Executive Compensation, Supervisory Incentives, and Banking Regulation*

Robert Hauswald†
American University

Lemma Senbet
University of Maryland

Current Version September 2009

JEL Classification: G21, L51, O31

*Stimulating discussions with Bill Alexander, Mike Baye, Gillian Garcia, Uli Hege and Ed Kane are gratefully acknowledged. We also benefited from the comments of seminar participants at Indiana, CentER - Tilburg University, Seoul National University, Texas, and the 2000 EFA Meetings on an early version of the paper. Special thanks go to Jean Tirole and Viral Acharya whose comments improved the paper's exposition. The usual disclaimers apply.

†Corresponding author: Finance Department, Kogod School of Business, American University, Washington, DC 20016-8044, *hauswald@american.edu.*

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Abstract

This paper analyzes the optimal design of banking regulation when three layers of agency conflicts between society and banks, society and supervisors, and bank owners and managers are present. We argue that regulatory rules, supervisory incentives, and managerial compensation form an interdependent nexus. Since managerial incentives reveal information about banks' operating policies comprehensive regulatory schemes can limit the scope for regulatory capture, enhance the power of supervisory incentives, and ultimately minimize banks' risk-shifting incentives. In fact, the interaction of public and private agency conflicts improves overall risk-taking by banks to the benefit of society at large. We distill lessons for regulatory design and show that there exist tradeoffs between regulatory incentives and investments in institutional development.

1 Introduction

A string of well publicized banking crises, such as the US Savings & Loans debacle of the 1980s, fallout from emerging-market crises in Latin American, Asia, and Russia during the 1990s, or the current financial crisis have shown that banking failures typically arise from a combination of excessive risk taking, weak enforcement of regulation, and other supervisory or political failures.[1] At the root of the problem lies the fundamental divergence of regulators', depositors', and bank owners' objectives leading to the suboptimal design and application of regulatory rules. As the seminal work of Alchian and Demsetz (1972) and Jensen and Meckling (1976) has shown contractual relationships do not exist in isolation but are interdependent.[2] In this paper, we apply this insight to banking regulation and argue that supervisory and corporate incentives interact to create a web of interlocking incentive schemes. In particular, we show that optimal banking regulation, which recognizes the interaction between incentive conflicts in the public and private sectors, improves upon outcomes derived under the standard regulatory paradigm, which only considers the conflicting interests of bank owners and regulators.

The need for a more comprehensive perspective arises because one cannot simply assume that regulators or bank supervisors face the "right" incentives to apply and implement rules and regulations.[3] Instead, they often act as self-interested parties and may distort the regulatory process in their own or the regulated industry's favor. Hence, the design of banking regulation should encompass both regulatory rules and appropriate incentives for their implementation. At the same time, compensation schemes of bank managers can reveal information about lenders which is useful to further improve the outcome of banking regulation as first noticed in John, Saunders and Senbet (2000). In fact, recent legislation to create a bail-out fund for the stricken financial industry includes restrictions on executive pay explicitly "to discourage excessive risk taking" (Financial Times, September 29, 2008, p. 2). Hence, an investigation into the interaction of regulatory rules, supervisory incentives, managerial compensation, and risk taking by banks is important from both

[1] For a more detailed survey of regulatory failures in banking and finance and their underlying mechanisms see Lindgren, Garcia and Saal (1996).

[2] Indeed, the view of the firm as a nexus of contracts that has become the predominant paradigm in analyzing its financial, organizational, and legal structure.

[3] An example in point is the recently promoted Basel II framework for banking regulation which allows banks to use their own proprietary risk-assessment methodology but charges regulators with verifying methodology, procedures and inputs. However, such an approach presuppose that management and employees face the right incentives to truthful calculate and report those risks to supervisors and shareholders.

an academic and policy perspective.

To study these issues, we specify a simple model of financial intermediation and regulation, in which supervisors examine ("audit") financial institutions ("banks") and apply bank-specific rules in light of the examination's outcome through the risk-adjusted pricing of deposit insurance.[4] Banks facing either high- or low-quality investment opportunities have an incentive to engage in excessive deposit collection and socially suboptimal lending to earn risk-shifting rents. However, bank owners need to provide managers with explicit incentives through compensation to implement such privately optimal lending policies. Supervisors collect information on the quality of financial intermediaries' balance sheets that is not costlessly available to third parties and, therefore, creates an informational monopoly and invites rent extraction. Since examinations are imperfect, the supervisory agency may misrepresent the collected information, apply deposit-pricing schemes allowing low-quality banks to engage in excessively risky lending, and split the resulting rents with the bank or its owners.

We first derive the bank's optimal deposit collection and loan policies and establish that uniform deposit insurance pricing, in the absence of full information, implies socially suboptimal lending by low-quality banks. Informed supervision through examinations and type-contingent deposit-insurance pricing curtails such risk-shifting but introduces the risk of regulatory capture and distortion of enforcement in favor of low-quality lenders. We show how explicit supervisory incentives, whose power crucially depends on the quality of the ambient institutional environment (i.e., political accountability, likelihood of detecting collusion, legal system, etc.), can prevent such collusive outcomes and improve regulatory outcomes. In particular, we establish that society can address typical supervisory shortcomings by either providing explicit incentives through funding to the regulatory agency or by investing in the requisite legal, political, and institutional infrastructure.

The presence of bank-internal agency conflicts requires explicit managerial incentives which introduce a subtle rent dissipation mechanism into the regulatory process. We show how the incentive features of compensation separate low- from high-quality banks, and how they can improve bank supervision through regulation which explicitly takes into account agency conflicts both in

[4] All results go through if, instead, we cast the analysis in terms of capital-adequacy rules as an alternative regulatory instrument.

the public and private sectors. Risky lending affects the prospects of bank owners and managers differently when their interests diverge. Intuitively, the equity of low-quality banks is less valuable so that management compensation must include either a larger equity component revealing the bank's type or a bonus payment which partially aligns managerial objectives with socially desirable risk choices. Excessively risky lending and risk-shifting rents fall, which both enhance the power of supervisory incentives, and welfare improves. If management incentive schemes are fully observable regulatory enforcement becomes collusion-proof and first-best outcomes result. However, even when managerial compensation is unobservable managerial agency conflicts drive a wedge between bank owners and supervisors so that bank regulation becomes less susceptible to regulatory capture and welfare improves beyond second-best outcomes.

In terms of empirical evidence John et al. (2007) find that the more compensation aligns bank managers' and owners' interests the more levered, i.e., riskier, the institution becomes. They also find that monitoring by regulators increases in the power of managerial incentives which is consistent with our predictions. In a similar vein, Mehran and Rosenberg (2008) find that the riskiness of banks increases in managerial stock-option grants whose payoffs replicate the stock-and-bonus scheme at the heart of our analysis. Once again, their findings provide empirical support for our predictions. Brewer et al. (2004) also report that riskier banks have significantly higher levels of equity-based compensation as do banks with more investment opportunities.

Our main contribution consists in showing how regulation contingent on banks' *ex ante* incentive schemes rather than *ex post* outcomes improves welfare because the incentive features of management compensation partially reveal banks' unobservable operational policies. Furthermore, we extend the existing paradigm for regulatory design. Instead of focusing on one conflict of interest at a time, i.e., between society and supervisors, society and banks, or bank owners and managers, we analyze the regulation process as an web of interlocking contracts because regulatory rules interact with incentives both for supervisors and bank managers. This perspective allows us to derive comprehensive regulatory schemes which provide strong incentives for supervisors to truthfully reveal information and enforce regulation. Although we illustrate the principle of information revelation through incentive contracts in the context of banking regulation, the same insights apply to other situations in which agency conflicts interact, for instance owner-manager conflicts affecting those between owners and creditors. Our results suggest that managerial compensation can reveal

information about the firm's attributes and the riskiness of its operational policies so that debt contracts contingent on management incentives should improve their efficiency.

Closest to our work is Acharya (2003) who also studies trade-offs between *ex ante* incentives and *ex post* regulatory policies and points out the dangers of regulatory capture for the application of sound prudential supervision but focuses on capital-adequacy standards and their global convergence. Studying conflicts of interest in the regulation of natural monopolies, Laffont and Tirole (1991) were the first to point out the need for explicit incentives for regulators to prevent their capture by interest groups. By contrast, Kane (1989), in the context of deposit insurance, and Boot and Thakor (1993) in their analysis of banking supervision argue that reputational mechanisms can overcome regulatory failures due to self-interested regulators.[5] Their work complements our analysis and explains supervisors' incentives to acquire the requisite auditing expertise and to actively participate in the regulatory process. In fact, Alesina and Tabellini (2006a, b) show that society should allocate administrative tasks to bureaucrats, i.e., regulators, rather than politicians the more technical ability as opposed to effort is important because the career concerns of both groups differ. Their results motivate some of our modeling assumptions and confirm the complementarity of regulatory incentives and the rule of law in the face of interest groups and regulatory capture, which we also find.

Our work also contributes to the very large literature on optimal banking regulation. Giammarino, Lewis and Sappington (1993) study the optimal design of risk-adjusted deposit insurance whereas John, Saunders and Senbet (2000) show how deposit insurance provides incentives to bank owners to choose managerial-compensation schemes that lead to first-best investment choices. By contrast, Bris and Cantale (2002) find that optimal capital and deposit-insurance regulation can adversely affect bank owner-manager agency conflicts and result in too little risk taking (underinvestment). Dewatripont and Tirole (1994) and Rochet, Bensaid and Pages (1996) analyze various aspects of capital-adequacy and deposit-insurance regulation in the presence of informational asymmetries between banks and society. Hovakimian and Kane (2000) provide empirical evidence on the respective merits of the two regulatory instruments and find that capital requirements did little to control risk-shifting by US banks whereas deposit-insurance reform has improved but not yet fully established regulatory control over lenders' risk-shifting incentives.

[5]For a comprehensive treatment of different approaches to regulatory behavior see Kane (1997).

From an empirical perspective, Heinemann and Schüler (2003) find widespread evidence for regulatory capture in banking whose aim is to lower supervisory stringency pointing to the need for explicit incentives for regulators. In fact, Jeitschko and Jeung (2004) empirically show that regulatory incentives are an important determinant of banks' asset risk, especially for lowly capitalized ones. Similarly, Das *et al.* (2004) report that regulatory governance together with the ambient institutional development (quality of public-sector governance and political institutions) significantly influences the soundness of financial systems. Masciandaro *et al.* (2006) report that, consistent with our results, regulatory-capture concerns and the degree of institutional development are important determinants for the actually funding of bank supervision. In the same vein, Cull *et al.* (2005) provide cross-country evidence on the counterproductive nature of deposit insurance unless the rule of law is well established and supervisors are sufficiently independent, which again agrees with our findings.

The paper is organized as follows. The next section presents a model of financial intermediation and regulation. Section 3 analyzes rent seeking by banks and uninformed regulation. Section 4 derives comprehensive regulatory schemes in the presence of public and private public agency conflicts. Section 5 draws implications for financial-system and regulatory design. The last section discusses wider implications of our findings and concludes. We relegate all proofs to the Appendix.

2 Model Description

Our model comprises three parties which interact in the regulatory process similar to Laffont and Tirole (1991). The social planner (e.g., Congress) sets broad rules for banking regulation in terms of bank-specific attributes but lacks the necessary auditing and financial expertise to enforce the standards. Hence, the planner charges a regulatory agency (e.g., FDIC) to assess the banks' risk characteristics and to apply the requisite individualized rule. Banks raise equity capital K and solicit deposits with face value F to fund investments of size I ("loans").

Banks have investment opportunities characterized by risky assets (e.g., loans) and riskless assets (e.g., government securities). Let a fraction q of risky projects be of high quality h and a fraction $(1-q)$ of low quality l. In addition to quality, projects also differ in their riskiness: project

returns $\xi_i, i \in \{h, l\}$ which we take to be net of search and screening costs are distributed as

$$\xi_i = \begin{cases} H_i & \text{with probability } \theta \\ L_i & \text{with probability } 1-\theta \end{cases}$$

with $0 < L_l < L_h < I < H_l < H_h$.[6] The differential quality and precise riskiness of investments is private information: only banks know their investments' type $i \in \{h, l\}$ and success probability θ which is uniformly distributed on the unit interval. By contrast, the riskless asset yields a certain return I. All parties are risk neutral and interest rates are normalized to 0.

Having learnt the type i and riskiness θ of a given investment opportunity, banks decide between this risky asset or the riskless alternative I in function of an optimally chosen threshold $\theta_i \in (0, 1)$.[7] This investment policy is noncontractible leading to a conflict of interest between bank owners and depositors or, in the presence of deposit insurance, society at large. For all realizations of θ exceeding the type-specific cutoff level θ_i the bank lends to the risky project of that type, whereas for all realizations below the threshold, it invests in the safe one.[8] Such investment policies yield terminal cash flows T which conform to the Hardy-Weinberg distribution conditional on the lending rule θ_i :

$$T(\theta_i) = \begin{cases} H_i & \text{with probability } \frac{1}{2}\left(1-\theta_i^2\right) \\ I & \text{with probability } \theta_i \\ L_i & \text{with probability } \frac{1}{2}\left(1-\theta_i\right)^2 \end{cases}$$

Upon realization of terminal cash flows all contracts are settled. Banks repay depositors the face value of deposits F or, in case of failure, the bank's distress value T so that depositors obtain $\min\{F, T\}$. If deposits are fully insured, regulators on behalf of society make good on any shortfall, i.e., they pay depositors $\max\{F - T, 0\}$. As a result, explicit or implicit ("too important to fail") deposit insurance schemes provide incentives for banks to shift risk to society through their investment behavior.

[6] All our results go through without loss of generality for more complicated return distributions as long as high-quality projects first or second order stochastically dominate low-quality ones.

[7] Given the deterministic regulatory environment, we restrict our attention to pure investment strategies, i.e., banks only invest in the risky or riskless asset; mixed investment strategies correspond to the formation of portfolios.

[8] Although we cast financial intermediation in terms of hidden information θ one can easily interpret the model as one of hidden action because returns are verifiable. Asset search, assessment and choice would now be costly in terms of managerial effort and give rise to moral hazard.

Given that both the riskiness θ and quality i of bank assets are unobservable to outsiders (bank owners, regulators, etc.), we take the interests of management and shareholders to diverge. Hence, bank owners need to provide appropriate incentives for management to implement investment decisions maximizing the value of equity. As in John, Saunders and Senbet (2000), we assume that incentive contracts potentially consist of the following three components: a fixed cash salary, a bonus payments $b \geq 0$ subordinated to deposits, and an equity stake $\alpha \in (0,1)$.[9] For expositional convenience, we take terminal cash flows T to be net of the fixed base salary so that management receives $\Pi_M = E\left[\min\left\{b, \max\left\{T-F, 0\right\}\right\} + \alpha \max\left\{T-F-b, 0\right\}\right] \geq \bar{s}_M$ where $\bar{s}_M$ is bank management's reservation pay. Consequently, bank owners as residual claimants get $\Pi_O = (1-\alpha) E\left[\max\left\{T-F-l, 0\right\}\right]$. Note that $\alpha = 0$ or $b = 0$ corresponds to the polar compensation schemes in which management's incentive bonus is either all subordinated to deposits (representing junior debt) or all equity based.

To control risk shifting through banks' lending policies, the social planner specifies a regulatory framework that maximizes homogeneous welfare for all agents and provides incentives for their implementation. Since the design and implementation of regulation are two separate tasks requiring very different expertise, the social planner delegates the necessary information collection and rule enforcement to a supervisory agency such as the FDIC or Federal Reserve Board.[10] For its auditing and enforcement efforts the agency receives funds s from government yielding payoffs $\Pi_R(s) = E[s] - \bar{s}_R \geq 0$ for reservation funding level $\bar{s}_R$ that reflect the agency's collective outside employment opportunities.

Bank examinations generate information η about banks' investment quality i which, however, is not always informative. Even under due regulatory process, examiners might fail to turn up any new or relevant information about the examined financial institution, its asset quality, balance-sheet structure, etc. We capture this possibility by assuming that the examination reveals the true investment opportunity set ("balance-sheet quality") of a bank $\eta = i$ with probability ϕ, which we think of as the examination's informativeness, and turns up no useful regulatory information ($\eta = \emptyset$) with probability $1-\phi$.

[9] It is easy to show that typical stock-option based incentive plans correspond simply to specific combinations of bonus payments and equity grants.

[10] Alesina and Tabellini (2006a, b) show that "bureaucrats" are preferable to politicians in administrative tasks the more technical a task is so that expertise counts more than effort and the greater the scope for influence activities by interest groups is.

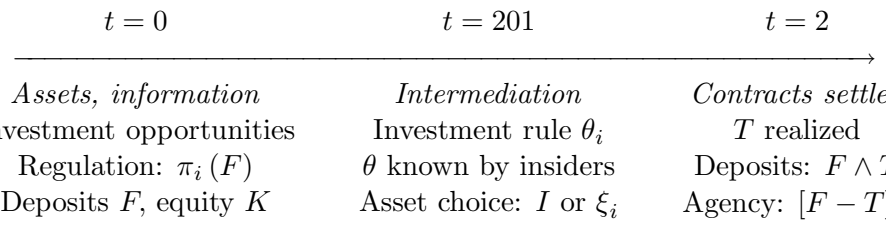

Figure 1: Financial Intermediation and Regulation

The uncertainty surrounding examination outcomes opens the door to information misrepresentation by the supervisory agency in order to create and appropriate information rents. Despite having learned a bank's true balance-sheet quality, supervisors might claim that the examination has turned up no relevant information and report $\eta = \emptyset$ to the social planner in order to apply a different rule than warranted by the audit's outcome. Such reports are credible because the auditing technology is not perfect so that the supervisory agency reports $r \in \{\emptyset, \eta\}$ to the social planner as the basis for their enforcement of regulatory rules. Given the reported asset quality supervisors levy fairly priced deposit-insurance premia $\pi_i(F)$ on banks that are a function of observed deposits F.

The public agency conflict between regulators and society expresses itself in the distortion of regulation in favor of one or more interest groups (regulatory capture). We consider the case in which an interest group such as the banking industry colludes with supervisors to protect or create rents. The most widely cited examples are regulatory favoritism of the regulated industry (banks) or consumer groups (depositors). To entice supervisors to engage in systematic misreporting and regulatory collusion, banks (owners or managers) might offer outright cash transfers, future employment benefits, a cut from the returns to risk-shifting, etc. to the agency. Figure 1 summarizes the model's time structure of financial intermediation and regulation.

3 Uninformed Regulation and Risk Shifting

A bank's ability to affect the regulatory process depends on the means which it can devote to the requisite influence activities. The available resources, in turn, are a function of its profitability and, especially, its ability to earn rents from excessive risk taking to the detriment of society at large. To derive the value of distortions in a lender's investment policy away from the social optimum we

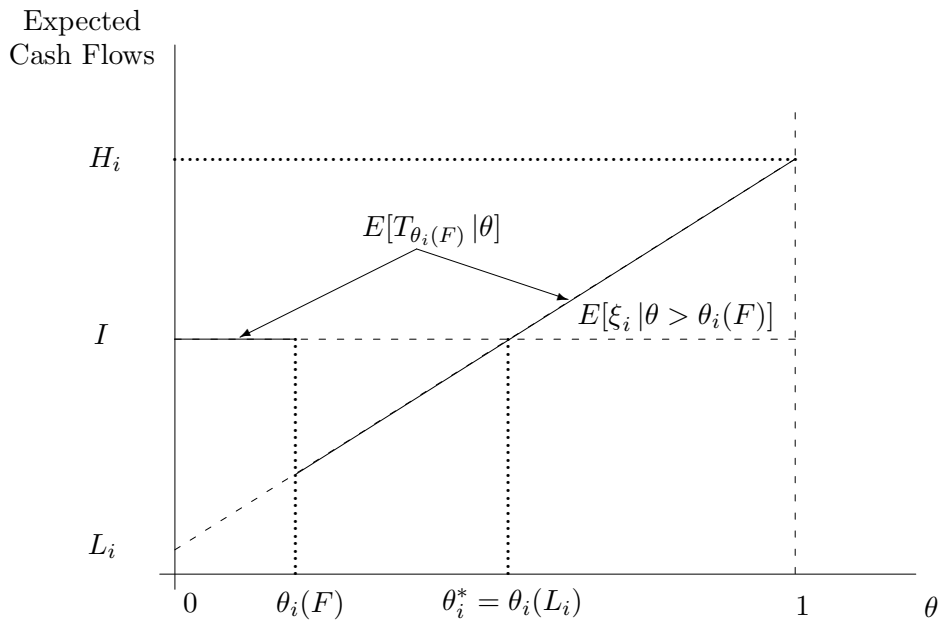

Figure 2: Investment Policy and Expected Cash Flows

first assume that the interests of bank owners and managers fully agree. Banks choose investment-policy thresholds θ_i, which are a function of deposits F in equilibrium, conditional on their type (and investment opportunities) i from the individual rationality constraint

$$\theta_i \max\{H_i - F, 0\} + (1 - \theta_i) \max\{L_i - F, 0\} \geq \max\{I - F, 0\}$$

In equilibrium, the preceding expression must hold with equality so that banks' privately optimal investment policy in terms of the risk threshold $\theta_i(F)$ is given by

$$\theta_i(F) = \begin{cases} \frac{I - L_i}{H_i - L_i} & \text{for } F \leq L_i \\ \frac{I - F}{H_i - F} & \text{for } L_i < F < I \\ 0 & \text{for } I \leq F < H_i \end{cases} \tag{1}$$

For realizations of θ above $\theta_i(F)$, banks invest in the risky asset and in the riskless asset otherwise.

When investment opportunities and risk choices are unobservable to outsiders, deposit collection provides the usual adverse incentives for bank policies. Maximizing expected terminal cash flows $T(\theta_i)$ with respect to the threshold θ_i yields the first-best investment threshold conditional on type

i

$$\theta_i^* = \frac{I - L_i}{H_i - L_i} \tag{2}$$

so that banks should invest in the risky asset of type i only if the realization of the success probability θ exceeds θ_i^*. Note that $\theta_h^* < \theta_l^*$ so that it is socially optimal for banks with better investment opportunities to take more risk.

Figure 2 illustrates how a bank's investment strategy establishes a one-to-one correspondence between deposit collection and asset choice conditional on the quality of investment opportunities. The higher the level of deposits F (i.e., bank leverage) the greater a bank's incentive becomes to engage in risk shifting because the safe-investment threshold decreases toward 0 as F approaches I. Comparing first-best and second-best investment thresholds in Equations (1) and (2) shows that deposit collection beyond the riskless level L_i implies excessive risk taking because by $\theta_i^* - \theta_i(F) = \frac{(H_i - I)(F - L_i)}{(H_i - L_i)(H_i - F)} > 0$ for $F > L_i$ banks of both types engage more often in risky lending than is socially optimal.

To prevent lenders from engaging in excessive risk taking society charges examiners and supervisors ("regulators") with identifying a bank's investment opportunities ("balance sheet") and applying the appropriate regulatory rules. Optimal regulation minimizes the cost of bailing out troubled banks and of regulatory services which inflict a disutility $(1 + \gamma)$ per tax dollar on society, where $\gamma > 0$ is the shadow cost of public funds. Furthermore, we take deposits to provide benefits to society (liquidity services, store of wealth, etc.) so that the social planner has a preference for banks of both types being active. As a result, regulatory rules trade off benefits from deposit collection net of regulatory costs with rent seeking by banks and socially costly bailouts of failed intermediaries.

Although regulation often relies on a combination of both capital-adequacy standards and deposit-insurance pricing, we focus on the latter for several reasons. First and foremost, capital-adequacy regulation often leaves risk-shifting incentives intact whereas fairly priced deposit insurance internalizes excessive risk taking as we will show below. In fact, Hovakimian and Kane (2000) report evidence that deposit insurance is a superior tool to capital requirements to control risk-shifting by US banks. Second, the solvency of deposit-insurance funds is potential indicator of supervisory success so that, consistent with our model, incentives for supervisors could directly

depend on the financial state of such schemes. However, all our results go through if we cast the analysis in terms of capitalization rules as the primary regulatory instrument.

Under full information, the socially optimal level of deposits is a function of bank type and is given by $F_i^* = L_i$ in the absence of additional benefits from deposits which might warrant a deposit base beyond the level maximizing overall bank value. By the investment thresholds in Equations (1) and (2) such narrow deposit collection implies socially optimal lending policies $\theta_i(F) = \theta_i^*$. To implement such an outcome supervisors simply collect actuarially fair deposit-insurance premia that correspond to the type-contingent expected shortfall of terminal cash flows with respect to deposits, which can never exceed I :

$$\pi_i^*(F) = E[\max\{F - T(\theta_i(F)), 0\}] = \frac{1}{2}[1 - \theta_i(F)]^2 (F - L_i) \tag{3}$$

Note that under first-best financial intermediation $F_i = L_i$ so that $\pi_i(L_i) = 0$ whereas, for $F \in (L_i, I)$, deposit insurance premia decrease in type: $\pi_h(F) < \pi_l(F)$.

Fairly priced deposit insurance acts like a tax on risk-shifting thereby internalizing the social cost of bank failure so that intermediaries might as well choose socially optimal deposits $F_i^* = L_i$ and investment strategies θ_i^* by Equation (1). In this case, the preceding rule corresponds to banks either holding riskless deposits (consistent with the notion of narrow banking) or being all-equity financed. Equation (2) also shows that the quality of investment opportunities and, hence, balance sheets determines the socially optimal amount of risk taking by lenders.[11] As illustrated in Figure 3, the higher the asset quality the more aggressive banks should be in their lending decision. In particular, the better prospects of bank h merit a lower threshold for risky investments θ_h^* than for low-quality banks. Furthermore, higher asset quality justifies more deposit collection so that banks with better lending opportunities need less capital and face lower deposit insurance premia.

In the presence of information asymmetries between banks and society, low-quality banks earn risk-shifting rents which are simply the difference in profits from privately and socially optimal optimal investment strategies:

Proposition 1 *If investment opportunities are unobservable optimal regulation requires uniform*

[11] Most risk-adjusted rules are specified with respect to banks' existing assets and, hence, balance-sheet quality. In a semi-static setting such as ours this approach is equivalent to viewing balance-sheet quality in terms of the underlying investment opportunities.

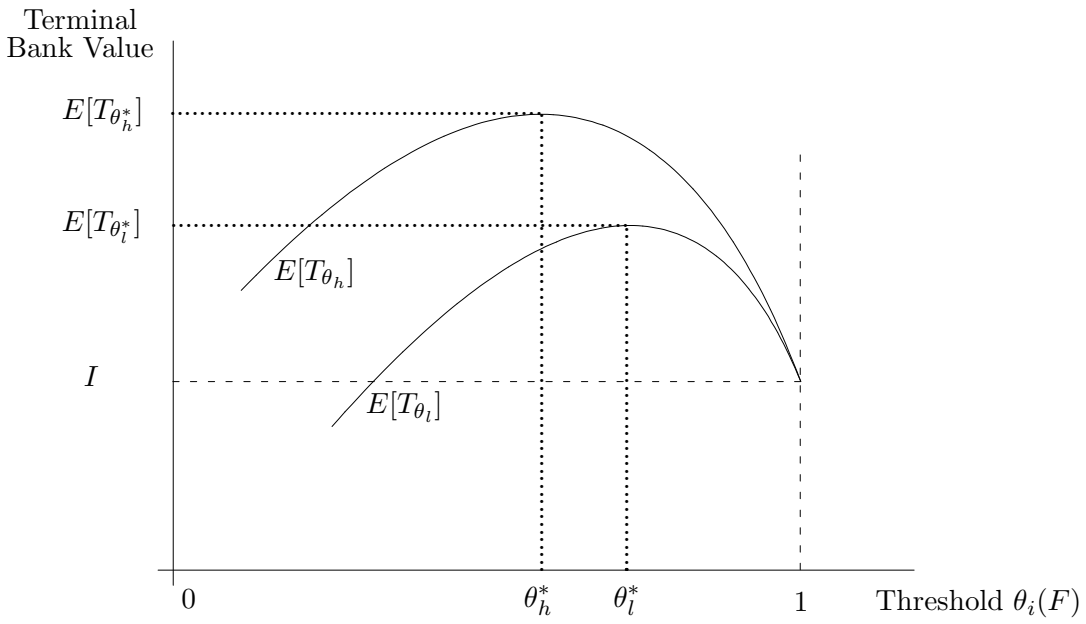

Figure 3: First-Best Lending Policies

deposit insurance premia $\pi^u(F) = \pi_h^*(F)$ *for banks of both types to be active in equilibrium. Low-quality banks* l *are undercapitalized, collect risky deposits* $F_l = L_h > L_l = F_l^*$ *and pursue second-best investment policies* $\theta_l(L_h) = \frac{I-L_h}{H_l-L_h} < \theta_l^*$ *yielding risk-shifting rents*

$$\Phi_l(L_h) = E\left[T\left(\theta_l(L_h)\right) - L_h\right]^+ - K_h - \left(E\left[T_l^* - L_l\right]^+ - K_l\right) = \frac{1}{2}\frac{(H_l - I)^2(L_h - L_l)}{(H_l - L_h)(H_l - L_l)}$$

Proof. See Appendix. ■

Since intermediaries are socially valuable through their lending and deposit services regulation should insure that banks of both quality remain active in equilibrium. If investment opportunities are unobservable the best society can do is to set uniform deposit-insurance rules at the efficient level for good banks $\pi_h^*(F)$. Levying deposit-insurance premia at the low-quality level does not help because high-quality banks would simply withdraw from the market. Hence, society is willing to give up informational rents to low-quality intermediaries, which pretend to have high-quality prospects and engage in excessive deposit collection, because uniform deposit-insurance pricing implies pooling in deposit collection $F_l = F_h = L_h$. In this situation, only intermediaries with good investment opportunities internalize the consequences of moral hazard in lending whereas banks with bad ones take advantage of the uniform regulatory standard by $\pi^u(F) < \pi_l^*(F)$. Furthermore,

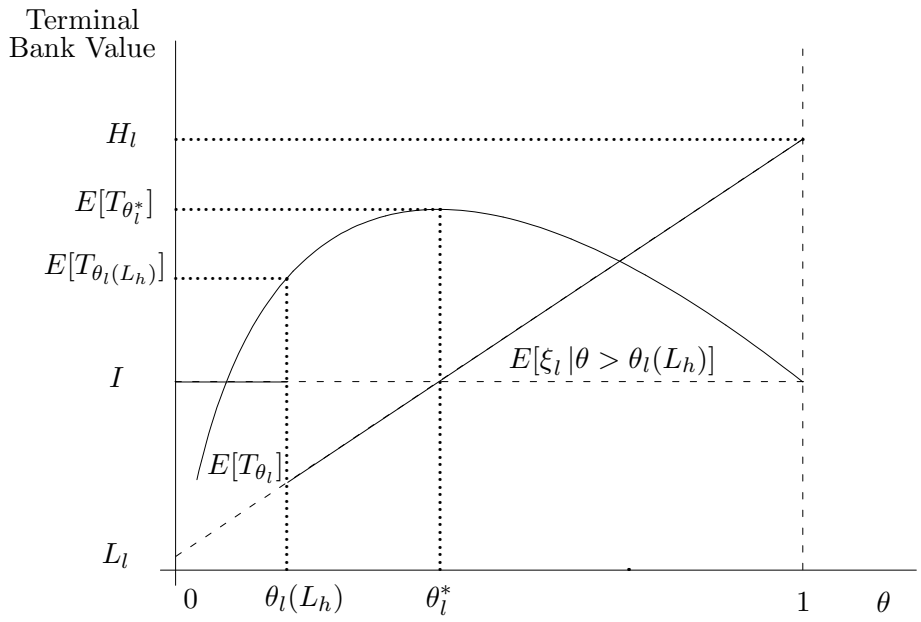

Figure 4: Welfare Consequences of Uniform Deposit Insurance

only high-quality banks are adequately capitalized whereas low-quality ones are undercapitalized and engage in risk-shifting.

Current FDIC arrangements illustrate the economic forces at work. Running deposit insurance schemes for both S&Ls and banks the agency administers separate funds that charge differential premia in light of both groups' perceived riskiness. As a result, healthier S&Ls have tried to gain access to the Bank Insurance Fund in order to escape the higher deposit-insurance premia levied by the Savings Association Insurance Fund. Although under US arrangements there is no doubt about the identity of a financial intermediary, our results suggest that commingling healthy S&Ls and commercial banks might open the door to inefficient influence activities and collusion.

Figure 4 illustrates the welfare consequences of the pooling equilibrium under uniform deposit-insurance pricing. By trading off bank participation with rent seeking, society gives up information rents $\Phi_l(L_h)$ to lenders with poor prospects. Informed regulation through the examination of banks and the generation of bank-specific information by supervisors should minimize the resulting social cost.[12] However, the existence of private gains to banks with poor investment prospects opens up the opportunity for informed regulators to collude with such institutions, thereby creating regulatory conflicts in the public sector which we investigate next.

[12]Risk-shifting reduces the value of low-quality banks and generates expected social cost $\Gamma(L_h) = (1-q)\,E\left[T_l^* - T\left(\theta_l\left(L_h\right)\right)\right] = \frac{1}{2}\left(L_h - L_l\right)\frac{(H_l-I)^2(L_h-L_l)+2(H_l-L_h)^2(H_l-L_l)}{(H_l-L_h)^2(H_l-L_l)}$.

4 Regulatory Conflict

When both a bank's type i and its investment risk θ are unobservable, informed regulation mitigates the social conflict between banks and society but introduces the danger of regulatory capture. To entice supervisors to distort the regulatory process, banks might offer outright cash transfers, future employment benefits, a cut from the returns to risk shifting, etc. to the agency. In our model, such collusion takes the form of "rule fixing" through the misreporting of bank type which allows regulators to deviate from fair deposit insurance in return for a share in the risk-shifting rents. Consequently, comprehensive regulation now includes incentive-compatible compensation for regulators to prevent regulatory capture by the industry together with fairly priced deposit-insurance premia. Such a regulatory mechanism implements socially optimal deposit collection while taking into account three levels of conflicts of interest: (i) conflicts between banks and society (risk shifting), (ii) conflicts between supervisors and society (regulatory capture), and (iii) agency conflicts between bank managers and owners (managerial moral hazard).

4.1 Informed Regulation and Regulatory Conflict

Suppose that banks can engage in socially wasteful side payments ("bribes") β to regulators to distort the application of regulatory rules in their (shareholders') favor. Such payments do not need to take the form of outright bribes but may represent future employment benefits discounted back at γ_β to yield a monetary value of $\left(1+\gamma_\beta\right)^{-1}\beta$ to regulators. Heinemann and Schüler (2004) report that regulatory capture is widespread in the banking industry and that it results in lax enforcement of regulatory and supervisory mandates. In fact, several countries such as France, Japan, or the US have well-established practices ("revolving doors") that regulators move between banks and the supervisory agency or retire to the financial services industry.

Alternatively, one can think of $\gamma_\beta > 0$ as the shadow cost of collusive transfers β so that the bank's total cost of seeking regulatory favors becomes $\left(1+\gamma_\beta\right)\beta$. We can also interpret this cost as the quality of the ambient legal and political institutions. In a dysfunctional regulatory regime, the cost of corruption in terms of detection, punishment, and side transfers is very low. In such an environment, γ_β could possibly be 0. Conversely, well functioning legal and regulatory institutions might impose very high costs on the colluding parties: outright punishment, loss of

reputation (see Boot and Thakor, 1993) or retirement benefits for regulators; prosecution, harsher future regulatory treatment for banks (1908s S&L crisis, implementation of the TARP Act in the current credit crisis).

Collusion takes the form of hiding asset-quality information from society in order to deliberately underprice deposit insurance. It can only occur if the misrepresentation of information benefits the bank through regulatory forbearance.[13] Since high-quality banks h do not earn risk-shifting rents they have no vested interest in the agency's examination report or its application. The same is not true for low-quality banks. Reporting the actual asset quality and deposit level together with levying the appropriate deposit insurance premium $\pi_l^*(L_h)$ lowers their rents from $\Phi_l(L_h)$ to 0 by the above results. To prevent such banks from bribing the agency, supervisory funding (and compensation) therefore has to depend on the examiners' reports r.

Let s_h, s_l and s_0 denote agency funding levels for reports $r \in \{h, l, \emptyset\}$, respectively. Regulatory incentive compatibility requires that agency income foregone by misreporting audit results are higher than proceeds from side payments, i.e., $(s_l - s_0) \geq \left(1 + \gamma_\beta\right)^{-1} \beta$. Furthermore, collusion proofness requires that bribes exceed available rents, i.e., $\beta \geq \Phi_l(L_h)$. Taken together, we obtain the following condition for regulatory funding:

$$s_l - s_0 \geq \left(1 + \gamma_\beta\right)^{-1} \Phi_l(L_h)$$

In equilibrium, the incentive compatibility constraint holds with equality after substituting $s_0 = \bar{s}$. To prevent regulatory collusion, society rewards the agency for reporting banks in trouble with a bonus equal in value to potential side payments $\left(1 + \gamma_\beta\right)^{-1} \Phi_l(L_h)$. Misreporting does not occur for examination outcomes in the other states because there is no scope for risk-shifting and rent capturing. Consequently, the social planner sets agency income at reservation levels $s_h = s_0 = \bar{s}$ and prescribes uniform deposit-insurance premia $\pi^u(F) = \pi_h^*(F)$ in these states.

Rewarding supervisors for truthful reporting of low asset quality permits the social planner to toughen capital standards and to eliminate collusive regulatory forbearance, albeit at the price of incentive-compatible funding for the agency. For successful audits $r = \eta = i$ supervisors now enforce first-best deposit-insurance regulation π_i^*. If an audit is unsuccessful in ascertaining bank-

[13] Note that forbearance is unambiguously detrimental in our framework because of excessive risk taking although it seems to benefit society through higher deposit levels.

asset quality, i.e., $r = \eta = \emptyset$, one is back in the asymmetric-information setting. Second-best uniform deposit-insurance premia are the only option and low-quality banks still earn informational rents. These observations prove the existence of robust deposit-insurance regulation:

Proposition 2 *To prevent regulatory collusion, the agency receives state-contingent funding*

$$s_l = \bar{s} + \left(1 + \gamma_\beta\right)^{-1} \Phi_l \left(L_h\right) \tag{4}$$

for reporting low-quality banks l and $\bar{s} = s_h = s_0$ otherwise; it enforces tougher regulatory standards depriving banks of risk-shifting rents for informative examinations:

$$\pi_r \left(F\right) = \begin{cases} \pi_i^* \left(F\right) & \text{for } r = i \in \{h, l\} \\ \pi^u \left(F\right) = \pi_h^* \left(F\right) & \text{for } r = \emptyset \end{cases} .$$

Intuitively, the supervisor's ownership of the auditing technology creates an information monopoly which threatens to transform the cost of risk-shifting into rents extracted by the regulator. The appropriability of such rents forces society to give up part of the gains from informed regulation through bonus payments to supervisors to prevent regulatory capture. This outcome would present a problem if supervisors were to capture more than the marginal product of their regulatory services despite the increase in aggregate social welfare due to reduced investment distortions. The following proposition shows that the size of the Pareto improvement through informed regulation crucially hinges on the quality of the ambient institutions as reflected by the shadow cost of corruption γ_β :

Proposition 3 *Informed regulation decreases distortions in investment decisions and increases aggregate welfare, which further increases in the quality of ambient institutions γ_β.*

Proof. See Appendix. ■

The more the rule of law applies, the more costly collusion becomes to the parties. Better legal systems increase regulatory efficiency by reducing the cost of providing supervisory incentives. Making the detection and punishment of collusion more likely increases the *ex ante* cost γ_β of bribes and thus decreases their *ex post* monetary value. Proposition 3 shows that the quality of legal institutions affects the efficiency of regulation because legal and regulatory systems interact.

In fact, society faces a choice between overall institutional development, which raises γ_β and might have ancillary benefits for economic development, or specific investment in banking supervision through regulatory funding. Poor legal and political institutions give rise to "crony capitalism," where regulatory collusion and endemic corruption become the very foundation of economic life. Corresponding to $\gamma_\beta = 0$, informed regulation does not improve welfare as risk-shifting rents are fully appropriated by a corrupt, extortionary regulatory agency.[14]

Consistent with Proposition 3 Das *et al.* (2004) provide empirical evidence that "regulatory governance," i.e., high γ_β through transparency, accountability, and detection and punishment of lax enforcement, has a significant positive effect on financial-system soundness. They also find that the quality of ambient institutions, in particular political institutions and public-sector governance, further enhances the beneficial impact of regulatory governance on the soundness of the financial system. Analyzing the financing of prudential supervision of banks across countries Masciandaro *et al.* (2006) report that, in line with Proposition 2, the greater the likelihood of regulatory capture of supervisors the more likely the agency is to be funded by the public budget to prevent an explicit financial link between regulators and the industry through private contributions. They also find that European countries with their well developed institutional and legal infrastructure, which, in our framework, corresponds to a high quality of ambient institutions and, hence, shadow cost of collusion γ_β, are much less likely to rely on public funding of supervisory activities.

In the preceding analysis, we assume that regulators hold all the bargaining power so that they can fully appropriate the information rents through side-payments. In reality, there might exist counterthreats by the banking industry such as legal recourse or disclosing unethical regulatory pressures, which would increase the cost of collusion γ_β and improve regulatory efficiency by Proposition 3. Competition among regulators, jurisdictions, and interest groups might also counteract regulatory capture, further raising the cost of collusion. If banks held bargaining power of their own the fraction of information rents available to regulators would decrease. Less scope for rent appropriation by regulators lowers the severity of the public agency conflict and reduces the cost of regulatory incentives from Equation (4). This observation hints at the interdependence of social and public agency conflict and points to another avenue to improve the efficiency of regulation,

[14]In the remainder of the analysis, we abstract from the distributional implications of regulatory incentive pay because a more complete analysis calls for modeling the characteristics of markets for regulatory services.

which we pursue next.

4.2 Self-Interested Managers and Deposit Insurance Pricing

We now assume that the interests of bank owners and managers diverge and show how such private agency conflicts drive a wedge between regulators and banks by diminishing available information rents and improving the power of regulatory incentives. Under the separation of bank ownership and control, shareholders delegate the choice of investments to self-interested managers that need to receive appropriate incentives through a mixture of bonus payments b_i (junior to deposit claims) and equity stakes α_i to act in shareholders' best interests. As a result, bank lending now depends on incentive contracts in addition to bank type. This need for managerial incentives adds the following incentive-compatibility constraints for management to the overall welfare maximization problem:[15]

$$\theta_i \left[b_i + \alpha_i \left(H_i - F - b_i \right) \right] \geq \left[b_i + \alpha_i \left(I - F - b_i \right) \right] \tag{5}$$

which holds with equality in equilibrium. Denoting investment policies in the presence of bank internal agency conflict by θ_i^M we solve out for the corresponding threshold and compare it to the case of full shareholder-management alignment in Equation (1) for $b_i > 0$, which establishes the following proposition:

Proposition 4 *Under managerial agency conflict, banks implement investment policies with risky lending thresholds*

$$\theta_i^M \left(F \right) = \frac{\left(1 - \alpha_i \right) b_i + \alpha_i \left(I - F \right)}{\left(1 - \alpha_i \right) b_i + \alpha_i \left(H_i - F \right)} \tag{6}$$

for given deposit levels F. The investment strategy conditional on bank type is at most as risky as under perfect alignment between management and bank owners: $\theta_i^M \left(F \right) \geq \theta_i \left(F \right)$.

Proposition 4 shows how the need for managerial incentives creates an explicit link between compensation and risk taking. Simple differentiation of the optimal threshold $\theta_i^M \left(F \right)$ establishes the following result:

[15] As in John, Saunders and Senbet (2000), modeling bank organization in terms of incentive contracts actually incorporates a continuum of different agency conflicts. Hauswald (1998) shows how mixed debt-equity contracts arise naturally when managerial attention is non-contractible. Risk sharing and effort incentives could necessitate equity arrangements α while costly-state-verification might call for junior debt stakes b.

Corollary 1 *Risk taking decreases in bonuses b_i and increases in managerial equity stakes α_i.*

As the bonus payment b_i decreases or the equity stake α_i increases management chooses riskier investment strategies. The intuition straightforward. The higher their equity stake α_i the more management's interests agree with those of shareholders and the more they wish to engage in excessive risk taking. In the limit, all-equity compensation ($b_i = 0$) perfectly aligns insiders' and owners' incentives so that $\theta_i^M(F) = \theta_i(F)$ as before. Conversely, the higher the bonus b_i is the more management's interests are aligned with depositors and the less risk they will take. In line with the preceding result, John et al. (2007) provide empirical evidence that the more compensation aligns bank managers' and owners' interests the more levered and, hence, riskier, the institution becomes. In a similar vein, Mehran and Rosenberg (2008) find that the riskiness of banks increases in managerial stock-option grants whose payoffs replicate our stock-and-bonus compensation scheme. Brewer et al. (2004) and Sullivan and Spong (2005) also report that riskier banks have significantly higher levels of equity-based compensation as do banks with more investment opportunities.

The misalignment of shareholder and management interests also affects deposit-insurance pricing. Given a bank's compensation scheme and deposit level, substituting management's optimal lending policy $\theta_i^M(F)$ from Equation (6) into Equation (3) shows that in the presence of managerial agency conflict fair deposit insurance pricing contingent on type requires

$$\pi_i^M(F) = E\max\left\{F - T_{\theta_i^M(F)}, 0\right\} = \frac{1}{2}\left[1 - \theta_i^M(F)\right]^2 (F - L_i). \tag{7}$$

Given a bank's investment opportunities shareholders or, rather, their board[16] can induce management to follow a particular lending policy through appropriate incentives. The following lemma characterizes optimal pay policies:[17]

Lemma 1 *To induce management to follow a particular investment policy $\theta_i(F) = \frac{I-F}{H_l-F}$ and collect deposit levels F shareholders offer management only equity stakes α_i, which decrease in type*

[16] We leave aside the role of directors in defining investment policy, which would add an additional layer of agency conflicts to our model. However, Becher *et al.* (2005) find that deregulation in the banking industry during 1990s coincides with an increase in bank directors' equity stakes which resulted in an alignment of shareholders' and directors' interests similar to the ones between shareholders and managers.

[17] The results go through for more general nonlinear contracts, which, however, do not yield a closed-form solution.

i and increase in deposits F and, hence, banks' risk taking:

$$\begin{aligned} b_i(F) &= 0 \\ \alpha_i(F) &= \frac{2\bar{S}(H_i - F)}{(H_i - F)^2 + (I - F)^2} \end{aligned}$$

Proof. See Appendix. ■

Since shareholders only pursue the maximization of equity value they provide explicit incentives for risk taking through stock compensation alone. The higher the quality of a bank's balance sheet or, equivalently, investment opportunities ($i = h$) the less costly such incentives are to shareholders. Conversely, the more risk shareholders want management to take and, correspondingly, collect deposits the larger the equity stake needs to be (see John et al., 2007 for evidence to this effect). Taken together, Lemma 1 therefore establishes that managerial incentives in the form of equity depend on the bank's "upside potential" $H_i - F$ reflecting shareholders' limited liability. Since shareholders face trade-offs between management participation and incentive compatibility given their bank's type i deposit insurance naturally limit the scope for rent seeking by supervisors, a topic which we consider next.

4.3 Minimizing the Incidence of Regulatory Failure

We now consider comprehensive regulation in the presence of agency conflicts between bank owners and managers. Under the regulatory scheme in Proposition 2 owners of high-quality banks h cannot possibly reap risk-shifting rents. Hence, they might as well provide managerial incentives which imply efficient lending policies θ_h^* by offering all-equity compensation contracts

$$\begin{aligned} b_h^* &= 0 \\ \alpha_h^* &= \frac{2\bar{S}(H_h - L_h)}{(H_h - L_h)^2 + (I - L_h)^2} \end{aligned} \tag{8}$$

Lemma 1 or simple substitution into Equation (6) shows that such compensation schemes implement first-best deposit collection. As a result, supervisors would levy deposit-insurance fees consistent with the optimal investment policy on high-quality banks. Alternatively, a simple application of the revelation principle shows that such lenders or, rather, their boards would truthfully reveal the

above compensation scheme irrespective of examination outcomes. Since it is incentive compatible for owners to pay b_h^* and α_h^* they might as well announce the exact composition of managerial incentives to third parties such as supervisors and regulators.[18]

The same is not true for low-quality banks l which, by Proposition 2, still have an incentive to seek risk-shifting rents and collusive arrangements with supervisors. If an examination reveals low asset quality the bank might tempt regulators to misreport its type in order to pay only $\pi_h(F) < \pi_l(F)$, collect higher deposits, and adopt socially suboptimal lending rules. However, the need for managerial incentives now complicates the creation of risk-shifting rents. Suppose that the equity component of banks' compensation policies is common knowledge due to regulatory requirements, voluntary disclosure, any combination thereof, or by the revelation principle applied to high-quality institutions, which have nothing to gain or lose by disclosing their compensation arrangements. The following result establishes that low-quality banks either reveal their type or naturally curtail their risk-shifting in their attempt to pool with high-quality banks:

Proposition 5 *If managerial equity stakes are observable intra-bank agency conflict implies either type revelation or diminished risk-shifting under uniform deposit insurance.*

Proof. See Appendix. ■

At the heart of Proposition 5 lies a tension between risk shifting, which presupposes pooling in deposit collection, and the requisite managerial incentives, which vary across bank types. To generate rents low-quality banks have to imitate not only high-quality banks' deposit collection but also their management's (observable) equity stake to avoid detection. But bank h and its equity are more valuable than bank l/so that the latter's board must either offer its management a higher equity stake revealing the lender's type or, for the same stake, add a bonus $b_l > 0$, which we derive in the proof of Proposition 5, to ensure management participation by Lemma 1. The bonus, in turn, reduces risk taking by Corollary 1 because it aligns managers, who have become *de facto* creditors of the bank, more with depositors than shareholders. As a result, banks facing unattractive investment opportunities engage in less risky lending than under perfect owner-manager alignment or fully reveal their lower asset quality.

[18]Strictly speaking, owners are indifferent between deposit levels $F \in [L_i, I)$ and compensation revelation. It is customary to assume that agents select first-best actions in this situation.

The need for managerial incentives creates a subtle rent-dissipation mechanism. Managers and owners do not benefit in equal measure from risk-shifting at low-quality institutions. The rents accrue to owners whereas managers bear some of their (expected) costs. As a consequence, bank management partly internalizes the consequences of shareholders' rent seeking through the bonus component which counteracts any incentives for excessive risk taking. As a result, we obtain the following corollary:

Corollary 2 *Bank-internal agency conflict decreases informational rents to* $\Phi_l^M(L_h) < \Phi_l(L_h)$; *the more dissimilar the two bank types are, the greater the reduction in rents becomes.*

Proof. See Appendix. ■

The existence of managerial agency conflicts reduces risk-shifting rents because owners of low-quality banks face a trade-off between type detection on the one hand and managerial participation and incentives on the other hand. The more difficult it is for such banks to pool with high-quality ones the more managerial incentive compatibility acts as a rent-dissipation mechanism. In the process, available rents Φ_l fall so that, by Proposition 2, less incentives are required for supervisors to properly perform their examination tasks and to manage deposit-insurance schemes:

Corollary 3 *Bank-internal agency conflict increases the power of regulatory incentives; the latter also increase in the dissimilarity of bank types.*

The greater the need for managerial incentives at low-quality institutions, i.e., the larger the difference $H_h - H_l$, the easier bank-type detection becomes or, in the case of pooling, the more bonus compensation the low-quality bank will offer to its management. In both cases, available rents to be split with supervisors decrease so that the power of regulatory incentives correspondingly rises. In fact, John et al. (2007) provide evidence that monitoring by regulators increases in the power of managerial incentives which is consistent with our predictions. The need for incentive compensation dissipates available rents so that the attractiveness of regulatory collusion diminishes accordingly. By mitigating the conflict between banks and society private agency conflict also attenuates the severity of supervisory moral hazard. Since regulatory incentives are a direct function of available risk-shifting rents which decrease with bank-internal agency conflicts, it takes less resources to

prevent collusion. Given the legal environment represented by collusion costs γ_β, the power of incentives to elicit truthful reports has increased.

Taken together Propositions 1 and 5 suggest that private agency conflicts can significantly improve regulatory incentives, the effectiveness of deposit insurance as a regulatory instrument, and, hence, welfare.

Proposition 6 *To elicit truthful reporting of audit information r and prevent collusion under private agency conflict, regulators receive incentive pay*

$$s_l^M = \bar{s} + \left(1+\gamma_\beta\right)^{-1} \Phi_l^M\left(L_h\right) > \bar{s}$$

for reporting low quality banks and reservation funding $s_h = \bar{s} = s_0$ otherwise, and collect deposit insurance premia with corresponding funding levels

$$\left(\pi_r\left(F\right), s_r\right) = \begin{cases} \pi_h^*\left(F\right), \bar{s} & \text{for } r = h \\ \pi_l^M\left(F\right), s_l^M & \text{for } r = l \\ \pi_h^*\left(F\right), \bar{s} & \text{for } r = \emptyset \end{cases} .$$

If examinations identify a high-quality lender supervisors simply set deposit insurance premia at the actuarially fair level. Since no party can earn any rents the supervisory agency only obtains reservation funding $\bar{s}$. An examination revealing low asset quality might tempt a bank and supervisors to collude so that a funding bonus of $\left(1+\gamma_\beta\right)^{-1} \Phi_l^M\left(L_h\right)$, which is contingent on the examined lender's compensation policy, provides the appropriate incentives for truthful reports and appropriate rule enforcement in this state. As before, the bonus is a function of the legal environment $\left(\gamma_\beta\right)$ and available information rents which are lower in the presence of bank-internal agency conflicts. Finally, in the case of uninformative audits supervisors receive reservation funding $\bar{s}$ and levy uniform deposit insurance $\pi^u\left(F\right) = \pi_h^*\left(F\right)$ so that banks of both type are active and low-quality ones earn information rents.

The fine balance of rents and incentives in the integrated deposit-insurance and regulatory-funding scheme improves welfare. For good banks the (first-best) outcome is unchanged. The Pareto improvement occurs with regard to banks of low asset quality. If audits are uninformative uniform premia $\pi^u\left(F\right) = \pi_h^*\left(F\right)$ partially internalize rent seeking and reduce risk-shifting by

Proposition 5 and Corollary 3. Should the audit reveal low asset quality banks examiners could at most reap information rents $\Phi_l^M(L_h)$ through collusion, which is lower by the required managerial bonus payment. In this state, compensation contingent premia π_l^M further enhance welfare by rewarding owners for managerial incentives that limit risk-shifting. Comparison with the results in Section 4 and, especially, Proposition 2, shows that for uninformative or low-quality reports welfare unequivocally increases albeit not to first best. Through the interplay of rent dissipation and internalization deposit insurance improves welfare in the presence of private and public conflicts of interest.

In addition to introducing a rent-dissipation mechanism the managerial agency conflict can also serve as a revelation device for bank type. Let both components of bank compensation policies (α_i, b_i) be fully observable, for instance as a consequence of regulatory-filing requirements. The social planner now specifies regulatory rules π_r^M that use compensation rather than deposit levels as a proxy for banks' type-contingent risk taking. Consider a bank with bad investment opportunities which attempts to imitate an h-bank by offering the latter's compensation scheme. We show in the next proposition that this contract would violate managerial participation or incentives so that low-quality banks would reveal their type. As a result, collusive outcomes are no longer feasible:

Proposition 7 *With fully observable management compensation policies actuarially fair deposit-insurance schemes are collusion-proof in the presence of public and private agency conflict.*

Proof. See Appendix. ■

The intuition behind the previous result is straightforward. Owners of banks with low-quality investment opportunities face two conflicting needs. To induce their management to engage in excessively risky lending they have to set bonus payments $b_l = b_h^* = 0$ but then management participation requires an equity stake $\alpha_l > \alpha_h^*$ that reveals the bank's type. Management compensation is more type-sensitive than investment policy because owners reap most of the benefits from risk-shifting. Hence, the existence of a private agency conflict drives a wedge between bank supervisors and owners in the form of self-interested management. Conditioning regulation on observed executive contracts therefore eliminates all scope for risk-shifting in case of uninformative audits and would reveal collusion between bank owners and supervisors because deposit-insurance premia would not match bank type as revealed by managerial incentives.

5 Lessons for Regulatory Design

The current credit crisis has forcefully demonstrated how a toxic combination of strong managerial incentives for risk taking, weak regulatory incentives to curb such tendencies, and essentially limitless implicit deposit insurance can imperil not only the whole financial system but also undermine public finances and the economy at large. Given the extent of the crisis across the financial sector regulators, legislators and commentators have finally started to pay attention to the interplay of management compensation, regulatory intervention, and risk taking. While the Basel II accord does not even mention managerial compensation (BIS, 2006) the Financial Stability Forum concludes in its recent report on "Enhancing Market and Institutional Resilience" (FSF, 2008a) that "[c]ompensation schemes in financial institutions encouraged disproportionate risk-taking with insufficient regard to longer-term risks. This risk-taking was not always subject to adequate checks and balances in firms' risk management systems." In a follow-up report (FSF, 2008b) the FSF cites typical recommendations by industry groups that "compensation practices should be based on the performance of the bank as a whole and be heavily stock-based..."

However, in light of our results it is doubtful that all-equity compensation (see, e.g., CPRG, 2008) alone will improve risk taking by the banking industry.[19] In fact, it is more likely than not to be counterproductive unless the regulatory framework explicitly links the extent of stock compensation and the overall degree of owner-manager alignment to supervisory incentives and deposit insurance. Although popular and political indignation is as much about the size as the composition of compensation packages in the banking industry commentators have started to single out their lack of sensitivity to the resulting risk taking as one of the primary drivers of the current crisis (see, e.g., Sorkin, 2008). The preceding analysis shows how deposit insurance priced as a function of managerial incentives can provide this missing link and, at the same time, increase the power of incentives for supervisors, regulators, or their political masters. However, in the absence of explicit supervisory incentives it is hardly surprising that regulators have shown remarkable complacency with respect to banks' risk taking ever since the first tremors of credit crisis were felt in spring 2007.

[19] For instance, Citigroup's chairman, Winfried Bischoff, is unconvinced that simply limiting pay and including more stock and longer-term rewards is the right solution: "[b]y itself, more share and retention-based compensation is not the magic bullet, because it certainly didn't stop us from running up very large losses" (NY Times, Dec 02, 2008).

Although the adverse incentives of deposit insurance are well understood, the benefits of fairly priced insurance premia which account for management incentives are often overlooked. Indeed, one justification of capital-adequacy regulation is the perverse risk-shifting incentive of uniform deposit-insurance pricing. Both instruments require the collection of bank-specific information but only deposit insurance internalizes the institutions' rent-seeking behavior. By shifting the cost of excessive risk-taking back to bank owners, this instrument exploits the separation of ownership and control as long as insurance premia reflect the incentive features of management compensation. Furthermore, the combination of rent internalization through deposit insurance and rent dissipation through private agency conflict increase the power of regulatory incentives thereby mitigating the consequences of conflicts between society and regulators.

Our results also hold lessons for regulatory design. In many well documented instances of regulatory failure conflicts of interest between bank owners and insiders are paramount, witness the deeper causes of the current turmoil or, earlier, the Asian and Russian and financial crises. Contrary to the common perception that bank-internal agency conflicts exacerbate the consequences of conflicts between regulators and society our results suggest that such conflicts might improve regulatory incentives and enforcement provided that regulators receive the appropriate compensation and that deposit insurance premia reflect managerial incentives. Since banks' compensation practices reveal their operating policies at least partially they can provide the missing link between incentives for bank managers and supervisors and risk taking by lenders. However, aligning managerial compensation with risk taking for bank CEOs after bailing out institutions is only the first step. Any comprehensive overhaul of banking regulation needs to account for the nexus of risk taking, oversight, and compensation practices by providing ex ante incentives to regulators conditional on banks' expected operating policies to curb any supervisory complacency which amounts to tacit collusion.

Another straightforward, but nevertheless often overlooked implication is that regulators should receive their reservation income $\bar{s}$. In many instances, the markets for regulatory and managerial services in financial intermediation are highly integrated. Paying less than the reservation wage regardless of performance only serves to align bank owners with regulators to the detriment of society. Since the latter will hide audit information excessive risk taking by lenders again becomes an issue. In emerging economies, anecdotal evidence suggests that regulators are extremely poorly

paid. Their economic hardship makes them susceptible to side payments that might lead to regulatory capture.[20] In the absence of appropriate legal institutions the private cost of collusion γ_β often approaches 0 so that a small fraction of available risk-shifting rents might suffice to capture regulators (see also Alesina and Tabellini, 2006a and 2008b). Poor training and inadequate disclosure standards leading to very low likelihoods of informative examinations complete the picture. At a small cost to themselves, banks can circumvent prudential regulation and engage in excessively risky lending and deposit collection.

Ultimately, economies face an intriguing trade-off in regulatory design by Proposition 6. They can make collusion more costly for regulators through investment in legal institutions, create misalignment between bank owners and managers, provide more incentive pay to regulators or a combination of the preceding. The existence of financial markets facilitates regulatory reform by making fair deposit insurance pricing and managerial equity stakes possible. If insider-owner agency conflicts are too severe, owners will be aligned with insiders through all equity compensation with no bonus payments $b_i = 0$. As the current credit crisis shows, this scenario is not confined to emerging economies, where insiders and owners jointly shift risk to society. The low levels of regulatory expertise in the form of small detection probabilities ϕ and sub-reservation level pay render regulators particularly vulnerable to collusion. Even abstracting from political interference, capitalization forbearance and underpricing of both explicit and implicit deposit insurance has been wide spread in these countries.

6 Discussion

This paper makes a very simple but fundamental point. Observable incentive schemes such as managerial compensation provide information not only about the agency conflict itself but also about the parties' attributes and, especially, the principal's objectives. Consequently, if managers need incentives to take actions on behalf of owners which are detrimental to third parties the latter can improve on contracting outcomes by conditioning their response on *ex ante* compensation schemes. We apply this insight to banking regulation and show how the existence of bank-internal

[20] In economies where graft and influence activities are endemic the regulators' political masters are often the colluding party. We do not explicitly model this aspect here but it is easily introduced by relabeling the various parties.

agency conflicts introduces a rent dissipation mechanism which, in turn, mitigates the severity of public agency conflicts between self-interested regulators and society. In particular, the need for explicit managerial incentives to induce excessively risky lending reveals information about the bank's balance-sheet quality which allows society to design collusion-proof comprehensive regulatory schemes. Regulatory rules conditional on bank compensation can curtail or eliminate a bank's incentives for risk shifting, enhance the power of financial incentives for supervisors, and lead to a welfare improvements in banking regulation.

The results hold several important empirical implications. Insider-owned banks are more likely to engage in excessively risky operating strategies, which is borne out by several well publicized S&L failures (e.g., Charles Keating and the failure of Lincoln Savings in 1989), the recent demise of Bear Stearns and Lehman Brothers, or affiliated lending in many emerging economies. Furthermore, the riskiness of banks' loan portfolios should increase in the importance of equity or stock-option compensation for management and fall in outright bonus payments. Absent explicit incentives, the intensity of supervision should decrease and the likelihood of regulatory capture increase in funding for the regulating entity. Also, the likelihood of regulatory capture, forbearance, and other supervisory failures increase in banks' riskiness and the size of management's and, in fact, insiders' equity stake.

Our analysis also offers empirical predictions on regulatory design. Given the trade-off in the quality of ambient legal institutions and regulatory incentives we would expect countries with insufficient institutional infrastructure to either provide more direct incentives to regulators through public funding arrangements (Masciandaro *et al.*, 2006) or suffer from regulatory capture and distorted supervision. Hence, the solvency of deposit-insurance schemes should increase in the power of regulatory incentives as revealed by the source and level of funding, the ambient legal institutions, and the quality of investment opportunities but decrease in the equity component of banks' managerial compensation. The opposite predictions hold for loan-loss provisions. In a similar vein, regulatory incentives without appropriate enforcement are ineffective which suggests that regulatory reform be preceded by the development of the legal system and appropriate monitoring devices to hold regulators and the industry accountable.

The insight that the observability of management compensation can reveal attributes of regulated firms is of much wider application than just the banking industry. Whenever there is a

conflict of interest between society and regulators or supervisors due to the specialized nature of regulatory expertise regulation contingent on compensation arrangements of the regulate firms should increase welfare. Examples include public procurement or tariff regulation for utilities and cost-shifting, drug pricing and insufficient pharmaceutical R&D, or freight regulation and lack of infrastructure investment. In all these instances, conditioning regulatory rules and funding on the observed contractual arrangements within the regulated firms might reduce social costs, enhance the power of regulatory incentives, and decrease the risk of regulatory capture through the reduction of information rents.

A similar line of reasoning applies to the conflict of interest between a firm's shareholders and debtholders. A central tenet of corporate finance holds that debt in the presence of informational asymmetries provides incentives for owners to engage in excessively risky operational policies from a social point of view. However, the separation of ownership and control in many corporations means that shareholders need to provide management with incentives to pursue such socially suboptimal corporate strategies. Our results then suggest that debtholders can at least in part avoid bearing the consequences of excessive risk taking by designing debt contracts that are contingent on the information revealed by managerial compensation and incentive schemes. We leave this question for future research.

Appendix

We first define the parties participation and incentive-compatibility constraints and the social-welfare maximization problem. Let $\Pi^D, \Pi^M, \Pi^O, \Pi^R$ denote the payoffs to bank depositors, managers and owners, and regulators so that respective participation constraints are

$$\begin{aligned}
E\left[\Pi^D\right] &= E\left[\min\left\{T, F\right\} + \tau\right] - B \geq 0 && (9)\\
E\left[\Pi^M\right] &= E\left[\alpha_i \max\left\{T_{\theta_i(F_i)} - F_i - b_i, 0\right\} + \min\left\{b_i, \left[T_{\theta_i(F_i)} - F_i\right]^+\right\}\right] - \bar{S} \geq 0 && (10)\\
E\left[\Pi^O\right] &= (1-\alpha_i) E\left[\max\left\{T_{\theta_i(F_i)} - F_i - b_i, 0\right\}\right] - K_i \geq 0 && (11)\\
E\left[\Pi^R\right] &= E\left[s\right] - \bar{s} \geq 0 && (12)\\
K_i + B &\geq I + \pi && (13)
\end{aligned}$$

whereas banks' individual rationality and incentive compatibility constraints are

$$\begin{aligned}
\theta_i(F_i) \max\left\{H_i - F_i, 0\right\} + (1 - \theta_i(F_i)) \max\left\{L_i - F_i, 0\right\} - \max\left\{I - F_i, 0\right\} &\geq 0 && (14)\\
E\left[T_{\theta_i(F_i)} - F_i\right]^+ - K_i - \left\{E\left[T_{\theta_i(F')} - F'\right]^+ - K'\right\} &\geq 0 && (15)
\end{aligned}$$

for $i \in \{h, l\}$. All constraints hold with equality in equilibrium with the possible exception of either the bank owners' or managers' participation constraint. In addition, we require that banks of both types are active in equilibrium, i.e., that regulation does not lead to the withdrawal of high- or low-quality banks.

Substituting out from the participation constraints, enforcing the relevant budget condition, setting $s = \bar{s}$ and noting that the constraints are binding shows that welfare maximization consists in maximizing bank value net of investment and regulatory costs through the choice of deposit levels F_i. Equivalently, the social planner minimizes expected losses from bank failures by choice of fairly priced deposit-insurance premia $\pi_i(F)$ subject to having both types of bank active in equilibrium.

Proof of Proposition 1. If bank type is unobservable, only uniform deposit-insurance pricing is feasible. Suppose that deposit-insurance premia

$$\pi_i(F) = E\left[F - T\left(\theta_i(F)\right)\right]^+ = \frac{1}{2}\left(1 - \theta_i(F)\right)^2 \left[F - L_i\right]^+$$

are set at the low-quality bank's first-best level $\pi^u = \pi_l^* > \pi_h^*$. Internalizing the cost of excessive deposit collection banks choose $F_i = L_l < L_h$ preventing low-quality banks from risk-shifting. However, by Equation (13) high-quality banks h now need to raise more capital than their type warrants ($K_l > K_h$) and take less risk than is socially optimal by $\theta_h(L_l) > \theta_h^*$, which violates their participation constraint. Consequently, no high-quality bank would be active under a uniform deposit-insurance scheme $\pi^u = \pi_l^*$.

Since society prefers banks of both types to be active in equilibrium the social planner charges supervisors with levying uniform deposit insurance premia $\pi^u = \pi_h^*$ which implement deposit levels at the high-quality bank's optimal capitalization level $F = L_h$. As a result, banks of type l engage in excessive deposit collection $F_l = L_h > L_l = F_l^*$, which implies socially suboptimal lending thresholds $\theta_l(L_h) = \frac{I - L_h}{H_l - L_h} < \frac{I - L_l}{H_l - L_l} = \theta_l^*$ by $L_h > L_l$, whereas high-quality ones adopt first-best deposit levels and lending thresholds. We find low-quality banks' risk-shifting rents from bank

profits $\Pi_i(\theta_i(F)) = E[T_{\theta_i} - F]^+ - K_i$ and the balance-sheet identity $K_i + F = I$ as

$$\Phi_l(L_h) = E[T(\theta_l(L_h)) - L_h]^+ - K_h - \left(E[T_l^* - L_l]^+ - K_l\right) = \frac{1}{2}\frac{(H_l - I)^2(L_h - L_l)}{(H_l - L_h)(H_l - L_l)} \quad \blacksquare$$

Proof of Proposition 3. Let social welfare under full and asymmetric information be denoted by V^{FI} and V^{AI}, respectively. With incentive-compatible regulatory implementation the agency will truthfully report investment opportunity quality. With probability ϕ banks pay first-best (full information) fairly priced deposit-insurance premia $\pi_i^*, i \in \{h, l\}$ whereas with probability $(1-\phi)$ one is back in the asymmetric information regulatory regime of $\pi^u = \pi_h^*$. By $\phi \in (0,1)$ risk-shifting now occurs with probability $(1-\phi)(1-q) < (1-q)$, its asymmetric information probability, so that expected investment inefficiencies and risk-shifting rents decrease under informed regulation. As result, welfare under informed regulation V^R net of regulatory cost is given by

$$V^R(F^*) = \phi V^{FI}(F^*) + (1-\phi)V^{AI}(L_h) - \phi(1-q)\gamma\left(1+\gamma_\beta\right)^{-1}\Phi_l(L_h) \tag{16}$$

for the shadow cost of public funds γ so that $V^R > V^{AI}$ by $V^{AI} = V^{FI} - \gamma(1-q)\Phi_l(L_h)$. The envelope theorem now (16) reveals $\frac{\partial V^R}{\partial \gamma_\beta}\Big|_{F^*} = \phi(1-q)\frac{\gamma\Phi_l(L_h)}{(1+\gamma_\beta)^2} > 0$. But collusion costs vary positively with the degree of the rule of of law: better legal instutions increase the shadow cost of collusion γ_β and thus social welfare. $\blacksquare$

Proof of Lemma 1. To find the appropriate type-contingent compensation scheme which implements a given investment strategy $\theta_i(F)$ for $F \in (L_i, I)$ we simply equate the latter to $\theta_i^M(F)$ and solve the resulting expression together with management's participation constraint (10), which holds with equality, for α and b, i.e.,

$$\begin{aligned}
\frac{(1-\alpha)b + \alpha[I-F]}{(1-\alpha)b + \alpha[H_i - F]} &= \frac{I-F}{H_i - F} \\
\alpha\frac{1}{2}\left(1 - \left(\frac{I-F}{H_i-F}\right)^2\right)(H_i - F - b) + \alpha\frac{I-F}{H_i-F}(I - F - b) + b &= \bar{S}
\end{aligned}$$

which yields $\alpha_i(F) = \frac{2\bar{S}(H_i-F)}{(H_i-F)^2+(I-F)^2}$ and $b_i(F) = 0$ as the only solution with $b_i \geq 0$. Simple differentiation of $\alpha_i(F)$ shows that

$$\begin{aligned}
\frac{\partial \alpha_i}{\partial H_i} &= -2\bar{S}(H_i - I)\frac{(I-F) + (H_i - F)}{\left((H_i-F)^2 + (I-F)^2\right)^2} < 0 \\
\frac{\partial \alpha_i}{\partial F} &= 2\bar{S}\frac{(H_i-F)^2 + (I-F)(2H_i - I - F)}{\left((H_i-F)^2 + (I-F)^2\right)^2} > 0
\end{aligned}$$

by $H_i > I \geq F$ so that $\alpha_h(F) < \alpha_l(F)$ by $H_h > H_l$ establishing the lemma. $\blacksquare$

Proof of Proposition 5. Since uniform premia are set at $\pi^u(F) = \pi_h^*(F)$ boards of high-quality banks h banks might as well implement first-best lending policies by offering management compensation schemes $\alpha_h(L_h) = \frac{2\bar{S}(H_h-L_h)}{(H_h-L_h)^2+(I-L_h)^2}$ by Lemma 1. To realize risk-shifting rents a low-quality bank l needs to imitate a high-quality one by collecting observable deposits $F = L_h$ and also

offering its management $\alpha_h(L_h)$. However, by Lemma 1 $\alpha_h(L_h) < \alpha_l(L_h)$ violating a low-quality bank's managerial participation constraint (10). To ensure management participation, the board of a low-quality bank therefore has to offer either the larger equity stake $\alpha_l(L_h)$, which reveals the low quality of the lender's assets by its observability, or a bonus $b_l > 0$ which is decreasing in α_h. But by Corollary 1 such a bonus raises the risky-investment threshold $\theta_l^M(L_h) = \frac{(1-\alpha_h)b_l+\alpha_h[I-L_h]}{(1-\alpha_h)b_l+\alpha_h[H-L_h]} > \theta_l(L_h)$ and reduces the bank's risk taking.

The bonus follows from management's participation constraint for a low-quality bank offering a high-quality one's equity compensation $\alpha_h(L_h) = \frac{2S(H_h-L_h)}{(H_h-L_h)^2+(I-L_h)^2}$ by solving $E\left[\Pi^M\right] = \alpha_h E\left[T_l\left(\theta_l^M(L_h)\right) - L_h - b_l\right]^+ + b_l - \bar{S} = 0$ for b_l. For instance, for b_l small, i.e., $b_l \downarrow 0$, one can approximate $\theta_l^M(L_h)$ by $\theta_l(L_h)$ so that $E\left[\Pi^M\right] = \alpha_h \frac{1}{2}\left(1 - \left(\frac{I-L_h}{H_l-L_h}\right)^2\right)(H_l - L_h - b) + \alpha_h \frac{I-L_h}{H_l-L_h}(I - L_h - b) + b - \bar{S} = 0$ implies $b_l = \frac{\left(\alpha_h\left((H_l-L_h)^2+(I-L_h)^2\right)-2S(H_l-L_h)\right)(H_l-L_h)}{\alpha_h\left((H_l-L_h)^2-(I-L_h)(I-2H_l+L_h)\right)-2(H_l-L_h)^2}$. The non-negativity $b_l > 0$ and, similarly, $\frac{\partial b_l}{\partial \alpha_h} < 0$ is a consequence of the distributional assumptions $0 < L_l < L_h < I < H_l < H_h$ and implicit differentiation. ■

Proof of Corollary 2. By Proposition 5 l banks pay a bonus $b_l > 0$ so that by Proposition 4 $\theta_l^* \geq \theta_l^M(L_h) > \theta_l(L_h)$. Hence, risk-shifting rents, which decrease in the risky-lending threshold $\theta_i(F)$, decrease with private-agency conflicts so that $\Phi_l^M(L_h) := E\left[T\left(\theta_l^M(L_h)\right) - L_h\right]^+ - K_h - \left(E\left[T_l^* - L_l\right]^+ - K_l\right) < \Phi_l(L_h)$ as previously defined.

The second part of the corollary is a simple consequence of the fact that more dissimilar banks are in type, i.e., the larger $H_h - H_l$, the larger the bonus payment to l bank management has to be because either the h-bank equity stake $\alpha_h(L_h)$ is small (for H_h large) or the value of l-bank equity is small (for H_l small). But the larger the bonus payment, the less risk management takes, and the smaller risk-shifting rents become. Formally, it follows simply from an application of the chain rule because, for instance,

$$\frac{\partial \Phi_l^M}{\partial H_h} = \frac{\partial \Phi_l^M}{\partial \theta_l^M}\frac{\partial \theta_l^M}{\partial b_l}\frac{\partial b_l}{\partial \alpha_h}\frac{\partial \alpha_h}{\partial H_h} < 0$$

from $\frac{\partial \Phi_l^M}{\partial \theta_l^M} < 0$ as previously argued, $\frac{\partial \theta_l^M}{\partial b_l} > 0$ by Corollary 1, $\frac{\partial b_l}{\partial \alpha_h} < 0$ by Proposition 5, and $\frac{\partial \alpha_h}{\partial H_h} < 0$ by Lemma 1. ■

Proof of Corollary 3. By Corollary 2 risk-shifting rents decrease with private-agency conflicts. But regulatory incentive schemes are a function of risk-shifting rents Φ by $s_l = \bar{s} + \left(1+\gamma_\beta\right)^{-1}\Phi$ (see Proposition 2) so that under managerial agency conflict we have $s_l^M = \bar{s} + \left(1+\gamma_\beta\right)^{-1}\Phi_l^M(L_h) < s_l = \bar{s} + \left(1+\gamma_\beta\right)^{-1}\Phi_l(L_h)$ by $\Phi_l^M(L_h) < \Phi_l(L_h)$. Since regulators receive less bonus pay for reporting low-quality banks the power of regulatory incentives has increased *ceteris paribus.* The more dissimilar the banks are, i.e., the larger $H_h - H_l$, the larger the bonus payment to l bank management, the higher the risky-lending threshold $\theta_l^M(L_h)$ becomes, which, in turn, decreases risk-shifting rents by Corollary 2. Hence, supervisors require a smaller reward for reporting low-asset quality banks and levying the appropriate deposit-insurance premia which is equivalent to an increase in the power of regulatory incentives. ■

Proof of Proposition 7. Recall that uniform premia are set at $\pi^u(F) = \pi_h^*(F)$. With this rule high-quality banks implement first best lending policies by offering management compensation schemes with an equity stake $\alpha_h^* := \alpha_h(L_h)$ and no bonus ($b_h^* := b_h(L_h) = 0$) by Lemma 1 and Proposition 5. Suppose a bank audit reveals $\eta = l$ so that bank owners and regulator have

an incentive to collude by misrepresenting information as $r = h$, paying no deposit insurance by $\pi_h^*(L_h) = 0$, engaging in excessively risky lending, and splitting the resulting informational rents. However, by the proof of Proposition 5, the board of a low-quality bank therefore has to offer either the larger equity stake $\alpha_l(L_h)$ or a bonus $b_l > 0$ to ensure management participation. Under full observability of management compensation, i.e., both equity stake and bonus component, either action reveals the low quality of the lender's assets, thereby preventing supervisors from pretending that an otherwise informative examination did not reveal any useful information.

Furthermore, high-quality banks can commit to first-best investment strategies by revealing their investment opportunities through compensation packages (α_h^*, b_h^*) so that low-quality banks have to do the same. Since by Lemma 1 $\alpha_i(F)$ is decreasing in type all low-quality banks regardless of the examination outcome have to offer either $\alpha_l(L_h) > \alpha_h^*(L_h)$ or $\alpha_h^*(L_h)$ with $b_l > 0$ to induce their management to engage in excessively risky lending. As a result, no bank of type l can pool with h banks without violating their management participation constraint or revealing their type. Hence, even in the presence of uninformative examinations $\eta = \emptyset$ management compensation reveals bank type so that supervisors do not need additional incentives in the form of bonus pay s_l^M for reporting low-quality lenders. Unable to hide the false nature of their examination reports, regulators will truthfully reveal audit information and obediently implement the requisite regulatory rule. ■

References

[1] Acharya, V. (2003), "Is the International Convergence of Capital Adequacy Regulation Desirable?" Journal of Finance 58: 2745-2782.

[2] Alchian, A. and H. Demsetz (1972), "Production, Information Costs, and Economic Organization," *American Economic Review* 62: 777-795.

[3] Alesina, A. and G. Tabellini (2006a), "Bureaucrats or Politicians? Part I: A Single Policy Task," mimeo, Harvard University.

[4] Alesina, A. and G. Tabellini (2006b), "Bureaucrats or Politicians? Part II: Multiple Policy Tasks," mimeo, Harvard University.

[5] Baron, D. and D. Besanko (1987), "Commitment and Fairness in a Dynamic Regulatory Relationship", *Review of Economic Studies* 54: 413–436.

[6] Basel Committee on Banking Supervision (2006), "Basel II: International Convergence of Capital Measurement and Capital Standards: A Revised Framework - Comprehensive Version," Bank for International Settlements, June 2006.

[7] Becher, D., T. Campbell and M. Frye (2005), "Incentive Compensation for Bank Directors: The Impact of Deregulation," *Journal of Business* 78: 1753-1778.

[8] Boot, A. and A. Thakor (1993), "Self-Interested Bank Regulation," *American Economic Review* 83: 206–212.

[9] Brewer, E., W.C. Hunter, and W. E. Jackson (2004), "Investment Opportunity Set, Product Mix, and the Relationship between Bank CEO Compensation and Risk-Taking," Working Paper 2004-36, Federal Reserve Bank of Atlanta.

[10] Caprio, G. and D. Klingebiel (1996), "Bank Insolvency: Bad Luck, Bad Policy, or Bad Banking?," mimeo, The World Bank.

[11] CRMPG (2008), "Containing Systemic Risk: The Road to Reform," Counterparty Risk Management Policy Group III, August 6, 2008.

[12] Cull., R., L. Senbet and M. Sorge (2005), "Deposit Insurance and Financial Development," *Journal of Money, Credit, and Banking*, 37: 43-82.

[13] Das, U., M. Quintyn and K. Chenard (2004), "Does Regulatory Governance Matter for Financial System Stability? An Empirical Analysis," IMF Working Paper 04/89.

[14] Dewatripont, M. and J. Tirole (1994), *The Prudential Regulation of Banks*, MIT Press.

[15] Diamond, D. and P. Dybvig (1986), "Banking Theory, Deposit Insurance and Bank Regulation," *Journal of Business* 59: 53-68.

[16] Financial Stability Forum (2008a), "Report of the Financial Stability Forum on Enhancing Market and Institutional Resilience," 7 April 2008.

[17] Financial Stability Forum (2008b), "Report of the Financial Stability Forum on Enhancing Market and Institutional Resilience. Follow-up on Implementation," 10 October 2008.

[18] "Fragile, Handle with Care: A Survey of Banking in Emerging Markets," *The Economist* April 12, 1997.

[19] Giammarino, R., T. Lewis and D. Sappington (1993), "An Incentive Approach to Banking Regulation," *Journal of Finance* 48: 1523-1542.

[20] Hauswald, R. (1998), "Financial Contracting, Reorganization and Mixed Finance: A Theory of Banking Systems," mimeo, American University.

[21] Heinemann, F. and M. Schüler (2004), "A Stiglerian View on Banking Supervision," *Public Choice* 121: 99-130.

[22] Jeitschko, T. and S.D. Jeung (2005), "The Effect of Capitalization on Banks' Risk under Regulation and Managerial Moral Hazard," mimeo, Michigan State University.

[23] Jensen, M. and W. Meckling (1976), "Theory of the Firm: Managerial Behavior, Agency Costs, and Capital Structure," *Journal of Financial Economics* 3: 305-360.

[24] John, K., H. Mehran, and Y. Qian (2007), "Regulation, Subordinated Debt and Incentive Features of CEO Compensation in the Banking Industry," mimeo, NYU.

[25] John, K., A. Saunders and L. Senbet (2000), "A Theory of Banking Regulation and Management Compensation," *Review of Financial Studies* 13: 95-125.

[26] John, K., T. John and L. Senbet (1991), "Risk Shifting Incentives of Depository Institutions: A New Perspective on Federal Deposit Insurance Reform," *Journal of Banking and Finance* 15: 895-915.

[27] Kane, E. (1989), "Changing Incentives Facing Financial-Services Regulators," *Journal of Financial Services Research*: 265-274.

[28] Kane, E. (1997), "Foundations for Financial Regulation," mimeo, Boston College.

[29] Laffont, J.J. and J. Tirole (1990), "The Politics of Government Decision Making: Regulatory Design," *Journal of Law, Economics and Organization* 6: 1-32.

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

[31] Lewis, T. and D. Sappington (1990), "Sequential Regulatory Oversight," *Journal of Regulatory Economics* 2: 327–348.

[32] Lindgren, C.-J., G. Garcia and M. Saal (1996), *Bank Soundness and Macroeconomic Policy*, IMF.

[33] Masciandaro, D., M. J. Nieto and H. Prast (2006), "Who Pays for Banking Supervision? Principles, Practices and Determinants," mimeo, Bocconi University.

[34] Mehran, H. and J. Rosenberg (2008), "The Effect of Employee Stock Options on Bank Investment Choice, Borrowing, and Capital," Federal Reserve Bank of New York Staff Report 305.

[35] Merton, R. (1977), "An Analytic Derivation of the Cost of Deposit Insurance and Loan Guarantees," *Journal of Banking and Finance* 1: 3–11.

[36] Rochet, J.C., B. Bensaid and H. Pages (1996), "Toward a Theory of Optimal Banking Regulation," mimeo, IDEI Toulouse.

[37] Sorkin, A.R. (2008), "Putting a Value on a C.E.O.," New York Times, December 02, 2008.

[38] Sullivan. R. and K. Spong (2005), "Managerial Wealth, Ownership Structure, and Risk in Commercial Banks," mimeo, Federal Reserve Bank of Kansas City.

[39] Tirole, J. (1986), "Hierarchies and Bureaucracies: on the Role of Collusion in Organizations," *Journal of Law and Economics and Organization* 2: 181-214.