Centre de Recherche en Economie Publique et de la Population

CREPP WP No 2011/07

A Theory of Soft Capture

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June 2011

CREPP - Centre de recherche en Economie Publique et de la Population
Boulevard du Rectorat 7 (B31)
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CREPP Working Paper Series

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June 15, 2011

Abstract

Capture of regulatory agencies by firms or other stakeholders has given rise to a rich literature, much of which is dominated by models in which the motivation for the welfare-reducing behavior is found in side-contracting (bribes, corruption), threats (blackmail, political support) or corresponding mechanisms for repeated games (reputation, career concerns, signaling for promotion). Notwithstanding, the empirical support for monetary corruption and 'revolving doors' is scarce and inconclusive. We propose an alternative and more intuitive model for regulatory capture that is based on information transmission and asymmetric information. In a three-tier model, a regulator is charged by a political principal to provide a signal for the type of a regulated firm. Only the firm can observe his type and the production of a correlated signal with a given accuracy is costly for the regulator. The firm can costlessly provide an alternative signal of lower accuracy that is presented to the regulator. In a self-enforcing equilibrium, the regulator transmits the firm-produced signal, internalizes its own savings in information cost and the firm enjoys higher information rents. The main feature of soft capture is that it is not based on a reciprocity of favors but on a congruence of interests between the firm and the regulator.

JEL Codes: D72, L51

Keywords: Regulation, Capture, Information

*The authors would like to thank J. Calzada, S. Gilpatrick, J. Jacqmin, P. M. Picard, W. Sand-Zantman, X. Wauthy, seminar participants at the University of Barcelona and conference participants at the international industrial organization conference (Boston, March 2011) for useful comments and suggestions.

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1 Introduction

Regulatory capture is an area that has attracted considerable attention from both academia and, in legal and organizational contexts, from practitioners. Generally, the notion that an agency, monitoring a sector in order to prevent abuse of market power or to insure non-discriminatory service provision, is unduly influenced by same firms that it is set to supervise is *per se* a justified motivation to scrutinize regulatory design.

Capture is often analyzed using a three-layer hierarchy composed of a political principal (government), a regulatory agency and a firm. Regulatory capture is then a side agreement between the regulator and the firm to act against the interests of the political principal.[1] When the regulatory environment is designed under asymmetric information, capture originates in the combination of regulatory discretion and rents left to the firm. In Tirole (1986) and Laffont and Tirole (1993, chapter 11), the regulator possibly observes a signal correlated with the firm's private cost parameter. This informative signal, if reported to the political principal, reduces the rent left to the regulated firm. Hence, information collection is valuable and justifies the existence of a regulator as an information gathering intermediate. But, if the regulator has some discretion when it reports information to the principal, the firm is ready to bribe the regulator for not disclosing rent-reducing information. Thus, the incentives and the resources of the regulatory agency must be carefully designed to prevent this form of collusion to occur.

In most of the capture models, the firm influences the regulatory behavior by a mechanism based on threats (damaged reputation) and rewards (bribes, revolving doors); see Dal Bó (2006) for a recent survey. Capture is thus based on an exchange of favors between the regulator and the regulated firm. The regulator leaves extra-rent to the firm, for instance by not disclosing valuable information or by applying softly the regulations; The firm or the industry offers a bribe[2] or the possibility of post-regulatory employment in a regulated firm (revolving doors). Taking the possibility of capture into account, the government optimally limits the regulatory discretion (Hiriart and Martimort, 2009) and/or decentralizes its objective to the regulator who

[1] In the general setting, capture may be induced not only by the regulated firm, but also by potential clients, staff or other stakeholders that have an interest in biasing the outcome (see Peltzman, 1976 and Becker, 1983).

[2] Excluding the empirically rare 'suitcase', the firm may provide contracts for services to firms associated with the regulator or members of his family, provide valuable private information on publicly traded assets or foreseen business projects, real estate or other (costly) indirect transfers.

is then accountable for the regulatory outcome.

According to this classical view, we should observe either capture of regulators by special interest groups or a regulatory design that prevent capture. In practice, we observe none of this. Empirical support for monetary corruption and revolving doors are scarce and inconclusive[3] and few regulator are responsible for the regulatory outcomes. We thus have a *paradox of capture*: existence is widely acknowledged but evidences are scarce.

In this paper, we consider another channel for influencing the regulatory outcome: regulated firms can transmit pieces of information relevant for the decision makers. Indeed, many regulated firms finance R&D, produced in-house or by third-parties, and disseminate the results of these studies publicly. This knowledge can be (and actually is) used for regulatory purposes for the benefit of both the regulator and the firm: the firm because it controls the content of the information and the regulator because it saves on information gathering costs. The regulator is thus captured by accepting biased information from the firm. We will refer to this situation as *soft capture* and we believe that this form of capture is quite common in regulated industries. In highly technical sectors such as utility regulation, the regulator may be subject to political pressure to present new regulation for specific areas (e.g. technical quality norms, cost allocation grids, grid codes) within a given time and budget frame. Facing the risk of professional failure if an inadequate regulation is presented and the risk of career concerns if refusing the task, the regulators have tendency to accept industry "input", "sector consultations" or "cooperative development" of such regulatory projects.

Soft capture is not based on threats and rewards: both parties are better off if the regulator rubber-stamps the information produced by the firm instead of producing its own. The regulator comes to the political principal with information (what the principal expected it to do). The firm, if it transmits less precise information, increases its information rent. Hence, capture benefits both parties without requiring any form of side contracting nor side payments between parties. Thus, there is no smoking gun when the regulator is softly captured by the firm.

[3]The 'revolving door' hypothesis has weak empirical support (Freitag, 1983 and Makkai and Braithwait, 1992). Although, 'softer' application of regulatory supervision and empathy towards regulated entities are prevalent among low- and medium-level staff members of regulatory authorities, only a small fraction seek or obtain employment in the regulated sector. However, Makkai and Braithwait (1992) document 'situational capture' as a consequence of the extra workload caused by higher incidence of detected non-compliance. In our setting, this can be interpreted as a problem of moral hazard linked to cost of effort in enforcement.

Models based on information provision as incentive for capture are relatively rare. In a stream addressing lobbying of vote-seeking political principals, Austen-Smith and Wright (1992) present a model where two competing interest groups invest in biased information transmission, subject to the possibility of costly auditing from the principal. The results show that the information provision is welfare increasing on average and that the presence of multiple information providers may discipline the tendency to distort information.

In this paper, we develop a model where, as in Laffont and Tirole (1993), the regulator is an information gathering intermediate for the political principal. At some cost, the regulator observes a signal correlated with the firm's unknown cost parameter. The regulator reports the signal only if it is induced to do so and we assume that, in the absence of capture, the benefits of a better fitted regulation when the signal is reported exceeds the cost of adding an extra layer between the firm and the political power. Next, we consider the case where the firm can substitute the regulator and produces a signal itself. If it does so, the regulator can either report the firm's signal or its own signal if it had invested the necessary resources to produce one.[4] The firm is interested in transmitting information to the regulator only if (i) this information will be used for regulatory purposes and (ii) this information is less accurate than that of the regulator. We therefore consider that the signal produced by the firm contains more noise. In our model, the signal is 'soft' information meaning that no one can be punished if the information is inaccurate. If the regulator is paid when it reports information, the firm will provide a signal to the regulator to avoid that the regulator invests resources to produce a more precise one. The regulator is softly captured by the firm and the regulation by the political principal is based on a less accurate information, though the cost of operating the regulatory agency is left unchanged. Though the regulator no longer collects information, it is the threat of a more precise information that induces the firm to disclose biased information to the regulator. To observe this biased signal, the political principal must still appoint a regulator but the role devolved to the regulatory agency changes from an information gathering intermediate to an information transmission intermediate.

To benefit from a more accurate information, produced by the regulator, the principal must thus change its incentive package. In particular, this

[4]In our model, the regulator is the sole source of information for the political principal. Dual sourcing of information, for instance lobbying by the firm and reporting by the regulator, is not considered here. See Laffont and Martimort (1998) on this point.

would entail a decentralization of the welfare objective and a raise in the expected payment to the regulator. Given costs in bureaucracy and incomplete contracting, the principal may prefer to tolerate (soft) capture of the regulator by the firm (cf. Che, 1995).

Finally, letting the firm decide on the quality of the information transmitted by the firm, we show that it depends on the ability of the regulator to produce independently its own information. Should the regulator be able to produce only low quality information, for instance because it lacks of the necessary resources or because the sector is highly technical, the firm will then be able to softly capture the principal by disclosing low quality information and thereby it collects high rents. Conversely, if the regulator has a strong capacity to gather high quality information, if the firm wants to supplant the regulator in the information production process, then it must produce information of higher quality. Thus, even if the political principal may tolerate soft capture at equilibrium, it is important to have a regulator endowed with enough resource to, at least, incentivize the firm to disclose information of sufficiently high quality.

1.1 Motivating examples

To motivate the model, we provide an extreme example from US regulation and two recent examples from European utility regulation.

1. The Occupational Safety and Health Administration (OSHA) is responsible for the regulation, monitoring and enforcement of workplace health and safety in the USA under Occupational Safety and Health Act (1970). Seen as an aggressive action against private industry, the agency has been continuously target of resource deprivation since its foundation. Covering a vast domain of regulation, OSHA is de facto applying regulation using "national consensus standards", developed by "trade or professional associations for the practices, systems, processes, or raw materials of their members"(Hamilton, note 13, 1978). The resulting enforcement record of OSHA is dismal[5] due to inappropriate regulatory design. The industry-inspired regulations are found to systematically overestimate the costs of regulatory

[5]The OSHA regulations are extremely difficult to enforce: from 85.539 safety violations in 2003, only 404 were considered 'willful' and eligible for the highest criminal sanctions (Barstow, 2003). The outcome is striking: from a reported 2,197 workplace fatalities in 1982-2002, 1,242 were investigated by OSHA, thereof finally referring 119 cases for legal prosecution, resulting in nine convictions to prison for the employer. Most investigations were dropped already at reporting, the rest from ambiguities in the regulation (Barstow, 2003).

impact in a number of industrial sectors[6], potentially to provide the agency with politically viable arguments to justify the regulation. OSHA can be seen as an example where the regulatory agency develops from an information production intermediary to primarily monitoring in a mechanism based on 'voluntary' or 'self-regulation' by the regulated firms (Shapiro and Rabinowitz, 2000).

2. The European sectorial energy regulation has wide economic, technical and judicial consequences for the firms and the final consumers. The regulatory framework in Europe under the Third Directive (EC 2009/72/EC and 2009/73/EC) is based on national implementations, monitored by independent national regulatory authorities (NRA), loosely coordinated by a community agency (Agency for the Coordination of European Energy Regulators, ACER). The financial and human resources of the NRAs widely vary, limiting their possibilities to undertake independent information gathering. The information processing costs are substantial from most NRAs, with up to 800 regulated firms subject to heterogenous technical and economic conditions, each subject to an ex ante tariff regulation based on a number of verifiable principles.

The regulated sector, on the other hand, enjoys resources for information provision far larger than the NRA, with effective coordination also at community level in organs such as Eurelectric and ENTSO-E (EC 714/2009, art 5). One mission of primary importance for the functioning of the integrated electricity market is the development of a common standard (code) for all connecting transmission grids (EC 714/2009, art 6). Figuring as a mission and competence of ACER (EC 733/2009, art 6), the development of the network code is *de facto* made by the operators' organ ENTSO-E, starting their activities July 1, 2009 whereas the competent regulatory authority is planned to start their activities in March 2011. The editing of later documents reflects this change in initiative, where the regulated entities invest to propose their own detailed regulation, pre-emptying the regulatory authority by initiative and resources. Parallel initiatives of the same type are made for integrated market design and system operations.

3. A third example is found in the development of quality regulation for electricity distribution in Sweden. The Swedish NRA regulates 180 electric-

[6]E.g. Vinyl Chloride (Oct 4, 1974, 39 FR 35890), OSHA relied on industry consultants' estimate of 1,000 M$ in compliance costs. Actual spending in equipment, and incremental operating cost is around 228 - 278 M$. (US Congress, 1995). The report documents similar findings for the exposure regulations for cotton dust, lead, ethylene oxide and formaldehyde, as well as for the operating regulations for grain handling, mechanical power presses and powered platforms for building maintenance.

ity distributors providing five million households under heterogenous technical delivery conditions, asset bases and customer profiles. Deregulated in 1996, the government explicitly prompted the NRA also to provide regulation for service quality (Swedish Government, 2001). However, in 2001 the NRA endorsed a detailed voluntary service regulation with repayments for interruptions, developed by the sector association Svensk Energi. In operation until 2006, when again urged by Parliament to issue independent regulation, the final proposal (STEM, 2005) draws on the structure and amounts stipulated in the industry regulation.

2 The model and benchmark results

We consider a three-tier hierarchy composed of a political principal (P), a regulatory agency (R) and regulated firm (F).

The regulated firm produces a good in quantity q at a constant marginal cost θ. The cost parameter is the firm's private information but it is common knowledge that $\theta \in \{\underline{\theta}, \overline{\theta}\}$, with $\Delta\theta = \overline{\theta} - \underline{\theta} > 0$ and $\Pr(\theta = \underline{\theta}) = \nu$. The firm signs a contract with the political principal that specifies a production level q and a transfer t. The firm's utility is

$$U = t - \theta q,$$

with its reservation level normalized to zero.

The regulatory agency is an information gathering intermediate, whose main task consists in producing a signal for the principal. The signal is a piece of information correlated with the firm's hidden cost parameter. Analogous to the cost parameter θ, the signal is a binary variable $\sigma \in \{\sigma_1, \sigma_2\}$ with the conditional probabilities of the realizations $\Pr(\sigma = \sigma_1|\theta = \underline{\theta}) = \mu$ and $\Pr(\sigma = \sigma_2|\theta = \overline{\theta}) = \mu$. Signals are informative when $\mu > \frac{1}{2}$ where μ can be interpreted as a measure of the *informativeness* or quality of the signal i.e. a higher μ means a higher correlation between the true type θ and the signal σ. When $\mu = 1$, signal and type are perfectly correlated while $\mu = \frac{1}{2}$, signifies a white noise.

Producing a signal is costly for the regulator; it must incur a cost $m > 0$ to produce a signal of quality $\mu^R > \frac{1}{2}$. We assume that the signal is non-verifiable, which means that it cannot be included in the contract between the firm and the principal. However, the potential disclosure of information by the regulator is observable and the regulator's compensation can be made contingent on that.[7] The political principal cannot thus not verify the

[7] Examples could be cost, impact or efficiency studies performed by or for the regulator

quality of an assessment, but only its existence. Conditional on submitting a signal, the regulator receives a payment w and its utility is

$$V = w - m.$$

The regulator has a reservation utility of zero and it is protected by limited liability.

The political principal remains in charge of the main regulatory tasks and designs a regulatory contract (t, q) for the firm after observing the signal σ. When the quality of the observed signal is $\mu \geq \frac{1}{2}$, after observing σ_i, $i = 1, 2$, the principal revises its beliefs on the firm's private cost parameter to:

$$\nu_1(\mu) = \Pr(\theta = \underline{\theta}|\sigma_1) = \frac{\mu\nu}{\mu\nu + (1-\mu)(1-\nu)} \geq \nu$$

or

$$\nu_2(\mu) = \Pr(\theta = \underline{\theta}|\sigma_2) = \frac{(1-\mu)\nu}{(1-\mu)\nu + \mu(1-\nu)} \leq \nu.$$

When the firm produces a quantity q, the value for the principal of these q units is $S(q)$ with $S' > 0$, $S'' < 0$ and $S(0) = 0$. The principal's net surplus[8], W, is defined as

$$W = S(q) - t - w.$$

The timing of the events is as follows:

$\underline{t = 0}$

- The firm learns its private cost parameter θ.

$\underline{t = 1}$

- The political principal offers a contract (w) to the regulator.
- The regulator potentially produces a signal σ at cost m.

$\underline{t = 2}$

- The political principal observes σ_i (if produced) and offers a contract (t, q) to the firm.
- The firm accepts or rejects the contract.

The model presented in this section and the associated results are perfectly standard (see for example Laffont and Martimort, 2002, chapter 2).

and included in annual reports or preambles to regulatory rulings.

[8]We assume that the political principal attributes no value to the utility of the regulator, a conventional assumption.

2.1 Benchmark results in the absence of capture

At $t = 1$, the principal can offer two possible contracts to the regulator: either it offers a contract $w = m$ and the regulator produces a signal of quality μ^R or it offers $w = 0$ and the regulator does not invest in information acquisition to produce the signal. Equivalently, we can consider that, in the latter case, the principal observes a noisy signal with quality $\mu = \frac{1}{2}$. Then, we can parametrize the optimal date-2 contract as a function of μ and afterwards compare the two options: a signal of quality μ^R at a cost of m or a signal of quality $\mu = \frac{1}{2}$ for free.

At $t = 2$, after observing σ_i, $i = 1, 2$, the principal offers the firm a menu of contracts $\{(\underline{t}, \underline{q}); (\overline{t}, \overline{q})\}$. Such a menu is incentive feasible if it satisfies the efficient firm's incentive compatibility constraint and the inefficient firm's individual rationality constraint:

$$\underline{t} - \underline{\theta q} \geq \overline{t} - \underline{\theta}\overline{q}, \tag{1}$$

$$\overline{t} - \overline{\theta}\overline{q} \geq 0. \tag{2}$$

The other two constraints, individual rationality for the efficient firm and incentive compatibility for the inefficient one, are slacks at the optimal contract.

The principal solves

$$\max_{\{(\underline{t},\underline{q});(\overline{t},\overline{q})\}} \nu_i(\mu)(S(\underline{q}) - \underline{t}) + (1 - \nu_i(\mu))(S(\overline{q}) - \overline{t})$$

subject to (1) and (2).

The optimal contract offered to the firm after observing the signal σ_i satisfies:

$$S'(\underline{q}_i(\mu)) = \underline{\theta} \tag{3}$$

$$S'(\overline{q}_i(\mu)) = \overline{\theta} + \frac{\nu_i(\mu)}{1 - \nu_i(\mu)}\Delta\theta \tag{4}$$

$$\underline{t}_i(\mu) = \underline{\theta}\underline{q}_i + \Delta\theta\overline{q}_i \tag{5}$$

$$\overline{t}_i(\mu) = \overline{\theta}\overline{q}_i \tag{6}$$

This contract is standard.

Now let's turn to the choice of the principal at date 1. If it pays the regulator $w = m$, the latter produces a signal of quality μ^R and the principal's expected surplus (at date-1) is

$$EW(\mu^R) = \nu[\mu^R(S(\underline{q}_1(\mu^R)) - \underline{t}_1(\mu^R)) + (1 - \mu^R)(S(\underline{q}_2(\mu^R)) - \underline{t}_2(\mu^R))]$$
$$+(1 - \nu)[\mu^R(S(\overline{q}_2(\mu^R)) - \overline{t}_2(\mu^R)) + (1 - \mu^R)(S(\overline{q}_1(\mu^R)) - \overline{t}_1(\mu^R))] - m \tag{7}$$

If the political principal offers $w = 0$ to the regulator, the principal's expected surplus is:

$$EW(\frac{1}{2}) = \nu[S(\underline{q}(\frac{1}{2})) - \underline{t}(\frac{1}{2})] + (1-\nu)[S(\overline{q}(\frac{1}{2})) - \overline{t}(\frac{1}{2})] \tag{8}$$

Adding a tier between the political principal and the firm is socially valuable whenever $EW(\mu^R) - EW(\frac{1}{2}) \geq 0$. Given that $EW(\mu)$ is increasing in μ, we have

Lemma 1 *There exists $\tilde{\mu}_1 > \frac{1}{2}$ such that if $\mu^R \geq \tilde{\mu}_1$, the principal sets $w = m$ and the regulator produces a signal; otherwise it sets $w = 0$ and does not observe any informative signal.*

The principal employs a regulator when the gains from a more accurate information on the firm's cost parameter exceeds the cost of gathering information. For the remaining of the analysis, we will assume that it is indeed the case: $\tilde{\mu}_1 < \mu^R \leq 1$.

Finally notice that when the signal's quality is μ, the efficient firm's expected utility is:

$$E\underline{U}(\mu) = \mu\Delta\theta\overline{q}_1(\mu) + (1-\mu)\Delta\theta\overline{q}_2(\mu) \tag{9}$$

and that this expression is decreasing in μ. Hence, a more accurate information reduces the expected rent left to the firm.

3 Capture

3.1 The scope for capture

The mechanism above is not immune to capture when the firm can substitute the regulator and produce a signal σ by itself. Suppose that, at no cost, the firm is able to produce a signal that is less informative than the signal produced by the regulator. More precisely, let us denote by μ^F the informativeness of the firm's produced signal with $\frac{1}{2} \leq \mu^F < \mu^R$. Examples could be found in the use of methodologies, models and data collection routines that provide results that are more favorable to the firm. If the firm transmits such information to the regulator, both the firm and the regulator are better off. Indeed, the regulator can transmit the signal to the political principal, receiving the payment $w = m$ since the principal cannot distinguish the origin or precision of the signal. Given that the production cost is

lower, the regulator's utility is strictly higher: $V = m$. The firm also benefits from providing the signal to the regulator. The lower accuracy in the signal provides the efficient firm with a higher expected information rent.[9]

For instance, if the political principal is fooled and believes that it receives a piece of information made by the regulatory agency, the expected rent of the efficient firm is equal to:

$$\mu^F \Delta\theta \overline{q}_1(\mu^R) + (1 - \mu^F)\Delta\theta \overline{q}_2(\mu^R) > E\underline{U}(\mu^R). \tag{10}$$

This self-enforcing capture is obviously detrimental to the political principal and hurts welfare.

The implicit collusion between the firm and the regulator above is in contrast with other models of collusion in three-tier hierarchies (Tirole, 1986, Laffont and Tirole, 1993, chapter 11, Kofman and Lawaree, 1993) where side contracting and side payments (or some form of reciprocity) are necessary conditions for collusion. In these latter models, the firm should bribe the regulator for not disclosing information that is valuable to the principal but detrimental to the firm. In our set-up, the firm does not need to bribe the regulator. The firm produces and transmits noisy information to the regulator who is free to use it as it wishes. It turns out that, if producing acquisition is costly and if the information quality cannot be verified, both the firm and the regulator are better off if the regulator transmits the firm's less precise signal. Thus, there is no need of an explicit agreement to support collusion.

In practice, there are many channels that the firm can use to disclose (biased) information to the regulator.[10] Firms can produce their own research, data collection and analyses or finance third parties (consultants, researchers, universities,...). These studies or research reports, produced or sponsored by firms, may be disseminated through professional forums, conferences or published as reports. In the case of OSHA above, the firms submit the information formatted as proposed regulation, including all technical details. Firms can also train regulatory staffs and make available their special field expertise. All these practices are commonly observed, for instance in the field of utility regulation, and there is no doubt that the information emanating from the firm percolates throughout the regulators.

[9] The rent of the inefficient firm is, in any case, equal to zero. Thus, if producing a signal is costly for the firm, only the efficient firm would produce it provided that the cost exceeds the benefit. Considering costly signals would not qualitatively change the results.

[10] In fact, agencies sometimes actively solicit data from (likely biased) sources: "*I am actually surprised how often they [ministerial civil servants] ring me up looking for data I would have assumed they should be the ones who have it.*" (Interview with lobbyist, Bernhagen and Bräuninger, 2005, p. 47)

Majone (1997) announces the information-based regulation the new modus operandi for the European regulatory agencies, less armed by formal enforcement rights. Our model is indeed a simple example how information access, production and asymmetry interplay to create a socially costly collusion between industry and regulators. We call this practice **soft capture**: self-enforcing and undetectable, its apparent lack of commitment is deceptive. The main feature of soft capture is that it is not based on a reciprocity of favors but on a congruence of interests between the firm and the regulator.

Taking this phenomenon into account, the political principal has three options. First, it may refrain from using the information gathering expertise of the regulator and to design the regulatory contract on the basis of its prior knowledge of the firm's cost. Second, it may continue to exploit the information produced by the firm, i.e., accept the regulator to be softly captured by the firm, but changing its interpretation of the information transmitted. Third, it may design and implement a collusion-proof mechanism. In this latter case, the political principal incentivizes the regulator only to transmit high quality and to balk low quality signals. Unfortunately, the threat of capture raises the cost of this mechanism for the principal.

We have already described the mechanism in the absence of a regulator, the associated expected welfare is $EW(\frac{1}{2})$. Without the threat of capture, this solution is always dominated (by assumption) but, as we will see, this may longer be the case when capture can take place. Below, we model and evaluate the remaining two options for the political principal.

3.2 Soft capture: The firm produces the signal

Consider the case in which the political principal uses the firm-produced signal for designing the regulatory contract. The firm and the regulator engage in the soft collusion described above.

Even if the firm produces the information for free and is ready to transmit it to the regulator, the political principal must still pay $w = m$ to the regulator to obtain any information. Indeed, if $w < m$, the regulator has no incentives to produce the signal in the case it would not have been transmitted by the firm. Given that any information about its type would make the firm strictly worse off, the firm will never transmit a signal to the regulator when it is the sole source of information. When the threat of an independently produced signal is absent, the firm has no incentive to disclose information at all. Hence, to benefit from the firm's produced signal, the principal must pay $w = m$ to the regulator, conditionally on reporting a signal. This nicely illustrates the rational behind soft capture. It is the

threat of a more informative message that motivates the firm to disclose less precise information. Should this threat disappear, the firm will no longer produce information.[11]

With $w = m$, the signal transmitted by the regulator is produced by the firm. Taking that into account, after observing a σ_i, the principal revises his beliefs to $\nu_i(\mu^F)$. The optimal contract is given by (3) to (6) for $\mu = \mu^F$ and the corresponding expected welfare is equal to:

$$EW(\mu^F) = \nu[\mu^F(S(\underline{q}_1(\mu^F)) - \underline{t}_1(\mu^F)) + (1-\mu^F)(S(\underline{q}_2(\mu^F)) - \underline{t}_2(\mu^F))]$$
$$+(1-\nu)[\mu^F(S(\overline{q}_2(\mu^F)) - \overline{t}_2(\mu^F)) + (1-\mu^F)(S(\overline{q}_1(\mu^F)) - \overline{t}_1(\mu^F))] - m \quad (11)$$

This welfare is obviously lower than $EW(\mu^R)$.

3.3 Collusion-proof: The regulator produces the signal

With a wage equal to the signal's production cost, the regulator transmits the noisy information obtained from the firm. In order to have a more informative signal, produced by the regulator, the political principal must adapt the contract offered to the regulatory agency. In particular, both the level and structure of the compensation should be changed. Clearly enough, the payment can no longer be conditional on the submission of a signal since, in this case, the regulator reports the signal produced by the firm. The payment should be made contingent on the regulatory outcome and in particular on the transfer paid to the firm, in such a way that, when a better information leads to a more efficient regulatory contract, part of the welfare gain is internalized by the regulator. The political principal must thus partially decentralize its objective to the regulator.

As already mentioned, the efficient firm is strictly worse-off when the regulator gathers information itself. At worst thus, the firm would be ready to bribe the regulator for not gathering information (as in the standard models of collusion such as Laffont and Tirole, 1993). For observing the high-quality signal produced by the regulator, the political principal must take into account that the firm is ready to transfer part of its benefit to the regulator if the latter does not produce the signal and discloses, instead, the firm's produced signal.[12]

[11] This effect is analogous to the results obtained in lobbying models (Cf. Austen-Smith and Wright, 1992): a lobbyist would only invest in costly information transmission provided the [regulator] enjoys a sufficiently low cost of independent information acquisition, or else the message would be discarded by default as non-informative.

[12] Whether the regulator discloses or not a signal is a verifiable outcome. The political

Only the efficient firm with type $\underline{\theta}$ is ready to bribe the regulator. The efficient firm' potential gain from collusion is given by (10). The firm is ready to pay up to $(\mu^R-\mu^F)\Delta\theta[\overline{q}_2(\mu^R)-\overline{q}_1(\mu^R)]$ to the regulator if the latter uses the signal the former produces. Let us assume that side contracting between the regulator and the firm is costly and denote by $k \leq 1$ the transaction cost of side contracting. When the firm transmits 1\$ to the regulator, the latter has k\$ in its pockets.[13]

At $t = 1$, when the principal designs the contract for the regulatory agency, it must take into account that, with probability ν, the regulator faces an efficient firm that is ready to bribe the regulator for not producing a signal. Thus, for a collusion-proof contract, the principal must take into account that the regulator's utility under collusion is

$$V' = \nu k(\mu^R - \mu^F)\Delta\theta[\overline{q}_2(\mu^R) - \overline{q}_1(\mu^R)]. \tag{12}$$

A more precise signal makes the transfers $\underline{t}_1$ and $\overline{t}_2$ more likely and $\underline{t}_2$ and $\overline{t}_1$ less likely. To induce information acquisition by the regulator, the principal must thus reward the regulator when $t \in \{\underline{t}_1, \overline{t}_2\}$. Let us denote by $w(t)$, the wage paid to the regulator contingently on a transfer t to the firm. Assume further that the regulator is protected by limited liability, $w(t) \geq 0$, the regulator's incentive constraint writes as follows:

$$(\mu^R - \mu^F)[\nu(w(\underline{t}_1) - w(\underline{t}_2)) + (1-\nu)(w(\overline{t}_2) - w(\overline{t}_1))] \geq m + V' \tag{13}$$

The left hand side of (13) is the extra wage received when the signal has a quality μ^R instead of μ^F. The right hand side is the cost of producing a high quality signal including the opportunity cost of renouncing to the bribe.

At equilibrium, (13) is binding and the expected payment to the regulator for a high quality signal is equal to

$$\tilde{w} = \frac{m + V'}{\mu^R - \mu^F} = \frac{m}{\mu^R - \mu^F} + \nu k\Delta\theta[\overline{q}_2(\mu^R) - \overline{q}_1(\mu^R)]. \tag{14}$$

Clearly enough, the possibility of capture inflates the expected compensation paid to the regulatory agency for producing a high quality signal: $\tilde{w} > m$.

Notice that the contract with the regulator $w(t)$ is designed prior the regulatory contract (q, t). Then, commitment to the regulatory contract

principal can thus put pressures on the regulator for providing him with information, for instance by not reappointing a failing regulator. Should this threat be effective, the principal can avoid that the firm pays the regulator for not disclosing information at all. The concern of the principal is thus to prevent that the firm bribes the regulator for disclosing an information that the former produced.

[13] On the foundations of the transactions costs of side contracting, see Martimort (1999).

$(\underline{t}_i, \underline{q}_i; \overline{t}_i, \overline{q}_i)$ after observing σ_i might be a concern. By deviating to $t_i + \epsilon$, the principal saves on the regulator's wage $w(t_i)$. Commitment to the optimal regulatory contract requires that the regulator specifies a sufficiently large wage $w(t)$ for out-of-equilibrium values of $t \notin \{\underline{t}_1, \underline{t}_2, \overline{t}_1, \overline{t}_2\}$. Given that, the optimal date-2 contract with the firm are given by (3) to (6) for $\mu = \mu^R$. The welfare with the collusion-proof contract is:

$$EW(\mu^R) - \frac{m}{\mu^R - \mu^F} - \nu k \Delta\theta[\overline{q}_2(\mu^R) - \overline{q}_1(\mu^R)]. \tag{15}$$

3.4 Comparisons

At $t = 1$, the political principal's choice of a contract with the regulator will be driven by the comparison of (8), (11) and (15). We have:

Lemma 2 *There exists $\tilde{\mu}_2 > \tilde{\mu}_1$ such that (i) if $\mu^R \geq \tilde{\mu}_2$, $EW(\mu^R) - \tilde{w} \geq EW(\frac{1}{2})$ and (ii) $d\tilde{\mu}_2/d\mu^F > 0$.*

Proof: Part (i) follows from the fact that $\tilde{w} > m$; Part (ii) from the fact that $d\tilde{w}/d\mu^F > 0$.

Notice that our assumptions do not guarantee that $\tilde{\mu}_2 < 1$. If this condition does not hold true, the collusion proof mechanism is always dominated by direct regulation by the political principal. This might happen when the agency cost of incentivizing the regulator becomes prohibitive compared to its informational benefit.

Lemma 3 *There exists $\tilde{\mu}_3$ such that (i) if $\mu^R \geq \tilde{\mu}_3$, $EW(\mu^R) - \tilde{w} \geq EW(\mu^F)$, (ii) $\tilde{\mu}_3 > \mu^F$ and (iii) $d\tilde{\mu}_3/d\mu^F > 0$.*

Proof: If μ^R is large enough, then $d(EW(\mu^R) - \tilde{w})/d\mu^R > 0$ which implies (i). Part (ii) follows from the fact that $\lim_{\mu^R \to \mu^F} EW(\mu^R) - \tilde{w} < EW(\mu^F)$; Part (iii) from the facts that $dEW(\mu^F)/d\mu^F > 0$ and $d\tilde{w}/d\mu^F > 0$.

Likewise, our assumptions do not guarantee that $\tilde{\mu}_3 < 1$. This lemma establishes that when the quality of the firm produced signal is sufficiently close to the quality of the regulatory produced signal, the agency cost of information acquisition becomes prohibitive and the political principal is better off if it only induces the regulator to transmits information.

From our three lemmas, it follows that:

Proposition 1 *The political principal tolerates soft capture of the regulator when $\mu^F \geq \tilde{\mu}_1$ and $\mu^R \leq \tilde{\mu}^3$. Under our assumptions, this parameter set is non-empty.*

As in Che (1995), the principal accepts the regulator to be softly captured by the firm in equilibrium when the cost of fighting collusion exceeds the benefits of improved regulatory power. This happens when the accuracy of the firm produced information is high enough in absolute terms and relative to the accuracy of the regulator's own-produced signal.

Proposition 1 is illustrated in figure 1 (assuming $\tilde{\mu}_2, \tilde{\mu}_3 < 1$). Absent the threat of capture, the political principal appoints a regulator whenever $\mu^R \geq \tilde{\mu}_1$ (regions **I**, **II** and **III** in figure 1). When capture is taken into account, the principal no longer uses a regulator in region **I**: both the firm's and the regulator's signal are not accurate enough to justify the extra cost of an intermediate layer in the hierarchy. In region **II**, the political principal tolerates soft capture by the firm i.e. the regulator's mission changes and it is no longer used as an information collection intermediate. Finally, in region **III**, the political principal actively fight collusion by decentralizing its objective to the regulator (at some extra cost) and the regulator acts as an information gathering intermediate.

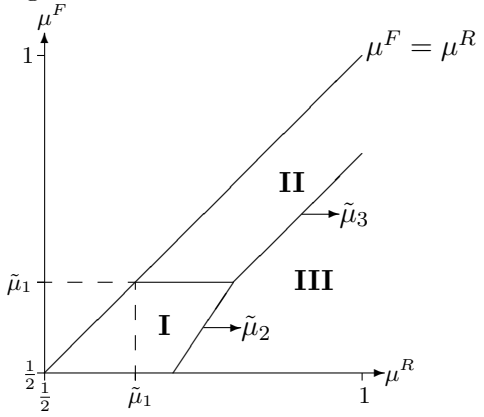

Figure 1: Regulatory regimes.

3.5 Discussion

The mechanism of soft capture is based on the threat of having information produced (at some cost) by the regulator. The firm who is hurt by information is ready to supply less accurate information for free.

In our model, we have so far considered as exogenous the accuracy of the signals produced by the firm and the regulator. In this section, we relax this assumption and we discuss briefly the implications of endogenous

information quality. Suppose that the firm can choose the quality of the signal it transmits to the regulator. We have:

Proposition 2 *The firm's preferred signal accuracy* μ^F *is equal to* $Max[\tilde{\mu}_1 - \epsilon, \tilde{\mu}_3 + \epsilon]$.

If the firm can choose the quality of its signal, it will set μ^F at a level that leads to the less informative regulatory regime. For the firm, the worst regime is the collusion proof mechanism. Referring to figure 1, it is possible for the firm to escape this regime by choosing a sufficiently informative signal. If $\mu^R \leq \tilde{\mu}_2(\tilde{\mu}_1)$, by choosing a low accuracy for its information, the firm will be directly regulated by the political principal who no longer uses the expertise of the regulator. If $\mu^R \geq \tilde{\mu}_2(\tilde{\mu}_1)$ and if the firm provides a sufficiently precise signal ($\mu^F > \tilde{\mu}_3$), the political principal tolerates soft capture. When the firm provides sufficiently reliable information, the rents saved by the political principal when the signal is less noisy do not exceed the extra cost of producing such a signal.

But the political principal can use the fact that the firm is ready to supply sufficiently accurate information to avoid toughest regulation. The quality of information the firm is ready to provide increases with the threat exerted by the regulator. Should the regulator be able to produce very precise information on the firm's cost, then the signal produced by the firm will be precise too. Conversely, should the regulator have little competency in information gathering, the firm will transmit very noisy information, if at all. The accuracy of the firm's signal is thus correlated with the accuracy of the regulator's signal. So, even if the political principal tolerates soft capture at equilibrium (due to high incentive costs), it is important that regulators are endowed with a sufficiently high expertise. Firms are thus induced to transmit higher quality information if they want to short-circuit the regulatory process.

Soft capture is based on the threat of regulatory investigation and, the stronger the threat (a more accurate signal), the more informative will be the firm's produced signal. Regulatory resources and expertise keep a central role even if, at equilibrium, the political principal let the firm produces its own information.

The evolution of OSHA since its creation nicely illustrates our findings. The regulator OSHA has in fact transformed its internal resources from technical analyses to site inspections (although the absolute frequency has dropped proportionally), meaning that it maintains only an "analyst in being" as a threat, rather than performing parallel editing of standards, which

is politically and economically risky. In our words, OSHA is softly captured by the industry. Moreover, the resources of OSHA have continuously decreased since it foundation: in the period 1971-2004, the number of US employed under regulation doubled from 58 million to 115 million while the agency's staff decreased from 2,300 employees to 2,100 employees, in addition to continuous budget cuts in real and nominal terms since 1980 (OHSA, 2010). Resource deprivation and reallocation to site inspections mean that the threat on the industry of better internally produced regulations decreases over time. Consistently with our model, indications (US Congress, 1995) about the accuracy of industry studies over time seem to suggest that the discrepancy actually decreases over time. In terms of our model, it means that the quality of the information produced by the industry move along with the capabilities of the regulator.

4 Conclusions

Accepting the conjecture that capture indeed exists and influences public authority decision making and enforcement of economic regulations, the critical question is to find its intrinsic motivational functions in order to address it adequately. Prior literature is primarily based on the hypotheses that regulators are driven by private monetary opportunism in the sense of rent appropriation, leading to remedies where collusive outcomes or 'bribes' are thwarted by delegation of the social welfare objective to the regulator. However, both the precondition and the remedy are relatively rare in empirical work from the Western hemisphere, although economic regulation is omnipresent. Although incidents of outright corruption of staff at regulatory agencies are reported, most agencies employ civil servants with origins and future in public service, exercising only limited discretionary power and subject to restrictions of due process and transparency. Still, many regulatory rulings, albeit motivated, are clearly biased in favor of the regulated entities. Our model offers one explanation to this apparent paradox by 'soft capture', where the firm acts as a co-producer of information for the regulator, without imposing any agreement on the sharing of benefits from the side of the firm, nor commitment to use the information from the side of the regulator. The resulting outcome is 'soft' in the sense that it is voluntary, quality-adjusted and flexible to the type of information and the abilities of the regulator to produce equivalent information. Indeed, the political principal accepts this capture in equilibrium for the case where the information submitted by the firm is of sufficiently high quality not to justify further

investments in independent information acquisition. In a context of stricter budget balancing for governmental agencies, fiscal competition among firms and countries and pressure for technically detailed regulation in e.g. utility regulation, one may plausibly expect soft capture to be at work.

The findings in this work are not limited to the pure moral hazard setting for an effort-averse regulator. They can also be interpreted as an alternative explication for the 'revolving door' phenomenon in capture, based on the idea on 'minimum squawk' (Leaver, 2002). Leaver (2002) finds a evidence for correlation between falling propensity of regulators to open rate-reviews in the case of observed cost decreases (i.e. rent extraction) and reductions in the term limits of the regulator (i.e. reappointment stress). The model in Leaver (2002) is based on a signaling behavior, where the regulator takes a risk to reveal its true type only by a 'tough' decision, since the firm would then threaten to announce the quality of the decision ('squawk'). The empirical findings from US State Public Utility Commissions' suggest that less able regulators set more generous price caps when terms are shorter and that firms earn higher rents when regulators serve short-term mandates. Comparing the 'squawk' with the pre-decision signal in our model and the cost of information as a decreasing function of the time allocated, the outcome is consistent and confirm the intuition. The regulator presented with convincing, yet biased information on a given decision, prior to undertaking an investment in information acquisition, may hypothesize that the firm will carefully scrutinize, oppose and appeal any decision that is not consistent with the information provided. The cost of providing an information signal of the same or higher quality as that of the firm may be prohibitive in the short run and the risk of subsequent failure great for the regulator if faced by a renewal or career decision. Thus, one interpretation may be that the information provision protects the regulator from two concerns: the political principal's potential audit of the basis for the regulatory enforcement and the firm's legitimate review of the technical quality of the rulings to which it is subject.

Capture of regulatory agencies, or information gathering intermediaries in general, is a composite phenomenon that empirically may be the result of a number of the explanatory factors proposed in the literature (monetary bribes, revolving doors, political reputation and prestige, etc.), in addition to, or in combination with, the relatively intuitive effort-resource motivation that we advance in this work. Consequently, further empirical work based on specific sectors, countries and legislations may be necessary to derive reliable policy results that surpass the general guidelines found in contemporary work on good governance. However, anecdotal evidence suggests that the

simple "benchmarks" related to regulatory endowments as a proxy of regulatory empowerment should be enriched with supplementary analyses of the actual decision-making basis used by the regulators.

References

[1] Austen-Smith, D. and J. Wright (1992), 'Competitive Lobbying for a Legislator's Vote,' Social Choice and Welfare, 9(3), 229-257.

[2] Barstow, D. (2003), 'U.S. Rarely Seeks Charges for Deaths in Workplace,' New York Times , December 22, 2003.

[3] Becker, G. (1983), 'A Theory of Competition among Pressure Groups for Political Influence,' The Quarterly Journal of Economics, 98(3), 371-400.

[4] Bernhagen, P. and T. Bräuninger (2005), 'Structural Power and Public Policy: A Signaling Model of Business Lobbying in Democratic Capitalism,' Political Studies, 53(1), 43-64.

[5] Che, Y.-K. (1995), 'Revolving Doors and the Optimal Tolerance for Agency Collusion,' RAND Journal of Economics, 26(3), 378-397.

[6] Dal Bó, E. (2006), 'Regulatory Capture: A Review,' Oxford Journal of Economic Policy, 22(2), 203-225.

[7] Freitag, P. J. (1983), 'The Myth of Corporate Capture: Regulatory Commissions in the United States,' Social Problems, 30(4), 480-491.

[8] Hamilton, R. W. (1978), 'The Role of Nongovernmental Standards in the Development of Mandatory Federal Standards Affecting Safety or Health,' Texas Law Review, 56(8), 1329.

[9] Hiriart, Y. and D. Martimort (2009), 'How Much Discretion for Risk Regulators?,' University of Toulouse, mimeo.

[10] Kofman F. and J. Lawaree (1993), 'Collusion in Hierarchical Agency,' Econometrica, 61(3), 629-656.

[11] Laffont, J.-J. and D. Martimort (1998), 'Collusion and Delegation,' RAND Journal of Economics, 29(2), 280-305.

[12] Laffont, J.-J. and D. Martimort (2002), 'The Theory of Incentives,' Princeton University Press.

[13] Laffont, J.-J. and J. Tirole (1993), 'A Theory of Incentives in Procurement and Regulation,' MIT Press.

[14] Leaver, C. (2002), 'Bureacratic Minimal Squawk Behaviour: Theory and Evidence from US Regulatory Policy,' University of Oxford, mimeo.

[15] Majone, G. (1997), 'The New European Agencies: Regulation by Information,' Journal of European Public Policy, 4(2), 262-275.

[16] Makkai, T. and J. Braithwaite (1992), 'In and out of the Revolving Door: Making Sense of Regulatory Capture,' Journal of Public Policy, 12(1), 61-78.

[17] Martimort, D. (1999), 'The Life Cycle of Regulatory Agencies: Dynamic Capture and Transaction Costs,' Review of Economic Studies , 66(4), 929-947.

[18] Peltzman, S. (1976), 'Toward a More General Theory of Regulation,' Journal of Law & Economics, 19(2), 211-240.

[19] Shapiro, S. A. and R. Rabinowitz (2000), 'Voluntary Regulatory Compliance in Theory and practice: The Case of OSHA,' Administrative Law Review, 52(1), 97-155.

[20] Swedish Government (2001), 'Energimarknader i utveckling – bättre regler och tillsyn' (Energy markets under development - improved regulation and monitoring), Proposal 2001/02:56, (In Swedish).

[21] STEM (2005), 'En leveransäker elöverföring (A reliable electricity distribution),' Report to the Government, April 26, 2005. Swedish Energy Market Inspectorate. (In Swedish)

[22] Tirole, J. (1986), 'Hierarchies and Bureaucracies: On the Role of Capture in Organizations,' Journal of Law and Economic Organization, 2(2), 181-214.

[23] U.S. Congress (1995), 'Gauging Control Technology and Regulatory Impacts in Occupational Safety and Health—An Appraisal of OSHA's Analytic Approach,' Report OTA-ENV-635, Office of Technology Assessment, Washington, DC: U.S.