The Media as a Supervisor: The Constitutional Approach

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Abstract

In this work we extend Laffont [2000]'s constitutional optimal contract with supervision to the three-type case. This allows us to investigate the role of the Media in Political Economy issues. Citizens have to decide upon a matter that has consequences that are difficult to assess. Through a contract at the constitutional level they are able to ask advice from experts. However, experts differ in their ability to extract informative signals. At the same time, for a given ability, experts might have ideological concerns (which can take the form of manipulation or pressure from interest parties) that lower the experts' final virtual ability in reporting accurately. The Media can improve this accuracy by using a technology that is able, with some probability, to find out whether the expert is being influenced or not. We find that there is an important role for the Media as a supervisor, providing the conditions under which this holds true. Furthermore, we explore the interplay between parallel commercial activities that the Media may be allowed to carry out, and the optimal constitutional contract affecting information on the best decision to be made concerning the public affair.

1 Introduction

What would be the optimal contract between society and the Media industry when the former wants to be informed on what is the best decision to be made on matters that have consequences on the public's welfare, and the latter is able to supervise the accuracy of those who are called upon to give advise on the matter on which society has to decide upon (being these agents the *experts* that we refer to hereafter)? Is there a role for the Media as a supervisor?

In this paper we provide some insights to these questions, by assuming the simplest form of supervision. We follow therefore the Constitutional approach proposed by Laffont [2000, chapter 2]'s. While extremely theoretical, we wish to give a boundary on the optimal welfare society is able to achieve in this particular type of problem.

Our problem naturally calls for an extension of Laffont [2000] to the *more-than-two-types case* (the problem becomes meaningless otherwise). We do so by assuming the simple three-type case, following Laffont and Martimort [2002]. In this sense, this work is an extension to Laffont [2000]'s constitutional approach on politicians as supervisors.

The main contribution of this paper is the application of the contract design approach at the constitutional level to a problem that has not been studied along these lines so far. We find that there is indeed a role for the Media as a supervisor, and we provide the conditions under which this supervision is performed.

2 The Model

2.1 The Political Economy Problem

There's a choice to be made concerning a reform that has consequences on citizens' welfare[1]. These consequences[2] are difficult to assess. We assume that they are state-dependent. They are difficult to assess because citizens do not know the state when deciding upon the matter at stake. To be precise, there are two states, a and b. When a the reform works (citizens will perceive positive benefits from its implementation[3]); when b it does not work (citizens do not derive any positive benefit out of the reform)[4]. The state of nature, denoted by $\widetilde{n}$, has the following distribution:

$$\widetilde{n} = \begin{cases} a & \text{with probability} \quad \frac{1}{2} \\ b & \text{with probability} \quad \frac{1}{2} \end{cases}$$

These outcomes are observed only when the reform has been accomplished, at the end of the period. The decision to be made is whether the reform should be carried out or not. Importantly, we assume that the implementation of the reform is costless.

[1] A community must vote on a proposal to increase school funding, for instance.

[2] We use here Prat (2005)'s distinction between *consequences* and *actions*:

"...we distinguish between two types of information that the principal can have about his agent: information about the *consequences* of the agents' action and information directly about the *action*."

[3] Everyone would favour the proposal in state a if they knew the state.

[4] Note that this type of problem resembles that in Maskin and Tirole [2004].

2.2 Agents

2.2.1 Experts

There is one "expert" that privately *elicits* a signal $\widetilde{s}$ that is correlated with the state of nature with probability $p > \frac{1}{2}$[5]:

$$\Pr\left[\widetilde{n} = n | \widetilde{s} = n\right] = p > \frac{1}{2} \tag{1}$$

This is true for all n belonging to $\{a, b\}$. However, the expert can be of high or low predictability power. This is captured by the informational parameter p: the higher p the higher the expert's ability in eliciting signals that are highly correlated to the true state of nature. In addition, the expert can be influenced by interest parties whose payoffs are directly affected by the outcome of the decision to be made (negatively or positively; it does not matter here). This influence distorts the expert's predictability downwards.

To capture the basic interplay between *intrinsic predictability power* and the eventual external influence on the expert's final public report we assume a rather simplistic description of experts. There are three possible types captured by the informational parameter p: a highly accurate (efficient) type whose reports are not influenced at any rate, with $p = \underline{p}$; a highly efficient type that is influenced by interest parties in his reports, denoted by $p = \widehat{p}$; and a low type[6], denoted $p = \overline{p}$. Therefore, we have

$$\Pr\left[\widetilde{n} = n | \underline{s} = n\right] = \underline{p} > \frac{1}{2}$$

$$\Pr\left[\widetilde{n} = n | \widehat{s} = n\right] = \widehat{p} > \frac{1}{2}$$

$$\Pr\left[\widetilde{n} = n | \overline{s} = n\right] = \overline{p} > \frac{1}{2}$$

So experts can be of three types, $\left\{\underline{p}, \widehat{\underline{p}}, \overline{p}\right\}$ with respective probabilities $\underline{v}$, $\widehat{\underline{v}}$, and $\overline{v}$ ($\overline{v} = 1 - \widehat{\underline{v}} - \underline{v}$). However, only the expert knows the true value of p. Simplifying further a bit, let $\triangle p = \left(\underline{p} - \widehat{p}\right) = \left(\widehat{\underline{p}} - \overline{p}\right) > 0$.

[5]The introduction of this expert follows Bénabou and Laroque [1992].

[6]Note that by assuming the existence of only three types we have dismissed the possibility of an existing low type that is influenced by third parties. We assume that only highly efficient types, those who attract the attention of the public, are in the interest party's interest.

Modelling the game between the efficient expert and the interest party goes beyond the aim of this work. However, it is worth describing it at least superficially.

This game may take many forms. One possibility is that the existence of the interest party (always defined in relation to the policy under scrutiny) is a random event with probability π. If π is arbitrarily small, then we can interpret $\widehat{p}$ as the *ex-ante* computation of the expert's signal given that an interest party may be influencing his report. That is, $\widehat{p} = \pi(1 - \underline{p}) + (1 - \pi)\underline{p}$. Alternatively, one may think of π as the probability that the efficient expert is of a corruptible type (with probability $1 - \pi$ he is intrinsically honest), while assuming the existence of the interest party at all times. In any case, π would have to be small enough so as to make $\widehat{p} > \frac{1}{2}$ and $\widehat{p} > \overline{p}$ (in particular, $\pi < 1/2$), and in both cases we would have to model the offered bribe as well. The latter somewhat complicates the analysis, because then we would have to consider type-dependent participation constraints.

As we do not wish to describe the game between the expert and the interest party, nor allow for intrincated participation constraints, we follow an interpretative shortcut. We assume that $\underline{p}$ can be distorted downwards by ideological biases that are intrinsic to some highly accurate experts (i.e. they might have evidence supporting the reform, but they do not present this evidence in a transparent way because by doing so they perceive a private cost - in the form of pressure from their ideological *milieu*).

The expert is protected by limited liability. We assume a simple cost function form of eliciting the signal: $C(p) \equiv \alpha (1 - p)$, with $\alpha > 0$. We interpret this cost function as reflecting the loss in reputation that the expert faces everytime the signal proves to be wrong. The extent to which this loss in reputation is perceived and anticipated by the expert is captured by the parameter α.

2.2.2 The Supervisor

There is a monopoly (a newspaper or a broadcaster) owning a technology capable of finding out whether the expert has been influenced by a interest party in his report or not (or, in our interpretation, able to find out whether the expert's report is influenced or not by ideological concerns that are verifiable). Thus, this newspaper only provides information on capture or influence (which we regard here as actions as opposed to consequences), and does not learn nothing on the state of nature[7] apart from what she learns from the expert's report.

The technology is capable of extracting a signal that is informative

[7]We interpret the newspaper as the supervisor in Laffont [2000].

only when there are proven ideological biases (or when captured has occured). Therefore, when $p = \widehat{p}$, with probability ζ the signal, denoted σ, is such that $\sigma = \widehat{p}$; and with probability $1 - \zeta$ the signal is $\sigma = \emptyset$. Finally, whenever $p = \underline{p}$ or $p = \overline{p}$, $\sigma = \emptyset$. Importantly, note that finding out capture (ideological bias) means finding out the expert's true efficiency level ($\underline{p}$).

2.2.3 The Constitution

There's a benevolent central planner (The Principal) interested in maximizing the citizens' total welfare. The planner wishes to ask the expert, on behalf of citizens, what the best policy is. However, he does not know the expert's type. We assume that this Principal is able to write down and enforce a contract at the constitutional level, with experts and supervisors. Because the expert is protected by limited liability, the Principal offers a transfer t, which is independent of the outcome (state).

All the described information structure so far is common knowledge.

We first study the optimal contract without supervision, as a benchmark.

2.3 The Optimal Constitution Without Supervision

Under the contract offered by the Principal to the expert, an individual rationality constraint must be fulfilled for all values on the informational parameter p:

$$U \equiv t - C(p) = t - \alpha(1-p)x \geq 0 \tag{2}$$

Citizens derive utility from the outcome of the decision to be made. If the state of nature is a they get $w > 0$; if the state of nature is b instead, they get nothing. In addition, we assume that finding out what the right policy is is time-consuming for any individual[8]. Whenever citizens delegate this task they can enjoy the consumption of other goods from their spare time. If x is the rate, according to the constitution, at which the expert will be called-in to give advice on the matter at stake (an advice that is made extensive to the public), we assume that the aggregate utility perceived by all citizens from being released from the toil of investigating the issue by themselves, is described by the function $B(x)$, with $B^{'} > 0$, $B^{''} < 0$[9].

The provision of accurate information to decide upon the matter requires financing the expert. This is funded by indirect taxation with

[8] We are implicitly assuming here that citizens are voters who wish to be informed before making a decision.

[9] Note that this is isomorphic to introducing a convex cost instead.

cost of public funds $(1+\lambda) > 1$ (Laffont [2000]).

Thus, under the constitutional contract the consumers' (citizens') expected welfare is

$$S \equiv \frac{1}{2}pwx + \frac{(1-x)\,w}{4} + B(x) - (1+\lambda)t = \frac{w}{2}\left[\frac{1}{2} + x\left(p - \frac{1}{2}\right)\right] + B(x) - (1+\lambda)t \tag{3}$$

With probability $\frac{1}{2}px$ citizens get w (in state b, independently of the expert's report, no benefit is perceived; in state a (which occurs with probability $1/2$), with probability p the expert's signal and therefore report is correlated to the true state, which is meaningful only when the public asks for this report, which happens with probability x). When citizens do not ask for the expert's advice (with probability $(1-x)$) they still get benefits from implementing the reform with probability $1/4$). So society gains from experts, as $\frac{w}{2}\left[\frac{1}{2} + x\left(p - \frac{1}{2}\right)\right] > \frac{w}{4}$ (recall $p > \frac{1}{2}$, for all p), where the right hand side of the inequality is what citizens would get from 'tossing the coin' on every occassion. In addition, citizens anticipate utility from extra spare time that is granted everytime the Constitution asks for the expert's advice (this occurs with frequency x), $B(x)$.

Social welfare (which adds also the expert's utility), given the expert's type, is defined as

$$W \equiv S + U = \frac{w}{2}\left[\frac{1}{2} + x\left(p - \frac{1}{2}\right)\right] + B(x) - (1+\lambda)\alpha\,(1-p)\,x - \lambda U \tag{4}$$

2.3.1 A note on commitment issues

Before proceeding any further, an important remark regarding the timeline of the contract and commitment.The time line of the contract is as follows

We assume throughout the paper that commitment issues are not at stake. The Principal, being benevolent, does not change the rate at which he consults the expert, even when doing so is optimal *ex-post*, once the contract has been signed and the expert's type has been revealed to the Principal. If the Principal was tempted to change his mind, this will also change the expert's best strategy. To keep simplicity therefore, we assume that the Principal commits itself to make sure contracts are carried out according to the Constitution (commitment issues and dynamics are left as possible extensions).

2.3.2 Incentive constraints and the optimal contract

By the revelation principle, without loss of generality, to obtain the optimal contract we can focus on direct mechanisms that are incentive compatible. Thus, we look after the optimal triple of contracts of the form $\left\{(\underline{t}, \underline{x}), (\widehat{\underline{t}}, \widehat{\underline{x}}), (\underline{t}, \underline{x})\right\}$, offered by the Principal.

There are six incentive compatibility constraints to consider:

$$(\underline{IC}1) \qquad \underline{U} \geq \widehat{U} + \alpha \widehat{x} \triangle p \tag{5}$$

$$(\underline{IC}2) \qquad \underline{U} \geq \overline{U} + 2\alpha \overline{x} \triangle p \tag{6}$$

$$(\widehat{IC}1) \qquad \widehat{U} \geq \overline{U} + \alpha \overline{x} \triangle p \tag{7}$$

$$(\widehat{IC}2) \qquad \widehat{U} \geq \underline{U} - \alpha \underline{x} \triangle p \tag{8}$$

$$(\overline{IC}1) \qquad \overline{U} \geq \widehat{U} - \alpha \widehat{x} \triangle p \tag{9}$$

$$(\overline{IC}2) \qquad \overline{U} \geq \underline{U} - 2\alpha \underline{x} \triangle p \tag{10}$$

Two of these contraints, (6) and (10), are global (they consider non-adjacent types), while the rest can be classified as local (they consider adjacent types).The individual rationality constraints are

$$(\underline{IR}) \qquad \underline{U} \geq 0 \tag{11}$$

$$(\widehat{IR}) \qquad \widehat{U} \geq 0 \tag{12}$$

$$(\overline{IR}) \qquad \overline{U} \geq 0 \tag{13}$$

There are six additional constraints to consider, that have to do with x being a probability. Indeed, for any x the following must be true

$$x \geq 0$$

and

$$x \leq 1$$

Because we have not specified any particular functional form for $B(x)$, we cannot check whether these constraints are binding or not.

In what follows we assume that $B(x)$ is such that these probabilities are always well defined, and therefore dismiss these constraints.

To save some notation, lets define $D(x,p) \equiv D(x;\lambda,\alpha,p) = \frac{w}{2}\left[\frac{1}{2} + x\left(p - \frac{1}{2}\right)\right] + B(x) - (1+\lambda)\alpha\,(1-p)\,x$. Then $D'(x,p) = p\frac{w}{2} + B'(x) - (1+\lambda)\alpha\,(1-p)$. Importantly, it should be noted that in the case of an *influenced* expert (with $\widehat{p}$) citizens would correct the probability that they will get benefits from following the expert's advice from $\widehat{p}$ to $\underline{p}$. However, this does not prevent this type of expert from perceiving some private reputational losses, which happen at rate $\widehat{p}$. That is: $D(\widehat{x},\widehat{p}) = \frac{w}{2}\left[\frac{1}{2} + x\left(\underline{p} - \frac{1}{2}\right)\right] + B(\widehat{x}) - (1+\lambda)\alpha\,(1-\widehat{p})\,\widehat{x}$.

The program at the constitutional level is then to select the triple of contracts that maximizes, under constraints (5) to (13), the expected social welfare

$$W = \underline{v}\left[D(\underline{x},\underline{p}) - \lambda\underline{U}\right] + \widehat{v}\left[D(\widehat{x},\widehat{p}) - \lambda\widehat{U}\right] + \overline{v}\left[D(\overline{x},\overline{p}) - \lambda\overline{U}\right]$$

Following Laffont and Martimort [2002], from adding (5) and (8), and (7) with (9), we get the monotonicity constraints

$$\underline{x} \geq \widehat{x} \geq \overline{x} \tag{14}$$

Likewise, by simplifying the constraints (focusing on upward incentive constraints), this program can be reduced to

$$(P): \qquad \max_{\left\{(\underline{U},\underline{x}),\left(\widehat{U},\widehat{x}\right),(\underline{U},\underline{x})\right\}} W$$

subject to (5), (7), (14)and (13).

Where, as usual, all (5), (7) and (13) are binding. Using this fact, the Principal's problem can finally be expressed as maximizing

$$W = \underline{v}\left[D(\underline{x},\underline{p}) - \lambda\alpha\triangle p\left(\widehat{x}+\overline{x}\right)\right] + \widehat{v}\left[D(\widehat{x},\widehat{p}) - \lambda\alpha\triangle p\overline{x}\right] + \overline{v}\left[D(\overline{x},\overline{p})\right]$$

subject to (14).

2.3.3 Solution

Denoting by x^{ns} and t^{ns} as the contracted quantities and transfers under the optimal constitution *without supervision*, respectively, we can now describe the solution to this problem.

Dismissing the monotonicity constraint for a while, the solution of this program delivers

$$B'(\underline{x}^{ns}) = (1+\lambda)\alpha\left(1-\underline{p}\right) - \underline{p}\frac{w}{2} \tag{15}$$

$$B'(\widehat{x}^{ns}) = (1+\lambda)\alpha\,(1-\widehat{p}) - \underline{p}\frac{w}{2} + \frac{\underline{v}}{\widehat{v}}\lambda\alpha\triangle p \tag{16}$$

$$B'(\overline{x}^{ns}) = (1+\lambda)\alpha\,(1-\overline{p}) - \overline{p}\frac{w}{2} + \left(\frac{\underline{v}+\widehat{v}}{\overline{v}}\right)\lambda\alpha\triangle p \tag{17}$$

Optimal transfers under this constitutional contract are

$$\underline{t}^{ns} = \alpha\triangle p\,(\widehat{x}^{ns} + \overline{x}^{ns}) + \alpha\left(1-\underline{p}\right)\underline{x}^{ns} \tag{18}$$

$$\widehat{t}^{ns} = \alpha\triangle p\overline{x}^{ns} + \alpha\,(1-\widehat{p})\,\widehat{x}^{ns} \tag{19}$$

$$\overline{t}^{ns} = \alpha\,(1-\overline{p})\,\overline{x}^{ns} \tag{20}$$

2.3.4 No-Bunching Condition

We now check for the monotonicity constraints. By simple inspection of $B'(\underline{x}^{ns})$ and $B'(\widehat{x}^{ns})$ we get $\underline{x}^{ns} > \widehat{x}^{ns}$. To have $\widehat{x}^{ns} \geq \overline{x}^{ns}$ (in which case there is no implementability limitation) the following condition must hold

$$\frac{\underline{v}}{\widehat{v}} - \frac{(1-\underline{v})}{\overline{v}} \leq \frac{(1+\lambda)}{\lambda} + \frac{w}{\lambda\alpha} \tag{21}$$

There are two opposing forces that make the assessment on whether monotonic implementation is feasible or not, harder than in the standard canonical three-type model in Laffont and Martimort [2002]. On one hand, first note that the left-hand side can be written as $\left(\frac{1}{1-\underline{v}}\right)\underline{v}\overline{v}-\widehat{v}$, with $\left(\frac{1}{1-\underline{v}}\right) > 1$. In the canonical model, to avoid bunching we needed $\underline{v}\overline{v} < \widehat{v}$ to obtain monotonicity. In our model however the analogous monotonicity constraint is harder to satisfy. Indeed, we need $\underline{v}\overline{v} < \left(\frac{1}{1-\underline{v}}\right)\underline{v}\overline{v} < \widehat{v}$. On the other hand, however, the higher the right hand side the more likely is the monotonicity constraint satisfied.

We assume that condition (21) holds in what follows, leaving the case for bunching as a possible extension. Alternatively, a sufficient condition for (21) to hold would be to impose the *monotone hazard rate property*:

$$\frac{\Pr\,(p<\widehat{p})}{\Pr\,(p=\widehat{p})} = \frac{\underline{v}}{\widehat{v}} < \frac{\Pr\,(p<\overline{p})}{\Pr\,(p=\overline{p})} = \frac{\underline{v}+\widehat{v}}{\overline{v}} \tag{22}$$

We assume this is the case.

However, independently of the distribution of types, we would like to describe briefly *when* bunching is more likely to arise, by using the right hand side of the inequality, which contains important parameters of our specific model. Define $\Psi\left(w,\alpha,\lambda\right)=\frac{(1+\lambda)}{\lambda}+\frac{w}{\lambda\alpha}$. Clearly, $\frac{\partial\Psi}{\partial\alpha}<0;\frac{\partial\Psi}{\partial w}>0$; and $\frac{\partial\Psi}{\partial\lambda}<0$. On one hand, the higher the perceived reputational loss α, and the higher the cost of public funds λ, the more likely is bunching. On the other hand, the higher the eventual benefit derived from implementing the reform w the less likely is bunching to occur.

2.3.5 Comparing to the complete information contract

We can compare now this contract (with asymmetric information) to the complete information contract. Under complete information we get

$$B'(\underline{x}^{*})=(1+\lambda)\alpha\left(1-\underline{p}\right)-\underline{p}w \tag{23}$$

$$B'(\widehat{x}^{*})=(1+\lambda)\alpha\left(1-\widehat{p}\right)-\underline{p}w \tag{24}$$

$$B'(\overline{x}^{*})=(1+\lambda)\alpha\left(1-\overline{p}\right)-\overline{p}w \tag{25}$$

with transfers

$$\underline{t}^{*}=\alpha\left(1-\underline{p}\right)\underline{x}^{*} \tag{26}$$

$$\widehat{t}^{*}=\alpha\left(1-\widehat{p}\right)\widehat{x}^{*} \tag{27}$$

$$\overline{t}^{*}=\alpha\left(1-\overline{p}\right)\overline{x}^{*} \tag{28}$$

Clearly, and as expected, $\underline{x}^{*}=\underline{x}^{ns}$. In addition, $\widehat{x}^{ns}<\widehat{x}^{*}$ and $\overline{x}^{ns}<\overline{x}^{*}$. At the same time, under the incomplete information contract there are informational rents that must be given away. The Principal faces the usual trade-off between efficiency and informational rents. Both $\underline{p}$ and $\widehat{p}$ perceive informational rents.

Expected welfare under the asymmetric information contract without supervision can be written then as

$$W^{ns}=\underline{v}\left[D(\underline{x}^{*},\underline{p})-\lambda\alpha\triangle p\left(\widehat{x}^{ns}+\overline{x}^{ns}\right)\right]+\widehat{v}\left[D(\widehat{x}^{ns},\widehat{p})-\lambda\alpha\triangle p\overline{x}^{ns}\right]+\overline{v}\left[D(\overline{x}^{ns},\overline{p})\right]$$

Next we study the optimal constitution when supervision is allowed.

2.4 The Optimal Constitution With Supervision

Now the time-line to consider is

To begin with, we assume that the Media (the supervisor) reports truthfully (by denoting r as the report, we have then $r = \sigma$), and that he has no wealth. By s we denote, as in Laffont [2000], the reward given to this supervisor. His utility function therefore is

$$V \equiv s \geq 0 \tag{29}$$

where s can be monetary or any other private benefit associated to his task as a supervisor.

There are two cases to consider, in accordance to the supervision technology described above. First, if the media is informed (that is $\sigma = \widehat{p}$), the Principal is informed and therefore can implement the complete information allocation. Welfare in this case would be[10]

$$W \equiv D(\widehat{x}^{*}, \widehat{p}) \tag{30}$$

which happens with probability $\zeta\widehat{v}$.

If the supervisor receives no information, $r = \sigma = \emptyset$, the beliefs at the constitutional level can be revised following Bayes law

$$\underline{v}^{\emptyset} = \Pr\left[p = \underline{p} | \sigma = \emptyset\right] = \frac{\Pr\left(\sigma = \emptyset | p = \underline{p}\right) \Pr\left(p = \underline{p}\right)}{\Pr\left(\sigma = \emptyset\right)} = \frac{\underline{v}}{1 - \zeta\widehat{v}} > \underline{v} \tag{31}$$

$$\widehat{v}^{\emptyset} = \Pr\left[p = \widehat{p} | \sigma = \emptyset\right] = \frac{\Pr\left(\sigma = \emptyset | p = \widehat{p}\right) \Pr\left(p = \widehat{p}\right)}{\Pr\left(\sigma = \emptyset\right)} = \frac{(1 - \zeta)\,\widehat{v}}{1 - \zeta\widehat{v}} < \widehat{v} \tag{32}$$

$$\overline{v}^{\emptyset} = \Pr\left[p = \overline{p} | \sigma = \emptyset\right] = \frac{\Pr\left(\sigma = \emptyset | p = \overline{p}\right) \Pr\left(p = \overline{p}\right)}{\Pr\left(\sigma = \emptyset\right)} = \frac{\overline{v}}{1 - \zeta\widehat{v}} > \overline{v} \tag{33}$$

[10] Without loss of generality we are assuming $s = 0$ here, as in Laffont[2000].

2.4.1 Monotonicity constraints

Under the $r = \sigma = \emptyset$ case, recall that bunching is more likely the higher $\underline{v}$ and $\overline{v}$, and the lower $\widehat{v}$ (there are no changes on the parameters α, λ, and w to consider). As the first two increase, and the third decreases, when supervision is allowed, we can conclude that bunching is more likely to be optimal under supervision than without it. As before, however, we proceed without regarding this possibility.

2.4.2 Welfare and the presence of the media as supervisor

Denote by $x^{\emptyset}$ the contracted probabilities when $\sigma = \emptyset$. The expected welfare with supervision can then be written as

$$W^{ws} = \zeta\widehat{v}W^{FI} + (1 - \zeta\widehat{v})\, W^{AI}$$

Where

$$W^{FI} = D(\widehat{x}^{*}, \widehat{p})$$

and

$$W^{AI} = \frac{\underline{v}}{1-\zeta\widehat{v}}\left[D(\underline{x}^{*}, \underline{p}) - \lambda\alpha\triangle p\left(\widehat{x}^{\emptyset} + \overline{x}^{\emptyset}\right)\right] + \frac{(1-\zeta)\,\widehat{v}}{1-\zeta\widehat{v}}\left[D(\widehat{x}^{\emptyset}, \widehat{p}) - \lambda\alpha\triangle p\overline{x}^{\emptyset}\right] + \frac{\overline{v}}{1-\zeta\widehat{v}}\left[D(\overline{x}^{\emptyset}, \overline{p})\right]$$

Thus, the social gain of having a supervisor is obtained by comparing W^{ws} to W^{ns}. This gain must also compensate for the cost of the technology used by the media (the supervisor). We assume this is indeed the case.

So far there are two latent problems we would like to address next. One has to do with the possibility of collusion between the supervisor and the agent. We have assumed a non-cooperative behaviour between them that is likely to be violated in our context. Indeed, the media may well decide not to report $\sigma = \widehat{p}$ when it is the case (there's no stake of collusion when $p = \overline{p}$ because the expert's utility has been optimally set to zero in this case). By informing $\sigma = \emptyset$, instead, he is giving the firm an informational rent equal to $\alpha\triangle p\overline{x}$. The other problem is the possibility of the media making profits out of other activities (say, entertainment), not directly related to the task of informing the public on the expert's type.

We start studying the first type of problem next.

2.5 Optimal Collusion-proof Constitution: the possibility of capture of the Media

Following Laffont [2000], the maximum amount that the expert (or some interest group on behalf of the expert) is willing to offer as a bribe to the supervisor is

$$\frac{\alpha \triangle p \overline{x}^{\emptyset}}{1+\lambda_c}$$

Where λ_c denotes some transactional costs between the expert and the media (this is why the media does not perceive full $\alpha \triangle p \overline{x}^{\emptyset}$). Denote $k = \frac{\alpha \triangle p \overline{x}^{\emptyset}}{1+\lambda_c}$.

The Principal can give the media some incentives. For instance, it can offer $\widehat{s} = k\alpha \triangle p \overline{x}^{\emptyset}$ only when the media reports the (verifiable) signal $\widehat{p}$, and zero otherwise. This might prevent capture. The expected cost for society of this payment scheme is

$$\lambda \widehat{v} \zeta \underline{s}$$

Now we can find the optimal contract assuming that it is optimal to prevent capture (see Laffont [2000]); that is, we can obtain the Optimal Collusion-proof Constitution.

Lets denote by $x^{\emptyset c}$ the contracted probabilities when collusion is possible and $\sigma = \emptyset$. Now we can write the expected social welfare as

$$\begin{aligned}
&\widehat{v}\zeta\left[D(\widehat{x}^{*},\widehat{p})\right] + \\
&(1-\zeta\widehat{v})\left\{\begin{array}{c}
\frac{\underline{v}}{1-\zeta\widehat{v}}\left[D(\underline{x}^{\emptyset c},\underline{p}) - \lambda\alpha\triangle p\left(\widehat{x}^{\emptyset c} + \overline{x}^{\emptyset c}\right)\right] + \\
\frac{(1-\zeta)\widehat{v}}{1-\zeta\widehat{v}}\left[D(\widehat{x}^{\emptyset c},\widehat{p}) - \lambda\alpha\triangle p\overline{x}^{\emptyset c}\right] + \frac{\overline{v}}{1-\zeta\widehat{v}}\left[D(\overline{x}^{\emptyset c},\overline{p})\right]
\end{array}\right\} \\
&-\lambda\widehat{v}\zeta k\alpha\triangle p\overline{x}^{\emptyset}
\end{aligned}$$

Reoptimizing we get

$$B'(\underline{x}^{\emptyset c}) = B'(\underline{x}^{*}) = (1+\lambda)\alpha\left(1-\underline{p}\right) - \underline{p}w \tag{34}$$

$$B'(\widehat{x}^{\emptyset c}) = (1+\lambda)\alpha\left(1-\widehat{p}\right) - \underline{p}w + \frac{\underline{v}}{(1-\zeta)\,\widehat{v}}\lambda\alpha\triangle p \tag{35}$$

$$B'(\overline{x}^{\emptyset c}) = (1+\lambda)\alpha\left(1-\overline{p}\right) - \overline{p}w + \lambda\alpha\triangle p\left(\frac{\underline{v} + \widehat{v}\left[1-(1-k)\,\zeta\right]}{\overline{v}}\right) \tag{36}$$

with

$$\underline{t}^{\emptyset c} = \alpha \triangle p \left(\widehat{x}^{\emptyset c} + \overline{x}^{\emptyset c}\right) + \alpha \left(1 - \underline{p}\right) \underline{x}^{*} \tag{37}$$

$$\widehat{t}^{\emptyset c} = \alpha \triangle p \overline{x}^{\emptyset c} + \alpha \left(1 - \widehat{p}\right) \widehat{x}^{\emptyset c} \tag{38}$$

$$\overline{t}^{\emptyset c} = \alpha \left(1 - \overline{p}\right) \overline{x}^{\emptyset c} \tag{39}$$

If $k = 0$ (costs of transfers are too high) we are as with the benevolent supervisor. If $k = 1$ the supervisor makes no difference as we are back to the constitution without supervision. Importantly, the expected rent from collusion is $(1 - \zeta)\, \widehat{v} \triangle p \overline{x}^{\emptyset c}$, lower than before. Thus, the fear of collusion lowers $\overline{x}$. But note that it does not change $\widehat{x}^{\emptyset}$ nor $\underline{x}$, nor the posterior probabilities. This means that a collusion-proof contract between the Principal and the agents will crowd-out lower types as a consequence.

Next, we study the possibility of commercialized media.

3 Extensions: The Role of Commercialized Media

As we noted before, the media can well offer some additional services to the public, that have no relation whatsoever with the public decision to be made. Even so, we'll show that the existence of these parallel activities might change the optimal contract.

Lets assume that the media can offer entertainment to the public. In addition, assume that the media enjoys a monopoly on this service. Moreover, for the sake of simplicity, we assume that the marginal cost of providing these services is constant and equal to zero. Hence, the monopoly extracts all the consumers' surplus. We denote this surplus as S, equal to the profit this monopoly makes.

Lets assume that this activity can only be implemented with permission of the Principal, who can decide **when** these extra services can be provided.

Indeed, if the Principal allowed the media to offer entertainment at all times, then we would be back to the collusion-proof optimal contract. To see this, note that when the media reports the (verifiable) signal $\widehat{p}$ she gets

$$V = S + \widehat{s}$$

Where $\widehat{s}$ is to be determined. Now suppose that she observes $\sigma = \widehat{p}$ and decides to collude ($r = \emptyset$). In this case she would get

$$V = S + k\alpha \triangle p \overline{x}^{\emptyset}$$

Clearly, the commercialization of the media does not alter our main findings in this case, as $\widehat{s}$ will be optimally set equal to $k\alpha\triangle p\overline{x}^{\emptyset}$, as before.

However, what happens if the Principal is capable of enforcing these services to be provided only when advice from experts is called upon? (that is, these services are provided contingent on x). We explore this next.

3.0.1 Contingent commercialized Media optimal contract

If the media was to report truthfully when $\sigma = \widehat{p}$, she would get:

$$V = S\widehat{x}^{*} + \widehat{s}^{e}$$

where $\widehat{s}^{e}$ is to be determined. From above, we know that if the Media was to report truthfully, then the Principal would be able to identify the expert's type, whereby setting the efficient level $\widehat{x}^{*}$. Now suppose the media decides not to report the truth when $\sigma = \widehat{p}$ (she reports $r = \emptyset$ and colludes with the expert). In that case she perceives

$$V = S\widetilde{x} + k\alpha\triangle p\overline{x}^{\emptyset ce}$$

Where $\widetilde{x} \equiv \underline{v}^{\emptyset ce}\underline{x}^{\emptyset ce} + \widehat{v}^{\emptyset ce}\widehat{x}^{\emptyset ce} + \overline{v}^{\emptyset ce}\overline{x}^{\emptyset ce}$, which is the *ex-ante* expected value of x when $\sigma = \emptyset$; *ce* denotes the contracted probabilities under the optimal collusion proof contract when entertainment is allowed. $\widehat{s}^{e}$ must be set to make the media indifferent between reporting truthfully and colluding. Therefore: $\widehat{s}^{e} = S\left(\widetilde{x} - \widehat{x}^{*ce}\right) + k\alpha\triangle p\overline{x}^{\emptyset ce}$. Expected welfare can be written as

$$\begin{aligned}
&\widehat{v}\zeta\left[D(\widehat{x}^{*ce},\widehat{p})\right] + \\
&(1-\zeta\widehat{v})\left\{\begin{array}{c}\frac{\underline{v}}{1-\zeta\widehat{v}}\left[D(\underline{x}^{\emptyset ce},\underline{p}) - \lambda\alpha\triangle p\left(\widehat{x}^{\emptyset ce} + \overline{x}^{\emptyset ce}\right)\right] + \\ \frac{(1-\zeta)\widehat{v}}{1-\zeta\widehat{v}}\left[D(\widehat{x}^{\emptyset ce},\widehat{p}) - \lambda\alpha\triangle p\overline{x}^{\emptyset ce}\right] + \frac{\overline{v}}{1-\zeta\widehat{v}}\left[D(\overline{x}^{\emptyset ce},\overline{p})\right]\end{array}\right\} \\
&-\lambda\widehat{v}\zeta\left[S\left(\widetilde{x} - \widehat{x}^{*ce}\right) + k\alpha\triangle p\overline{x}^{\emptyset ce}\right]
\end{aligned}$$

The new and important term to consider now is the last term $\lambda\widehat{v}\zeta\left[S\left(\widetilde{x} - \widehat{x}^{*}\right) + k\alpha\triangle p\overline{x}^{\emptyset ce}\right]$. Reoptimizing we get the following

$$B'(\underline{x}^{\emptyset ce}) = (1+\lambda)\alpha\left(1-\underline{p}\right) - \underline{p}w + \lambda\widehat{v}\underline{v}\zeta S \tag{40}$$

$$B'(\widehat{x}^{*ce}) = B'(\underline{x}^{*}) = (1+\lambda)\alpha\left(1-\widehat{p}\right) - \underline{p}w - \lambda\widehat{v}\zeta S \tag{41}$$

$$B'(\widehat{x}^{\emptyset ce}) = (1+\lambda)\alpha\left(1-\widehat{p}\right) - \underline{p}w + \frac{\underline{v}}{(1-\zeta)\,\widehat{v}}\lambda\alpha\triangle p + \lambda\widehat{v}^{2}\zeta S \tag{42}$$

$$B'(\overline{x}^{\emptyset ce}) = (1+\lambda)\alpha\left(1-\overline{p}\right) - \overline{p}w + \lambda\alpha\triangle p\left(\frac{\underline{v}+\widehat{v}\left[1-\left(1-k\right)\zeta\right]}{\overline{v}}\right) + \lambda\widehat{v}\overline{v}\zeta S \tag{43}$$

with

$$\underline{t}^{\emptyset c} = \alpha\triangle p\left(\widehat{x}^{\emptyset ce} + \overline{x}^{\emptyset ce}\right) + \alpha\left(1-\underline{p}\right)\underline{x}^{*\emptyset ce} \tag{44}$$

$$\widehat{t}^{\emptyset ce} = \alpha\triangle p\overline{x}^{\emptyset ce} + \alpha\left(1-\widehat{p}\right)\widehat{x}^{\emptyset ce} \tag{45}$$

$$\overline{t}^{\emptyset ce} = \alpha\left(1-\overline{p}\right)\overline{x}^{\emptyset ce} \tag{46}$$

There are important results worth mentioning here. First, when S is large enough, the optimal contract with contingent entertainment lowers the contracted levels of both the high type $\underline{p}$ and the low type $\overline{p}$, while increasing that of the middle type $\widehat{p}$. Furthermore, the contracted quantity for the most efficient type is lower than the first best quantity ($\underline{x}^{\emptyset ce} < \underline{x}^{*}$). This differs from standard results. At the same time, $\widehat{x}^{*ce} > \widehat{x}^{*}$. More strickingly, $\widehat{x}^{*ce}$may be even higher than $\underline{x}^{\emptyset ce}$. This would happen if $(1+\lambda)\alpha\Delta p > \lambda\widehat{v}\zeta S\left(1-\underline{v}\right)$. However, and most importantly, the reward that has to be given to the media in exchange for her services on the public matter is lowered if $\widehat{x}^{\emptyset ce} > \underline{x}^{\emptyset ce}$. This is more likely the higher the profitability S from entertainment. Indeed, the effect on the reward could even vitiate collusion altogether if S is large enough. Thus, contingent commercialized media may put an end to collusion at no cost of public funds. As for the public matter, note that whenever $\sigma = \widehat{p}$ the public expects to 'get it right' with probability $\underline{p}$ (they correct posterior probabilities conditional on the signal). Indeed, the expected welfare derived from the public matter, when there is supervision and contingent commercialized media is $\frac{w}{2}\left[\frac{1}{2} + \widehat{x}^{*ce}\left(\underline{p} - \frac{1}{2}\right)\right]$. Commercialized media may coexist with ideological experts, and this may improve the chances of making public decisions right, as long as the expert's ideological interests are made public (the role of supervision works well).

4 Conclusions and extensions

We have studied the conditions under which the Media can act as a supervisor when a contract at the constitutional level is implemented, and under which conditions this supervision is welfare improving. We find that there is a role for the Media as a supervisor of *experts' advice.* In particular, we find that a collusion-proof contract may be welfare improving all in all, as there would be crowding-out of lower types that would diminish both the informational rents to be paid to higher types and the reward to be paid to the supervisor in order to prevent collusion.

We also explore the role of commercialization of the Media on how its supervision is carried out. We find interesting results. First, only if the provision of additional services is made contingent on the rate at which experts are consulted on public affairs, there will be an effect on the optimal contract. If these services were allowed to be commercialized all times, instead, we are back to the optimal collusion-proof framework. In addition, we find that when these services are contingent there may be substantial improvements. In particular, the rate at which influenced experts are called upon when the Media has observed its type is increased; and what is more important, this may happen without having to give in exchange any substantial reward to the Media the more profitable is the entertaintment commercialization. Therefore, optimal behaviour may lead to the coexistence of highly commercialized Media and ideologized *expert reporting*.

This interpretative framework may be extended in many directions. One major concern in this model is the extent to which the Principal can commit itself in respecting the contract. *Ex-post* and once the types are known to him, he might want to change the rate at which he asks for their advice. A more general model should consider this possibility explicitly. At the same time, and along these lines, one could explore how may the optimal contract change if we were to allow for repetitive contracting across time. This would call for dynamic analysis that has not be done in this paper. Another possible extension is to study, perhaps within a multiple and continuos type framework, the effect of bunching.

5 References

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