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Bargaining and Collusion in a Regulatory Model

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Bargaining and Collusion in a Regulatory Model*

Raffaele Fiocco† and Mario Gilli‡

Abstract

Within a standard three-tier regulatory model, a benevolent principal delegates to a regulatory agency two tasks: the supervision of the firm's (two-type) costs and the arrangement of a pricing mechanism. The agency may have an incentive to manipulate information to the principal to share the gains of collusion with the firm. The novelty of this paper is that both the regulatory mechanism and the side contracting between the agency and the firm are modelled as a bargaining process. While as usual the inefficient firm does not have any interest in cost manipulation, we find that the efficient firm has an incentive to collude only if the agency's bargaining power is high enough, and the total gains of collusion are now lower than those the two partners would appropriate if the agency could make a take-it-or-leave-it offer. Then, we focus on the optimal institutional responses to the possibility of collusion. In our setting, where the incompleteness of contracts prevents the principal from designing of a screening mechanism and thus Tirole's equivalence principle does not apply, we show how the players' bargaining powers crucially drive the optimal response to collusion.

Keywords: bargaining, collusion, regulation.

JEL classification: D73, D82, L51.

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1. Introduction

The aim of this paper is to examine the possibility of collusion in the regulation of a monopolistic market when a benevolent principal delegates to a regulatory agency two tasks: the *supervision* of the firm's (two-type) costs and the *negotiation* with the firm over a pricing policy. In this new setting we investigate the classic questions: which regulatory policy should we expect in such a situation? What are the characteristics of the collusive gains? Which is the best response to collusion? What are the determinants of this response? This paper is a first attempt to derive some preliminary results within this general setting.

We consider a standard model of a three-tier regulatory hierarchy, where the political principal (Congress) directs the activities of a supervisor (the regulatory agency), which in turn oversees the operation of a monopoly (the regulated firm). We innovate the usual approach assuming that the principal delegates to the supervisor a general negotiation with the monopolist on the regulatory policy. The reason for this generalization is that usually regulation does *not* boil down to a passive enforcement of a policy, but actually involves a *negotiation* between the regulator and the firm. In other words, regulatory arrangements are generally the result of a *give-and-take* process rather than of a take-it-or-leave-it offer, since the possibility of pre-committing to a specific offer is actually unrealistic. Another important issue to analyse would be the bargaining process between the political principal and the regulatory agency, but we limit the scope of this paper within the negotiation between the agency and the firm.

The literature on regulation has long ago recognized the relevance of introducing general bargaining processes in the interaction between regulator and firm. For example, Kahn (1971) had already observed that often public utilities represent cases of bilateral monopolies, while Spulber (1989) proposed regulatory models dealing with bargaining processes. Similarly, Scarpa's (1989, 1994) work represents a preliminary attempt to model this aspect of regulatory situations. Finally, Armstrong and Sappington in their survey on optimal regulation have recently recognized that the standard formulation, which ignores negotiations between the regulator and the firm, ‹‹generally is adopted for technical convenience rather than for realism›› (2007, p. 1564). Also empirical studies support this idea. Among others, Brotman (1987) reported that negotiations with private firms are a normal way to decide on industry regulation.

In our model a benevolent Congress (interested in the consumer surplus)

delegates to a regulatory agency[1] two activities: a *supervisory* job and a *bargaining* task.[2] Therefore, the regulator is *not* only a *mere conduit* of information about the firm's costs, but it carries out the *additional* task of negotiating a regulatory settlement with the firm. Congress delegates the full contracting authority to the regulator since it lacks financial resources, skills or expertise to run this task.[3] As usual in collusion models, the agency cannot be trusted to perfectly enforce Congress's intent because it may be *self-interested* and thus have an incentive to *collude* with the firm by manipulating its information to Congress in return of a side transfer from the firm.[4] However, differently from standard models, side contracting between the agency and the firm is considered as a bargaining process *parallel* to the negotiations over the regulatory mechanism. The two bargaining stages are modelled using the Nash solution concept (1950, 1953), which we argue is the most effective way to deal with our view.

Our analysis shows how standard results are altered by these two bargaining processes. This does not mean at all that the approach in this paper contradicts the classic one. Our setup turns out to be a generalization of the standard model, which represents the specific case where all the bargaining power is allocated to the agency.

In absence of collusion (Section 3), the regulatory mechanism agreed by the agency and the firm maximizes the total gains from trade, which are shared between players according to their bargaining power. However, the introduction of negotiation between the regulator and the monopoly induces a radical change in the collusion stage. While the inefficient firm as usual does not have any interest in cost manipulation, we find that the efficient firm has an incentive to collude only if it is sufficiently weak in the bargaining process. Interestingly, collusion pays off when the firm's revenue from a higher price more than compensates the lower subsidization. Since the latter reduces

[1] We take Tirole's (1986) assumption of *unique* regulator, which may be justified either by a cost of duplication of the regulatory function or by collusive behaviour between regulators.

[2] As in Laffont and Tirole (1990), we assume that regulatory institutions result from a constitution drafted by some *benevolent* "founding fathers" or "social planners", which may be identified with Congress. The latter delegates some activities to a public decision maker, which is represented by a regulatory agency.

[3] It seems natural to assume that a legislative assembly does not have the right skills to contract directly with the firm. Of course, this does not mean that full delegation is optimal. The characterization of the conditions under which this is the case is a very stimulating topic, but it is outside the scope of this paper. See on this issue the contribution of Faure-Grimaud *et al.* (2003).

[4] Tirole stresses the importance of reciprocity in the side contracting and states that ‹‹one-sided favors call for reciprocated ones›› (1986, p. 185).

with the agency's bargaining power, this can be the case only if the agency is strong enough. If the latter could make a standard take-it-or-leave-it offer, the total gains of collusion would be maximized. This implies that bargaining *mitigates* the incentive to collude.

In the second part of the paper (Section 4), we focus on the optimal organizational responses to the possibility of collusion. The well-known Tirole's (1986) *equivalence principle* predicts that, under some conditions, deterring collusion through appropriate incentives is always optimal in equilibrium. In our setting, incompleteness of contracts arising from institutional constraints prevents Congress from devising a mechanism which perfectly discriminates between the agency's types, and thus the equivalence principle does not apply.[5] We assume that Congress can use one of the following three instruments: an incentive reward to the agency, the shutdown of the inefficient firm (of course both intended to deter collusion), or tolerating collusion *tout court*. As long as the probability of facing the efficient firm is low enough and thus the shutdown policy is not convenient, Congress finds it optimal to *tolerate* collusion in equilibrium if the cost of the incentive reward which induces the agency *not* to collude outweighs the expected consumer loss from collusion. In other terms, collusion is optimal when tolerating this possibility is *less* costly than deterring it. We explore this condition and show that the players' bargaining powers crucially drive the optimal response to collusion. Interestingly, we find that *preventing* collusion is optimal if the agency's bargaining power is below a certain threshold. A stronger agency improves Congress's incentives to tolerate collusion in equilibrium. The idea is that such an agency can exact a higher bribe from the firm and thus the incentive reward for not colluding is more expensive. In other terms, a *high* bargaining power of the agency in the negotiation process can make collusion too *costly* to fight.

On the other hand, when the probability of facing the efficient firm is sufficiently high, the *shutdown* policy may become a valuable option. In this case, Congress *never* finds it optimal to tolerate collusion and prefers to fight it either by giving the agency an incentive reward or by shutting down the inefficient firm. The latter policy outperforms the former when the agency is *strong* enough in the bargaining process. This occurs since the expected benefit of allowing the inefficient firm to produce is lower than the incentive reward for not colluding.

Clearly these results suggest that the players' bargaining powers in regulatory relationships should deserve careful consideration, since they crucially drive the potential for collusion. The arbitrary limitation to model with all

[5] See Tirole (1992), Kofman and Lawarrée (1996).

the bargaining power allocated to the regulatory agency may neglect interesting institutional regulatory mechanisms as endogenous best responses to the possibility of collusion.

The paper is organized as follows. In Section 2 we describe the basic structures of the model. Section 3 considers the case where collusion is freely possible: in Subsection 3.1 we derive the regulatory policy with a benevolent agency, while Subsection 3.2 analyses the case of a nonbenevolent agency. In Section 4 we characterize the optimal institutional responses to collusion. Finally, Section 5 is devoted to concluding remarks.

2. The model

2.1. The players

2.1.1. Congress

Congress is a benevolent principal concerned with consumer surplus only. It hires a regulator which supervises the firm's unknown marginal costs and bargains with the firm over the regulatory mechanism. Full delegation of contracting authority arises from Congress's lack of time, skills or resources to run this task. Congress's problem is to offer a delegation contract that considers both roles of the regulatory agency and provides the compensation $T^{CS} \geq 0$ for the supervision and the negotiation over a regulatory policy.

The consumers buy a quantity $q(p)$ for the good and pay a *two-part* tariff, characterized by a unit price p and a fixed amount S. Consumer surplus is equal to the benefit from the marketplace net of the aggregate fixed charges S[6] minus the transfer to the agency T^{CS}, collected through distortionary taxes which impose a shadow cost $\lambda \geq 0$,[7] i.e.

$$CS\left(p, S; T^{CS}\right) = \int_{p}^{+\infty} q\left(p^{o}\right) dp^{o} - S - (1+\lambda) T^{CS}.$$

For the sake of convenience, consumer demand is supposed to depend linearly on price. Thus, without loss of generality we consider the following simple expression

$$q(p) = 1 - p$$

[6] The fixed payment S may be thought of as apportioned among consumers in such a manner that no consumer is excluded from purchasing the good.

[7] Our results do not crucially depend on the presence of a (strictly) positive shadow cost of public funds, which is considered only for the sake of completeness. This implies that the assumption of non-distortionary fixed charges is (qualitatively) inconsequential.

and consumer surplus reduces to

$$CS\left(p,S;T^{CS}\right)=\frac{(1-p)^2}{2}-S-(1+\lambda)\,T^{CS}. \tag{1}$$

2.1.2. The firm

The firm's cost function $C(.)$ is affine:

$$C(q;c_i)=c_iq+K,$$

where K denotes the fixed costs which are assumed to be common knowledge, while the marginal cost c_i, with $i\in\{L,H\}$, is private information of the firm. The two cost parameters c_L and c_H, with $\Delta c\equiv c_H-c_L>0$, are drawn with (common knowledge) probabilities ν and $(1-\nu)\in(0,1)$, respectively. Moreover, we assume that $c_H<1$ to ensure that production is always first-best efficient.

Therefore the c_i-type firm's profit function is

$$\pi(p,S;c_i)=pq(p)+S-c_iq(p)-K. \tag{2}$$

2.1.3. The regulatory agency

The regulator has a *twofold* role: supervising the firm's unknown marginal costs *and* bargaining with the firm over the regulatory mechanism.

There are two types of agency: benevolent and self-interested. The *benevolent* regulator, which is drawn with (common knowledge) probability $\gamma\in(0,1)$, always reports truthfully to Congress the signal received from the surpervisory technology (see below). Moreover, it *settles* for a transfer T, needed to finance its activity, equal to its reservation value $\widetilde{T}$ (normalized to zero) and *perfectly* internalizes Congress's interests during the bargaining process with the firm. Therefore, the utility function of a *benevolent* agency is

$$V_B=CS. \tag{3}$$

A *self-interested* regulator, which occurs with complementary probability $(1-\gamma)$, has an incentive to forge the informative signal and collude with the firm (see below). Moreover, it internalizes only *partly* Congress's interests and aims to receive a transfer $T\geq\widetilde{T}$. The utility function of a *nonbenevolent* agency is given by

$$V_{NB}=T+\beta CS, \tag{4}$$

where $\beta \in \left[0, \overline{\beta}\right]$, with $\overline{\beta} < 1$, is a parameter that captures the regulator's *degree of internalization* of Congress's objectives. If $\beta = 0$, the agency is only interested in its private transfer.[8] A higher β implies that it gives more weight to Congress's aim.

The supervisory technology is characterized by *perfect* monitoring, so that the signal the agency receives is always informative about the firm's marginal costs. However, the signal is supposed to be *soft* information, and thus it can be manipulated.[9] This means that the regulator may lie and convey a report $r \in \{c_L, c_H\}$ different from the actual c_i by altering the result of its audit activity. Manipulating information is the agency's degree of discretion: it can announce a wrong cost parameter since this report is never verifiable.

A benevolent agency always reports $r = c_i$ to Congress, while a self-interested agency has an incentive to declare $r \neq c_i$ colluding with the firm.[10]

2.2. Timing

The timing of the regulatory game is as follows.

1. Nature draws a type - benevolent or nonbenevolent - for the agency with probability γ and $(1-\gamma)$ respectively, and privately informs the agency. Nature also draws a type for the firm $c_i \in \{c_L, c_H\}$, with respective probabilities ν and $(1-\nu)$, and privately informs the firm.

2. Congress offers to the agency a contract which determines a transfer $T^{CS}(r) \geq 0$ conditional on the report r and delegates the negotiations with the firm about a regulatory mechanism.

3. The contract is signed or rejected by the agency.

[8] This is the classic case of perfectly nonbenevolent agency, see Laffont and Tirole (1991).

[9] See Laffont and Rochet (1997) for an analysis of the difference between *hard* information and *soft* information models.

[10] It is usually assumed in the literature that the firm observes the agency's signal. This can be the case if before signing the collusive agreement the agency must disclose to the firm the signal it has received. We do not need such an assumption because the signal is always informative and this is common knowledge, hence the firm knows the agency's signal. However, in line with the literature we need to assume that the agency cannot forge the signal against the firm's will. In other terms, we require that cost manipulation occur when it is profitable for both partners. We can imagine that the firm is able to prove before Congress its actual costs. This assumption rules out the possibility of blackmail by the agency in our setting. Khalil and Lawarrée (1995) underline the importance for future research of studying this phenomenon.

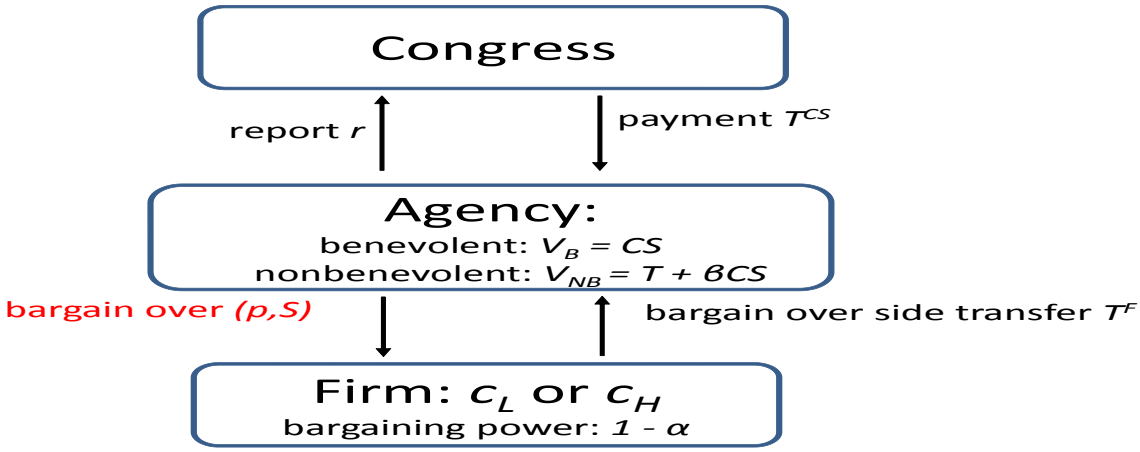

Figure 1: Figure 1. The basic structures of the model

4. If the contract is rejected, the game ends. In case of acceptance, the agency performs its audit activity and receives the informative signal. The firm learns the agency's type.[11]

5. Negotiations between the agency and the firm take place on a regulatory mechanism $\{p, S\}$.

   - If it is benevolent, the agency reports $r = c_i$ to Congress.
   - If it is dishonest, the agency has an incentive to collude with the firm and manipulate its information, i.e. $r \in \{c_L, c_H\} \neq c_i$. In this case, they bargain over a side transfer $T^F(r)$ as a reward for the agency's report.

6. Contracts are executed and the regulatory policy is implemented.

Figure 1 summarizes the basic structures of the model.

2.3. Use of the Nash bargaining solution

The novelty of this paper is that the agency negotiates with the firm both on a regulatory mechanism $\{p, S\}$ and on the split in collusion gains when the

[11] This assumption is made, among others, by Kofman and Lawarrée (1996). The firm can discover the agency's type when it proposes side contracting. A benevolent agency would not accept such a proposal, while a dishonest agency can be willing to collude. Attempted bribery is not punishable, since it is extremely difficult or costly to prove. Alternatively, the agency can show its type, since it is the party which takes the initiative to collude.

agency is dishonest. Therefore we need to consider a model for both these negotiation processes.

As well known, the outcome of a bargaining game is very sensitive to all the details of the negotiation process as well as to the delay costs of the two players, i.e. to all the bargaining protocols. For example, in the simple one-shot simultaneous offer protocol, any outcome is a possible equilibrium even using strong refinement concepts.[12] A crucial point in the specification of a bargaining game is whether the players are assumed to commit to their actions, thus providing a specific extensive form. Obviously, in many settings it is difficult to provide a reliable specification of all the possible moves, of their sequence and of the information available to the players during the play.

Therefore, instead of describing the specific bargaining procedure in full details, i.e. a specific and therefore arbitrary extensive form, we choose to characterize the outcome by a more general approach. The driving idea of this paper is to use the cooperative asymmetric Nash model (1950, 1953). We believe there are at least five good reasons to make such a modelling choice.

1. Its generality allows to avoid the specification of a particular extensive form structure.

2. The Nash solution is efficient so that our results do not depend on the unexploited gains from trade in the specific bargaining procedures which can be considered. This means that our approach might underestimate the transaction costs between the colluding parties, but we capture this aspect with a shadow cost of side transfers (see Section 3).

3. The uniqueness of the Nash solution implies that the principal can anticipate the outcome of bargaining to determine its optimal reaction, which is crucial for this kind of collusion models.

4. As we will show, this solution leads to easy calculations but also to interesting and plausible results.

5. As Spulber (1989, ch. 2) emphasizes, a crucial feature of regulatory hearing processes is the direct interaction between players which may result in a consensus, so that the bargaining game can be modelled as a cooperative game.

[12] See Sàkovics (1993).

Even though there are alternative cooperative concepts such as the Kalai-Smorodinsky solution, for our purposes the asymmetric Nash bargaining solution is probably the most convincing and effective.[13]

3. Regulation when collusion is tolerated

3.1. The benevolent agency

With probability γ a benevolent agency is drawn, which completely internalizes Congress's interest in consumer surplus. Hence, Congress would offer a reward $T^{CS} = \widetilde{T} \equiv 0$ to the agency, independently of its report r. As long as the regulator is benevolent, it transmits its information truthfully and there is no threat of collusion.

The regulatory policy negotiated between a benevolent agency and a c_i-type firm solves

$$\max_{\{p(c_i),S(c_i)\}} \left[V_B(p\left(c_i\right), S\left(c_i\right))\right]^{\alpha} \times \left[\pi(p\left(c_i\right), S\left(c_i\right))\right]^{1-\alpha} \quad s.t. \tag{5}$$

$$V_B \geq 0 \tag{PC$_A$}$$

$$\pi \geq 0, \tag{PC$_F$}$$

where the parameters α and $(1-\alpha) \in (0,1)$ are respectively the agency's and the firm's bargaining power. Notice that this is independent of the benevolence of the agency. A low α does not mean regulatory capture arising from collusion, but it denotes the agency's weakness in the bargaining process, which may stem from limited resources in terms of skills and expertise to assert its own interests and find the best compromise with the firm.

The nonnegativity constraints (PC$_A$) and (PC$_F$) represent the agency's and firm's participation constraints. A benevolent agency is interested in consumer surplus, which must be nonnegative in order to induce the purchase of the good. Similarly, the firm cannot accept to produce by making losses. Hence, also the disagreement payoffs are zero for both bargaining parties.

Substituting (2) and (3), as defined by (1), into (5) yields

$$\max_{\{p(c_i),S(c_i)\}} \left[\frac{\left(1-p\left(c_i\right)\right)^2}{2} - S\left(c_i\right)\right]^{\alpha} \times \left[\left(p\left(c_i\right)-c_i\right)\left(1-p\left(c_i\right)\right) + S\left(c_i\right) - K\right]^{1-\alpha}$$

[13] The Nash solution can be justified using different extensive form structures. See among others Binmore and Dasgupta (1987), Osborne and Rubinstein (1990), Rubinstein (1982).

$$(6)$$

$$s.t. \quad (PC_A),\ (PC_F).$$

After replacing the choice variable S with π from (2) into (6), the maximization problem may be rewritten as

$$\max_{\{p(c_i),\pi(c_i)\}} \left[\frac{(1-p(c_i))^2}{2} + (p(c_i)-c_i)(1-p(c_i)) - K - \pi(c_i) \right]^{\alpha} \times \pi^{1-\alpha}$$

$$s.t. \quad (PC_A),\ (PC_F).$$

Ignoring the constraints,[14] from the first-order condition for p it is immediate to find that the *price* agreed by the regulated firm and a benevolent agency is equal to

$$p(c_i) = c_i. \tag{7}$$

As the Nash bargaining process is efficient, the negotiated regulatory policy clearly implements the marginal cost pricing, *independently* of bargaining powers. The agency and the firm do *not* have any incentive to distort price from marginal cost, since both prefer to maximize the total gains from trade. Not surprisingly, we will see that the firm tries to extract these gains through the subsidy S.[15]

From the first-order condition for π we find

$$\pi(c_i) = (1-\alpha)\left[\frac{1}{2}(1-c_i)^2 - K\right] \equiv (1-\alpha)\,TGT(c_i), \tag{8}$$

i.e. the *profit* arising from negotiations is a share $(1-\alpha)$ of the total gains from trade $TGT(c_i)$ for marginal costs c_i.[16] Clearly, the stronger the agency, the smaller the profit that the firm can obtain from the regulatory arrangement. Note that, even though the agency is benevolent and does not collude, the firm gets a profit which is strictly greater than its reservation value, without any consequence on the allocative efficiency.

[14] It can be easily shown that they are satisfied in equilibrium.

[15] As well known, a monopolist that maximizes its profit subject to a nonnegative consumer surplus constraint sets a price equal to marginal cost and captures all the consumer gains through the subsidy.

[16] We assume that the fixed costs K are small enough so that total gains from trade are always positive.

Substituting (7) and (8) into (2) yields

$$S(c_i) = (1-\alpha)\left[\frac{1}{2}(1-c_i)^2 - K\right] + K = (1-\alpha)\,TGT(c_i) + K, \qquad (9)$$

i.e. the *subsidy* covers the fixed costs K and assigns to the firm a share $(1-\alpha)$ of the total gains from trade $TGT(c_i)$. Obviously, an increase in the agency's bargaining power reduces the firm's subsidy: very weak agency $(\alpha \to 0)$ allows the firm to get a high subsidy, while if all the bargaining power is allocated to the agency $(\alpha \to 1)$ as in standard principal-agent models, the firm is hardly able to cover its fixed costs through subsidy $(S(c_i) \to K)$ and receives no profit.

The *consumer surplus* is given by

$$CS(c_i) = \alpha\left[\frac{1}{2}(1-c_i)^2 - K\right] = \alpha TGT(c_i), \qquad (10)$$

i.e. it is a share α of the total gains from trade. The positive relation between α and $CS(c_i)$ shows that clearly consumers *benefit* from a strong benevolent regulator.

We summarize the main results in the following Lemma.

Lemma 1 *If the agency is benevolent, then the negotiated regulatory mechanism maximizes total gains from trade, and in particular*

- *applies marginal cost pricing, i.e.* $p(c_i) = c_i$
- *gives the firm a subsidy* $S(c_i) = (1-\alpha)\,TGT(c_i) + K$*, which is decreasing in the agency's bargaining power* α*.*

3.2. The self-interested agency

A nonbenevolent agency, which is drawn with probability $(1-\gamma)$, is interested in consumer surplus and in the private transfer T. This income may come either from consumers, through the taxes they pay, or from the firm, which may give a bribe to the agency for the manipulation of the informative signal.

We assume that Congress tolerates the possibility of collusion. Hence, Congress continues to offer a constant reward $T^{CS} = \widetilde{T}$ to the agency, independently of its report r, so that a nonbenevolent regulator has an incentive to collude with the firm.

A self-interested agency *opens* the possibility of collusion, since the firm may have a stake in the agency's report.

Proposition 1 *Define* $\widetilde{\alpha} \equiv \frac{\Delta c}{2-c_H-c_L} \in (0,1)$. *Then, if* $\alpha \in (0, \widetilde{\alpha}]$ *collusion is not attractive for any type of firm. If* $\alpha \in (\widetilde{\alpha}, 1)$ *only the* c_L*-type firm has a stake in collusion* $\Delta\pi(c_H; c_L) \equiv \pi(c_H; c_L) - \pi(c_L)$ *from report manipulation which amounts to*

$$\Delta\pi(c_H; c_L) = \Delta c(1 - c_H) - (1 - \alpha)(TGT(c_L) - TGT(c_H)). \qquad (11)$$

Proof. Using (7), (8) and (9), a report $r = c_L$ while the firm's true cost is c_H yields an extra profit equal to

$$\pi(c_L; c_H) - \pi(c_H) = -\frac{\Delta c}{2}[\alpha(2 - c_H - c_L) + \Delta c] < 0.$$

The c_L-type firm's extra gain $\Delta\pi(c_H; c_L)$ from forging the agency's report can be written as

$$\Delta\pi(c_H; c_L) = \Delta c(1 - c_H) - (S(c_L) - S(c_H)) = \Delta c(1 - c_H)$$
$$-(1 - \alpha)(TGT(c_L) - TGT(c_H)) = \frac{\Delta c}{2}[\alpha(2 - c_H - c_L) - \Delta c],$$

which is positive if and only if $\alpha \in (\widetilde{\alpha}, 1)$, where $\widetilde{\alpha}$ is defined in Proposition 1. ■

While as usual the inefficient firm is never interested in cost manipulation, the efficient firm finds it profitable to collude only if it is sufficiently weak, i.e. $\alpha \in (\widetilde{\alpha}, 1)$. Note from (11) that collusion pays off only if the extra gain from a higher market price $\Delta c(1 - c_H)$ more than compensates the subsidy loss $(1 - \alpha)(TGT(c_L) - TGT(c_H))$. Interestingly, the *stronger* the agency in the bargaining process, the *higher* the firm's extra profit from pure informational advantage with respect to Congress. This occurs because the agency's bargaining power reduces the subsidy loss from cost manipulation. In fact, we know from (9) that a weaker firm can extract a lower subsidization. Since the extra gain from a higher market price is independent of the bargaining power, the stake in collusion increases with a stronger agency. If the latter could make a take-it-or-leave-it offer ($\alpha \to 1$) the total gains of collusion would be maximized. This means that the bargaining process *mitigates* the firm's incentives to collude.

In line with the main literature, the side contract between the firm (with $\alpha \in (\widetilde{\alpha}, 1)$) and the self-interested regulator is supposed to be enforceable, even though it is illegal.[17] According to Stigler's (1971), collusion is driven by

[17] This assumption is clearly a shortcut since it simply presumes that any gain from trade between parties is realized. The enforcement of side contracts may actually be assumed to rely on non-judicial mechanisms, like reputation in long-term relationships or the "word of honor" in one-shot relationships. Among others, see Laffont and Tirole (1993, ch. 11) for a discussion on this issue.

two crucial factors: the *stake in collusion* and the *organization costs*. In our setting, the stake in collusion is given by the extra profit $\Delta\pi\left(c_H; c_L\right)$ in (11) that the c_L-type firm can obtain if its private information is altered before Congress. As Tirole (1992) emphasizes, collusion is likely to be a serious issue only if information can be manipulated.

The firm's costs of organization are represented by transfer costs,[18] which are related to the deadweight loss associated with the side transfer of income from the firm to the regulator.[19] Following Laffont and Tirole (1991), we capture this inefficiency by introducing an exogenous shadow cost of side transfers $\mu \geq 0$. The idea is that a monetary equivalent of one dollar received by the agency costs $(1+\mu)$ dollars to the firm. This parameter determines the transaction technology between the firm and the agency. If $\mu \to +\infty$, the transaction technology is so inefficient that no coalition forms. Otherwise, the transaction technology makes collusion profitable. If $\mu = 0$ then there is no deadweight loss from side contracting.

The regulatory arrangement arising from collusive negotiations allows the c_L-type firm to keep its informational advantage over Congress ($r = c_H$) even though the agency is informed about the firm's costs. The side contract specifies a covert transfer $T^F(r) \geq 0$, which is paid by the firm to the agency only if $r = c_H$ and costs $(1+\mu)T^F(r)$ to the firm.

We assume that in case of *disagreement* about the side contract the agency and the firm continue to bargain and can reach the no-collusion outcome $\left(V_{NB}^D, \pi_{NB}^D\right)$.[20] Thus the solution to this bargaining problem arises from the maximization of the Nash product of the two parties' gains in utility over the no-side-contract outcome. Formally,

$$\max_{T^F \geq 0} \left[V_{NB}\left(T^F, .\right) - V_{NB}^D\right]^{\alpha} \times \left[\pi\left(T^F, .\right) - \pi_{NB}^D\right]^{1-\alpha} \quad s.t. \tag{12}$$

$$V_{NB} \geq V_{NB}^D \tag{PC$_A$}$$

$$\pi \geq \pi_{NB}^D \tag{PC$_F$}$$

[18] Furthermore, the firm incurs mobilization costs to collect information and intervene in specific regulatory issues. These costs are ignored in our setting.

[19] A monetary bribe exposes the parties to the possibility of legal sanctions. Alternatively, the agency's staff values nonmonetary side transfers (for entertainment, jobs after the tenure in the agency,...) *less* than the monetary expenses incurred by the firm.

[20] We follow Tirole's (1986) idea that each party can guarantee itself the no-side-contract outcome.

$$\pi = \pi(c_L) + \Delta\pi(c_H; c_L) - (1+\mu) T^F. \qquad (\mathrm{C}_\pi^C)$$

The last constraint (C_π^C) indicates the profit of the c_L-type firm under collusion. The rationale is the following. When the collusive agency lies and reports $r = c_H$, we know from (11) that the firm's profit from signal manipulation is the sum of the first two addends of (C_π^C). This represents the gross earning of the firm from collusion. The firm spends a part of this gain, equal to $(1+\mu) T^F$, to pay a side transfer T^F to the agency.

We have assumed that, in case of disagreement about the side contract, the agency and the firm continue to negotiate over the regulatory mechanism. In this case, we would be in the same setting as in Subsection 3.1 except for the parameter β. The agency would not receive any bribe ($T^F = 0$) and would reveal the truth to Congress ($r = c_L$), which could save the extraprofit to the firm ($\Delta\pi = 0$). Hence, the agency's no-collusion utility is equal to the consumer surplus $CS(c_L)$ weighted by β (i.e. $V_{NB}^D = \alpha\beta TGT(c_L)$ from (10)). The firm's no-collusion profit is given by $\pi(c_L)$ (i.e. $\pi_{NB}^D = (1-\alpha) TGT(c_L)$ from (8)). As from (10) $r = c_H$ implies that Congress expects $CS(c_H)$, we replace (2) and (4), as defined by (1), into the maximization problem in (12), which becomes

$$\max_{T^F \geq 0} \left[T^F - \alpha\beta\left(TGT(c_L) - TGT(c_H)\right)\right]^\alpha \times \left[\pi - (1-\alpha) TGT(c_L)\right]^{1-\alpha} \quad s.t. \qquad (13)$$

$$(PC_A),\ (PC_F),\ (C_\pi^C).$$

Substituting (C_π^C) into (13) and ignoring for the moment the other constraints yields after some manipulations

$$\max_{T^F \geq 0} \left[T^F - \frac{\Delta c}{2}\alpha\beta(2 - c_H - c_L)\right]^\alpha$$

$$\times \left[\frac{\Delta c}{2}\left(\alpha(2 - c_H - c_L) - \Delta c\right) - (1+\mu) T^F\right]^{1-\alpha}. \qquad (14)$$

Notice from (14) that the agency's gain ΔV_{NB}^C over the no-collusion outcome, represented by the first factor in the Nash product, is the side transfer

from the firm minus the consumer loss weighted by β. The firm's gain in collusion $\Delta\pi^C$, captured by the second factor of the Nash product, is the difference between the total stake in collusion $\Delta\pi$ and the expense $(1+\mu)\,T^F$ to bribe the agency.

After some manipulations the first-order condition for T^F can be written as

$$-(1+\mu)\,T^F+\frac{\Delta c}{2}\alpha\left[(2-c_H-c_L)\left(\alpha+\beta\,(1-\alpha)\,(1+\mu)\right)-\Delta c\right]=0. \quad (15)$$

From (15) in equilibrium the *side transfer* is given by

$$T^F=\alpha\frac{(2-c_H-c_L)\left(\alpha+\beta\,(1-\alpha)\,(1+\mu)\right)-\Delta c}{2\,(1+\mu)}\Delta c$$

$$=\alpha\frac{\Delta\pi}{1+\mu}+\frac{\Delta c}{2}\alpha\beta\,(1-\alpha)\,(2-c_H-c_L)\,. \quad (16)$$

We emphasize now a result of some relevance.

Proposition 2 *Define* $\widehat{\alpha}\equiv\frac{\Delta c}{(2-c_H-c_L)[1-\beta(1+\mu)]}$, *with* $1-\beta\,(1+\mu)\in(0,1]$. *Then, collusion occurs in equilibrium if and only if* $\alpha\in(\widehat{\alpha},1)$ *when Congress tolerates this threat.*

Proof. Using (16) the two bracketed expressions in (14) are positive if and only if $\alpha\in(\widehat{\alpha},1)$, where $\widehat{\alpha}$ is defined in Proposition 2. This implies that (PC_A) and (PC_F) in (12) are satisfied. ■

We find that $\widehat{\alpha}\geq\widetilde{\alpha}$ (defined in Proposition 1) since the nonbenevolent agency's degree β of consumer surplus internalization reduces its willingness to collude. Only if the agency is completely dishonest ($\beta=0$) the incentives to collude of both players perfectly align, i.e. $\widehat{\alpha}=\widetilde{\alpha}$. Notice that $\widehat{\alpha}<1$ as long as $\beta<\frac{2(1-c_H)}{(1+\mu)(2-c_H-c_L)}$, i.e. for β low enough. Otherwise, a dishonest agency will not collude since no bribe can compensate its disutility from lying, and then there is no difference between the two types of agency. Since we are interested in the possibility of collusion, we focus hereafter our attention on the case $\overline{\beta}<\frac{2(1-c_H)}{(1+\mu)(2-c_H-c_L)}$.

A straightforward consequence of our discussion is that the side transfer T^F in (16) increases in β. The greater the weight the nonbenevolent agency attaches to consumer surplus, the higher the amount of side transfer that it requires to manipulate its information. Hence, β can be thought of as the inverse of the level of *corruptibility* of the regulator. An increase in β implies

more disutility from lying (in terms of consumer surplus loss) and makes the agency more costly to bribe.

The bribe that the agency can extort from the firm is increasing in its bargaining power. If $\alpha \to 0$, the regulator does not collect anything ($T^F \to 0$) since it is too weak. If $\alpha \to 1$, all the bargaining power is allocated to the agency and the side transfer tends to

$$\lim_{\alpha \to 1} T^F = \frac{\Delta\pi}{1+\mu} = \frac{\Delta c\,(1-c_H)}{1+\mu}, \tag{18}$$

which is just the maximum extra profit that the firm can obtain from the manipulation of evidence discounted by the shadow cost of side transfers. Note that the side transfer in (18) approximates the take-it-or-leave-it call for a bribe taken by the agency which is commonly assumed in collusion models.[21]

Not surprisingly, the side transfer to the regulator is decreasing in the transaction costs of collusion. If $\mu = 0$, the side contracting is fully efficient and the firm can afford to pay a high bribe. If $\mu \to +\infty$, transaction technology is so inefficient that collusion is infeasible ($T^F \to 0$).

Using (16), we derive after some computations the extra gains from collusion of the agency and the firm. They are given by

$$\begin{aligned}\Delta V_{NB}^C &= \frac{\Delta c}{2}\frac{\alpha}{1+\mu}\left[\alpha\,(2-c_H-c_L)\,(1-\beta\,(1+\mu)) - \Delta c\right] \\ &= \frac{\alpha}{1+\mu}\left[\Delta\pi - \frac{\Delta c}{2}\alpha\beta\,(1+\mu)\,(2-c_H-c_L)\right] \end{aligned} \tag{19}$$

and

$$\begin{aligned}\Delta\pi^C &= \frac{\Delta c}{2}\,(1-\alpha)\left[\alpha\,(2-c_H-c_L)\,(1-\beta\,(1+\mu)) - \Delta c\right] \\ &= (1-\alpha)\left[\Delta\pi - \frac{\Delta c}{2}\alpha\beta\,(1+\mu)\,(2-c_H-c_L)\right].\end{aligned}$$

Figure 2 illustrates the patterns of ΔV_{NB}^C (thick solid line) and $\Delta\pi^C$ (thin solid line) as functions of α. The difference between the total stake in collusion $\Delta\pi$ (dashed thin line) and the total stake discounted by the shadow cost of side transfers $\frac{\Delta\pi}{1+\mu}$ (dashed thick line) captures the deadweight loss from side contracting.[22]

[21] See, among others, Laffont (2000, ch. 2).

[22] The functions depicted in Figure 1 are derived by assuming $c_L = 0.2$, $c_H = 0.5$, $\mu = 0.5$ and $\beta = 0.3$.

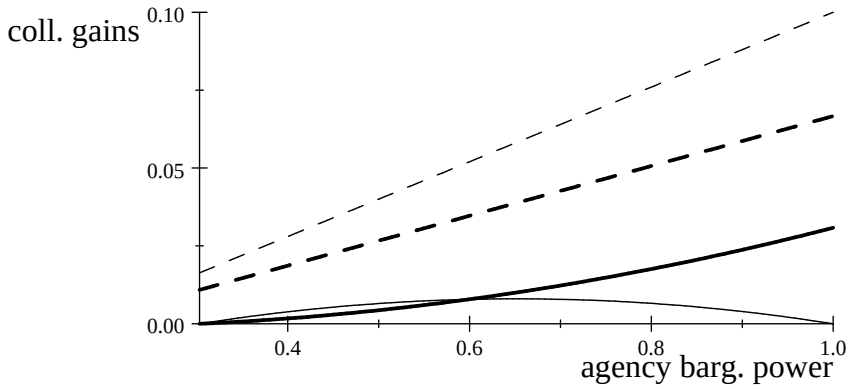

Figure 2. Gains from side contracting

Notice that the parameter β introduces a second source of inefficiency in the collusion process. In fact, a part of the net collusion gains $\frac{\Delta\pi}{1+\mu}$ directly finances the share β of the consumer loss internalized by the agency and constitutes a mere waste of resources in the bribing game. An increase in the agency's bargaining power reduces the fraction of the total pie appropriated by the firm, since the agency requires a greater side transfer. Nevertheless, the firm gets an increasing extra rent from collusion over some range. Hence, the benefit for the firm from an increase in the total stake in collusion induced by α outweighs the cost of a reduced bargaining power. When the agency's bargaining power is sufficiently high, the trade-off becomes detrimental to the firm, whose gain from collusion decreases.

4. The institutional responses to collusion

So far we have supposed that Congress tolerates *tout court* the possibility of collusion. In this section we characterize the institutional responses that Congress should devise to give consumers the highest (expected) surplus. We consider three alternative options:

1. Congress, acting as a Stackelberg leader, deters collusion through an incentive payment to the agency at least equal to the extra gain which is anticipated to arise from side contracting,[23]

2. the inefficient firm is shut down,

3. collusion is tolerated *tout court*.

[23]Following Laffont (2000, ch. 2), we assume that limited liability constraints prevent Congress from designing a system of punishments and fines against the agency.

Note that when choosing option *1* Congress is supposed to design an incentive scheme which applies to *both* types of the regulator. This assumption is quite common in literature and can be justified by institutional settings that allow compensations contingent to agency's report only. As Tirole (1992) suggests, the impossibility of discriminating between the agency's types may be thought of as Congress's uncertainty about a binary transaction technology of collusion. Indeed, as shown in Section 4 if $\mu \to +\infty$ the side contracting is so inefficient to make collusion infeasible, i.e. we obtain the same outcome as with a benevolent agency. For lower values of μ, collusion becomes profitable, i.e. we find the same outcome as with a nonbenevolent agency.

Baiman *et al.* (1991) rule out the screening assumption by modelling the option to collude as a random event which is not an inherent characteristic of a subject but it is associated with the environment. In Kofman and Lawarrée's (1996) model, the principal is not able to discriminate between the different types of auditors because the latter have the same utility function but different strategy spaces.[24] Following Laffont (2000, ch. 2), we suppose that incompleteness of contracts arising from institutional constraints prevents Congress from devising an incentive compatible mechanism which induces the self-selection of regulators according to their type. In other words, Congress cannot distinguish between the regulator's types because legal arrangements prohibit from making the reward of the agency's staff contingent on some variables that reveal the regulator's type.[25] Collusion literature has shown that removing the screening condition implies that Tirole's equivalence principle does not apply. Starting from this observation, we first derive the conditions which drive the institutional responses to collusion. Then, we show how the players' bargaining powers crucially affect these conditions.

If Congress decides to prevent collusion through an *incentive* reward to the agency (option *1*), the expected consumer surplus is equal to

$$E\left[CS^{I}\right] = \nu CS\left(c_{L}\right) + \left(1-\nu\right) CS\left(c_{H}\right) - \nu\left(1+\lambda\right)\Delta V_{NB}^{C}. \tag{20}$$

In order to get the no-collusion outcome and the associated expected consumer surplus, Congress has to design a *bunching* mechanism. This scheme

[24] In Kofman and Lawarrée's words, ‹‹the auditors have no feature that enables the principal to discriminate between them by means of providing different incentives. If the principal were simply to ask for type reports, promising a high reward for dishonest auditors, every auditor would claim to be dishonest; if he were to threaten punishment for the dishonest auditors, every auditor would claim to be honest›› (1996, p. 386).

[25] For instance, it may be common knowledge that the regulatory staff coming from a certain region is more likely to collude, but rewards to commissioners cannot be differentiated on the basis of their origins.

gives any type of agency the minimum reward to deter collusion $T^{CS} = \Delta V_{NB}^{C}$ in (19). The reward is weighted by the probability ν that the firm is efficient, since only in this case collusion may emerge (see Proposition 1), and it is paid by consumers through possibly distortionary taxes which involve a social cost λ.

If Congress wants to fight collusion through the *shutdown* of the inefficient firm (option *2*), the expected consumer surplus is given by

$$E\left[CS^{S}\right] = \nu CS\left(c_{L}\right). \tag{21}$$

This policy rules out the threat of collusion, as the c_L-type firm's interest in cost manipulation vanishes. However, this occurs at the cost of forgoing production when the firm is inefficient.

If Congress tolerates *collusion* (option *3*), the expected consumer surplus amounts to

$$E\left[CS^{C}\right] = \gamma\left[\nu CS\left(c_{L}\right) + (1-\nu) CS\left(c_{H}\right)\right] + (1-\gamma) CS\left(c_{H}\right)$$

$$= CS\left(c_{H}\right) + \nu\gamma\left(CS\left(c_{L}\right) - CS\left(c_{H}\right)\right). \tag{22}$$

Congress expects to receive the consumer surplus $CS\left(c_{H}\right)$ arising with an inefficient firm plus the extra gain in consumer surplus if the agency is benevolent and the firm is efficient, which occurs with probability $\nu\gamma$.

When designing the optimal response to collusion, Congress compares costs and benefits of any option. We start by comparing the strategy of deterring the collusion through an incentive reward (option *1*) with that of tolerating it *cout court* (option *3*). Clearly, the latter outperforms the former if and only if the cost incurred to induce the agency not to collude outweighs the expected benefit of deterring collusion. This condition is then formally expounded in the following Lemma.

Lemma 2 *Congress prefers to tolerate collusion rather than deter it through an incentive payment if and only if the cost of rewarding the agency for not colluding exceeds the consumer loss from collusion. That is,* $E\left[CS^{C}\right] \geq E\left[CS^{I}\right]$ *if and only if*

$$(1+\lambda)\,\Delta V_{NB}^{C} \geq (1-\gamma)\,\Delta CS^{C}, \tag{23}$$

where $\Delta CS^{C} \equiv CS\left(c_{L}\right) - CS\left(c_{H}\right)$.

Proof. Compare (20) and (22). ■

As stressed before, the incentive reward ΔV_{NB}^{C} on the left-hand side of (23) costs $(1+\lambda)\,\Delta V_{NB}^{C}$ to consumers, since taxes entail a deadweight loss. The expected consumer loss from collusion ΔCS^{C} on the right-hand side of (23), which represents the benefit of preventing collusion, is weighted by $(1-\gamma)$, because only the self-interested agency has an incentive to collude.

More importantly, from (10) and (11) the difference between ΔCS^{C} and $\Delta\pi$ is after some manipulations

$$\Delta CS^{C} - \Delta\pi = \Delta c\,(1-c_H) - \frac{1}{2}\left[(1-c_L)^2 - (1-c_H)^2\right] = \frac{(\Delta c)^2}{2} > 0. \quad (24)$$

Expression (24) shows that the consumer loss from collusion offsets the total stake in collusion. While the impact of side contracting on firm's subsidization constitutes a mere transfer of resources between consumers and firm, the extra gain the firm gets from a higher price is lower than the corresponding consumer loss. In fact, the result in (24) stems from the allocative inefficiency due to the price distortion above marginal costs. This implies that collusion does *not* reduce to a zero-sum game in which the amount of resources extorted from consumers just forms the total pie which can be shared between collusive partners, but it shrinks the total gains from trade and then creates a further distortion in the efficient allocation of resources.

Let us consider now the impact of γ on condition (23). As γ increases, the righ-hand side decreases. Hence, a raise in the probability of drawing a benevolent agency relaxes condition (23) and then allowing collusion is more attractive. The rationale for this result is obvious. Collusion literature has emphasized that if the probability of an honest regulator is sufficiently high, costly measures to eliminate collusion may become unnecessary and the optimal contract may allow collusion in equilibrium.

In this framework, we examine the impact of the agency's bargaining power α on condition (23). Notice that ΔV_{NB}^{C} and ΔCS^{C} are *both* increasing in α. A *trade-off* emerges between deterring and allowing collusion. On one hand, a stronger agency (α goes up) can extort a higher bribe from the firm. Tolerating collusion becomes more attractive since this allows to save the incentive payment to the agency. On the other hand, the agency's bargaining power increases the consumer loss from collusion and then it makes deterring this threat more desirable. From this trade-off we get the following Corollary of Lemma 2.

Corollary 1 *Define* $\alpha^* \equiv \widehat{\alpha} + \frac{(1+\mu)(1-\gamma)}{(1+\lambda)[1-\beta(1+\mu)]}$, *where* $\widehat{\alpha}$ *is defined in Proposition 2. Then, if* $\alpha \in (\widehat{\alpha}, \alpha^*)$ *Congress prefers to deter collusion through an*

incentive reward rather than tolerate it. If $\alpha \in [\alpha^*, 1)$ allowing collusion is more desirable.

Proof. Substitute (10) and (19) into (23). ■

Allowing collusion can be preferred if the interval $[\alpha^*, 1)$ is nonempty, which occurs if and only

$$1 - \gamma < \frac{1+\lambda}{1+\mu}\left[\frac{2(1-c_H)}{2-c_H-c_L} - \beta(1+\mu)\right],$$

where the bracketed expression is positive. This is clearly the case when the probability of drawing a nonbenevolent agency is low enough. Of course, collusion not is desirable *per se*, since consumers would be better off if side transfers were infeasible, but it can be allowed when it is too *costly* to fight. Notice that the parameter β crucially affects the width of the interval $(\widehat{\alpha}, \alpha^*)$ where preventing collusion is preferable. A higher β makes this option more attractive. A lower level of corruptibility of the agency (β goes up) increases the desirability of deterring collusion, because the agency internalizes more the surplus loss incurred by consumers and asks for a lower incentive reward (ΔV_{NB}^C in (19) decreases). Hence, the agency's interests align with those of Congress, by making collusion less expensive to fight. The same effect emerges when the shadow cost μ increases as side contracting is more inefficient and then easier to prevent.

We have so far neglected the possibility of shutdown. It is well known in the literature that Congress may find it optimal to close up production when facing an inefficient firm.[26] Comparing the strategy of incentivizing the agency not to collude (option *1*) with the shutdown policy (option *2*) yields the following result.

Lemma 3 *Congress prefers to fight collusion through the shutdown of the inefficient firm rather than through an incentive payment if and only if the cost of rewarding the agency for not colluding outweighs the loss in consumer surplus from shutdown. That is, $E\left[CS^S\right] \geq E\left[CS^I\right]$ if and only if*

$$\nu(1+\lambda)\Delta V_{NB}^C \geq (1-\nu)CS(c_H). \tag{25}$$

Proof. Compare (20) and (21). ■

The shutdown policy has the benefical effect of saving the incentive reward to the agency but imposes the cost of closing up the production of the inefficient firm.

We immediately obtain the following result, which represents a Corollary of Lemma 3.

[26] See, among others, Laffont and Martimort (2002).

Corollary 2 *Define* $\alpha^{**} \equiv \widehat{\alpha} + \frac{(1-\nu)(1+\mu)\left[(1-c_H)^2-2K\right]}{\nu(1+\lambda)(2-c_H-c_L)[1-\beta(1+\mu)]\Delta c}$. *Then, if* $\alpha \in (\widehat{\alpha}, \alpha^{**})$ *Congress prefers to deter collusion through an incentive reward rather than shut down the inefficient firm. If* $\alpha \in [\alpha^{**}, 1)$ *shutdown is more desirable.*

Proof. Substitute (10) and (19) into (25). ■

We know from (10) and (19) that both $CS(c_H)$ and ΔV_{NB}^C are increasing in α. Corollary 2 reveals which effect prevails in equilibrium. With a strong agency, i.e. $\alpha \in [\alpha^{**}, 1)$, the expected benefit of allowing the inefficient firm to produce is lower than the incentive reward for not colluding, and then the shutdown is preferable. Notice that the interval $[\alpha^{**}, 1)$ is increasing in ν. A high probability of facing the efficient firm raises the scope for closing the inefficient firm's production, which creates a low consumer surplus in expected terms. If $\nu \to 1$ the shutdown policy is clearly always preferable to paying an incentive reward to the agency ($\widehat{\alpha} \to \alpha^{**}$), since Congress incurs no expected costs by excluding the inefficient firm.

Comparing the shutdown policy (option *2*) with the strategy of allowing collusion (option *3*) yields the following result.

Lemma 4 *Congress prefers to shut down the inefficient firm rather than tolerate collusion if the probability of facing the efficient firm is sufficiently high. That is,* $E\left[CS^S\right] \geq E\left[CS^C\right]$ *if and only if* $\nu \in [\widetilde{\nu}, 1)$, *where*

$$\widetilde{\nu} \equiv \frac{(1-c_H)^2 - 2K}{(1-\gamma)(1-c_L)^2 + \gamma(1-c_H)^2 - 2K} \in (0,1).$$

Proof. Compare (21) and (22) using (10). ■

The shutdown policy is obviously a valuable option only if the firm is sufficiently likely to be efficient.

We are now in a position to summarize our main results.

Proposition 3 *With* $\nu \in (0, \widetilde{\nu})$ *the optimal response to collusion exhibits the following features*

- *if* $\alpha \in (\widehat{\alpha}, \alpha^*)$ *collusion is deterred through an incentive payment to the agency*
- *if* $\alpha \in [\alpha^*, 1)$ *collusion is tolerated tout court,*

and Congress never chooses to close up production of the inefficient firm.

With $\nu \in [\widetilde{\nu}, 1)$ *collusion is deterred*

- *if* $\alpha \in (\widehat{\alpha}, \alpha^{**})$ *through an incentive payment to the agency*
- *if* $\alpha \in [\alpha^{**}, 1)$ *through the shutdown of the inefficient firm,*

and tolerating collusion is never optimal.

When $\alpha \in (0, \widehat{\alpha}]$ *collusion is never attractive.*

Proposition 3 implies that preventing collusion with an incentive scheme is a desirable strategy independently of the *ex ante* distribution of firm's types, as long as the agency is sufficiently weak. On the other hand, Congress views the shutdown policy and the tolerance of collusion as mutually exclusive alternatives. The latter is a valuable option only if the high probability of having an inefficient firm, i.e. $\nu \in (0, \widetilde{\nu})$, makes the former too costly.

The result in Proposition 3 suggests that policy makers should seriously care about some important elements of regulatory relationships like players' bargaining powers in order to evaluate the potential for collusion and the optimal responses to this threat.

6. Concluding remarks

In this paper we have examined a monopolistic market, where the regulatory mechanism is not a take-or-leave-it offer but the outcome of a bargaining process between the regulatory agency and the regulated firm. A benevolent Congress delegates to an agency, which may be either honest or dishonest, the audit of the firm's unknown marginal costs. To this end, the agency adopts a supervision technology. Furthermore, it carries out the additional task of negotiating with the firm a regulatory mechanism.

Even though it has been developed in a quite simple model, our analysis has shown how the bargaining process affects the standard results, which turn out to be a specific case of our more general approach. In particular we have focused on the effects of players' bargaining power on equilibrium values. The regulatory mechanism agreed by the benevolent agency and the firm maximizes the total gains from trade which are shared between the two players. The introduction of a negotiation between the regulator and the monopoly induces a radical change in the collusion stage when the agency is dishonest. We have showed that the efficient firm finds it profitable to collude only if the agency's bargaining power is high enough. Moreover, the total gains of collusion are now lower than those the two partners would appropriate if the agency could make a take-it-or-leave-it offer.

In the second part of the paper, we have investigated the optimal organizational responses to the possibility of collusion, in absence of discrimination between agency's types. We have showed that the players' bargaining powers crucially affect the optimal response to collusion. In particular, we have found that preventing collusion through an incentive reward to the agency is optimal if the agency's bargaining power is low enough, independently of the *ex ante* distribution of firm's types. With a low probability of the efficient firm, a stronger agency improves Congress's incentives to tolerate collusion

in equilibrium as this can be too costly to fight. Otherwise, the shutdown of the inefficient firm is the best option. This result has implications of some relevance for the optimal design of regulatory agencies.

We believe that our simple generalization provides useful insights on the role of the bargaining power in institutions or in organizations. Of course, this is just a simple step towards more realistic and complex analysis of the negotiation processes within a hierarchy structure.

Our model may be extended in a variety of directions. The supervisory technology may be modified in order to consider the possibility of imperfect monitoring, which implies that the signal received by the agency may be wrong or uninformative. This would allow to study the bargaining process between the agency and the firm under asymmetric information. Another possibility is to extend the model by introducing the agency's effort to audit, since in practice the regulator can affect the functioning of the supervisory technology and moral hazard turns out to be an important issue.

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