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ABSTRACT

Safety Nets Within Banks*

We study how banks should protect their credit departments against the external influence from potential borrowers. We analyze four mechanisms that are widespread in practice: a credit board with unanimity or simple majority, a hierarchy and an advisory system. A bank faces a trade-off between the quality of information aggregation and the effectiveness of barriers against external influence. We provide a ranking of the different schemes. Some of them are equivalent even though the credit managers' decision power differs. In large credit decisions, banks should sacrifice on the quality of information aggregation in order to better protect the decision making process from outside influence.

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1 Introduction

A growing fraction of bank's credit decisions are delegated to or supported by more or less automatic scoring systems. However, major credit decisions still need to be based on complex information, part of which cannot easily be quantified. Such decisions benefit from an additional individual analysis by one or more expert credit managers. Automated credit scoring is unlikely to fully replace the human component in such credit decisions. A complete credit analysis requires the credit managers' expertise and involves some personal judgement on his side.

One drawback of such discretionary credit decision making is that the interested party, i.e. the potential borrower, may try to influence the credit department's decision in his favor. A feature of some recent corporate scandals is that banks continued financing the operations of companies in financial difficulties at stages where they would have better withdrawn their funds. In some cases, it has been argued that such harmful credit decisions arise as a consequence of a too close involvement of credit managers with their customers. Indeed, anecdotal evidence suggests that entrepreneurs often make more or less legal attempts to bias the decision of the credit department in their favor. Such attempts involve the provision of false information, private benefits to the credit manager or bribery. An extreme example is the Enron scandal in which it was alleged that four Merrill Lynch bankers deliberately conspired to help Enron to conceal debts.

It is a major task of the internal organization of a bank to limit the extent to which outsiders may influence the decision process in their favor. In the present paper we provide a theoretical analysis of intra-bank decision making

when a potential borrower attempts to lobby bank managers.[1] In order to avoid inefficient distortions and to render influence expensive, the bank may design safety nets. It may counteract detrimental lobbyism by choosing an appropriate organizational form.

This paper aims to determine the bank´s optimal organizational structure with regard to credit decisions. We consider five schemes that are widespread in practice.[2] In the simplest case the bank does not have a safety net. A single manager then makes the decision to award a credit. More sophisticated is a **hierarchy**. Here, a clerk has limited decision power. He may reject borrowers but can not finally accept them. If he is in favor of the credit, he has to consult a superior manager, e.g. the head of department or even the CEO, who finally decides. A slightly different scheme is an **advisory system**, where the advisor does not hold any formal decision power but is required to provide information to a manager. Finally, a **credit board** with two equally powerful managers may decide. The rules within the board may be **simple majority** or **unanimity**. Under a simple majority rule the credit is awarded if at least one manager is in favor of it. Unanimity requires that both of them give their okay.

We address the bank´s organizational choice in an information aggregation setup. All bank officials involved in the decision making process receive equally good but independent private signals about the quality of the credit. The information structure is such that the credit should be awarded as soon as at least one official obtains a favorable signal. We assume that the officials are costless

[1] There are few papers that study lobbying by borrowers. An exception is a paper by Mazumdar and Yoon (1996) who focus on the capital regulation of a bank that may collude with a borrower in order to extract regulatory subsidies.

[2] Throughout the paper we assume that the bank deploys at most two officials within a safety net.

for the bank and that they - in the absence of bribes - aim to maximize the bank´s profits. The bank thus designs the appropriate decision process.

We assume that the potential borrower attempts to influence the bank's credit decision. Many sorts of borrower-lobbying can be observed in practice. We assume for simplicity that the borrower offers to pay the managers an amount that is conditioned on the final credit decision. Bank managers are willing to misreport their signal if the bribe is high enough.

We find that some systems are equally good for the bank. In particular we can show that the bank should be indifferent between a credit board with unanimity and the hierarchy. Similarly, a credit board with simple majority is as good as an advisory system. These results are somewhat surprising, since the systems differ with respect to the formal decision power the officials are endowed with. The idea is to look at the *real decision power* arising from strategic interaction.[3] For example the clerk in the hierarchy does not have the power to grant the credit. But neither has each manager in a credit board with unanimity. In addition, if some official is bribed, this tends to change the remaining official's real decision power.

We provide a ranking for the five schemes. The trivial organizational structure - no safety net - is never best. It is highly vulnerable to external influence and wastes information in the absence of external influence.[4] The ranking of the remaining four alternatives results from a trade-off between information aggregation and bribing barriers stemming from real decision power. For low borrower

[3] This terminology is in spirit borrowed from Aghion and Tirole (1997), who distinguish between formal and real authority in a different context.

[4] This result clearly hinges on the assumption that the bank officials are costless for the bank. Introducing costs would render the system without a safety net more attractive in comparison to the other schemes.

valuations, a board with unanimity and the hierarchy are strictly worse than the board with simple majority and the advisory system. For these valuations no credit manager is bribed under all schemes. However, unanimity rule and the hierarchy do not aggregate information efficiently, rendering them inferior. For intermediate borrower valuations the bank´s preferences are reversed. Now, a credit board with unanimity and the hierarchy are best. Under an advisory system the bribes are such that the decision is in favor of the borrower regardless of the information available. Granting some real decision power to all officials makes it more expensive to bribe them.

2 Related literature

This paper is related to a branch of the agency theory that studies the relationship of a principal and one or more supervisors. The principal may hire a supervisor in order to reduce the costs of asymmetric information. The problem is that the supervisor may collude with the agent.[5] Potential bribes give rise to collusion-proofness constraints on the transfer scheme. In our paper the bank corresponds to the principal, the supervising body resembles our bank officials and the borrower may be interpreted as the agent. Several authors study models with more than one supervisor.[6] Kofman and Lawarree (1993) consider a costless internal auditor and a costly external auditor who is always sincere and serves as a collusion deterrence device. In a later paper (Kofman and Lawarree (1996)) they investigate a setting with two auditors that both respond to bribes. Still, the principal may deter collusion by designing transfers such that

[5] See for example Tirole (1986), Laffont and Tirole (1991), Olson and Torsvik (1998), Faure-Grimaud, Laffont and Martimort (2002), Kim, Lawarree and Shin (2004).

[6] As for example in Kofman and Lawarree (1993), Khalil and Lawarree (1995), Kofman and Lawarree (1996), Laffont and Martimort (1999) and Laffont and Pouyet (2003).

a prisoner´s dilemma between the auditors arises.[7] A crucial assumption is that a sincere auditor is able to provide evidence that he reported truthfully. In our information aggregation model in contrast, the "supervisors" (e.g. clerks) may possess soft information. They could get the wrong signal about the true state of the world and the principal is not able to distinguish between bad luck and collusion.

Laffont and Martimort (1999) compare a single supervisor with two separated supervisors. The single auditor may obtain information about all aspects concerning the agent, whereas the separated supervisors specialize on different aspects. They show that if the supervisors only demand safe bribes that are always accepted by the agent, then competition between the separated supervisors relaxes collusion-proofness constraints and renders this scheme superior. They also show that this result is robust to different timings of the game. Laffont and Pouyet (2003) study centralized versus decentralized regulation.

In contrast to the classical principal - agency approach we exclusively focus on the principal's organizational choice of the supervising body. We add complexity by introducing widespread organizational designs with differing degrees of decision power and we show that some of them are equivalent for the principal. Abstracting from additional monetary incentives helps to keep the model tractable and often describes real organizations pretty well.

This paper is also related to the literature on political economy.[8] The model

[7] They also consider sequential auditors, where the principal may tell them the timing of their reports. In contrast to this paper, the principal can introduce private information among the auditors that is beneficial for him.

[8] For example, Diermeier and Myerson (1999) study the organizational response of a legislature in the presence of two interest groups. In their model there is no information aggregation. Acemoglu and Verdier (2000) investigate the optimal size of bureaucracy in a setting with a tradeoff between market failures and government failures. The bureaucrats may be bribed in

that we study is based on the information aggregation setup that has been introduced in the papers by Austin-Smith and Banks (1996) and Feddersen and Pesendorfer (1996). Feddersen and Pesendorfer (1998) explore the role of information aggregation with different voting rules, like simple majority or unanimity. However, they do not consider interest group influence.[9] We will see later on, that lobbying may change the voting rule for the unbribed voters. In addition, we consider other schemes that are widespread in practice - like an hierarchical structure and an advisory scheme - that may also be used to aggregate information.

3 The model

3.1 Projects

An entrepreneur approaches a bank for the funding of an investment project of fixed size $I > 0$. He derives a private benefit of value θ if the project is carried out. This private benefit can e.g. represent the entrepreneur's perceived benefit from running the project or, in the case of an internal capital market, the division head's private benefit from an increased budget. The project's observable and verifiable return Av depends on the realization of state $v \in \{0, 1\}$. High quality projects yield the high return $A > 1$. Low quality projects yield a return of 0. Both types of projects are equally likely. For simplicity we shall assume that the entrepreneur is uninformed about the quality of his project.[10] The bank

their model.

[9] Lobbying in an information aggregation framework is also studied by Felgenhauer and Grüner (2006). They ask whether open or closed (simple majority) voting is better from a social perspective in the presence of interest groups.

[10] Things become more complicated when the borrower is informed about the value of the project to the bank. In this case the need to bribe bank officials is reduced when the borrower

has all the bargaining power. Therefore it offers to finance the project with a repayment of A, provided that the probability of success is sufficiently large.[11]

3.2 Agents

The bank delegates the decision to finance a prospective project to one or two decision makers, $i = 1, 2$. Each of these officials obtains a private signal about the project´s value. The signal of individual i is denoted by $v_i \in \{0, 1\}$. Each signal is correct with probability $p \in (\frac{1}{2}, 1)$. The officials choose a decision x that is 1 if the project is financed and 0 otherwise, according to one of the five rules described in the introduction. We denote the individual decisions by $x_i \in \{0, 1\}$. Finally, the potential borrower tries to manipulate the outcome. We assume that he can only observe the decision x and may thus only make transfers contingent on x.

3.3 Preferences

The project´s value for the bank is $A - I$ for a good project and $-I$ for a bad one. The bank shall prefer to award the credit if and only if at least one of the

knows that the expected quality of the project is high. The bribing game then becomes a signalling game between borrower and bank employees. In this case there should also be a pooling equilibrium where the different borrower´s types offer the same bribes to the officials that should not alter our results. The present paper studies a much more simple setup.

[11] Alternatively we could assume that not only the return of the project is relevant for the bank, but also the correlation of this project's returns with the returns to the rest of the bank's portfolio. When the bank and the borrower are symmetrically informed about expected returns the bank may want to use the skills of their employees to find out whether the project fits into banks' credit portfolio. The borrower has no intrinsic interest to obtain information on this issue. He will try to manipulate the outcome of the banks decision making process if he is able to do so.

officials' signals is greater than zero, i.e.

$$\frac{(1-p)^2}{(1-p)^2+p^2}A < I < \frac{1}{2}A. \tag{1}$$

We assume that the bank managers' payoffs are related to the credit department's total performance, e.g. through a bonus contract. A bank official i derives the utility $u_i = y + t_i$ where t_i is the bribe to official i and

$$y = \begin{cases} 1 & \text{if } x = v \\ 0 & \text{if } x \neq v \end{cases}. \tag{2}$$

In the absence of bribes we thus assume that each official prefers to choose in line with the bank´s interest.[12]

The entrepreneur has the utility function $u = \theta x - \sum_{i=1}^{2} t_i$, with θ being the valuation for obtaining the credit. The parameter θ is common knowledge.

3.4 Timing

The timing is such that first the bank determines the intra firm decision rule. Then the borrower offers a transfer scheme. For simplicity we assume that the transfer scheme is known to all officials.[13] Next nature draws a state v. Each official privately observes the signal v_i. Then the officials decide according to the bank´s rule, whether to finance the project. Finally, the transfers are paid in the pre-specified way.

[12] We do not consider communication among the officials. The reason is that we do not want to stress the assumption that the officials' preferences are perfectly aligned too much.

[13] Alternatively, one could consider the case where the transfers are only known to the respective official. In this case the strategy of an official would be a mapping from the individual transfer(s) to the vote.

3.5 Strategies and equilibrium concept

A strategy of the borrower is given by the conditional transfers. A bank official's strategy maps transfers and the private signal into the set of possible actions. In the advisory system and the hierarchy, the second manager's strategy also conditions the own decision on the first official's action. The bank determines the decision rule.

Let us call the stage, where the officials interact, the "stage game". Depending on the decision rule, the stage game may be static or dynamic. The equilibrium concept in a static stage game is Bayesian Nash equilibrium. In the dynamic variant the equilibrium concept is weak perfect Bayesian equilibrium. The beliefs on the equilibrium path are obtained by Bayesian updating and otherwise have to fulfill Kreps and Wilson‘s condition C. The borrower anticipates the behavior in the stage game and offers the transfers that maximize his utility. Finally the bank anticipates the behavior in all later stages and determines its preferred organizational structure.

We exclusively focus on pure strategy equilibria and use the Pareto criterion as a selection device if several equilibria coexist in the stage game. That is, the two officials $i = 1, 2$ in the stage game coordinate on the equilibrium that is Pareto superior for them.

4 Intra bank behavior for given bribes

We will now describe the officials' interaction in the stage game for given bribes. The borrower´s transfer choice then boils down to a simple decision problem.

4.1 No safety net

As a benchmark case consider a single bank manager. He always decides according to his signal if $p \geq (1-p) + t$, i.e. if his bribes t do not exceed $2p-1$. Otherwise he is in favor of the borrower even if his signal is against this choice.

The borrower´s optimal bribing strategy is to purchase the manager only if $\theta - (2p-1) \geq \frac{\theta}{2}$ which simplifies to $\theta \geq 4p-2$. Otherwise the borrower´s valuation is too low and he prefers a fifty percent chance to win at zero costs.

4.2 Advisory system

Here, the advisor (official 1) does not hold any formal decision power whereas the manager (official 2) is always pivotal. Still, the advisor is not completely powerless. By sending sincere messages he may influence the decision. In particular he may render bribing the manager more expensive for the borrower. The reason is that without the advisor, the bribes only matter for the manager if his own signal is zero. By adding an (in equilibrium) sincere advisor, the bribes only matter if both signals are zero. Otherwise the project should be implemented anyway. Two zero signals strongly suggest that the true state of the world is against the borrower. This makes bribing potentially expensive. The manager´s cost to decide insincerely if he observes two zero signals is $\frac{(1-p)^2}{(1-p)^2+p^2}$, whereas the benefit from being truthful is $\frac{p^2}{p^2+(1-p)^2}$. Thus a manager observing two zero signals only decides insincerely if the transfers more than compensate the difference, i.e. $t_2 \geq \frac{2p-1}{2p^2-2p+1}$. We can easily see that these transfers are larger than in the case without a safety net.

We now claim that there is a Pareto dominant weak perfect Bayesian equilibrium where all officials are sincere as long as $t_2 < \frac{2p-1}{2p^2-2p+1}$ and $t_1 < k$, where

$k > 0$ is some constant that is not too large.[14] In this equilibrium the decentralized information is aggregated efficiently. As long as the manager decides based on all information available, the advisor faces a cost from being insincere. He is decisive if the manager´s signal is zero. Thus, if the bribes to the advisor are too small then he does not have an incentive to deviate. As argued above, given that the advisor is sincere, the manager also does not have an incentive to deviate. In any other equilibrium for these bribes, both officials clearly have to be worse off.[15] In this equilibrium the borrower wins his favored decision with a fifty percent chance.

For $t_1 < k$ and $t_2 \geq \frac{2p-1}{2p^2-2p+1}$ there is an equilibrium where exclusively the manager is bribed and the advisor sends truthful messages. Given that the manager is bribed, any of the advisor´s strategies is a best response and so is truthtelling. Given that the advisor is sincere, the manager observes all signals and is thus only willing to decide insincerely if he is compensated in case there are two zero signals. In this equilibrium the probability to win his favored decision is one for the borrower. Here we see nicely the advisor´s real influence. It is more expensive to bribe the manager than in the single official case - even if he is not more capable than the single clerk - because he can rely on more information.[16] All other potential equilibria have to be Pareto inferior.

[14] We will see later on that it is not necessary to explicitly calculate the maximum k. All that we need is that the maximum k is greater than zero.

[15] For $t_1 < k$ and $t_2 \geq 2p-1$ there is an equilibrium where the advisor sends uninformative messages and the manager is bribed. The manager ignores the advisor's messages since they are uninformative and the advisor´s uninformative messages are a best response, given that they are ignored anyway. In this equilibrium the manager is in the same position as a single decision maker without a safety net. He thus accepts the bribe if $t \geq 2p-1$. However this equilibrium is Pareto dominated by an equilibrium where all officials are sincere.

[16] Notice that for these transfers there is a second (Pareto equivalent) equilibrium where the advisor sends uninformative messages and the manager decides in favor of the borrower. Both

By offering the transfer scheme, the borrower buys his favored decision with probability one.

The borrower may also attempt to bribe exclusively the advisor. Notice that there is babbling equilibrium where the advisor sends uninformative messages, which is known by the manager. The latter therefore ignores these messages. This equilibrium exists for all transfers to the advisor, but as argued above for $t_1 < k$ and $t_2 < \frac{2p-1}{2p^2-2p+1}$ it is Pareto dominated by a sincere equilibrium. Thus bribing exclusively the advisor is not costless. However if the advisor is bribed in equilibrium then again this is expected by the manager who then ignores the messages and decides exclusively based on his own signal. The probability that the borrower wins his favored decision is thus $\frac{1}{2}$. This probability can be obtained cheaper by not bribing any official.

The borrower thus never bribes exclusively the advisor but the top level manager may be corrupted. Bribing exclusively the manager is cheapest for transfers $t_1 = 0$ and $t_2 = \frac{2p-1}{2p^2-2p+1}$ and yields a favorable decision with certainty. Bribing both officials is weakly more expensive but yields the same probability to win. Thus the borrower optimally purchases exclusively the manager and thus the decision if $\theta - \frac{2p-1}{2p^2-2p+1} \geq \frac{\theta}{2}$ which simplifies to $\theta \geq \frac{4p-2}{2p^2-2p+1}$.

4.3 Credit board with simple majority

In a credit board with simple majority each manager has the power to grant the credit. This is different from the advisory scheme, where the clerk is not

equilibria yield the same payoff for the officials and are equivalent for the borrower.

This equilibrium however is Pareto dominated for transfers $t_2 < \frac{2p-1}{2p^2-2p+1}$ and $t_1 < k$ by a sincere equilibrium, as argued in the text. The advisor´s real influence here means that he induces a Pareto dominant sincere equilibrium even if the manager´s transfers are relatively large.

formally allowed to decide. Even though the formal decision power under both schemes differs, we get the following somewhat surprising result.

Proposition 1 *For each borrower valuation, the credit decision is the same with a credit board with simple majority and an advisory system.*

Once a manager is in favor of the project, then the other´s opinion can not alter the decision. If one manager i is thus bribed, any behavior of $-i$ is a best response. In a sense $-i$ becomes a powerless advisor. Hence the same argument as in the previous section applies and an equilibrium with one sincere and one manager in favor of the borrower exists and is Pareto dominant for bribes $t_1 < k$ and $t_2 \geq \frac{2p-1}{2p^2-2p+1}$.[17] Bribing one manager costs as much as bribing the decision maker in the advisory system.[18]

The borrower again purchases the decision only if $\theta \geq \frac{4p-2}{2p^2-2p+1}$.

4.4 Credit board with unanimity

A credit board with unanimity aggregates information inefficiently. In the absence of bribes there is no equilibrium where both officials decide truthfully. The reason is as follows. Given that $-i$ decides truthfully, official i does not wish to do so as well. He is only decisive if $-i$´s signal is in favor of the borrower. But in this case the project should be implemented anyway. Thus he prefers to decide in favor of the borrower regardless of his signals and for all transfers.

It can easily be seen that there is an equilibrium where one official i decides in favor of the borrower regardless of his signal for all transfers and the other

[17] Similarly for $t_1 < k$ and $t_2 < \frac{2p-1}{2p^2-2p+1}$ a sincere equilibrium exists.

[18] Bribing two officials is weakly more expensive, since there is a sincere equilibrium for some $k > 0$ where $t_1 < k$ and $t_2 < \frac{2p-1}{2p^2-2p+1}$ that is Pareto superior for these transfers. But since the decision is already bought if one manager is bribed for $t_2 \geq \frac{2p-1}{2p^2-2p+1}$ where the other one gets nothing, the borrower does not gain by paying transfers to both.

official $-i$ decides sincerely as long as $t_{-i} < 2p - 1$. A deviation of official i is not profitable, as just argued. Given i´s behavior, the sincere official $-i$ also does not have an incentive to deviate. He is always decisive and i´s behavior is uninformative. Thus $-i$ is in the same position as a single decision maker without a safety net. He will thus only decide sincerely if the transfers do not exceed $2p - 1$. In a sense, the borrower can "bribe" one official at zero costs. Any other potential pure strategy equilibrium for these transfers clearly is Pareto inferior.[19]

Bribing two officials however requires positive transfers. Suppose that for given bribes there is an equilibrium where both officials decide in favor of the borrower. From the above arguments it can be seen that each official is always pivotal and the other´s behavior is uninformative. Thus each official is in the same position as a single official without a safety net. Bribing him therefore requires transfers greater than $2p - 1$. For $t_i \geq 2p - 1$ and $t_{-i} \geq 2p - 1$ the unique equilibrium is where both officials decide in favor of the borrower.

Thus if the borrower optimally purchases both officials then he has to pay $t_i = t_{-i} = 2p - 1$. Doing so is best if $\theta - 2(2p - 1) \geq \frac{\theta}{2}$ which simplifies to $\theta \geq 8p - 4$. Otherwise he does not pay any bribes.

4.5 The hierarchy

In a hierarchy the clerk (official 1) has the power to deny the credit, but not to finally grant it. Final acceptance is delegated to a manager (official 2). Similar to a credit board with unanimity, information aggregation works poorly under

[19] A symmetric mixed strategies equilibrium in which managers with negative results vote insincerely with positive probability also exists. This equilibrium also has a counterpart in the case of a hierarchy. The main result of the present paper also holds if one considers the mixed srategies equilibrium to be the most obvious way to play this game.

this scheme even without transfers. The reasoning however is different. Under unanimity there is no sincere equilibrium as shown above. In a hierarchy, in contrast, we will show that there is a sincere equilibrium, where everyone decides based on all information available to him. The problem causing the inefficiency is, that the sincere clerk denies the credit if his own signal is zero, regardless of the manager´s information.

Let us check whether there is indeed such a sincere equilibrium for low bribes. Suppose the transfers are $t_1 < 2p - 1$ and $t_2 \geq 0$. If the clerk is sincere and delegates the decision to the manager then the latter knows that at least one signal is positive and in this case the project should be implemented anyway. The manager therefore does not have an incentive to deviate. Given the manager´s behavior, the clerk knows that the manager grants the credit as soon as the decision is delegated to him. The clerk is in the same position as a single official and thus is sincere if $t_1 < 2p - 1$. We now easily see that the overall decision is based on only a single official´s - namely the clerk´s - signal. The manager can be "bribed" at zero costs. The result is analogous to the one in a credit board with unanimity.

Actually, for $t_1 \geq 0$ and $t_2 < 2p - 1$, there is also an equilibrium where the clerk always delegates the decision and the manager decides exclusively based on his own information. Here the clerks "message" is uninformative and hence ignored by the manager. The manager is in the same position as a single official and thus decides sincerely based exclusively on his own information if $t_2 < 2p-1$. Given the manager´s behavior, the clerk clearly does not have an incentive to deviate.[20]

[20] Notice that there are some transfer schemes such that the two equilibria are possible. However they are Pareto equivalent for the manager and the clerk. In addition, the decision quality in both equilibria is the same.

Therefore, once a single official is bribed and the transfers to the other do not exceed $2p-1$, then the latter behaves sincerely based on his own message. Since the manager as well as the clerk has the power to deny the credit, the probability to win his favored decision is $\frac{1}{2}$ for the borrower. The same probability can be obtained cheaper by not paying any bribes.

Bribing both officials is as expensive as doing the same under a credit board with unanimity. Given that official i is bribed, the other one $-i$ is in the same position as a single decision maker without a safety net. For $t_i \geq 2p-1$ and $t_{-i} \geq 2p-1$ the unique equilibrium is where both officials decide in favor of the borrower. This leads immediately to the following result.

Proposition 2 *For each borrower valuation, the credit decision is the same with a credit board with unanimity and a hierarchy.*

Again, the borrower bribes the officials only if $\theta \geq 8p-4$.

5 The optimal safety net

Given the bribing strategies we can now derive the optimal safety net. No safety net is never (strictly) best. Proposition 1 states that a credit board with simple majority and an advisory system are equivalent for the borrower and thus are equally valuable for the bank. Similarly, Proposition 2 implicitly finds that a credit board with unanimity and the hierarchy yield the same benefit for the bank. Comparing the efficiency properties of the schemes and their vulnerability against external influence yields:

Proposition 3 *The bank´s ranking of organizational design depends on the borrower´s valuation θ as follows:*

(i) For low borrower valuations $(0 \leq \theta < \frac{4p-2}{2p^2-2p+1})$ *a board with simple majority and an advisory system are equally good and better than the other schemes.*

(ii) For intermediate borrower valuations $(\frac{4p-2}{2p^2-2p+1} \leq \theta < 8p-1)$ *a board with unanimity and the hierarchy are equally good and better than the other schemes.*

(iii) For high borrower valuations $(\theta \geq 8p-1)$ *all systems always yield a distorted decision.*

For low borrower valuations no member is bribed under all schemes. However, information aggregation works better under some organizational designs, which drives the result. For intermediate valuations the decision is bought with probability one under the inferior schemes. Under the superior systems the decision is exclusively based on the signal of one official. We thus have at least some information aggregation and a better defense against external influence. Finally, if the borrower's valuation is sufficiently high then no system offers protection against corruption.

6 Discussion

Some procedural rules in credit decisions, like a hierarchy, make it hard to aggregate information efficiently. According to our analysis, this inefficiency may have to be taken into account if the borrower has a sufficiently high valuation for a favorable decision. In a hierarchy, bribing both officials leads to a situation in which each of them considers himself as always decisive. This makes it too costly to buy a favorable decision. Bribes may however be sufficient to buy all officials' votes under other organizational schemes that, in the absence of bribes,

aggregate information efficiently.

In our model the credit should be awarded as soon as one signal is favorable. This assumption is introduced, in order to make the rules comparable to the single official case. If in contrast for example the credit should only be awarded if two signals are favorable, then it per se does not make sense to consider a single official.[21] He simply does not have sufficient information. If two favorable signals are required, then a credit board with unanimity and the hierarchy by construction have desirable information aggregation properties and are thus best in a world without external influence.

The analysis could be extended to safety nets with more than two officials. In such a setting there still is a trade-off between bribing barriers via real decision power and information aggregation. Such an analysis quickly becomes complex. In practice there are costs to employ clerks and managers. These costs put a natural limit on the optimal size of safety nets. By considering at most two officials in the decision process we think that we approximate most relevant cases.

Our analysis can be easily extended to cases where the borrower observes the officials' individual behavior. The borrower can then draw upon a larger set of contracts. Therefore his utility should increase and consequently the bank´s payoff should decrease. Thus the bank should have an incentive to keep the individual decisions secret, which strengthens our assumption.

The model predicts the equivalence of the hierarchy and a credit board with unanimity. Out of our framework, a hierarchy may have additional advantages. The manager only has to decide if the clerk delegates the decision to him. With limited capabilities, costly officials or costly signals this structure should

[21] Notice that information aggregation is superfluous if the credit should be awarded even if both signals are against it.

be superior to a credit board with unanimity. For example, in a hierarchy the manager may supervise several clerks. He does not always have to give an opinion, simply because the clerks may already deny credits. Still, for low borrower valuations the hierarchy should be inferior to an advisory system or a credit board with simple majority. Without influence, the latter systems aggregate information more efficiently.

REFERENCES

ACEMOGLU, D. and T. VERDIER (2000): "The choice between market failures and corruption", *The American Economic Review*, Vol. 90, No. 1, pp. 194-211.

AGHION, P. and J. TIROLE (1997): "Formal and real authority in organizations", *The Journal of Political Economy*, Vol. 105, No. 1, pp. 1-29.

AUSTEN-SMITH, D. and J. S. BANKS (1996): "Information aggregation, rationality, and the Condorcet Jury Theorem", *American Political Science Review*, Vol. 90, No. 1, pp. 34-45.

DIERMEIER, D. and R. B. MYERSON (1999): "Bicameralism and its consequences for the internal organization of legislatures" , *The American Economic Review*, Vol. 89, No. 5, pp. 1182-1196.

FAURE-GRIMAUD, A., J. J. LAFFONT and D. MARTIMORT (2003): "Collusion, delegation and supervision with soft information", *Review of Economic Studies*, Vol. 70, No. 2, pp. 253-279.

FEDDERSEN, T. J. and W. PESENDORFER (1996): "The swing voter's curse", *The American Economic Review*, Vol. 86, No. 3, pp. 408-424.

FEDDERSEN, T. J. and W. PESENDORFER (1997): "Voting behavior and information aggregation in elections with private information", *Econometrica*, Vol. 65, No. 5, pp. 1029-1058.

FEDDERSEN, T. J. and W. PESENDORFER (1998): "Convicting the innocent: the inferiority of unanimous jury verdicts under strategic voting", *American Political Science Review*, Vol. 92, No. 1, pp. 23-35.

FELGENHAUER, M. and H. P. GRÜNER (2006): "Committees and special interests", forthcoming in *Journal of Public Economic Theory.*

KHALIL, F. and J. LAWARREE (1995): "Collusive auditors", *The Ameri-*

can Economic Review, Vol. 85, No. 2, pp. 442-446.

KIM, D., J. LAWARREE and D. SHIN (2004): "Exit option in hierarchical agency", *International Journal of Industrial Organization*, Vol. 22, pp. 1265-1287.

KOFMAN, F. and J. LAWARREE (1993): "Collusion in hierarchical agency", *Econometrica*, Vol. 61, No. 3, pp. 629-656.

KOFMAN, and J. LAWARREE (1996): "A prisoner´s dilemma model of collusion deterrence", *Journal of Public Economics*, Vol. 59, pp. 117-136.

LAFFONT, J. J. and D. MARTIMORT (1999): "Separation of regulators against collusive behavior", *The RAND Journal of Economics*, Vol. 30, No. 2, pp. 232-262.

LAFFONT, J. J. and J. POUYET (2003): "The subsidiarity bias in regulation", *Journal of Public Economics*, Vol. 88, pp. 255-283.

LAFFONT, J. J. and J. TIROLE (1991): "The politics of government decision-making: a theory of regulatory capture", *The Quarterly Journal of Economics*, Vol. 106, No. 4, pp. 1089-1127.

MAZUMDAR, S. C. and S. H. YOON (1996): "Loan monitoring, competition, and socially optimal bank regulations", *The Journal of Risk and Insurance*, Vol. 63, No. 2, pp. 279-312.

OLSON, T. E. and G. TORSVIK (1998): "Collusion and renegotiation in hierarchies: a case of beneficial corruption", *International Economic Review*, Vol. 39, No. 2, pp. 413-438.

TIROLE, J. (1986): "Hierarchies and bureaucracies: on the rule of collusion in organizations", *Journal of Law, Economics and Organization*, Vol. 2, No. 2, pp. 181-214.