Regulatory Capture by Sophistication*

Hendrik Hakenes†
University of Bonn, MPI Bonn, and CEPR

Isabel Schnabel‡
Johannes Gutenberg University Mainz, MPI Bonn, and CEPR

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Abstract: One explanation for the poor performance of regulation in the recent financial crisis is that regulators had been captured by the financial sector. We present a micro-founded model with rational agents in which banks capture regulators by their sophistication. Banks can search for arguments of differing complexity against tighter regulation. Finding such arguments is more difficult for weaker banks, which the regulator wants to regulate more strictly. However, the more sophisticated a bank is, the more easily it can produce arguments that a regulator does not understand. Reputational concerns prevent regulators from admitting this, hence they rubber-stamp weak banks, which leads to inefficiently low levels of regulation. Bank sophistication and reputational concerns of regulators lead to capture, and thus to worse regulatory decisions.

Keywords: Regulatory capture, special interests, banking regulation, sophistication, reputation, career concerns, financial stability, complexity.

JEL-Classification: G21, G28, L51, P16.

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†Institute for Financial Economics and Statistics, University of Bonn, Adenauerallee 24-42, 53113 Bonn, Germany, hakenes@uni-bonn.de.

‡Gutenberg School of Management and Economics, Johannes Gutenberg University Mainz, 55099 Mainz, Germany, isabel.schnabel@uni-mainz.de.

1 Introduction

When the model-based approach to capital regulation was introduced [...] the regulatory community was so impressed with the sophistication of recently developed techniques of risk assessment and risk management of banks that they lost sight of the fact that the sophistication of risk modeling does not eliminate the governance problem which results from the discrepancy between the private interests of the bank's managers and the public interest in financial stability.

Martin Hellwig, 2010

One of the most disturbing features of the recent financial crisis is the inability of regulation, especially capital regulation, to prevent the crisis or at least mitigate its consequences. This is all the more surprising as, in recent decades, we have seen an increasing sophistication of regulatory approaches, moving from rigid capital ratios under Basel I to highly sophisticated methods based on banks' internal models, first with regard to market risk under the 1996 Amendment of the Basel Accord, and then with regard to credit risk under Basel II. But rather than making the system more resilient, these approaches allowed banks to reduce their unweighted capital ratios to levels as low as 2 percent (Basel Committee on Banking Supervision, 2009). So why did banking regulation not prevent this development? Why did bank regulators and supervisors approve an approach that made the system less rather than more stable?

Hellwig (2010) argues that regulators had been captured by the sophistication of bankers and their models. In his view, regulators did not sufficiently appreciate that there was a conflict of interest between banks and the public. In particular, regulators may not have realized that banks do not internalize the effects of their failure on the remaining financial system and the real economy. While there probably is some truth to this argument, it is based on limited rationality and only vaguely related to the issue of sophistication. In this paper, we propose an alternative explanation of *regulatory capture by sophistication* that derives from a sophistication gap between bankers and regulators.

In our model setup, banks try to persuade the regulator to abstain from (tighter) regulation. We show that unsophisticated regulators may "rubber-stamp" banks even though regulation would be desirable from a social perspective. The reason is that regulators are not willing to admit that they do not understand the bank's arguments because they are afraid of harming their own reputation, and thus, for example, their future careers. This may leave weak banks under-regulated, endangering the stability of the financial system. While regulatory capture may occur at the level of the entire banking sector, capture may be even more likely at the bank-individual level when banks and supervisors enter into a dialogue about appropriate regulation, as intended in Pillar 2 of the Basel Accord ("Supervisory Review Process"). In such interactions between supervisors and banks, supervisors are especially susceptible to persuasion, and reputational concerns are most pressing.

Our model has three important ingredients. First, we need a persuasion technology. Second, we allow for differing complexities of arguments and for varying degrees of sophistication of agents. Third, we propose reputational concerns (microfounded as career concerns in our model) as a reason for why a regulator may not admit that an argument is too complex for him. We model the interaction between a regulator and a bank. The probability of default (PD) differs across banks, but this cannot be observed by the regulator. From a social perspective, a bank with a high PD should be regulated, one with a low PD bank should not. Regulation comes at a cost for the bank, so the bank wants to persuade the regulator to abstain from regulation. It can do so by presenting an argument. One can think of arguments as balls from an urn. A bank is represented by an urn filled with red and green balls, the fraction of red balls being equal to the probability of financial distress. At a cost, the bank can draw a ball at random, look at it and decide whether to show it to the regulator. The bank can repeat this process as often as it likes, until it has found a ball that it wants to show to the regulator. The regulator will then update his beliefs about the bank's type, and possibly refrain from regulation.

We assume that the complexity of arguments differs. More precisely, each ball has a "complexity" represented by a number between 0 and 1. Moreover, the bank and the regulator each have a certain degree of sophistication, again lying between 0 and 1. If the bank's (or the regulator's) sophistication exceeds the ball's complexity, it can observe the color; otherwise it cannot. The regulator comes in two types: type H understands all arguments, whereas type L is less sophisticated than the bank. The regulator's future salary is assumed to depend on his perceived type. He thus wants to keep his reputation as high as possible. In some equilibria, the bank is always (or never) regulated, hence argumentation is unnecessary and does not occur in equilibrium. In the interesting parameter range, however, the equilibrium induces regulatory capture by sophistication. The type H regulator sets the standard for arguments so high that he is just convinced. If the bank is more sophisticated, it is easier for the bank to make arguments, and the standard for arguments is set higher in order to keep the argument informative. This entails negative consequences for a type L regulator. He does not understand a larger portion of arguments. Yet if he admitted that he did not understand, his reputation would be lost; he thus nods the argument through. The more sophisticated the bank, the easier it becomes to fool the regulator (if he is of type L) and the worse the regulatory decision becomes. The unsophisticated regulator is captured by the bank's sophistication.

Our model is applicable to different areas of financial regulation. The first is financial supervision when the supervisor has discretionary power, as is the case under Pillar 2 of the Basel Accord. In fact, the discretion of supervisors under current regulation is substantial. For example, supervisors check the appropriateness of internal models in the IRB approach. The bankers can try to convince the supervisors of the high quality of their risk management tools in order to avoid regulatory intervention. Another example is the application of Volcker Rule type regulations where supervisors have to distinguish between transactions carried out for speculation, hedging, or market making purposes. Discretion will also be important in the specification of countercyclical capital buffers and in other areas of macroprudential regulation. Finally, the same issues arise in resolution planning, for example in the preparation of living wills. The problem is most severe when the sophistication gap between bankers and supervisors is substantial, as is typically the case in modern banking. Hence, according to our model, the observed shift towards more discretionary powers of regulators involves the risk of exacerbating regulatory capture, especially in combination with an increasing discrepancy between regulators' and bankers' sophistication.

A second application is optimal bank closure. When a bank is in distress, the supervisor has to decide whether the bank should be resolved or bailed out. The bank has a strict preference for being bailed out. The bail-out decision of the regulator will depend, for example, on the chances of bank recovery and on the degree of systemic risk from bank failure. The bank will try to persuade the regulator that it deserves to be bailed out. One way to do so is to present favorable future scenarios to give proof of the bank's strength or picture the disastrous consequences of bank failure.

Finally, the model may also be applied to the regulatory process. Consider, for example, the discussions surrounding the introduction of risk-based models, as described by Hellwig (2010). The banking lobby argued in the 1990s that capital regulation at the time fell well behind the current standard of banks' risk management. While there was some truth to this, rigid capital ratios were much easier to understand and hence to be controlled by regulators than banks' internal models. Given the discrepancy in salaries and hence presumably also expertise in risk management between the financial sector and regulatory bodies, regulators could not easily be on par with the banks to be regulated. It is well possible that regulators were not willing to admit this discrepancy due to reputational concerns.

While there exists a broad literature on the governance of financial institutions, the governance of regulatory bodies and the incentive structures of regulators are still poorly understood and the literature is scarce. Some recent empirical papers suggest, however, that regulatory capture may be an important feature of the finance industry. Becker and Opp (2014) present evidence from the insurance industry that regulatory changes may have been driven by regulatory capture. Behn, Haselmann, and Vig (2014) show empirically that the use of internal models in bank capital regulation benefited large banks but adversely affected financial stability, which they interpret as evidence of regulatory capture in banking.

Our paper is also closely related to several strands of literature that are not directly concerned with banking but with lobbying in general. The literature on regulatory capture dates back to Laffont and Tirole (1991, 1993) and Giammarino, Lewis, and Sappington (1993).[1] An excellent survey and introduction to the theory of lobbying is given by Grossman and Helpman (2001, chapter 4).[2] Moreover, our paper is related to the theoretical literature on games of persuasion (see Milgrom and Roberts, 1986; Shin, 1994; Glazer and Rubinstein, 2001, 2004, 2006; Sher, 2010). In our model, the bank presents verifiable information to the regulator, the decision maker. It thus influences the regulator's beliefs, but the regulator anticipates the bank's objectives. Our paper introduces the sophistication of players and the complexity of arguments into games of persuasion.

[1] The theory of regulation is much older, including Huntington (1952); Bernstein (1955); Stigler (1971); Levine and Forrence (1990), to name a few prominent articles.

[2] The literature on lobbying has also been very active in recent years (see, e. g., Armstrong and Sappington, 2004, 2007; Feldmann and Bennedsen, 2006).

There are different kinds of regulatory capture that we do not address in the model. The first is social capture, which occurs when former bank managers start to work for the regulator, or when bankers and regulators are just too tight.[3] Another kind of capture we do not model is a judicial arms' race, where the regulator has problems to regulate a bank because the bank's lawyers can kill any attempt.[4] Monetary capture, involving side payments and bribes, or the outlook of regulators to get well-paid jobs at banks, is also left aside.

Our paper has important policy implications. The welfare analysis shows that the whole process of argumentation does not improve overall welfare in our model. In fact, the outcome is always worse than if the regulator always regulated the bank. Hence, our model suggests that a rule-based regulatory process may be preferable to discretion, which casts some doubt on the observed tendency towards more discretion in banking supervision. The outcome is worst when the sophistication gap between regulators and bankers is large. Therefore, capture could be reduced by offering competitive salaries in supervisory agencies in order to allow supervisors to be at eye level with the banks to be supervised. Professional training of supervisors is also important to reduce the sophistication gap. Moreover, regulators should be immunized against pressure from career concerns, for example by offering tenure. However, even with tenure career concerns are likely to persist when regulators want to climb up the hierarchy within their institution. Finally, our model questions the benefits of increasingly complex regulatory procedures, in line with suggestions by Haldane and Madouros (2012) and Hellwig and Admati (2013). The advantages of complexity may be outweighed by the higher vulnerability to capture. Hence, it may be useful to complement the current highly sophisticated regulatory regime

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[3]For an example of social capture at the top, one can look at the publicly available calendars of Treasury Secretary Timothy F. Geithner and his predecessor, Henry M. Paulson Jr. In the United States, the people regulating the financial industry largely come from that industry, or interact with that industry in their social lives. They play squash with them and dine with them, and these are the peers they look to when they have issues to discuss. Jo Becker and Gretchen Morgenson of The New York Times documented this in their April 2009 article on Mr. Geithner's social interactions during his time as head of the Federal Reserve Bank of New York.

[4]"You have two lawyers from the regulator, going to a bank to talk about some issue. When they approach the bank, they would see 19, uh, SUVs outside the bank. Right? So you got to the bank, and you have the 19 lawyers sitting in front of you, right? They are very well prepared; ready to kill any argument you make. And then, if you do really well, they offer you a job, right?" (Gylfi Zoega in the documentary *Inside Job*, Sony Pictures Classics 2010).

by a less sophisticated regulatory regime that provides a minimum level of financial stability (for example, by complementing risk-based capital regulation by a simple leverage ratio).

The broader message of our paper is that any regulatory reform should also take the governance and incentive structures within regulatory and supervisory bodies into account, an aspect that has been largely ignored by the theoretical literature on banking regulation. Regulatory agents do not necessarily try to maximize social welfare but they also respond to private incentives. Moreover, setting up legal frameworks for banking regulation is not sufficient. The outcome of the regulatory process depends crucially on the implementation, which may be influenced substantially by the lobbying efforts of the financial industry and by supervisors pursuing private objectives. Hence, the governance of the regulatory process is a promising area for future research.

The remainder of the paper is organized as follows. Section 2 defines the basic model ingredients: the characteristics of banks and regulators, the model of persuasion, and the role of the complexity of arguments. Section 3 discusses the benchmark equilibrium. Section 4 discusses the implications for social welfare and comparative statics, and derives some policy implications. Section 5 concludes. Proofs are in the Appendix.

2 The Model

The basic setup of our model is as follows. We consider an economy with two dates, 0 and 1, and two agents, a bank and a regulator. At date 0, the regulator chooses one of two regulatory regimes. Beforehand, the bank can try to persuade the regulator to choose the softer regime. At date 1, the bank may run into distress, the costs of which depend on the regulatory regime. In the following, we describe all modeling components in detail: the properties of the two agents (banker and regulator), the persuasion technology, the role of complexity and sophistication, and the model's time and information structure.

The bank. We consider a risky bank. The bank is successful (outcome $Y = 1$) with probability p, otherwise it runs into distress (outcome $Y = 0$).[5] The probability p is unknown ex ante. The prior distribution is $F(p)$ with density $f(p)$. Hence, p can be interpreted as the bank's type, with a higher p indicating a better type. The bank is assumed to know its own type, while the type is unobservable by the regulator. The bank dislikes regulation because it comes at a cost C_B.

The regulator and regulation. The regulator chooses between two regulatory regimes.[6] We think of a tightening of regulation but for brevity, we call the status quo "no regulation"; the tightened regulation is called "regulation". Ex ante, it is unclear whether regulation is beneficial. There is a trade-off between the social costs of regulation, $C_{\text{regulation}}$, and the costs from distress of an unregulated bank, C_{distress}. The social costs of regulation include, for example, the macroeconomic costs from tightening credit in response to higher capital requirements and the cost C_B incurred by the bank itself.

Without regulation, these costs are avoided. However, under distress (with probability $1 - p$, depending on the type of the bank), there is a social cost of $C_{\text{distress}} > C_{\text{regulation}}$ if the bank is unregulated. Hence, the socially optimal decision depends on the bank's type. In the extreme case, $p = 1$, the probability of distress is zero, and it is socially optimal not to regulate the bank. In the other extreme, $p = 0$, the bank ends up in distress with certainty. Then the bank should be regulated. There is thus a critical $\bar{p}$ where the expected costs from regulation and no regulation are equal, defined by

$$C_{\text{regulation}} = (1 - \bar{p})\, C_{\text{distress}} \qquad \Leftrightarrow \qquad \bar{p} = 1 - \frac{C_{\text{regulation}}}{C_{\text{distress}}}. \tag{1}$$

Hence, the bank should be regulated if $p < \bar{p}$.

In the absence of further information, the expected probability of success is $E[p] = \int_0^1 p\, f(p)\, dp$. Assume that, without further information, the regulator's expectation is such that regulation would be optimal, $E[p] < \bar{p}$.

[5] The risk can be interpreted as idiosyncratic risk, macroeconomic risk, or even systemic risk.

[6] In the following, we will call the captured agent "regulator." As was explained in the introduction, the model could just as well be applied to the behavior of supervisors in day-to-day interactions with banks.

Argumentation and persuasion. Regulation comes at a cost for the bank, so the bank wants to avoid regulation. It can try to *persuade* the regulator that its success probability is high. To this end, the banker can present an argument against tighter regulation. If this argument makes the regulator update his beliefs such that the expected p is at least $\bar{p}$, it becomes optimal to abstain from regulation.

An *argument* is a two-dimensional random variable with realization (y, κ). The first element y is a "test draw" from the outcome variable Y, which can be either success (with probability p) or distress (with probability $1-p$). Hence, the first component follows a Bernoulli distribution with success probability p. The actual outcome and the test realizations are stochastically independent.

The second component of an argument is its *complexity*, $\kappa \in [0,1]$, which w. l. o. g. follows a uniform distribution and is stochastically independent of the first component. The complexities of different arguments are also stochastically independent. As will be explained below, an argument can be understood by an agent only if he is *sophisticated* enough, or equivalently, if the argument's complexity is not too high.

The banker can draw an argument from a large pool of *potential* arguments at a cost c. He can show the drawn argument to the regulator. Alternatively, he can hide the result and draw a new realization (at a new cost), as often as he likes. The realizations of the random variables are observable (if presented to the regulator), but not the number of draws. We assume that the regulator has limited capacity and can listen to at most one argument. This assumption implies that there will be some learning through Bayesian updating, but no complete revelation of the bank's type.

Drawing a test realization is a metaphor for anything that can be used to persuade a regulator, such as writing a report, presenting new data, or carrying out an empirical study or stress test. The better the type p of the bank, the easier it is to make a good argument. The regulator listens to an argument and then updates his beliefs about the bank's type. In this way, the banker can persuade the regulator to abstain from tighter regulation. The regulator will take into account that the banker may have hidden unfavorable draws and that his motivation to keep searching for good arguments depends on his type.

Complexity of arguments and sophistication. An agent can understand an argument only if his sophistication is at least as high as an argument's complexity.

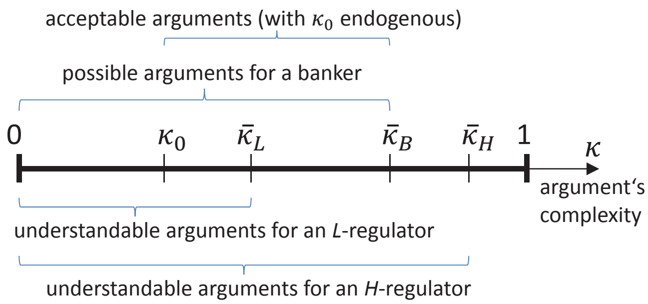
The banker's sophistication is called $\bar{\kappa}_B \in [0,1]$ and is public information. The higher $\bar{\kappa}_B$, the higher is the banker's degree of sophistication. For $\kappa > \bar{\kappa}_B$, the argument is so complex that the banker cannot make the argument because he does not understand it. The test draw is then unusable for the banker, and the cost c for the draw is sunk. Only for $\kappa \leq \bar{\kappa}_B$, the banker can present the argument to the regulator.

The regulator may be smarter than the banker, or vice versa. More specifically, we assume that the regulator's sophistication is either high, $\bar{\kappa}_H \in (0,1]$, with probability ϑ, or low, $\bar{\kappa}_L \in [0, \bar{\kappa}_H)$, with probability $1-\vartheta$. The regulator's type, H or L, is privately known, but not publicly observable. If a regulator is shown a test draw of complexity higher than his sophistication, he will not "understand" it—the realization y of the test outcome is then unobservable to him. He will observe the complexity κ of the argument, but not the outcome y. If a regulator is shown a test draw of complexity lower or equal to his sophistication, he will understand whether the argument is in favor of or against the regulation. An unsophisticated regulator understands only a subset of the arguments that a sophisticated regulator understands. We focus on the situation where the banker is smarter than an unsophisticated regulator, but not as smart as a sophisticated regulator, $\bar{\kappa}_L < \bar{\kappa}_B < \bar{\kappa}_H$. See Figure 1 for an illustration.

These assumptions have two consequences. First, the less sophisticated the banker (the lower $\bar{\kappa}_B$), the more expensive it is for him to make an argument. If $\bar{\kappa}_B$ is small, many arguments are unusable for him, so the expected costs of making a useable argument are high, which lowers the banker's inclination to search for an argument. Second, if a regulator is more sophisticated than the banker, he can understand all potential arguments that the banker can make. With the given parameter restriction, the banker can never outsmart a sophisticated regulator. However, the banker can outsmart an unsophisticated regulator because $\bar{\kappa}_B > \bar{\kappa}_L$. Whether a banker will try to outsmart the regulator, will therefore depend on the probability of a sophisticated regulator, ϑ.

Career concerns. For the mechanism of our model it is crucial that type-L regulators do not want to admit their types. Otherwise, one can show easily that regulators would simply announce their true types at the beginning of the game,

Figure 1: Possible constellations of sophistication



Notes: The line between 0 and 1 represents all possible complexities of arguments. A type-L regulator understands all arguments with complexity between 0 and $\bar{\kappa}_L$. A type-H regulator understands all arguments between 0 and $\bar{\kappa}_H$. The banker can make arguments in the range $[0, \bar{\kappa}_B]$. However, the regulator will not be convinced by all of these arguments. We will show below that there is a threshold κ_0; the regulator is convinced only by arguments in the range $[\kappa_0, \bar{\kappa}_B]$.

and the information asymmetry would be resolved. For example, an L-type regulator could hold the following speech to the banker: "I admit that I am type L, and therefore do not understand many arguments (those with $\kappa > \bar{\kappa}_L$). I am less sophisticated, but that does not imply that I can be fooled. If you want to convince me, you need to make simple arguments (with $\kappa \leq \bar{\kappa}_L$)."

In reality, there are various reasons why regulators may not want to admit their types. One is psychological: in general, people prefer to appear smart rather than dumb. This will also be true for regulators. But it can also be rationalized by assuming that the regulator is motivated by career concerns. We show in the following how such concerns can lead to the described behavior. Assume that after having taken the decision on bank regulation, the regulator has a new job opportunity (this could be an external labor market, or an internal market for promotion). The prior about the probability that the regulator is type H is ϑ before the decision is taken, but can be affected by the decision process. Assume that the regulator is assigned to a new task and that H-types are more productive in this task. If the labor market is competitive, the wage w for the regulator will depend on the updated prior of his type. The regulator's objective function is then

$$\mathrm{E}U_{\text{regulator}} = -\lambda \left(C_{\text{regulation}} + (1-p)\, C_{\text{distress}} \right) + w, \tag{2}$$

where λ is a weighting factor. This objective function assumes that the regulator does not simply maximize social welfare but that he is also self-interested. Assume that λ is strictly positive but sufficiently small, such that career concerns dominate the regulator's behavior (and he does not simply admit his true type). Formally, λ is assumed to be small enough such that only a pooling equilibrium exists.

There are a two important immediate consequences. First, as is common in pooling equilibria, the L-type regulator mimics the H-type's behavior. If the H-type reacts only to very sophisticated arguments, the L-type must follow suit, otherwise he would reveal his true type. The banker would infer that the regulator has to be of type L if he does not react upon a smart argument. Second, a fortiori, if an L-type regulator is confronted with an argument that he does not understand ($\kappa > \bar{\kappa}_L$), he must accept it and act accordingly. An H-type regulator, understanding the argument, would be smart enough to disprove it. An L-regulator cannot disprove the argument because he does not understand it. Dismissing the argument without disproving it would thus reveal his true type. Hence, he must accept the argument. This behavior will lead to a distortion in the regulator's decision, and the distortion depends on the sophistication of the banker and the regulator.

Time line. The timing of our model is as follows:

$t=0$ Nature draws the bank's type (p) and the regulator's type (H or L)

- ∗ The regulator announces which arguments will convince him (no commitment possible)
- ∗ The banker decides whether to produce arguments and draws test realizations
- ∗ The banker shows one argument to the regulator (or not)
- ∗ The regulator decides whether to regulate the bank or not

$t=1$ Nature draws the outcome (success $Y = 1$ or distress $Y = 0$)

- ∗ If the regulation is in place, costs $C_{\text{regulation}}$ (including C_B) are realized
- ∗ If the bank is in distress and the bank is unregulated, costs C_{distress} are realized

Let us briefly comment on the role of the second step in $t = 0$. Before the persuasion game starts, the regulator announces the set of arguments K that he will find convincing. By doing so, he solves a coordination problem. Otherwise, the banker might dismiss an argument that the regulator would have found convincing. For now, we do not assume that the regulator can commit to this set K. We will discuss the role of commitment below.

3 Equilibrium

We now derive the equilibrium. We start by describing the regulator's and the banker's strategies before solving the model for the bank's optimal argumentation choices and the regulator's optimal announcement of acceptable arguments.

The regulator's strategy. The regulator announces a set of acceptable arguments that will convince him to abstain from regulation, with the following two characteristics: First, the regulator will be convinced only by positive arguments, that is, arguments with $y = 1$. Second, without loss of generality, there will be an interval of "convincing complexities" $[\kappa_0, \bar{\kappa}_B]$: the regulator will be convinced by arguments with complexity within this interval, but not by arguments outside of this interval. The intuition is that a type-H regulator prefers the usage of smart arguments (those that a type-L regulator would not understand) because that way he can show his sophistication. This leads us to the first Lemma (the proof is found in the Appendix).

Lemma 1 (Acceptable arguments) *An argument is acceptable if its content is positive ($y = 1$) and its complexity is inside an interval $[\kappa_0, \bar{\kappa}_B]$, where the upper boundary is the banker's sophistication and the lower boundary is endogenous.*

In the following discussion, we concentrate on the case $\kappa_0 \leq \bar{\kappa}_L$, i.e., there are acceptable arguments that a type-L regulator understands. In the opposite case, $\kappa_0 > \bar{\kappa}_L$, the arguments are completely analogous.

The banker's strategy. The banker can follow three fundamentally different strategies for a given set $[\kappa_0, \bar{\kappa}_B]$ of acceptable arguments. First, he may decide that the search for convincing arguments is too expensive because it is too unlikely to be successful, and thus he may not even start searching for an argument. This is called the *zero* strategy.

Second, he may search for an argument until he finds a correct argument (with $y = 1$) in the acceptable range $\kappa \in [\kappa_0, \bar{\kappa}_B]$. In that case, he can be sure that the regulator will be convinced when he presents his argument to the regulator. A sophisticated regulator will be convinced because he understands the argument and sees that it is correct. An unsophisticated (type-L) regulator may not understand the argument, but he must follow the sophisticated (type-H) regulator's strategy and, consequently, drop the regulation although he is not convinced. This is called the *honest* strategy because presented arguments are always correct.

The third strategy is called the *cheating* strategy. The banker searches for an argument until he either finds a correct argument (with $y = 1$) in the acceptable range $[\kappa_0, \bar{\kappa}_B]$, or an incorrect argument (with $y = 0$) in the range $(\bar{\kappa}_L, \bar{\kappa}_B]$, i.e., the range which the unsophisticated regulator does not understand. Such an incorrect argument is not recognized as such by an unsophisticated regulator. A sophisticated regulator, however, will understand that the banker's argument is incorrect ($y = 0$). He will disprove the argument and impose the regulation on the bank. We now derive the banker's profits under the three strategies and his optimal choice depending on model parameters.

The banker's choice. Under the *zero* strategy, the banker never presents an argument. Consequently, he will always be regulated, and his profit equals the cost $-C_B$ from regulation.

Under the *honest* strategy, the banker draws an argument, which he can use with probability $p\,(\bar{\kappa}_B - \kappa_0)$: the argument must have $y = 1$ (probability p), and it must be in the acceptable interval (probability $\bar{\kappa}_B - \kappa_0$). If the banker cannot use the argument, he will continue searching until he finds a better argument. Importantly, the banker never changes his mind. He already knows his own type, hence he learns nothing in the process; the argumentation costs are sunk. If it is optimal for him to start drawing arguments, it will remain optimal until a valid argument is found. The expected costs are

$$\begin{aligned}
&p\,(\bar{\kappa}_B - \kappa_0) \cdot c \\
&+ (1 - p\,(\bar{\kappa}_B - \kappa_0))\, p\,(\bar{\kappa}_B - \kappa_0) \cdot 2\,c \\
&+ (1 - p\,(\bar{\kappa}_B - \kappa_0))^2\, p\,(\bar{\kappa}_B - \kappa_0) \cdot 3\,c + \ldots \\
&= \sum_{i=1}^{\infty} (1 - p\,(\bar{\kappa}_B - \kappa_0))^{i-1}\, p\,(\bar{\kappa}_B - \kappa_0) \cdot i\,c \\
&= \frac{c}{p\,(\bar{\kappa}_B - \kappa_0)}. \qquad (3)
\end{aligned}$$

The bank will never be regulated, leading to zero regulation costs. The expected profit is thus $-c/[p\,(\bar{\kappa}_B - \kappa_0)]$.

Finally, we turn to the *cheating* strategy. The banker draws arguments until he finds one that is either in the acceptable range (probability $\bar{\kappa}_B - \kappa_0$) and correct ($y = 1$, probability p), or that is in that part of the acceptable range that the unsophisticated regulator does not understand (probability $\bar{\kappa}_B - \bar{\kappa}_L$) and that is incorrect ($y = 0$, probability $1 - p$). The according probability of finding such arguments is thus $p\,(\bar{\kappa}_B - \kappa_0) + (1 - p)\,(\bar{\kappa}_B - \bar{\kappa}_L)$. In analogy to (3), the expected costs of the search for an argument are

$$\frac{c}{p\,(\bar{\kappa}_B - \kappa_0) + (1 - p)\,(\bar{\kappa}_B - \bar{\kappa}_L)}. \tag{4}$$

For each draw, the probability that the argument is correct and in the acceptable range is $p\,(\bar{\kappa}_B - \kappa_0)$; the regulator will then abstain from regulation with certainty. The probability that the argument can be used to fool an unsophisticated regulator is $(1 - p)\,(\bar{\kappa}_B - \bar{\kappa}_L)$. The regulator will then abstain from regulation only if he is unsophisticated and does not understand that the argument is incorrect (which occurs with probability $1 - \vartheta$). Consequently, the banker's expected profit is

$$-\frac{\vartheta\,(1 - p)\,(\bar{\kappa}_B - \bar{\kappa}_L)\,C_B + c}{p\,(\bar{\kappa}_B - \kappa_0) + (1 - p)\,(\bar{\kappa}_B - \bar{\kappa}_L)}. \tag{5}$$

For a given κ_0, we can now compare the profits from the three strategies. The banker's choice will depend on his type. A banker will do nothing if his success probability is very low, i. e. if

$$p < p_{\text{cheat}} := \frac{c/C_B - (1 - \vartheta)\,(\bar{\kappa}_B - \bar{\kappa}_L)}{(\bar{\kappa}_B - \kappa_0) - (1 - \vartheta)\,(\bar{\kappa}_B - \bar{\kappa}_L)}. \tag{6}$$

For very high success probabilities,

$$p \geq p_{\text{honest}} := \frac{c/C_B}{\vartheta\,(\bar{\kappa}_B - \kappa_0)}, \tag{7}$$

he will be honest. In between, he will choose the cheating strategy.

By setting κ_0, the regulator influences the banker's lobbying behavior. An increase in κ_0 (fewer acceptable arguments) raises the limiting p_{honest} (fewer banks choose the honest strategy), and it also raises the limiting p_{cheat} (more banks choose not to lobby at all).

Numerical example. For illustration, let us use one numerical example throughout the rest of the paper. Consider the following parameter values: $c = 0.2$, $C_B = 1$, $\vartheta = 0.8$, $\bar{\kappa}_B = 0.8$, $\bar{\kappa}_L = 0.6$, and $\bar{\kappa}_H = 1$. The lower boundary κ_0 of acceptable arguments will be endogenized later, but for now take $\kappa_0 = 0.4$. Then, $p_{\text{cheat}} = 0.444 = 44.4\%$, and $p_{\text{honest}} = 0.625 = 62.5\%$. Banks with a success probability p below 44.4% choose the *zero* strategy, they do not generate any arguments. Banks with a p above 62.5% choose the *honest* strategy; they generate arguments until they have found a correct argument ($y = 1$) in the acceptable range $[0.4, 0.8]$. Banks with a p between 44.4% and 62.5% choose the *cheating* strategy; they search for a correct argument in the range $[0.4, 0.8]$, but will not hesitate to present a false argument ($y = 0$) in the range $[0.6, 0.8]$ that a type-L regulator does not understand. Such a cheater hopes to fool an L-regulator, but he runs the risk of being caught by an H-regulator.

The regulator's choice of κ_0. We now derive how the regulator determines the minimum complexity κ_0 of acceptable arguments. If a banker presents an acceptable argument, the regulator updates his beliefs about the bank's type. A sophisticated regulator learns more from the presented arguments because he can always see whether the argument is correct or not. A priori, the expected type of a bank is $E[p] = \int_0^1 p\, f(p)\, dp$. By presenting a correct argument, the banker reveals that he either followed the honest strategy, or the cheating strategy and obtained a positive draw by luck. The probability of presenting an acceptable argument is 0 for a banker following the zero strategy, and 1 for a banker following the honest strategy. For a banker following the cheating strategy, it is

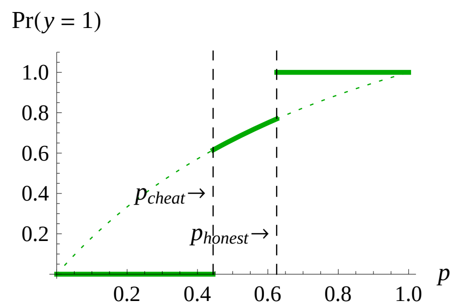
$$\frac{p\,(\bar{\kappa}_B - \kappa_0)}{p\,(\bar{\kappa}_B - \kappa_0) + (1-p)\,(\bar{\kappa}_B - \bar{\kappa}_L)}. \tag{8}$$

These probabilities are illustrated in Figure 2.

In order to derive the equilibrium κ_0, we first consider the Bayesian updating of the regulator's expectation for a given κ_0. A sophisticated regulator updates his beliefs about the success probability p of a bank that presents a valid argument as follows, using Bayes' rule,

$$E_H[p] = \frac{\int_{p_{\text{cheat}}}^{p_{\text{honest}}} \frac{p\,(\bar{\kappa}_B - \kappa_0)}{p\,(\bar{\kappa}_B - \kappa_0) + (1-p)\,(\bar{\kappa}_B - \bar{\kappa}_L)}\, p\, f(p)\, dp + \int_{p_{\text{honest}}}^{1} p\, f(p)\, dp}{\int_{p_{\text{cheat}}}^{p_{\text{honest}}} \frac{p\,(\bar{\kappa}_B - \kappa_0)}{p\,(\bar{\kappa}_B - \kappa_0) + (1-p)\,(\bar{\kappa}_B - \bar{\kappa}_L)}\, f(p)\, dp + \int_{p_{\text{honest}}}^{1} f(p)\, dp}. \tag{9}$$

Figure 2: Banker's probability of presenting a valid argument



Notes: The graph shows the banker's probability of presenting a valid argument when he follows the three different strategies (depending on p). The chosen parameter values are as in the numerical example from above. If a banker follows the zero strategy, he never presents a valid argument, $\Pr(y = 1) = 0$. If he follows the honest strategy, he always presents a valid argument, $\Pr(y = 1) = 1$. In between, when the banker follows the cheating strategy, the probability $\Pr(y = 1)$ increases in p.

The updated expected success probability of a sophisticated (type-H) regulator increases in the minimum complexity, κ_0.

Lemma 2 (Updated expectations) $E_H[p|y = 1]$ *increases in* κ_0.

The proof is in the Appendix. The lemma shows that the range of acceptable arguments can be used as an instrument to steer the expectation about bank's types. The higher the minimum complexity κ_0, the more difficult it is to make a suitable argument, and the more informative is such an argument (despite the fact that banks can cheat).

Remember that the regulator will abstain from regulation if he is convinced that the bank's average type is at least $\bar{p}$, as defined in (1). We now show that, in equilibrium, κ_0 will be chosen such that the sophisticated regulator is just willing to abstain from regulation. Hence, κ_0 is implicitly defined by the following equation:

$$E_H[p|y = 1] = \bar{p} \tag{10}$$

If κ_0 were lower, $E_H[p] < \bar{p}$. Then, a sophisticated regulator would not be convinced and would regulate the bank. More interestingly, if κ_0 were higher, $E_H[p] > \bar{p}$. The regulator would be "over-convinced." The banker could then hold a speech to the regulator if he finds an argument with a complexity lower than the required κ_0, but higher than the one implicitly defined by equation (10):[7] "I am presenting you an argument below the required κ_0. However, if you apply Bayes' rule, you will see that the updated success probability is sufficiently high to convince you to abstain from regulation. Therefore, you cannot ignore my argument." Any κ_0 with $E_H[p] > \bar{p}$ can thus also be ruled out. The only possible κ_0 that remains is defined by (10). There is one exception. If the regulator already proposes $\kappa_0 = 0$, the banker's speech does not apply because κ_0 cannot be reduced. Thus, if for $\kappa_0 = 0$ we already have $E_H[p]_{\kappa_0=0} > \bar{p}$, κ_0 will be equal to zero in equilibrium. In the following, we focus on the case where κ_0 is defined by (10).

In the absence of career concerns, the unsophisticated regulator would use a *lower* minimum complexity κ_0 than the sophisticated regulator (and also a lower maximum complexity, $\bar{\kappa}_L$). However, due to career concerns, he has to stick to the minimum complexity set by a sophisticated regulator. In order not to reveal his type, he also has to accept all arguments presented to him in the range where he does not understand the arguments although he knows that some of these arguments are incorrect. The equilibrium is summarized in Proposition 1.

Proposition 1 (Equilibrium) *In equilibrium, both types of regulators accept arguments with a complexity in the range $[\kappa_0, \bar{\kappa}_B]$. κ_0 is implicitly defined by*

$$E_H[p|y = 1] = \bar{p},$$

unless $E_H[p|y = 1] > \bar{p}$ even for $\kappa_0 = 0$, in which case $\kappa_0 = 0$. The banker presents arguments if $p \geq p_{cheat}$, and he always presents honest arguments if $p \geq p_{honest}$, with p_{cheat} and p_{honest} as defined in (6) and (7). For $p < p_{cheat}$, he does not present any arguments.

4 Policy Implications

In this final section, we first conduct a welfare analysis, leading to the result that the entire process of argumentation is wasteful from a social perspective. Rule-based regulation is shown to lead to superior outcomes. Then we consider various comparative statics and draw a number of policy conclusions.

[7] This is an application of the Intuitive Criterion (Cho and Kreps, 1987).

4.1 Welfare Analysis

Expected social costs. We now calculate the expected social costs including the costs of regulation, $C_{\text{regulation}}$, and the expected costs of distress for an unregulated bank, C_{distress}. At the moment, we ignore the effects on the regulators' wages (which are not relevant for the welfare comparison[8]) and the banker's cost of argumentation, which are also part of the welfare function and will be analyzed below. The banker's costs of regulation C_B are already comprised in $C_{\text{regulation}}$.

If the regulator is sophisticated (type H), the expected social cost is

$$\begin{aligned} E[C]_H = & \int_0^{p_{\text{cheat}}} C_{\text{regulation}}\, f(p)\, dp \\ & + \int_{p_{\text{cheat}}}^{p_{\text{honest}}} \frac{p\,(\bar{\kappa}_B - \kappa_0)\,(1-p)\,C_{\text{distress}} + (1-p)\,(\bar{\kappa}_B - \bar{\kappa}_L)\,C_{\text{regulation}}}{p\,(\bar{\kappa}_B - \kappa_0) + (1-p)\,(\bar{\kappa}_B - \bar{\kappa}_L)}\, f(p)\, dp \\ & + \int_{p_{\text{honest}}}^{1} (1-p)\,C_{\text{distress}}\, f(p)\, dp. \end{aligned} \tag{11}$$

Let us consider the different parts of this equation. In the range $p \in [0, p_{\text{cheat}}[$, the bank chooses the *zero* strategy. It does not present any arguments and is therefore regulated. The social cost is $C_{\text{regulation}}$. In the range $p \in [p_{\text{cheat}}, p_{\text{honest}}[$, the bank chooses the cheating strategy. For a given type p, the share of correct arguments is $p\,(\bar{\kappa}_B - \kappa_0)$; the bank then presents a $y = 1$ and remains unregulated. The bank ends in distress with probability $(1-p)$, and the expected social cost is $(1-p)\,C_{\text{distress}}$. The share of false arguments is $(1-p)\,(\bar{\kappa}_B - \bar{\kappa}_L)$. Since the regulator is of type H, he rebuts the bank's argument. The ensuing social cost is $C_{\text{regulation}}$. Aggregating terms yields the second integral. Finally, in the range $p \in [p_{\text{honest}}, 1]$, the bank presents an argument with $y = 1$ for sure. The regulation is dropped, and expected costs are $(1-p)\,C_{\text{distress}}$. Summing up, we get (11).

We now want to argue that the above $E[C]_H$ is exactly the same as if the regulator regulated *all* banks. There are three cases. Either, the bank does not present an argument (zero strategy), in which case the regulator does regulate—his utility is the same. Alternatively, the bank might present an argument which the type-H

[8]The regulator's reputation, or more specifically, his expected wage depending on reputation, is a constant. If the process reveals the true type of the regulator, he will suffer if he is unsophisticated, and he will benefit if he is sophisticated. In expectation, the effects cancel out. Consequently, the regulator's private component in the objective function does not need to be considered at all.

regulator finds to be false ($y = 0$, which can happen in the cheating strategy). In this case, the regulator does regulate—his utility is again the same. Finally, the bank might present an argument which the type-H regulator finds to be correct ($y = 1$). In this case, the regulator drops the regulation. But (10) implies that the regulator is just indifferent between regulating or not. Again, his utility is the same as if the regulator just regulated *all* banks. These arguments prove the following lemma.

Lemma 3 (Expected social costs) *If the regulator is of type H, the expected social costs (excluding argumentation costs) in equilibrium are exactly the same as if all banks were regulated,*

$$E[C]_H = \int_0^1 C_{regulation} \, f(p) \, dp = C_{regulation}. \tag{12}$$

Hence, a regulator of type H could also be replaced by a rule to simply regulate all banks.[9] However, this outcome is not efficient. The reason is a time inconsistency problem for the type-H regulator. If he could commit to a level of κ_0, he would choose a higher value than the equilibrium value. This κ_0 can be obtained by deriving the first-order condition of (11) with respect to κ_0, leading to a higher κ_0. As a consequence, an H-regulator would not be indifferent after seeing an argument, but would strictly prefer to leave the bank unregulated after having seen an argument.

Committing to a minimum complexity of an argument can be difficult, however. If the banker just goes ahead and talks to the regulator and he presents an argument that the regulator had initially planned not to accept, the regulator cannot avoid updating his beliefs nonetheless. If he is sufficiently convinced afterwards, he will abstain from regulation. This brings us back to the equilibrium level of κ_0 defined by (10), even if it is not welfare-optimal.

[9] Any rule can be based only on verifiable variables. In the context of our model, the rule could be based on all exogenous parameters, but not on the information generated by the bank. Hence, for a given set of parameters, the only possible rules are "impose the regulation, no matter what arguments the banker brings forward" or "do *not* impose the regulation, no matter what arguments the banker brings forward."

For a regulator of type L, the situation is even worse. Expected social costs are

$$E[C]_L = \int_0^{p_{\text{cheat}}} C_{\text{regulation}}\, f(p)\, dp + \int_{p_{\text{cheat}}}^1 (1-p)\, C_{\text{distress}}\, f(p)\, dp > E[C]_H, \quad (13)$$

consisting of two parts. A bank in the range $p \in [0, p_{\text{cheat}}[$ chooses the *zero* strategy. It does not present an argument and is regulated. A bank in the range $p \in [p_{\text{cheat}}, 1]$ chooses the *cheating* or the *honest* strategy. Either way, it presents an argument that the regulator cannot rebut, either because he does not understand or because the argument is correct. Expected costs are higher than for the type-H regulator and therefore higher than if he simply regulated all banks.

Costs of argumentation. Generating the studies used as arguments is costly for banks. These costs are wasteful from a social perspective, hence they must also enter the welfare analysis.

If a regulator did not base his decision on information, banks would have no incentive to start producing arguments in the first place. The argumentation costs would then be zero. We can make a follow-up statement to Lemma 3. Allowing banks to make arguments does not improve the decision quality if the regulator is sophisticated, it worsens the decision quality if the regulator is unsophisticated, and furthermore it leads to additional argumentation costs for banks.

We have seen that it is the regulator's time inconsistency problem, which leads to a decrease in κ_0; the regulator would like to commit to a higher κ_0. What is thus the effect of an increase in κ_0 on expected argumentation costs of banks?

There are two countervailing effects. Since banks must search longer for acceptable arguments, the search becomes more expensive (this holds for both the honest strategy and the cheating strategy). On the other hand, some banks choose the zero strategy instead of cheating ($\bar{\kappa}_{\text{cheat}}$ increases), and some banks choose the cheating strategy instead of the honest strategy ($\bar{\kappa}_{\text{honest}}$ increases). The aggregate effect of commitment on argumentation costs is unclear. Among others, it depends on the type distribution of banks. If there is little probability mass in the range of $\bar{\kappa}_{\text{cheat}}$ and $\bar{\kappa}_{\text{honest}}$ (formally, if $f(\bar{\kappa}_{\text{cheat}})$ and $f(\bar{\kappa}_{\text{honest}})$ are small, for smooth f), the first effect dominates: a higher κ_0 leads to higher argumentation costs. If, in contrast, the probability mass is evenly distributed, a higher κ_0 will discourage argumentation and lead to lower expected argumentation costs.

Proposition 2 (Welfare costs of argumentation and lacking commitment) *Basing regulatory decisions on arguments leads to an increase in the expected social costs from regulation and distress as well as in expected costs of argumentation, relative to rule-based regulation. The lack of commitment of the regulator to the range of acceptable arguments also leads to an increase in expected social costs from regulation and distress, whereas the effect on the expected costs of argumentation is ambiguous.*

Hence, discretion of regulators is welfare-decreasing from the perspective of our model. Even if the regulator is always sophisticated ($\vartheta = 1$) and argumentation costs are small (but positive), aggregate social costs rise when the regulator is given discretionary power. The outcome is worse than under a strict rule ("always regulate"). If the regulator is unsophisticated with some probability ($\vartheta < 1$), the outcome is even worse.

Note that, in the model, it is not possible to let the regulator decide himself to implement a strict rule and not listen to the banker's arguments. A sophisticated regulator knows that, from the social cost perspective, discretion is equally good as a rule. Argumentation costs vanish under a rule, but they affect the bank, not the regulator. But with discretion, some information about the regulator's true type is revealed. Consequently, a sophisticated regulator prefers discretion. This implies that, if a regulator chooses a rule-based regime, he would admit that he is unsophisticated. Because of our assumption that career concerns are important, this will not happen. Hence, the regulator cannot implement the rule-based regime himself—it must be *imposed* upon him.

4.2 Comparative Statics

The banker's sophistication. We now consider comparative statics with respect to the model parameters. We first analyze the effect of a change in the banker's sophistication on the regulatory outcome. Note that in all equations the variables κ_0, $\bar{\kappa}_B$, $\bar{\kappa}_L$, and $\bar{\kappa}_H$ enter only as differences (e. g., as $\bar{\kappa}_B - \kappa_0, \ldots$). This implies that the absolute level of the variables is irrelevant, only differences matter. As a consequence, if $\bar{\kappa}_B$, $\bar{\kappa}_L$, and $\bar{\kappa}_H$ increase by the same amount, the endogenous κ_0 will also increase by that amount. These increases will then cancel out, and the bank's strategies and the regulatory outcome will remain unchanged. As another consequence, an increase in the banker's sophistication $\bar{\kappa}_B$ has the same effect on the regulatory outcome as a decrease in both $\bar{\kappa}_H$ and $\bar{\kappa}_L$ by the same amount. Only *relative* sophistication matters.

Consider an increase in $\bar{\kappa}_B$; the banker becomes more sophisticated relative to the regulator. As a direct consequence, it becomes cheaper for him to collect arguments at a given κ_0. This must be countered by the regulator by raising κ_0. Otherwise, the banker's argument would no longer be convincing enough. An increase in both $\bar{\kappa}_B$ and κ_0 means that the fraction of arguments that the unsophisticated regulator can understand decreases. It becomes easier for a bank to fool the unsophisticated regulator. As a consequence, more relatively weak banks remain unregulated, and the regulatory outcome *deteriorates*. A higher bank sophistication relative to regulators turns out to be bad for the regulatory outcome.

From (6), one can see that for very high bank sophistication,

$$\bar{\kappa}_B \geq \bar{\kappa}_L + \frac{c}{C_B\,(1-\vartheta)}, \tag{14}$$

p_{cheat} becomes zero. Then, even extremely bad banks present arguments to fool the unsophisticated regulator because it is so cheap to gather arguments. Then the argument has no consequence at all for the unsophisticated regulator's decision. He never regulates - either because the argument is valid, or because he does not understand it.

Other comparative statics. The arguments for other comparative statics are similar. We have already discussed an increase in both $\bar{\kappa}_H$ and $\bar{\kappa}_L$: it has the opposite effect of an increase in $\bar{\kappa}_B$; it improves the regulatory outcome. An increase in $\bar{\kappa}_H$ alone does not change the equilibrium.

An increase in the fraction of sophisticated regulators ϑ makes cheating less beneficial for banks. In the extreme of $\vartheta \to 1$, a comparison between (6) and (7) reveals that $p_{\text{cheat}} \to p_{\text{honest}}$, i. e., the fraction of cheating banks converges to zero. In the limit no bank tries to fool the unsophisticated regulator. Consequently, even unsophisticated regulators can trust the banker's argument, even if they do not understand it. Still, even for $\vartheta \to 1$, the regulatory outcome is not better than rule-based regulation (regulation of all banks). The effect of an increase in $\bar{\kappa}_L$ would be similar to an increase in ϑ.

When the cost of argumentation c drops, the regulator must again counter this by raising κ_0, which reduces the fraction of arguments that the unsophisticated regulator understands. (6) shows that there is a critical c below which the argument becomes completely uninformative for the unsophisticated regulator. All banks present arguments, and the unsophisticated regulator drops the regulation independent of the bank's type.

The regulator's career concerns Finally, we discuss the role of the regulator's career concerns in the model. What would happens if the regulator cared less about his reputation? For example, if the regulator is tenured, he may care less about future job offers and wage bargaining positions. Consider the extreme case where the regulator does not care at all about his perceived sophistication, only $C_{\text{regulation}}$ and C_{distress} enter his utility function. Then, in equilibrium, the regulator will reveal his true type. In fact, sophisticated and unsophisticated regulators can set different values of κ_0. The sophisticated regulator will have a higher κ_0, the unsophisticated regulator a lower one, and the measures of the interval of acceptable arguments would be the same in both cases. The unsophisticated regulator will not accept arguments that he does not understand. Hence, banks cannot fool any type of regulator, neither smart nor unsophisticated. The regulatory outcome would be the same as if there were only smart regulators ($\vartheta = 1$). This thought experiment shows that, in our model, the problem does not derive from low sophistication of regulators as such, but from them wanting to appear more sophisticated than they really are.

5 Conclusion

Our paper has shown that reputational concerns of regulators may lead to inefficiently low levels of regulation because regulators may be captured by the financial industry due to a discrepancy in the degree of sophistication between the banks to be regulated and the regulatory bodies. This may help to explain why current regulation was not able to prevent the crisis in spite of its high degree of sophistication.

We have presented a micro-founded model with rational agents: a bank and a regulator. In order to persuade the regulator to abstain from regulation, banks can present arguments of differing complexity. Finding arguments against regulation is more difficult for weaker banks, which are also the ones that the regulator wants to regulate more strictly. A more sophisticated bank can more easily produce an argument that a less sophisticated regulator may not understand. If reputational concerns prevent the type-L regulator from admitting that he does not understand the argument, he will imitate the strategy of a sophisticated regulator and will rubber-stamp even weak banks. This leads to inefficiently low levels of regulation. Regulators are captured by banks' sophistication, which leads to worse regulatory decisions.

Our model implies that a less sophisticated regulation regime (such as the standard approach under the Basel Accord) may be preferable to highly sophisticated regimes (such as an internal models based approach) because this makes regulatory capture by sophistication less likely. However, current policy discussions appear to be moving in the opposite direction, namely towards even higher complexity. The same issue will be highly relevant for the implementation of resolution regimes, concerning for example the design of livings wills. As with capital regulation, there is a conflict of interest between banks and regulators. Moreover, banks are much better able to understand the details of the living wills' construction than regulators (let alone politicians). Again, the danger of regulatory capture by sophistication is significant.

The welfare analysis of our model has shown that a rule-based regulation would be preferable in our setting. Giving the regulator discretionary power makes him susceptible to regulatory capture. Even in the absence of career concerns or in a setting with only sophisticated regulators, discretion gives rise to costly lobbying activities, which reduces social welfare. In the presence of career concerns and with different types of regulators, the problem becomes even worse because rubber-stamping leads to inferior regulatory outcomes. Cheating could be avoided by closing the sophistication gap between regulators and banks. This would require a sharp increase in regulators' compensation in most countries in order to be able to compete with the financial sector for the brightest experts in risk management and related areas. Hence, moving supervision of systemically relevant banks in the euro area to the European Central Bank with much higher salaries than at the national regulatory authorities may have a positive side effect in this respect. Alternatively, one should think about complementing current banking regulation by defining additional minimum standards that require less sophistication on the side of regulators. The regulatory leverage ratio as a complement to risk-weighted capital ratios is a case in point. While not being able to reflect a bank's risk profile, it can provide for a minimum buffer of capital.

Our model suggests that the degree of regulatory capture by sophistication could be an important determinant of regulatory success. This is especially true if regulators have a lot of discretion in their regulatory or supervisory decisions (Pillar 2 of the Basel Accord). Any new regulation should take into account whether the supervisors have an incentive to actually implement it in the desired way. This calls for more research to better understand the governance of regulatory authorities.

A Proofs

Proof of Lemma 1: We start with the first part of the lemma. The outcome y of an argument must be positive ($y = 1$), i. e., the argument must be correct, in order to convince the regulator. An incorrect argument ($y = 0$) is easier to obtain for a weaker bank with a lower p, so it would not convince the regulator to abstain from regulation, but rather encourage him to enforce it. Consequently, we can now concentrate on the second element of an argument, its complexity κ.

Now we continue with the second part of the lemma. Let K denote the set of arguments' complexities that convince the regulator. Since the banker cannot make arguments that are more complex than $\bar{\kappa}_B$, acceptable arguments must be less complex than the bank's sophistication, hence $K \subseteq [0, \bar{\kappa}_B]$.

In the absence of career concerns, the two types of regulators (H and L) could have different sets of acceptable arguments. However, if the type-L regulator chose a different set $K_L \neq K_H$, he would reveal his low type. Therefore, in the presence of career concerns, he will choose to imitate the strategy of a type-H regulator, $K_L = K_H$. We can therefore drop the index (L or H). An H-type regulator is free to choose the set K as he wishes. In particular, he will not take into account the interests of an unsophisticated regulator.

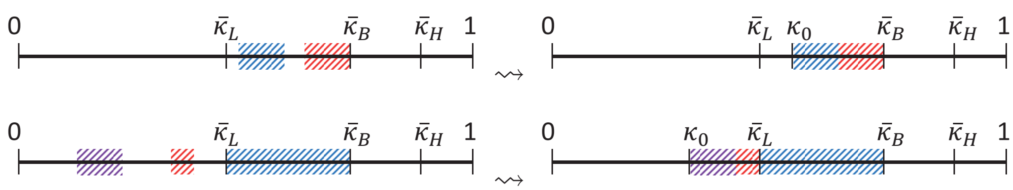
Note that K is often a proper subset of $[0, \bar{\kappa}_B]$, for the following reason. The regulator updates his beliefs about the bank's type not only because of the argument's content, but also because of the mere fact that the bank has engaged in the costly search for an argument. Hence, the more expensive the search for an argument, the stronger the regulator's Bayesian updating and the more convinced the regulator will be. The regulator can make the search more expensive by restricting the set of acceptable arguments K. We will derive a condition for this behavior below.

For now, focus on the case that K is a proper subset of $[0, \bar{\kappa}_B]$. In this interval, there are two subsets: $[0, \bar{\kappa}_L]$ is the set of arguments that everybody understands, even the type-L regulator; $]\bar{\kappa}_L, \bar{\kappa}_B]$ is the set of arguments that only the banker and a type-H regulator understand. We now want to argue that if K contains elements of $[0, \bar{\kappa}_L]$, then it also contains the complete $]\bar{\kappa}_L, \bar{\kappa}_B]$. Formally,[10]

$$K \cap [0, \bar{\kappa}_L] \neq \emptyset \quad \Rightarrow \quad K \cap]\bar{\kappa}_L, \bar{\kappa}_B] =]\bar{\kappa}_L, \bar{\kappa}_B]. \tag{15}$$

In words, a type-H regulator likes to fill his set of acceptable arguments first with arguments that the L-type does not understand. Why? If the bank presents a false argument (with $y = 0$) with positive probability (and we will show that it does), then if the argument is in $]\bar{\kappa}_L, \bar{\kappa}_B]$, only a type-$H$ regulator can disprove the argument. Doing so, he proves that his type is H, and the future wage w jumps to the maximum. If the argument is in $[0, \bar{\kappa}_L]$, both type (H and L) can disprove the argument, and nothing is learnt about the regulator's true type. Endogenously, a type-H regulator likes to show off, i. e., to define a task for himself that he can solve better than the type-L regulator.

Figure 3: Illustration of the argument



Notes: Areas with acceptable arguments are shaded (in different colors that stand for regions with the same measure).

Figure 3 illustrates this argument. There are four different examples for regions K of acceptable arguments (shaded). In the upper two cases, there are no acceptable arguments that a type-L regulator can understand. In the lower two cases, K contains the complete set of arguments that a type-L regulator cannot understand. Property (15) holds in all four cases. If K has elements in $[0, \bar{\kappa}_L]$, then the complete region $]\bar{\kappa}_L, \bar{\kappa}_B]$ must already be covered.

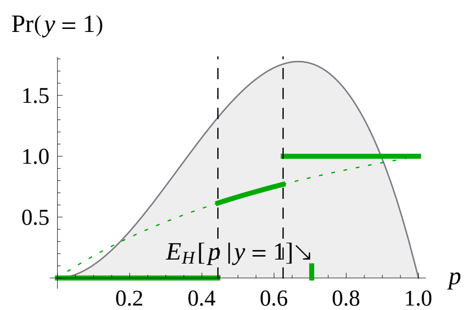
Now from the banker's and the type-H regulator's and the type-L regulator's perspective, the upper two examples are equivalent. The type-L regulator does not understand any possible argument, and for the banker and the type-H regulator, the measure of the set of acceptable arguments is identical. Also the lower two examples are equivalent. The measure of sets of arguments that one group understands

[10] We have abstracted from sets of measure zero. Taking these into account, (15) would read $\mu(K \cap [0, \bar{\kappa}_L]) > 0 \quad \Rightarrow \quad \mu(K \cap]\bar{\kappa}_L, \bar{\kappa}_B]) = \bar{\kappa}_B - \bar{\kappa}_L$.

whereas the other does not is unchanged. One can also formalize this argument, but even informally stated, it is now obvious that one can concentrate (without loss of generality) on sets K where the mass of acceptable arguments is pushed up as much as possible. These sets have the form $[\kappa_0, \bar{\kappa}_B]$. This property brings a great facilitation. Instead of handling sets of arguments that can become very complex, one can focus on just one number κ_0, the left side of an interval. This completes the proof. ■

Proof of Lemma 2: Before proving the lemma, to create some intuition, consider Figure 4. The gray bell curve in the background is one potential distribution $f(p)$ of banks' types. The green curve shows, for each possible type p, the probability with which it presents an acceptable argument. Bayes' rule weights the gray bell with the green curve and then takes the mean of the result. In the numerical example, with $f(p) = 12\,p\,(1-p)^2$ [11] and $\kappa_0 = 0.4$ and thus $p_{\text{cheat}} = 0.444 = 44.4\%$ and $p_{\text{honest}} = 0.625 = 62.5\%$, the mean is $E_H[p|y=1] = 0.704 = 70.4\%$. For that distribution, the prior is $E[p] = 0.6 = 60\%$. Hence, if the regulator is presented an argument and he sees that the argument is correct ($y = 1$), he no longer believes that the bank's probability of success is 60%, but updates his belief to 70.4%. At the same time, the expected probability of default (PD) decreases from 40% to 29.6%.

Figure 4: Bayesian updating after a valid argument



Notes:

Now we need to show that $E_H[p|y=1]$ increases if the regulator sets a higher κ_0.

[11] This is the beta distribution for parameters $\alpha = 3$ and $\beta = 2$, just as an example for a non-trivial distribution with support [0, 1]. Of course, one could also take the uniform distribution, which is a special case of the beta distribution with $\alpha = 1$ and $\beta = 1$.

There are two separate effects. When increasing κ_0, both the fractions within the single integrals in (9) change and the limits of the integrals change. We first consider the effect of the changing limits, taking the fractions in the integrals as constant. Second, we consider the effect of the fractions, taking the limits as constant. The aggregate effect on $E_H[p|y=1]$ is then the sum of both effects.

Both integral limits, p_{cheat} and p_{honest}, are increasing in κ_0. In Figure 4, the black dashed lines move to the right. Hence, a higher level of minimum complexity makes some bank types shift from the honest strategy to the cheating strategy, and from the cheating strategy to the zero strategy. Hence, there are fewer types with lower p in the pool, the expected type increases.

It becomes less likely for a banker following the cheating strategy to find a correct argument; the fraction within the integrals, equal to (8), is decreasing in κ_0. In Figure 4, the green dashed curve moves downward. Therefore, more weight is put on the upper part of the distribution $f(p)$, and it becomes more likely that the bank is of a high type.

Both effects go into the same direction. Hence, the updated success probability increases in the level of minimum complexity, $\mathrm{d}E_H[p|y=1]/\mathrm{d}\kappa_0 > 0$. ■

Proof of Proposition 1, Lemma 3, and Proposition 2: Contained in the main text.

B Definition and Parametrization of Variables

Variable	Value	Description
$C_{\text{regulation}}$	4.4	social cost from tight regulation
C_{distress}	10.0	social cost from a crisis when the bank is unregulated
C_B	1	bank's private cost from tight regulation
c	0.2	costs of collecting one argument
p		success probability (type) of a bank
$f(p), F(p)$		density and distribution function of bank types
$\bar{p}$	endogenous	minimum success probability to remain unregulated
κ		complexity of an argument, w. l. o. g. uniformly distributed
$\bar{\kappa}_L$	0.6	sophistication of the L-type regulator
$\bar{\kappa}_H$	1.0	sophistication of the H-type regulator
$\bar{\kappa}_B$	0.8	sophistication of the banker
κ_0	endogenous	minimum complexity of an acceptable argument
ϑ	0.8	fraction of H-type regulators

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