s are larger). Consequently, legal protection and accountability are the most important elements on a supervisory arrangement.

To summarize, the empirical implications of this paper are not rejected by FSAP’s data. The existence of an independent, legally protected and accountable bank supervisor significatively reduces the average probability with which banks’ loans default. Moreover, while all three elements individually contribute to the previous result, the existence of accountability arrangements and legal protection for bank supervisors are the most important elements to reduce the riskiness of the banking sector.

5.5. Robustness Checks

The empirical results presented in the previous section are robust to a series of checks. In this section I make brief comments about these robustness checks.

Different construction of $CP1$. Column (1) in Table B.5 in the Appendix shows the regression results of estimating Model 1 using a different definition for the explanatory variable ($CP_{1,1}$, see Table B.1 for details). The different construction of the explanatory variable implies only slight differences in the estimated coefficients but it does not change the qualitative results.

Statutory information. Columns (2) to (5) in Table B.5 in the Appendix reproduce the regressions in Table 2 using an enlarged data set. The concern that I analyze is whether the small size of the main data set affects the
results. I enlarge the main data set by replacing its missing values by an assessment of the compliance with Core Principle 1 that is based on the revision of statutory information for bank supervisors: I read the Charter Laws of bank supervisors and assigned a grade to each particular country in each component part of Core Principle 1 (that were missing in the main data set) according to the methodology published by Basel Committee on Banking Supervision (1999) (bold figures in Table B.2 show the information coming from this source). A possible caveat with these data is that they reflect declared compliance (e.g., the legislator’s desired level of supervisory independence and accountability) but do not account for the existence of shortcomings that prevent its implementation. The coefficients in columns (2) to (5) in Table B.5 differ only slightly from those that are in Table 2. Thus, the size of the main data set does not affect the results.

Control variables. Recent theoretical and empirical work suggests a number of factors that may affect the riskiness of a banking sector. Table B.6 in the Appendix shows the results for the following cross-country linear regression models:

\[ NPL_i = a_1^k + a_2^k \times CP1_i + a_3^k X^k + \epsilon_i, \quad \text{(Models 5-8)} \]

where \( X^k \) contains exogenous determinant of the riskiness of banks, and \( a_3^k \) is a vector of parameter to be estimated. The coefficients for \( CP1 \) estimated using Models 5 to 8 slightly differ from the coefficient for \( CP1 \) estimated using Model 1. Moreover, the introduction of exogenous control variables does not reduce the explanatory power of \( CP1 \). Thus, the empirical results in the last section are robust to the introduction of exogenous control variables.\(^{23}\)

Das et al. (2004) suggest that macroeconomic factors as the government’s fiscal position, the rate of inflation and the short-term real interest rate may affect the quality of bank loans. Column (1) in Table B.6 shows the regression results when \( X^k \) is the short-term real interest rate (\( RIR \), Model 5). Its coefficient has a positive sign, suggesting that higher real interest rates make it harder for borrowers to honor their loans, but it is not significant. Similar results (not reported) are obtained when controlling for the government’s fiscal deficit as a percentage of the gross domestic product, the rate of inflation, the rate of growth of the gross domestic product and the gross

\(^{23}\)The results for Models 2 to 4 are also robust to the introduction of exogenous control variables. Regression results, no reported, are available upon request.
domestic product per capita.

Column (2) in Table B.6 shows the regression results when controlling for an indicator of the institutional and governance environment (Model 6). Kaufmann et al. (2006) construct a Regulatory Quality (RQ) indicator as a measure of the ability of the government to formulate and implement sound policies and regulations. The higher the global quality of regulation in a country, the lower the level of non-performing loans in its banking sector: the coefficient of RQ is negative and significant at the 6 percent level. However, controlling for the RQ indicator does not reduce the explanatory power of CP1. Similar results (not reported) are obtained if the RQ indicator is replaced by an indicator of the quality of the civil service and the degree of its independence from political pressures, and by an indicator of the quality of contract enforcement, property rights, the police and the courts (Kaufmann et al.’s Government Effectiveness and Rule of Law indicators respectively).

Column (3) in Table B.6 shows the regression results when controlling for an indicator of the structure of the banking system (Model 7): the percentage of the banking system’s assets that is held by state-owned banks (SOB). Barth et al. (2006) suggest that it is important to control for this variable because government ownership may distort the application of different supervisory approaches. The SOB’s coefficient is not significant. Moreover, controlling for SOB (as well as for the degree of foreign-owned banks and for a measure of the concentration in the banking industry—these results are not reported) does not change the results with respect to CP1.

Finally, La Porta et al. (1998; 1999) argue that historically determined differences in countries’ legal systems help explain international differences in financial markets today. They find that countries whose legislation is inspired by the French Commercial Code and the Socialist Law are more willing to exhibit inferior government performance (La Porta et al. 1999) and inferior creditors’ protection (La Porta et al. 1998) than those countries whose legislation is inspired by the English Common Law. Thus, the former group of countries should show higher levels of non-performing loans than the latter group. Column (4) in Table B.6 confirms this hypothesis. However, the introduction of dummy variables to account for the legal origin of countries (Model 8) does not affect the results with respect to CP1.

Instrumental variables. CP1 and ε might be correlated. First, since the estimation of the probability with which country’s i bank loans default (i.e., NPLi) is done by country’s i supervisor, then country’s i compliance with
Core Principle 1 might affect this estimation, leading to a measurement error problem. Second, although one can think that supervisory institutions cannot be easily changed as a result of the current or past level of non-performing loans (because it is costly and complex to change institutions), one cannot rule out a series of “third factors” explaining both the supervisory arrangements and the level of non-performing loans. This leads to an endogeneity problem. I run instrumental variable regressions to check the robustness of the previous section results to these problems.

To select instrumental variables for \( CP_1 \) I use recent theoretical and empirical work. First, some argue that geography influences economic institutions (see Barth et al. 2004, p. 241, and 2006, p. 193, and the references therein). According to these work, countries with rich natural endowments are particularly conducive to the development of complex economic institutions. However, countries with poor climates (in particular the tropics) may be less likely to develop a wide array of institutions, including bank supervisory institutions. Thus, I use latitudinal distance from the equator as an instrument. Second, La Porta et al. (1998, 1999) argue that differences in the legal origin of countries may influence the strength of governments and its relationship with economic and financial institutions. Thus, I also use dummy variables accounting for the country’s legal origin as instruments. Importantly, the first stage regressions always reject the null hypothesis that these variables do not explain the cross-country variation in \( CP_1 \).

Table B.7 in the Appendix shows the results of the instrumental variables regressions using a two-stage least squares estimator. The estimated coefficients for \( a_1 \) and \( a_2 \) in Model 1 (column (1)) are significant at the 1 percent level and have the expected sign. Thus, the results obtained in the previous section are robust to potential measurement errors and endogeneity issues. Moreover, they are robust to both possible endogeneity and the consideration of exogenous factors (i.e., control variables) affecting the amount of non-performing loans simultaneously (columns (2) to (4) show the regression results for Models 5 to 7 respectively).

The second part of Table B.7 shows that the instruments pass a series of tests (the Sargan (1958)-Hansen (1982) test of over identifying restrictions, and two versions of the Kleibergen and Paap’s (2006) rank statistic to test for under and weak identification), confirming that the instruments are strongly correlated with the potentially endogenous regressors.
6. Concluding Remarks

This paper formalizes an optimal contract for a bank supervisor and derives policy implications. The results imply that political independence for the bank supervisor is necessary to ensure the credibility of a supervisory policy. Moreover, independence arrangements should be complemented by accountability arrangements (i.e., the bank supervisor should be answerable and responsible for the outcome of his actions), and by legal protection for the bank supervisor.

The theoretical analysis implies testable implications about the consequences of supervisory arrangements on the riskiness of the banking sector. The model allows the quantification of this effect on data coming from the Financial System Assessment Program: the existence of independent, legally protected and accountable bank supervisors significantly reduces the average probability of banks’ loans default from 10 percent to 3 percent approximately.

The empirical part of this paper also uncovers the key elements of a supervisory arrangement for effective banking supervision: legal protection and accountability. Around 30 percent of the countries in the sample fail to enact appropriate independence and accountability arrangements, and more than 50 percent of the bank supervisors are not legally protected. Hence, the results in this paper imply that policy makers should be persuaded of the benefits of enacting institutional arrangements for banking sector supervision along the lines suggested in this paper.

Acknowledgements

I am very grateful to Jean-Charles Rochet for his comments, encouragement and suggestions. I would also like to thank Rafael Repullo and Javier Suarez for helpful discussions during my visit to the Centro de Estudios Monetarios y Financieros (CEMFI), and Catherine Casamatta, Roberta Dessi, Fabiana Gómez, Gerardo Licandro, Donato Masciandaro, David Pacini, Leandro Zipitriá, and participants at the 2009 ENTER Meeting in London, the 2009 Augustin Cournot Doctoral Days in Strasbourg and the 2009 European Economic Association Meeting in Barcelona for their comments.
Appendix

A. Proof of Proposition 2

A priori, seven incentive compatibility conditions have to be satisfied. However, two of them are no relevant because the bank supervisor has no information to hide if he has not exerted effort to gather it (see Figure 1). The other incentive compatibility conditions can be written as follows.

Show information. The incentive compatibility condition under which the bank supervisor does not hide information on the riskiness of the bank is:

\[ \mu [w - p(e_1, e_2)(w + c)] + (1 - \mu) [w - p(e_1^c)(w + c)] \geq w - p(e_1^c)(w + c), \]

where the left-hand side is the bank supervisor’s expected payoff if he exerts effort to gather the information from the bank, he shows it and he does not engage on a side-contract with the banker (if the bank supervisor behaves, thereafter), and the right-hand side is his expected payoff if he hides the information. This incentive compatibility condition can be rewritten as:

\[ p(e_1^c) - p(e_1, e_2) \geq 0. \] (IC-1)

Gather information. The incentive compatibility condition under which the bank supervisor exerts effort to gather private information from the bank is:

\[ \mu [w - p(e_1, e_2)(w + c)] + (1 - \mu) [w - p(e_1^c)(w + c)] \geq w - p(e_1^c)(w + c) + B, \]

where the left-hand side is the bank supervisor’s expected payoff if he behaves, and the right-hand side is the sum of his expected payoff if he shirks and of the benefits from shirking. This incentive compatibility condition can be rewritten as:

\[ p(e_1^c) - p(e_1, e_2) \geq \frac{B}{\mu(w + c)}. \] (IC-2)

No side-contracts. The incentive compatibility condition under which the bank supervisor is not captured by the banker is:

\[ \mu [w - p(e_1, e_2)(w + c)] + (1 - \mu) [w - p(e_1^c)(w + c)] \geq \mu [w - p(e_1, e_2^c)(w + c)] + (1 - \mu) [w - p(e_1^c)(w + c)] + b, \]

where the left-hand side is the bank supervisor’s expected payoff if he behaves, and the right-hand side is the sum of his expected payoff if he engages
on a side-contract with the banker and of the benefits from being captured. This incentive compatibility conditions can be rewritten as:

\[ p(e_1, e_2^c) - p(e_1, e_2) \geq \frac{b}{\mu(w + c)}. \]  

**(IC-3)**

*Show information and no side-contracts.* The incentive compatibility condition under which the bank supervisor does not hide information and is not captured by the banker is:

\[ \mu [w - p(e_1, e_2)(w + c)] + (1 - \mu) [w - p(e_1^c)(w + c)] \geq w - p(e_1^c)(w + c) + b, \]

where the left-hand side is the bank supervisor’s expected payoff if he behaves, and the right-hand side is the sum of his expected payoff if he hides information and of the benefits from being captured. This incentive compatibility condition can be rewritten as:

\[ p(e_1^c) - p(e_1, e_2) \geq \frac{b}{\mu(w + c)}. \]  

**(IC-4)**

*Gather information and no side-contracts.* Finally, the incentive compatibility condition under which the bank supervisor exerts effort to gather private information from the bank and is not captured by the banker is:

\[ \mu [w - p(e_1, e_2)(w + c)] + (1 - \mu) [w - p(e_1^c)(w + c)] \geq w - p(e_1^c)(w + c) + B + b, \]

where the left-hand side is the bank supervisor’s expected payoff if he behaves, and the right-hand side is the sum of his expected payoff if he shirks and of the benefits from shirking and from being captured. This incentive compatibility condition can be rewritten as:

\[ p(e_1^c) - p(e_1, e_2) \geq \frac{B + b}{\mu(w + c)}. \]  

**(IC-5)**

Condition (IC-5) implies conditions (IC-1), (IC-2), and (IC-4). Thus, the latter three incentive compatibility conditions are redundant. The relevant incentive compatibility conditions are (IC-3) and (IC-5).

The bank supervisor has to be willing to accept the incentive scheme. His participation constraint is:

\[ \mu [w - p(e_1, e_2)(w + c)] + (1 - \mu) [w - p(e_1^c)(w + c)] \geq 0. \]
Rearranging terms, it can be rewritten as:

\[ p(e_1^c) + \frac{\mu}{1-\mu} p(e_1, e_2) \leq \frac{w}{(1-\mu)(w+c)}. \]  

(\text{PC})

Three technical constraints are introduced because \( p \) is a probability:

\[ 0 \leq p(e_1, e_2) \leq 1, \]  

(T1)

\[ 0 \leq p(e_1, e_2^c) \leq 1, \]  

(T2)

\[ 0 \leq p(e_1^c) \leq 1. \]  

(T3)

To reduce \( p(e_1, e_2) \) is good for participation and for incentives: it relaxes the participation constraint (PC), and the relevant incentive compatibility conditions (IC-3) and (IC-5). Thus, it is optimal to set \( p^*(e_1, e_2) = 0. \)

The participation constraint (PC), and the relevant incentive compatibility constraints (IC-3) and (IC-5) can be rewritten as:

\[ p(e_1^c) \leq \frac{w}{(1-\mu)(w+c)}, \]  

(PC’)

\[ p(e_1, e_2^c) \geq \frac{b}{\mu(w+c)}, \]  

(IC-3’)

\[ p(e_1^c) \geq \frac{B+b}{\mu(w+c)}. \]  

(IC-5’)

To set \( p(e_1, e_2^c) \) as large as possible is good for incentives (it relaxes (IC-3’)); thus, \( p^*(e_1, e_2^c) = 1 \). Given \( p^*(e_1, e_2^c) = 1 \), (IC-3’) can be rewritten as:

\[ w \geq \frac{b}{\mu} - c. \]  

(IC-3”)

Next, I combine conditions (PC’), (IC-5’), and (T3). Combining (PC’) and (T3) implies:

\[ w \geq 0. \]  

(PC-T3)

Combining (IC-5’) and (T3) implies:

\[ w \geq \frac{B+b}{\mu} - c. \]  

(IC5-T3)

Finally, combining (PC’) and (IC-5’) implies:

\[ w \geq \frac{1-\mu}{\mu}(B+b). \]  

(PC-IC5)
Condition (IC5-T3) implies condition (IC-3\textsuperscript{"s}'), and condition (PC-IC5) implies condition (PC-T3). Thus, the relevant conditions are (IC5-T3) and (PC-IC5).

In order to minimize the transfer to the bank supervisor (and preserve incentives), \( w^* = \max \left\{ \frac{1-\mu}{\mu} (B + b), \frac{B+b}{\mu} - c \right\}. \) The optimal values for \( p(e_1^c) \) are obtained by replacing \( w^* \) into (PC\textsuperscript{'}') and (IC-5\textsuperscript{'}): \( p^*(e_1^c) = 1 \) if \( c < B + b \), and \( p^*(e_1^c) = \frac{B+b}{(1-\mu)(B+b)+\mu c} \) if \( c \geq B + b. \)
### B. Tables

**Table B.1: Definitions and Data Sources for Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independence</td>
<td>Compliance with “Each such authority should possess operational independence, transparent processes, sound governance and adequate resources (...)”</td>
<td>IMF: FSAP Principle 1(2)</td>
</tr>
<tr>
<td>Legal Protection</td>
<td>Compliance with “A suitable legal framework for banking supervision is also necessary, including legal protection for supervisors.”</td>
<td>IMF: FSAP Principle 1(5)</td>
</tr>
<tr>
<td>Accountability</td>
<td>Compliance with “Each such authority should (...) be accountable for the overall exercise of its duties.” Note: Independence, Legal Protection and Accountability are coded: 0=Non-compliant, 1=Materially non-compliant, 2=Largely compliant, 3=Compliant. For regression purposes, 0 and 1 are recoded to 0, and 2 and 3 are recoded to 1.</td>
<td>IMF: FSAP Principle 1(2)</td>
</tr>
<tr>
<td>CP1</td>
<td>Compliance with Core Principle 1 (Independence, Legal Protection and Accountability). If all three component parts are equal to 1, then CP1=1; otherwise, CP1=0. Author’s calculation</td>
<td>Author’s calculation</td>
</tr>
<tr>
<td>CP1_1</td>
<td>Compliance with Core Principle 1 (Independence, Legal Protection and Accountability). (1) $CP1_1_{aux}=(Ind.+Legal\ Pro.+Acc)/3$; (2) if $CP1_1_{aux} \leq \text{median of } CP1_1_{aux}$, then $CP1_1=0$; (3) otherwise, $CP1_1=1$. Author’s calculation</td>
<td>Author’s calculation</td>
</tr>
<tr>
<td>CP1_2</td>
<td>Compliance with Core Principle 1 (Independence, Legal Protection and Accountability). If all three component parts are equal to 1, then CP1_2=1; otherwise, CP1_2=0. Statutory information (i.e., Charter Laws for bank supervisors) is used to replace missing values of Independence, Legal Protection and Accountability Author’s calculation</td>
<td>Author’s calculation</td>
</tr>
<tr>
<td>NPL</td>
<td>Non-performing loans to total loans (percentage). Average 1999 - 2009. IMF: FSAP</td>
<td></td>
</tr>
<tr>
<td>RIR</td>
<td>Real interest rate. Nominal lending rate (IFS’s line 60P) minus the contemporaneous rate of inflation (IFS’s line 64: CPI). Average 1999 - 2009. IMF: IFS</td>
<td></td>
</tr>
<tr>
<td>Latitude</td>
<td>Absolute value of the latitude of the capital city</td>
<td></td>
</tr>
</tbody>
</table>
Table B.2: Financial Sector Assessment Program’s and Statutory Data

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Albania</td>
<td>2005</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>Algeria</td>
<td>2004</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Antigua and Barbuda</td>
<td>2004</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>Australia</td>
<td>2006</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Austria</td>
<td>2004</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>Bahrain</td>
<td>2006</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Barbados</td>
<td>2009</td>
<td>1</td>
<td></td>
<td></td>
<td>Belarus</td>
<td>2009</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Belgium</td>
<td>2006</td>
<td>2</td>
<td></td>
<td></td>
<td>Bosnia and Herzegovina</td>
<td>2006</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>2002</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>Cameroon</td>
<td>2000</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Canada</td>
<td>2000</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>Chile</td>
<td>2004</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Colombia</td>
<td>2005</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>Costa Rica</td>
<td>2003</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Croatia</td>
<td>2002</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>Cyprus</td>
<td>2006</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Czech Republic</td>
<td>2001</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>Denmark</td>
<td>2006</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Estonia</td>
<td>2009</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>Finland</td>
<td>2001</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>France</td>
<td>2004</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>Gabon</td>
<td>2002</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Georgia</td>
<td>2001</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>Germany</td>
<td>2003</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Ghana</td>
<td>2003</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>Greece</td>
<td>2006</td>
<td>3</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Haiti</td>
<td>2009</td>
<td>1</td>
<td></td>
<td></td>
<td>Hong Kong</td>
<td>2003</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Hungary</td>
<td>2002</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>Iceland</td>
<td>2003</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Ireland</td>
<td>2006</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>Israel</td>
<td>2001</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Italy</td>
<td>2006</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>Jamaica</td>
<td>2006</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Japan</td>
<td>2003</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>Kazakhstan</td>
<td>2004</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Korea</td>
<td>2003</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>Kuwait</td>
<td>2004</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Kyrgyzstan</td>
<td>2003</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>Latvia</td>
<td>2002</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Lithuania</td>
<td>2002</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>Luxembourg</td>
<td>2002</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Macedonia</td>
<td>2003</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>Madagascar</td>
<td>2006</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Malta</td>
<td>2003</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>Mauritius</td>
<td>2003</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Mexico</td>
<td>2006</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>Moldova</td>
<td>2008</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Mongolia</td>
<td>2008</td>
<td>2</td>
<td>0</td>
<td></td>
<td>Morocco</td>
<td>2003</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mozambique</td>
<td>2004</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>Namibia</td>
<td>2007</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Netherlands</td>
<td>2004</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>New Zealand</td>
<td>2004</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Norway</td>
<td>2005</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>Pakistan</td>
<td>2004</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Panama</td>
<td>2007</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>Philippines</td>
<td>2004</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Poland</td>
<td>2001</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>Portugal</td>
<td>2006</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Romania</td>
<td>2003</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>Russia</td>
<td>2003</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Rwanda</td>
<td>2005</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Saudi Arabia</td>
<td>2006</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Serbia and Montenegro</td>
<td>2006</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>Singapore</td>
<td>2004</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Slovakia</td>
<td>2002</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>Slovenia</td>
<td>2004</td>
<td>3</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Spain</td>
<td>2006</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>Sweden</td>
<td>2002</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Switzerland</td>
<td>2002</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>Tajikistan</td>
<td>2008</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>2006</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>Tunisia</td>
<td>2002</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Turkey</td>
<td>2007</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>Ukraine</td>
<td>2003</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>2003</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>United Kingdom</td>
<td>2003</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Uruguay</td>
<td>2006</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Notes: 0=Non-compliant, 1=Materiailly non-compliant, 2=Largely compliant and 3=Compliant.
<table>
<thead>
<tr>
<th>Variables</th>
<th>NPL</th>
<th>Ind.</th>
<th>Pro.</th>
<th>Acc.</th>
<th>CP1</th>
<th>CP1_1</th>
<th>CP1_2</th>
<th>RIR</th>
<th>RQ</th>
<th>SOB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independence</td>
<td>-0.231</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legal Protection</td>
<td>-0.525</td>
<td>0.182</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accountability</td>
<td>-0.464</td>
<td>0.817</td>
<td>0.472</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CP1</td>
<td>-0.610</td>
<td>0.547</td>
<td>0.915</td>
<td>0.617</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CP1_1</td>
<td>-0.617</td>
<td>0.457</td>
<td>0.765</td>
<td>0.515</td>
<td>0.836</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CP1_2</td>
<td>-0.486</td>
<td>0.513</td>
<td>0.881</td>
<td>0.667</td>
<td>1.000</td>
<td>0.836</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RIR</td>
<td>0.219</td>
<td>0.034</td>
<td>-0.170</td>
<td>0.013</td>
<td>-0.124</td>
<td>-0.110</td>
<td>-0.223</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RQ</td>
<td>-0.639</td>
<td>0.452</td>
<td>0.413</td>
<td>0.486</td>
<td>0.581</td>
<td>0.541</td>
<td>0.556</td>
<td>0.049</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>SOB</td>
<td>0.241</td>
<td>-0.343</td>
<td>-0.334</td>
<td>-0.280</td>
<td>-0.378</td>
<td>-0.361</td>
<td>-0.321</td>
<td>-0.022</td>
<td>-0.301</td>
<td>1.000</td>
</tr>
<tr>
<td>Latitude</td>
<td>-0.064</td>
<td>0.090</td>
<td>-0.111</td>
<td>0.104</td>
<td>-0.151</td>
<td>-0.117</td>
<td>-0.078</td>
<td>0.063</td>
<td>0.228</td>
<td>-0.118</td>
</tr>
</tbody>
</table>

Note: p-values are in parenthesis below the correlation coefficients.
Table B.4: Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independence</td>
<td>0.716</td>
<td>0.454</td>
<td>81</td>
</tr>
<tr>
<td>Legal Protection</td>
<td>0.507</td>
<td>0.504</td>
<td>69</td>
</tr>
<tr>
<td>Accountability</td>
<td>0.696</td>
<td>0.464</td>
<td>56</td>
</tr>
<tr>
<td>CP1</td>
<td>0.542</td>
<td>0.504</td>
<td>48</td>
</tr>
<tr>
<td>CP1,1</td>
<td>0.458</td>
<td>0.497</td>
<td>48</td>
</tr>
<tr>
<td>CP1,2</td>
<td>0.421</td>
<td>0.497</td>
<td>76</td>
</tr>
<tr>
<td>NPL</td>
<td>8.752</td>
<td>8.050</td>
<td>76</td>
</tr>
<tr>
<td>RIR</td>
<td>0.070</td>
<td>0.092</td>
<td>66</td>
</tr>
<tr>
<td>RQ</td>
<td>0.550</td>
<td>0.915</td>
<td>77</td>
</tr>
<tr>
<td>SOB</td>
<td>13.789</td>
<td>19.412</td>
<td>75</td>
</tr>
</tbody>
</table>

Table B.5: Robustness: different construction of CP1 and statutory information (i.e., Charter Laws for bank regulators). OLS Regressions. Dependent variable: non-performing loans to total loans (percentage)

<table>
<thead>
<tr>
<th></th>
<th>(1) Model 1</th>
<th>(2) Model 1</th>
<th>(3) Model 2</th>
<th>(4) Model 3</th>
<th>(5) Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP1,1</td>
<td>-7.527***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CP1,2</td>
<td></td>
<td>-8.130***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.000)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independencea</td>
<td></td>
<td></td>
<td>-5.011**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.021)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Legal Protectiona</td>
<td></td>
<td></td>
<td>-8.043***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accountabilitya</td>
<td></td>
<td></td>
<td></td>
<td>-6.333***</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.003)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>9.883***</td>
<td>12.175***</td>
<td>12.312***</td>
<td>12.971***</td>
<td>12.843***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>N</td>
<td>44</td>
<td>71</td>
<td>76</td>
<td>73</td>
<td>73</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.366</td>
<td>0.228</td>
<td>0.068</td>
<td>0.235</td>
<td>0.128</td>
</tr>
</tbody>
</table>

Notes: p-values for $H_0$: the coefficient is equal to zero are in parentheses below the estimated coefficients. Each regression uses heteroskedasticity-consistent standard errors from an OLS model. a indicates the variables for which the missing values from the main data set (i.e., the Financial Sector Assessment Program) have been replaced by statutory information (i.e., Charter Laws for bank regulators). * significant at the 0.10 level, ** significant at the 0.05 level, *** significant at the 0.01 level.
Table B.6: Robustness: control variables. OLS Regressions. Dependent variable: non-performing loans to total loans (percentage)

<table>
<thead>
<tr>
<th></th>
<th>(1) Model 5</th>
<th>(2) Model 6</th>
<th>(3) Model 7</th>
<th>(4) Model 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP1</td>
<td>-6.799***</td>
<td>-5.211***</td>
<td>-6.108***</td>
<td>-5.780***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.002)</td>
<td>(0.000)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>RIR</td>
<td>7.245**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RQ</td>
<td></td>
<td>-1.977</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.141)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOB</td>
<td>0.067</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.263)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common</td>
<td>0.728</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.454)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>French</td>
<td>3.397**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Socialist</td>
<td>3.606*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.051)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>German</td>
<td>0.078</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.946)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>9.733***</td>
<td>10.897***</td>
<td>8.880***</td>
<td>7.331***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>N</td>
<td>39</td>
<td>44</td>
<td>43</td>
<td>44</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.358</td>
<td>0.394</td>
<td>0.376</td>
<td>0.337</td>
</tr>
</tbody>
</table>

Notes: p-values for $H_0$: the coefficient is equal to zero, are in parentheses below the estimated coefficients. Each regression uses heteroskedasticity-consistent standard errors from an OLS model. * significant at the 0.10 level, ** significant at the 0.05 level, *** significant at the 0.01 level.
Table B.7: Robustness: instrumental variable regressions. Dependent variable: non-performing loans to total loans (percentage)

<table>
<thead>
<tr>
<th></th>
<th>(1) Model 1</th>
<th>(2) Model 5</th>
<th>(3) Model 6</th>
<th>(4) Model 7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.011)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>RIR</td>
<td></td>
<td>5.128</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.264)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RQ</td>
<td></td>
<td></td>
<td>-1.579</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.301)</td>
<td></td>
</tr>
<tr>
<td>SOB</td>
<td></td>
<td></td>
<td></td>
<td>0.043</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.515)</td>
</tr>
<tr>
<td>Constant</td>
<td>11.750***</td>
<td>11.825***</td>
<td>11.202***</td>
<td>10.724***</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>N</td>
<td>44</td>
<td>39</td>
<td>44</td>
<td>43</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.317</td>
<td>0.292</td>
<td>0.415</td>
<td>0.351</td>
</tr>
<tr>
<td>Over Identification Test$^a$</td>
<td>1.770 (0.778)</td>
<td>1.700 (0.791)</td>
<td>2.733 (0.603)</td>
<td>2.275 (0.685)</td>
</tr>
<tr>
<td>Under Identification Test$^b$</td>
<td>13.842** (0.017)</td>
<td>12.429** (0.020)</td>
<td>4.319 (0.504)</td>
<td>11.267** (0.0463)</td>
</tr>
<tr>
<td>Weak Identification Test$^c$</td>
<td>- Bias 5% 10%</td>
<td>- Bias 5% 10%</td>
<td>- Bias 5% 10%</td>
<td>- Bias 5% 10%</td>
</tr>
</tbody>
</table>

Notes: p-values for Ho: the coefficient is equal to zero, are in parentheses below the estimated coefficients. Each regression uses heteroskedasticity-consistent standard errors from an IV model and is estimated using Two Stage Least Squares with corrections for small sample. CP1 is instrumented by: Latitude and Legal Origin dummy variables (Common, French, Socialist and German).


$^b$ Kleibergen and Paap’s (2006) rank statistic to test Ho: the instruments are uncorrelated with the endogenous regressors. No rejection casts doubt on the validity of the instruments.

$^c$ Kleibergen and Paap’s (2006) rank statistic to test Ho: the instruments are weak. Figures in rows Bias and Size show the minimal Bias and the minimal Size for which Ho is rejected using Stock and Yogo’s (2005) critical values. High values indicate weak instruments.
References


