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# Extremists into Truth-tellers: Information Aggregation under Asymmetric Preferences\*

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## Abstract

We set up a model of costly information production between two lobbies, a firm and a consumer group, competing for influence over an imperfectly informed but benevolent government. The government is endowed with a parametric amount of information and chooses the best policy from a finite, countable feasible set given the information available (its own and that forwarded by lobbies). Lobbies have asymmetric preferences, the firm being a “high-stakes” player with relatively extreme preferences and the consumer group a “low-stakes” player with preferences more aligned with the government’s. We show that lobbies spend too much on information production in any Nash equilibrium despite a timing-game structure in which the lobbies are free to choose the order of play. We also show that in some parameter configurations, the firm insures against a consumer win by forwarding unbiased information to the government, in spite of its own extreme preferences and high stakes. The resulting informational rent enables the government to adopt moderate policies aligned with its own (i.e. societal) preferences, suggesting a new way in which lobby competition can produce good policies even when the government is imperfectly informed.

**Keywords:** Game theory, lobbying model, imperfect information, timing game.

**JEL classification :** H4, K0, P1, D72, F13

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# 1 Introduction

Whether in environmental, innovation or public-health issues, firms find themselves frequently pitched against organized consumer groups in battles for influence over key regulatory decisions, using media coverage, professional lobbyists, and sometimes even academics, to sway the public and decision-makers.<sup>1</sup> In the 1990s, for instance, consumer groups in the US initiated a campaign against monosodium glutamate (MSG), arguing that it generated obesity and behavioral disorders among children and was even involved in Alzheimer’s disease. Consumer groups lobbied for MSG to be banned, producing studies that highlighted health hazards; in response, Ajinomoto, the developer of MSG, commissioned independent studies suggesting there was none, studies which however failed to quell public anxieties. In the end, governments in Western countries adopted a middle-of-the-road approach, imposing MSG labeling in prepared foods instead of the precautionary ban demanded by consumer groups. This raises a first question, namely how governments aggregate self-interested and conflicting messages from lobbies into information that is sufficiently reliable to be used for policy decisions.

In another case, in August 2006, Greenpeace released its first *Guide to Greener Electronics*, whose objective was to encourage more responsible waste management by key industry players and stricter waste-recycling and cleanup regulations. The guide featured a research ranking of 14 leading PC, mobile phone, TV, and game console manufacturers on their harmful-chemical elimination practices. In its first version, it ranked Nokia and Dell near the top, but gave failing grades to a number of large players. In particular, Toshiba was ranked thirteenth and Apple eleventh, something that caught the attention of tech-media news sites. In the ensuing controversy, Greenpeace was criticized for assigning companies a zero in all categories where they were not providing public information, although this was consistent with what economists call the “unraveling principle” (Milgrom and Roberts, 1986), namely, that all information that is withheld is interpreted as being unfavorable. Greenpeace responded to the criticism in a rebuttal, presented the results of a second report entitled *Toxic Chemicals in Your Laptop Exposed* and restated several of its initial claims. For instance, it highlighted the presence of small traces of Tetrabromobisphenol A (TBBPA), an unregulated fire retardant, in Apple computers. However, the EU Scientific Committee on Health and Environmental Risks concluded later that TBBPA “presented no risk to human health”, and so did a study conducted by the World Health Organization. In order to cut the ground from Greenpeace’s feet, Apple change its strategy and fully disclosed its private information. Based on the new information, the United States Environmental Protection Agency’s 2007 *Electronic Product Environmental Assessment Tool* showed Apple leading the ranks in all categories. This raises a second question, namely how much information a firm with high stakes in a policy/media dispute decides to disclose and why.

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<sup>1</sup>The rise in “consumer power” has been documented in a number of recent papers including King and Soule (2007) or Spar and La Mur (2003). Consumer groups can challenge firms directly through boycotts or protests (Baron and Diermeier, 2005; Feddersen and Gilligan, 2001; Lenox and Eesley, 2009)—what Baron (2003) calls “private politics”. They can also confront corporations indirectly through lobbying for policies and regulations (Bonardi and Keim, 2005; Lyon and Maxwell, 2004).

We tackle these two issues here and show that they are related, using a game with asymmetric stakes and preferences. Two lobbies, a firm and a consumer group, compete for influence over policy making through the production of policy-relevant information. Our modeling choice is to label a business lobby as having high stakes and “extremist” preferences, and a consumer organization as having low stakes and “moderate” preferences, following the tradition of the political-economy literature.<sup>2</sup> In that setting, we show that competition in the production of policy-relevant information enables a benevolent government to extract an informational rent from the extremist lobby. The intuition for our result is straightforward. Because of the preference asymmetry, when both lobbies make competing claims, those coming from the extremist lobby are discarded; the only way it can overcome this information-domination problem is by disclosing *all* information, not just the self-serving bits. In other words, extreme preferences do not necessarily translate into extremist propaganda. This effect is maximized when the government is itself poorly informed, relying on the lobbies’ information.

The nature of the uncertainty in our model departs from the bulk of the literature in that it is not about a state of nature determining which of the lobbies’ preferred policies happens to be the best one. Instead, both the set of outcomes and the set of feasible policies are common knowledge, but which policy leads to which outcome is not known, as in Anson (2007). In other words, players know where they are and where they want to be, but they don’t know how to get there. While new, this way of formalizing uncertainty in policy making is consistent with a wide range of situations.<sup>3</sup> The lobbies can search but at a cost and with random result; if successful, they uncover all relevant information. For tractability, the government, a benevolent automaton, does not search on its own but is endowed with a given level of information which can be interpreted as its experience and is a comparative-statics parameter.

Our setup generates the following results. Competition between lobbies leads them to “over-research” in equilibrium. This is a similar result to that of Henry (2009) but obtained through a very different mechanism.<sup>4</sup> While we allow lobbyists to mitigate it through a “timing game” (Hamilton and Slutsky 1990) where the Pareto-dominant equilibrium is a se-

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<sup>2</sup>We will use the term ‘consumer group’ throughout, although one may think of broader organized groups, for which we do not discuss collective-action problems. In reference to the example just given, we also refrain from making a stand on whether Greenpeace in particular qualifies as a moderate group.

<sup>3</sup>For instance, in 2010 the Indonesian government was faced with a complex issue in the regulation of the steel market, with a flood of low-quality steel imported from China depressing local prices and potentially jeopardizing the national steelmaker’s impending privatization. The government knew it wanted a sufficiently orderly market to proceed with the privatization; it was also clear that antagonizing the Chinese government or local Japanese automakers was to be avoided. However, whether the best approach was trade action (anti dumping or safeguard), a quality standard, or letting the market sort it out was not clear; nor was it very clear either for the lobbies involved (essentially the steelmaker and Japanese automakers), as interviews by one of the authors suggested. In the end, the government settled on a quality standard.

<sup>4</sup>In Henry’s setup, a researcher expends resources to generate a sequence of research results about the state of nature in order to influence a regulatory agency’s policy. While he cannot misrepresent results, he can withhold unfavorable ones; anticipating this, the agency interprets all unreported signals as negative. If the research effort is unobservable, Henry shows that the researcher will “over-research” in equilibrium, wasting resources so that the agency does not assume more negative signals than there actually are.

quential play and equilibrium search is reduced, the firm (the high-stakes player) overspends the consumer group in practically all parameter configurations, in particularly when the government is uninformed and the return to information production is at its highest. However, government preferences being closer to those of the consumer group, the firm's information is dominated. Over-searching and disclosing *all* the information (not just the self-serving bits) is then a way for the firm to undercut the consumer group's informational advantage; that is, in order to "neutralize" the consumers' message, the firm discloses unbiased information, enabling the government to reach the best decision. Thus, the most extremist and high-stakes lobby ends up being the one disclosing truthful information produced at its own expense. We show that the informational rent thus extracted by the government is highest when its information is weakest, generating a U-shaped pattern where the best policy is adopted when the government is either very well or very poorly informed.

Our model relates to several strands of the literature. Informational lobbying has generally been shown in the literature to lead to better decision-making under a broad set of conditions (Milgrom and Roberts, 1986). For instance, Dewatripont and Tirole (1999) show that delegating the task of collecting information to agents acting on behalf of interested parties ("advocates") leads to better-informed decisions than having a single, unbiased agent collecting it (see also Austen-Smith and Wright, 1992). The reason is that as decision-based rewards are more prevalent, in particular in politics, than rewards based on the quality of the supportive information, incentives to collect costly information are better under advocacy. However, advocacy naturally leads to moral hazard in the transmission of information, as interested parties tend to conceal unfavorable pieces; this is one of the key ingredients of our approach.

In political-economy (as opposed to normative) settings, politicians have been modeled as either selling policies, typically using all-pay auctions (Tullock 1980; Baye et al. 1993, Grossman and Helpman 1994, Che and Gale 1998, Gavigus et al. 2002), or selling access, in which case they get information only from those lobbies that choose to buy access (Austen-Smith 1998). The choice between the two is modeled in Cotton (2009). In this paper, we will keep political-economy issues away and assume a benevolent government.

Moreover, our costly-search approach raises the question of whether lobbies spend too much, too little or just enough resources on collecting information, from their collective point of view and that of society as a whole. The unraveling principle encourages lobbies to reveal more and, in some cases, to search more as well (in the case of a single information collector, see Henry 2009; with two lobbies, see Austen-Smith and Wright 1992). Moreover, competition between lobbies for the decision-maker's attention typically makes search efforts strategic complements, which also contributes to over-research in equilibrium.<sup>5</sup> Thus, the general intuition of informational-lobbying models is that lobbies typically search too much for their own good, but as more information contributes to better decision-making, this is good for society as a whole.

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<sup>5</sup>Games of strategic complements include e.g. rent-contest functions (Dixit, 1987) and R&D races (See Reinganum 1984 or Dixit 1988 and references therein); both display excessive effort or rent-dissipation in equilibrium.

Finally, lobbying battles are often characterized by an asymmetry of stakes and preferences. Firms are often high-stakes lobbyists, while consumer groups typically (though not necessarily) represent wider constituencies with objectives more aligned with those of society at large. The traditional political-economy literature, in which influence is bought by campaign contributions rather than informational lobbying, takes a dim view of how stakes asymmetries affect policy decisions: Typically, high-stakes lobbies subject governments to high-power incentives, thus tilting policies in favor of private interests, unless those incentives happen to offset each other (Bernheim and Whinston 1986a, 1986b; Grossman and Helpman 1994). In informational-lobbying models, stakes asymmetry has been left relatively unexplored; this is one of the ways in which the present paper seeks to contribute to the literature.<sup>6</sup>

The paper is organized as follows: Section 2 lays out the model; Section 3 characterizes the equilibrium; Section 4 extends it to a different payoff configuration; Section 5 concludes.

## 2 The model

Consider a two-stage game between three risk-neutral players: Two lobbies, labeled  $f$  (for a firm) and  $c$  (for a consumer group), and a government, labeled  $g$ . There are five feasible policies indexed by  $i = 1, \dots, 5$ . Four of them are “reform” policies in the sense that they depart from the status quo; the fifth is the status quo. Each policy  $i$  maps into an outcome in the form of a payoff triplet  $\mathbf{u}_i = (u_i^c, u_i^f, u_i^g)$  whose elements are payoffs to the consumer group, the firm, and the government, in that order. Policy  $s$ , the status quo, has payoff  $\mathbf{u}_s = (0, 0, 0)$  for all players; policy  $w$ , the worst, has payoff  $\mathbf{u}_w = (\ell^c, \ell^f, \ell^g)$  where  $\ell^j < 0$  for  $j = c, f, g$ . Each of the remaining three policies is the best alternative for one of the three players, although they do not know which one without searching.<sup>7</sup> Policy  $c$ , which delivers the highest payoff to the consumers, has payoffs  $\mathbf{u}_c = (u_c^c, u_c^f, u_c^g)$ ; policy  $f$ , best for the firm, has payoffs  $\mathbf{u}_f = (u_f^c, u_f^f, u_f^g)$ ; and policy  $g$ , best for the government, has payoffs  $\mathbf{u}_g = (u_g^c, u_g^f, u_g^g)$ .

The policy set  $\mathcal{P} = \{c, f, g, w, s\}$  and the outcome space  $\mathcal{U} = \{\mathbf{u}_c, \mathbf{u}_f, \mathbf{u}_g, \mathbf{u}_w, \mathbf{u}_s\}$  are both common knowledge. However, the mapping from  $\mathcal{P}$  to  $\mathcal{U}$  is unknown and can be revealed only through costly search. Lobby  $j$ ’s search intensity is  $e^j \in [0, 1]$ ,  $j = c, f$ , with cost  $(e^j)^2/2$ . The information is indivisible in the sense that successful search reveals the entire mapping from all policies to all payoffs. The probability that search is successful is just  $e^j$ . The government is a benevolent automaton with a parametric “information endowment”  $e$ ,

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<sup>6</sup>Cotton (2012) explores the effect of wealth asymmetry in a model where lobbies pay for access. Interestingly, he finds that even when enjoying exclusive access to the policymaker, the rich lobby may find itself worse off because its rents are creamed off by the access fee. In our model, the government extracts informational rather than monetary rents from the firm, which spends resources on the production of verifiable information rather than on buying access.

<sup>7</sup>The set of policies can be enlarged to more than five policies without altering the results. What matters is that there is one and only one best policy for each player.

which is the probability that it is independently informed. Once lobbies have spent resources searching for information, they can forward part or all of it to the government; whatever information they forward is verifiable. That is, as in “persuasion games” (Milgrom Roberts 1986), lobbies can withhold information, but they cannot misrepresent it. By contrast, a claim by a lobby that its search was not successful is *not* verifiable.

The game’s timing is partly fixed, partly endogenous. The fixed part is its overall two-stage structure. In stage one, lobbies search for information and strategically forward some of it to the government. In stage two, the government chooses the policy it prefers given its information and that forwarded by the lobbies. The endogenous part is within stage one, where the firm and the consumer group simultaneously decide on the timing of information search and disclosure. That is, the stage-one subgame is itself a two-period timing game à la Hamilton-Slutsky (1990); specifically, it is a game of “observable delay” in which both lobbies announce simultaneously when they will search, but not how much. If both lobbies prefer searching in sub-period one or both in sub-period two, the subgame is simultaneous. If one of them prefers sub-period one and the other sub-period two, it is sequential. Lobbies also choose the timing of disclosure. If the search is simultaneous, so is the disclosure. If the search is sequential, the leader (and only the leader) chooses whether to disclose in sub-period one, before the follower searches, or in sub-period two, after the follower has searched and simultaneously with the follower’s own disclosure.

Given the structure of the game, the lobbies’ strategy space has four dimensions: search intensity (a continuum between zero and one), search timing (a binary choice between sub-periods one and two within stage one), disclosure timing for the leader if the search game is sequential (again, sub-period one or sub-period two), and disclosure itself (partial or full, in a sense that we will make precise later on).

The following assumptions determine the structure of the payoff matrix. To recall, a subscript designates a policy and a superscript a player; so  $u_j^i$  designates the payoff from policy  $j$  (i.e. player  $j$ ’s best) to player  $i$ .

$$\text{A1} \quad u_i^i = 1 \ \forall \ i; \quad u_j^i < 1 \ \forall \ i \neq j;$$

$$\text{A2} \quad u_f^c = -1; \quad u_c^f = -2;$$

$$\text{A3} \quad 0 < u_f^g < u_c^g;$$

$$\text{A4} \quad 1/2 < u_g^f < u_g^c;$$

$$\text{A5} \quad 1 + u_c^g + u_f^g + \ell^g < 0;$$

A1 assigns a unitary payoff to each player’s best policy and less than unitary payoff to all other ones; this is a normalization. A2 assigns negative cross payoffs to the firm’s and the consumer’s policies, with a more negative payoff for the firm, making it a “high-stakes player” since it has more to lose from the consumers’ policy than conversely. The normalization to -1 and -2 is inconsequential provided that the inequality holds but facilitates the calculation



of expected payoffs. A3 states that the government prefers the consumers' policy to the firm's. A4 states that the consumer is better off than the firm under policy  $g$  and that both prefer it to the status quo, making reform socially beneficial; it adds a technical requirement that simplifies the solution. A5 states that the government's expected utility from a random draw among all policies (including the worst) is worse than the status quo. This generates a "conservative bias": when the government is completely uninformed, it prefers sticking to the status quo rather than firing a shot in the dark, as in Aghion and Tirole (1997). In turn, this creates an incentive for costly information search, because the status quo is dominated by at least another policy for each player.

The resulting payoff structure is summarized in Table 1. While these relationships are common knowledge, the identity of each policy is revealed only through successful search. Stated differently, all players know that  $\mathbf{u}_c = (1, -2, u_c^g)$ ,  $\mathbf{u}_f = (-1, 1, u_f^g)$ , and so on; but policies  $c$ - $w$  are like cards turned up side down, their identity unknown; in order to turn them over, players need to spend resources.

Table 1: Policy outcomes

Policy	Payoff to		
	$c$	$f$	$g$
$c$	1	-2	$u_c^g$
$f$	-1	1	$u_f^g$
$g$	$u_g^c$	$u_g^f$	1
$w$	$\ell^c$	$\ell^f$	$\ell^g$
$s$	0	0	0

As the government is assumed benevolent, policy  $g$  is taken as society's best. The payoff structure in Table 1 also makes it a "middle-of-the-road" one, as its payoffs for the firm and consumer can be expressed as convex combinations of the payoffs from policies  $c$  and  $f$ .

### 3 Equilibrium

The game is solved backwards, starting with the government's policy decision at the end of stage two. This decision is conditional on the government's aggregate information, including both its own and that forwarded by lobbies.

#### 3.1 Stage two

Let the "government's known set" be the set of policies whose outcomes have been revealed to the government, either through its own information endowment or forwarded by lobbies; we will call these policies "known policies". Table 2 shows the government's optimal policy choice as a function of its known set. The first five columns code each of the policies by a one if it is known, a zero if it is not, and a dot if it is not payoff-relevant for the government. The

sixth column gives the government's choice, and the seventh gives the corresponding payoff vector.

The status quo,  $s$ , is coded “one” throughout because it is known by construction, since it is the policy in force at the beginning of the game. The worst policy,  $w$ , is always coded with a dot because its relevance is only indirect; it is never the policy choice. In the first line, the government knows its best policy,  $g$ . In that case, whether it knows other policies or not, it chooses  $g$ ; so the other policies do not matter and are marked by dots. In the second line, the government knows the consumers' best policy,  $c$ , but not its own. As  $c$  is its second-best policy, it chooses  $c$  whether or not it knows policies  $f$  and  $w$ . In the third line, the government knows  $f$  but neither  $c$  nor  $g$ . As  $f$  is its third-best, it chooses  $f$ . In the fourth line, it knows only  $s$  and so, by A5, sticks to it. This exhausts the payoff-relevant information partition.

Table 2: Information, policy decisions, and payoffs

Gov. known set					Policy	Payoffs
$c$	$f$	$g$	$s$	$w$	choice	$(u^c, u^f, u^g)$
.	.	1	1	.	$g$	$(u_g^c, u_g^f, 1)$
1	.	0	1	.	$c$	$(1, -2, u_c^g)$
0	1	0	1	.	$f$	$(-1, 1, u_f^g)$
0	0	0	1	.	$s$	$(0, 0, 0)$

### 3.2 Stage one

In stage one, the lobbies decide on the game's timing, their search intensity, the timing of disclosure, and the disclosure itself. Consider first the disclosure strategy.

If a lobby's search is successful, the full mapping from policies to payoffs is revealed to it; that is, all policies become “known” to the lobby, but the information is private. The choice at this stage is how much to disclose. For the consumers, the choice is trivial because policy  $c$  is the government's second best; therefore, disclosing  $c$  and only  $c$  is always optimal. For the firm, however, it is non-trivial. Suppose that the firm's search is successful, and either that (i) the game is simultaneous, or (ii) it is sequential with the firm playing first, or (iii) it is sequential, but with the consumers playing first and delaying disclosure. Suppose further that the firm discloses only  $f$ ; we will call this “partial disclosure”. If the consumers fail in their search, the government will choose  $f$ , with a payoff equal to one for the firm. But if the consumers also succeed, the government will know both  $f$  and  $c$  and will choose  $c$ , with a payoff of minus two for the firm. Suppose now that the firm discloses both  $f$  and  $g$ ; we will call this “full disclosure” (here, whether or not the firm also discloses policy  $c$  is irrelevant). Then, whatever the outcome of the consumers' search, the government will pick its first best,  $g$ , with a payoff between zero and one for the firm. Thus, full disclosure is safe whereas partial is a lottery whose terms worsen with the consumers' search intensity.

We solve for optimal search intensities under full and partial disclosure and then fold back payoffs to determine the firm's disclosure choice as a function of the parameters. In doing so, we assume that the firm commits to a disclosure strategy at the beginning of the game.

### 3.2.1 Full disclosure

Under full disclosure, upon successful search the firm discloses not only its preferred policy, but also that preferred by the government in order to “insure” against a consumer win. Let  $v^j(e^c, e^f, e) = E[u^j(e^c, e^f, e)]$ , where the expectation uses equilibrium probabilities of success ( $e^c$ ,  $e^f$ , and the government's parametric probability of success  $e$ ). Given A1-A5, expected payoffs under full disclosure are

$$v^c(e^c, e^f, e) = eu_g^c + (1 - e)[e^c(1 - e^f) + e^f u_g^c] - \frac{(e^c)^2}{2} \quad (1)$$

for the consumers,

$$v^f(e^c, e^f, e) = eu_g^f + (1 - e)[e^f u_g^f - 2e^c(1 - e^f)] - \frac{(e^f)^2}{2} \quad (2)$$

for the firm, and

$$v^g(e^c, e^f, e) = e + (1 - e)[e^c(1 - e^f)u_g^c + e^f] \quad (3)$$

for the government. It is easily checked that all three functions are strictly quasi-concave in own search efforts. Their cross-partial derivatives are

$$\frac{\partial v^f}{\partial e^c} = -2(1 - e)(1 - e^f) \leq 0 \quad (4)$$

for the firm and

$$\frac{\partial v^c}{\partial e^f} = (1 - e)(u_g^c - e^c) \leq 0 \quad (5)$$

for the consumers. Thus, the consumers' search exerts a negative externality on the firm, except in a corner solution where  $e = 1$  (fully informed government) or  $e^f = 1$  (full search by the firm). In both cases, the government implements its preferred policy with probability one no matter what the consumers say (remember that under full disclosure, the firm reveals  $g$ ). By contrast, the externality that the firm's search exerts on consumers is ambiguous, as a higher search intensity by the firm has two conflicting effects. On one hand, it spoils the consumers' search by raising the chance that the government gets to know  $g$ , which would lead to a second-best outcome for the consumers. On the other hand, it reduces the probability that no one succeeds, which would result in maintenance of the status-quo, an undesirable outcome. When  $u_g^c$  is high (relative to the status quo's utility which is zero), the second effect dominates and the externality is positive; when it is low, the first effect dominates and it is negative.

In a simultaneous search game, lobby  $j$ 's maximization problem is

$$\max_{e^j} v^j \quad \text{s.t.} \quad 0 \leq e^j \leq 1, \quad ; j = c, f. \quad (6)$$

Let  $\lambda^j$  and  $\mu^j$  be two Lagrange multipliers. Kuhn-Tucker conditions are

$$\begin{aligned}(1 - e)(1 - e^f) - e^c - \lambda^c e^c - \mu^c (1 - e^c) &= 0, \\ \lambda^c &\geq 0, \quad e^c \geq 0, \quad \lambda^c e^c = 0, \\ \mu^c &\geq 0, \quad e^c \leq 1, \quad \mu^c (1 - e^c) = 0,\end{aligned}$$

for the consumers and

$$\begin{aligned}(1 - e)(u_g^f + 2e^c) - e^f - \lambda^f e^f - \mu^f (1 - e^f) &= 0, \\ \lambda^f &\geq 0, \quad e^f \geq 0, \quad \lambda^f e^f = 0, \\ \mu^f &\geq 0, \quad e^f \leq 1, \quad \mu^f (1 - e^f) = 0,\end{aligned}$$

for the firm. Reaction functions in  $(e^c, e^f)$  space are<sup>8</sup>

$$R^c(e^f, e) = (1 - e)(1 - e^f), \quad (7)$$

$$R^f(e^c, e) = \min \{ (1 - e)(u_g^f + 2e^c); 1 \}. \quad (8)$$

In an interior solution, their slopes are of opposite signs. The consumers' is downward-sloping:

$$\frac{\partial R^c}{\partial e^f} = -(1 - e) < 0,$$

whereas the firm's is upward-sloping:

$$\frac{\partial R^f}{\partial e^c} = 2(1 - e) > 0.$$

The positive slope of the firm's reaction function reflects the usual strategic complementarity in contest success functions in rent-seeking games (Dixit, 1987) or patent races (see Reinganum, 1984, and references therein). By contrast, the negative slope of the consumers' reaction function reflects the fact that, under full disclosure, the firm gives out the identity of policy  $g$ , which dominates any information they may provide. As a result, under full disclosure, a higher search intensity by the firm reduces the return to the consumers' own search.<sup>9</sup>

Their intercepts are respectively

$$R^c(0, e) = (1 - e), \quad (9)$$

$$R^c(1, e) = 0, \quad (10)$$

$$R^f(0, e) = (1 - e)u_g^f, \quad (11)$$

$$R^f(1, e) = \min \{ (1 - e)(u_g^f + 2); 1 \}. \quad (12)$$

While the direction of the externality from the firms to the consumers is, in general, indeterminate, Lemma 1 establishes that, under assumption A4, it is positive at the simultaneous game's equilibrium.

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<sup>8</sup>The formal definition of the reaction functions is given by  $R^c(e^f, e) = \max \{0; \min \{ (1 - e)(1 + e^f); 1 \} \}$ , and  $R^f(e^c, e) = \max \{0; \min \{ (1 - e)(1 - e^c); 1 \} \}$  but since some of the inequality constraints are never binding given A1-A5, we only write the possibly binding ones to facilitate reading.

<sup>9</sup>Note that this effect is different from the externality discussed above. While externalities have to do with the first cross-partial derivatives of the payoff functions, strategic complementarity/substitutability has to do with the second cross-partial derivative. See Kempf and Rota-Graziosi (2010) for a full discussion.

**Lemma 1** *At the equilibrium of the simultaneous search game under full disclosure,  $\partial v^c / \partial e^f > 0$ .*

**Proof.** Let  $e_*^i$  stand for  $e^i$  evaluated at the simultaneous game's equilibrium. By (5),  $\partial v^c / \partial e^f|_{(e_*^c, e_*^f)} > 0$  if  $u_g^c > e_c^c$ . As  $u_g^c > 1/2$  under A4, it suffices to show that  $e_*^c \leq 1/2$  for any value of  $e \in [0, 1]$ . Substituting (8) into (7), simplifying and expressing  $e_c^c$  as a function of  $e$  gives

$$e_*^c(e) = \frac{(1-e)[1-(1-e)u_g^f]}{1+2(1-e)^2}. \quad (13)$$

The function  $e_*^c(e)$  reaches a maximum at

$$e = \frac{1}{2} \left( u_g^f + 2 - \sqrt{(u_g^f)^2 + 2} \right) \quad (14)$$

at which

$$e_*^c = \frac{1}{4} \left( \sqrt{(u_g^f)^2 + 2} - u_g^f \right). \quad (15)$$

As  $e_*^c$  is decreasing in  $u_g^f$  on  $[0, 1]$ , it suffices to show that  $e_*^c(0) < 1/2$ ; but  $e_*^c(0) = \sqrt{2}/4 < 1/2$ , which completes the proof. ■

Reaction functions are illustrated in Figure 1 for  $e = 0.5$  and  $u_g^f = 0.6$ . As both payoff functions are quasi-concave, Lemma 1 allows us to superimpose payoff contours and to determine the region that Pareto-dominates the simultaneous game's equilibrium. We also illustrate the Stackelberg point inside this zone, which will be the solution of the timing game. Figure 1 shows that, in the simultaneous-game equilibrium, the consumers search too much and the firm too little. This is established formally in Lemma 2.

**Lemma 2** *At the equilibrium of the simultaneous search game under full disclosure, a combined rise in the search intensity of the firm and reduction in that of the consumers would make both better off.*

**Proof.** It suffices to note that, along a first-order Taylor expansion of  $v^c$  around  $(e_c^c, e_c^f)$ ,

$$v^c(e_*^c - \varepsilon, e_*^f + \varepsilon) = v^c(e_*^c, e_*^f) - \varepsilon \frac{\partial v^c}{\partial e^c} \Big|_{(e_*^c, e_*^f)} + \varepsilon \frac{\partial v^c}{\partial e^f} \Big|_{(e_*^c, e_*^f)} + R. \quad (16)$$

where  $R$  stands for higher-order terms. By the envelope theorem, the first partial derivative is zero, while the second is positive by Lemma 1. Similarly,

$$v^f(e_*^c - \varepsilon, e_*^f + \varepsilon) = v^f(e_*^c, e_*^f) - \varepsilon \frac{\partial v^f}{\partial e^c} \Big|_{(e_*^c, e_*^f)} + \varepsilon \frac{\partial v^f}{\partial e^f} \Big|_{(e_*^c, e_*^f)} + R \quad (17)$$

where the first partial derivative is negative by Lemma 1 while the second is zero by the envelope theorem. Thus,  $v^c(e_*^c - \varepsilon, e_*^f + \varepsilon) > v^c(e_*^c, e_*^f)$  and  $v^f(e_*^c - \varepsilon, e_*^f + \varepsilon) = v^f(e_*^c, e_*^f) > v^f(e_*^c, e_*^f)$ . ■

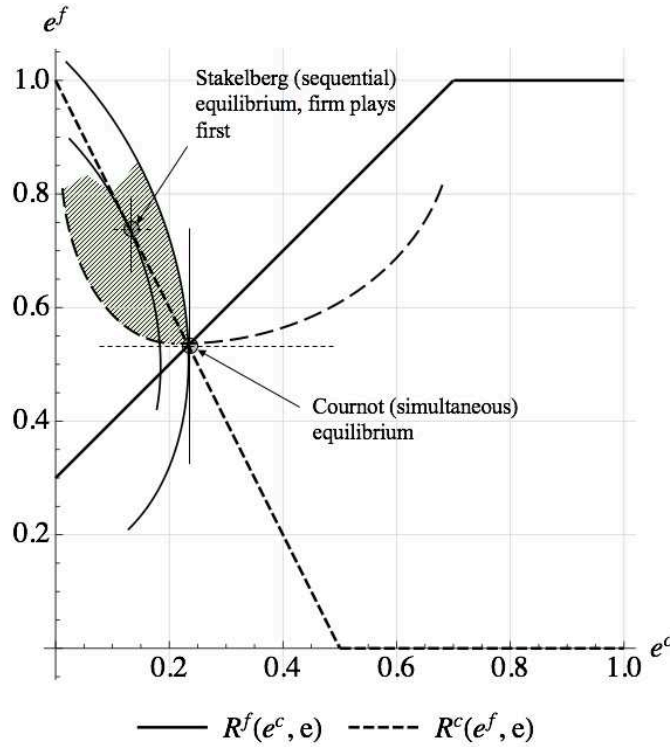
If the Pareto zone included the vertical axis in Figure 1, Lemma 2 would imply that a commitment by the consumers to stay out of the search game was optimal. However, under A1-A5 no feasible parameter configuration can be found that would yield that outcome. Instead, we allow players to improve on the simultaneous-game equilibrium by choosing the timing of play prior to the play itself, without committing in advance to a particular search intensity. This corresponds to Hamilton and Slutsky’s “observable-delay” game. The timing game’s equilibrium is characterized in Lemma 3 below.

**Lemma 3** *The unique equilibrium of the extended observable-delay game under full disclosure has the firm playing first and the consumers playing second.*

**Proof.** Follows directly from Lemma 2 and Theorem V of Hamilton and Slutsky. ■

Intuitively, Hamilton and Slutsky’s Theorem V states that the player whose reaction function crosses the Pareto set is the one playing second (see Kempf and Rota-Graziosi 2010 for an extended treatment).<sup>10</sup> Here, by Lemma 2, that player is the consumer group (see Figure 1).

Figure 1: Reaction functions under full disclosure



Having determined the order of play, we now determine the timing of disclosure. Suppose first that the firm adopts a strategy of not disclosing whether its search was successful or

<sup>10</sup>Kempf and Rota-Graziosi (2010) give a full characterization of all cases depending on the signs of first and second cross-partial derivatives of payoff functions. Our setting corresponds to the case where both first and second cross-partial derivatives have opposite signs.

not before the consumers move. Then consumers base their choice on the game's common-knowledge structure and parameters and choose  $e^c = R(e^f)$ . Suppose, on the contrary, that the firm chooses to disclose the result of its search before the consumers move. If the firm's search is successful, the consumers revise their prior probability of a firm success from  $e^f$  to one and choose  $e^c = R(1)$ .<sup>11</sup> If the firm's search is not successful, the consumers revise their probability down to zero and choose  $R(0)$ . The expected value of  $e^c$  given  $e^f$  is then  $e^f R(1) + (1 - e^f)R(0)$  which, by (7), boils down to  $(1 - e)(1 - e^f) = R^c(e^f, e)$ . The firm's optimization problem as Stackelberg leader, irrespective of the timing of its disclosure, is thus

$$\max_{e^f} v^f(e^c, e^f, e) \quad \text{s.t.} \quad e^c = R^c(e^f, e) \quad (18)$$

where  $v^f(\cdot)$  is given by (2) and  $R^c(\cdot)$  by (7). Equilibrium search efforts, with a subscript  $F$  for full disclosure, are then

$$e_F^f = \frac{(1 - e)(u_g^f - 4e + 4)}{4(e - 2)e + 5} \quad (19)$$

and

$$e_F^c = \frac{(1 - e)(u_g^f(e - 1) + 1)}{4(e - 2)e + 5}. \quad (20)$$

We have now completely solved the subgame conditional on the firm adopting a full-disclosure strategy, by which we mean that upon successful search it forwards to the government the identity of all policies including  $f$  and  $g$ , enabling it to pick  $g$ . The subgame's properties and equilibrium outcome are all put together in Proposition 1 below:

**Proposition 1** *Under full disclosure,*

- *The firm's and consumers' search efforts are strategic complements along the firm's reaction function and substitutes along the consumers'.*
- *The consumers' search exerts a negative externality on the firm, whereas the firm's exerts a positive one on the consumers; therefore, a reduction in the consumers' search intensity combined with an increase in that of the firm is a Pareto improvement for them relative to the equilibrium of a simultaneous search game.*
- *The unique equilibrium of the timing game is a sequential play where the firm moves first; the resulting search outcome, characterized by (19) and (20), Pareto-dominates the simultaneous game's equilibrium outcome.*

The outcome of the full-disclosure subgame illustrates the central result of this paper; namely, that the government extracts an informational rent from the most extremist lobby by obtaining complete information generated at the latter's expense. The equilibrium outcome also has the interesting feature that the firm goes "all out" whereas the consumers show restraint, for reasons unrelated to those usually invoked to explain the predominance of producer lobbies against consumer ones (financial resources, concentration, or organizational capabilities). Here, consumers show restraint because they observe the firm going all out and

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<sup>11</sup>Recall that  $e^f$  is both a search effort and a probability of success.

therefore undercutting the return on their own efforts. Moreover, the consumers' "reactive" posture is not imposed by an exogenous order of play: They *choose* to play after the firm in order to mitigate incentives for excessive search, a result that has appeared in different contexts in the literature on costly information production (Henry, 2009).

### 3.2.2 Partial disclosure

Under partial disclosure, upon successful search the firm reveals only policy  $f$ . Expected payoffs are now

$$v^c(e^c, e^f, e) = eu_g^c + (1 - e)[e^c - (1 - e^c)e^f] - \frac{(e^c)^2}{2}, \quad (21)$$

for the consumers,

$$v^f(e^c, e^f, e) = eu_g^f + (1 - e)[(1 - e^c)e^f - 2e^c] - \frac{(e^f)^2}{2}, \quad (22)$$

for the firm, and

$$v^g(e^c, e^f, e) = e + (1 - e)[e^c u_c^g + (1 - e^c)e^f u_f^g]. \quad (23)$$

for the government. The payoff functions' cross-partial derivatives are now

$$\frac{\partial v^c}{\partial e^f} = -(1 - e)(1 - e^c) \leq 0 \quad (24)$$

for the consumers and

$$\frac{\partial v^f}{\partial e^c} = -(1 - e)(e^f + 2) < 0 \quad (25)$$

for the firm. Thus, both externalities are now negative except at corner solutions, and we can state while omitting the proof for brevity:

**Lemma 4** *At the equilibrium of the simultaneous search game under partial disclosure, a combined reduction in the search intensity of the firm and consumers would make both better-off.*

Reaction functions in  $(e^c, e^f)$  space are

$$R^c(e^f, e) = \min \{(1 - e)(1 + e^f); 1\}, \quad (26)$$

$$R^f(e^c, e) = (1 - e)(1 - e^c) \quad (27)$$

with slopes of opposite signs again, but now search intensities are strategic complements along the consumers' reaction function and substitutes along the firm's:

$$\frac{\partial R^c}{\partial e^f} = 1 - e > 0,$$

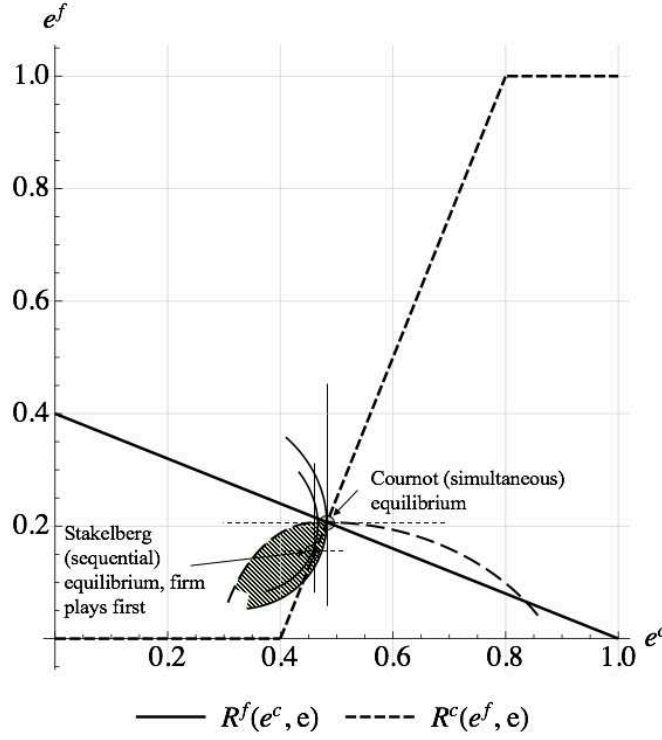
and

$$\frac{\partial R^f}{\partial e^c} = e - 1 < 0.$$

Reaction functions are shown in Figure 2 for  $e = 0.6$ , together with payoff contours and the Pareto set. Applying again Hamilton and Slutsky's Theorem V, we have



Figure 2: Reaction functions under partial disclosure



**Lemma 5** *The unique equilibrium of the extended observable-delay game under partial disclosure has the firm playing first and the consumers playing second.*

Disclosure timing is determined as before, and we can solve the game as a standard Stackelberg game, giving

$$e_P^f = \begin{cases} [e(5 - 3e) - 2] / [2e(e - 2) + 3] & \text{if } e \geq 2/3 \\ 1 - e & \text{otherwise} \end{cases} \quad (28)$$

and

$$e_P^c = \begin{cases} [1 + e^2(e - 2)] / [3 + 2e(e - 2)] & \text{if } e \geq 2/3 \\ 1 - e & \text{otherwise.} \end{cases} \quad (29)$$

Collecting together the results so far, we can state

**Proposition 2** *Under partial disclosure,*

- *The firm's and consumers' search efforts are strategic substitutes along the firm's reaction function and complements along the consumers'.*
- *Both the firm's and the consumers' search efforts exert negative externalities; therefore, a reduction in both is a Pareto improvement relative to the equilibrium of a simultaneous search game.*

- *The unique equilibrium of the timing game is a sequential play where the firm moves first; the resulting search outcome, characterized by (28) and (29), Pareto-dominates the simultaneous game's equilibrium outcome.*

Thus again, remarkably, the firm moves first. However, the reasons for this are now the opposite of what they were under full disclosure. Under partial disclosure, the information produced by both lobbies is a private good, since both forward only self-serving information to the government. As a result, there is now excessive search on both sides. Because search intensities are strategic complements along the consumers' reaction function, the only way for the firm to “cool down the game” is to move first at a low intensity, which also suits the consumers. In other words, instead of going all out to scare off the consumers as it did under full disclosure, now the firm plays a soft tune to soothe them.

### 3.3 Equilibrium outcomes

We now combine the subgame equilibrium outcomes of sections 3.2.1 and 3.2.2 to characterize the game's equilibrium as a function of the government's parametric information,  $e$ , under endogenous (switching) disclosure.

Substituting equilibrium search intensities (19) and (20) into (2) under full disclosure, let the firm's value function be  $\tilde{v}_F^f(e) = v_F^f[e_F^c(e), e_F^f(e), e]$ . Similarly, substituting (28) and (29) into (22) under partial, let the firm's value function be  $\tilde{v}_P^f(e) = v_P^f[e_P^c(e), e_P^f(e), e]$ . The firm's problem is now to choose a function  $\varphi(e) : e \rightarrow \{0; 1\}$  such that<sup>12</sup>

$$\varphi(e) \tilde{v}_F^f(e) + [1 - \varphi(e)] \tilde{v}_P^f(e) = \max_i \tilde{v}_i^f(e), \quad (30)$$

i.e. that picks the best of  $v_F^f$  or  $v_P^f$  at every value of  $e$ . Proposition 3 establishes that full disclosure is optimal for the firm [ $\varphi(e) = 1$ ] when the government is weakly informed.<sup>13</sup>

**Proposition 3** *Under assumptions A1-A5, there exists a critical value of  $e$ ,  $\tilde{e} > 0$ , such that  $\varphi(e) = 1 \forall e \leq \tilde{e}$ .*

**Proof.** Let  $\Delta v^f = v_F^f - v_P^f$ . The proposition is proved by establishing that (i)  $\Delta v^f$  is a continuous function of  $e$  at  $e = 0$ , and (ii)  $\Delta v^f|_{e=0} > 0$ . Expanding  $v_F^f$ , substituting from (7) and simplifying,

$$\begin{aligned} v_F^f(e) &= v_F^f\{e_F^f(e), R^c[e_F^f(e), e]\} \\ &= eu_g^f + (1 - e) \left[ e_F^f u_g^f - 2(1 - e) \left( 1 - e_F^f \right)^2 \right] - \frac{(e_F^f)^2}{2}. \end{aligned} \quad (31)$$

<sup>12</sup>We define the function  $\varphi$  as mapping  $e$  into  $\{0; 1\}$ , not the unit interval. This is a simplification. At any critical value of  $e$  where the firm is just indifferent between full and partial disclosure, the game may have mixed-strategy equilibria, which could be characterized using a function similar to  $\varphi$  but mapping  $e$  into interior values of the unit interval. However, the region of  $e$  where this happens has measure zero; so, generically, the game has only a pure-strategy equilibrium and we disregard any mixed-strategy one.

<sup>13</sup>It is not possible without further parameterization to establish a single-crossing property ensuring that there is only one critical value of  $e$ . Thus, it is possible that full disclosure becomes optimal again at some  $e > \tilde{e}$ , although we could not find numerical examples of that happening.

Similarly expanding  $v_P^f$ , substituting from (26) and simplifying,

$$\begin{aligned} v_P^f(e) &= v_P^f\{e_P^f(e), R^c[e_P^f(e), e]\} \\ &= eu_g^f + (1-e) \left[ e_P^f \left( 3e - 2 - e_P^f(1-e) \right) - 2(1-e) \right] - \frac{(e_P^f)^2}{2}. \end{aligned} \quad (32)$$

Subtracting (32) from (31) and simplifying,

$$\begin{aligned} \Delta v^f &= (1-e) \left[ e_F^f(4(1-e) - u_g^f - 2e_F^f(1-e)) + e_P^f(2 - 3e + e_P^f(1-e)) \right] \\ &\quad - \frac{(e_F^f)^2 - (e_P^f)^2}{2}. \end{aligned} \quad (33)$$

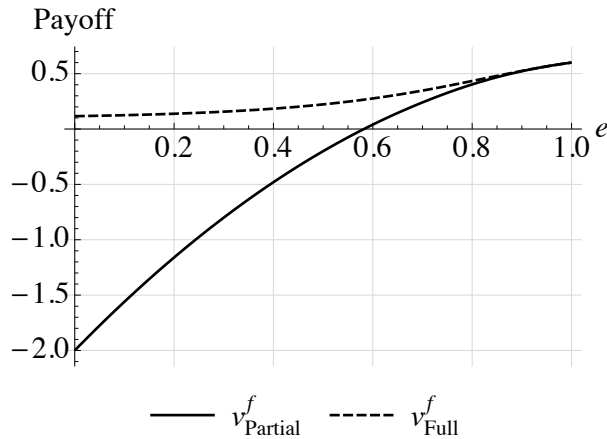
As  $e_F^f$  and  $e_P^f$  are continuous functions of  $e$  at  $e = 0$  by (19) and (28) respectively, so is  $\Delta v^f$ . Moreover, at  $e = 0$ , using (19),  $e_F^f = (u_g^f + 4)/5$ , whereas, using (28), the non-negativity constraint is binding for  $e_P^f$ . Thus, (33) simplifies to

$$\Delta v^f|_{e=0} = \frac{(u_g^f + 4)^2}{10} + \frac{35}{10} > 0.$$

■

Proposition 3 is illustrated in Figure 3, which plots the firm's value function under full and partial disclosure, i.e. its payoff evaluated at optimal search intensities  $(e_P^f, e_P^c)$  and  $(e_F^f, e_F^c)$  respectively, against the government's information  $e$ . The assumed value for  $u_g^f$  is 0.6, which means that the government's policy reduces firm profits by 40 percent compared to the firm's best policy ( $u_f^f = 1$ ); so full disclosure, which means that the firm's best policy is never implemented, is very costly. Nevertheless, under this parameterization, it remains the firm's optimal choice until the government's information reaches a critical value at  $e = 0.94$ , i.e. a probability of independently uncovering the policy-relevant information of 94 percent.

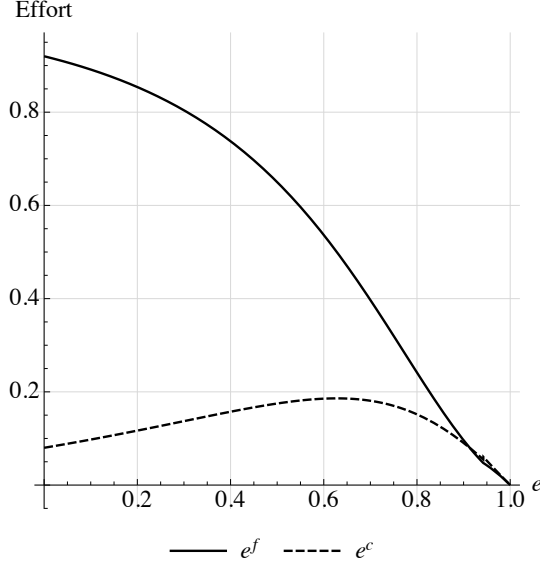
Figure 3: Firm's payoff against government information



The reason why the firm chooses full disclosure when the government is weakly informed ( $e$  low) is that the consumers' effort is highest, raising the risk of loss for the firm. This is

illustrated in Figure 4, using again  $u_g^f = 0.6$ .

Figure 4: Search intensities



We now turn to policy outcomes, i.e. to the equilibrium winning probability of each policy. Let us write  $\Pr(i)$  for the probability that policy  $i$  is chosen in equilibrium. The equilibrium probability that policy  $f$  is the one chosen by the government in stage 2 is

$$\Pr(f) = \begin{cases} 0 & \text{if } v_P^f(e) \leq v_F^f(e) \\ (1-e)(1-e_P^c(e))e_P^f(\cdot) & \text{otherwise.} \end{cases} \quad (34)$$

As discussed, it is zero when the firm chooses full disclosure. The equilibrium probability that policy  $c$  is chosen is

$$\Pr(c) = \begin{cases} (1-e)e_P^c(e)[1-e_F^f(e)] & \text{if } v_P^f(e) \leq v_F^f(e) \\ (1-e)e_P^c(e) & \text{otherwise.} \end{cases} \quad (35)$$

The probability that policy  $g$  is chosen is

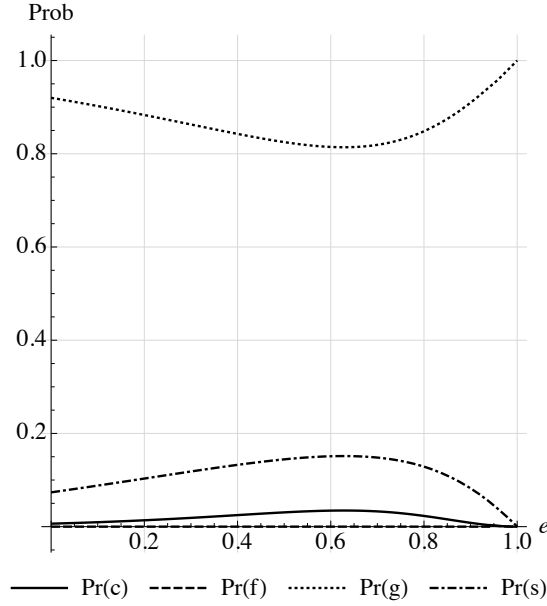
$$\Pr(g) = \begin{cases} e + (1-e)e_P^f(e) & \text{if } v_P^f(e) \leq v_F^f(e) \\ e & \text{otherwise.} \end{cases} \quad (36)$$

Finally, the probability that the government chooses to do nothing out of ignorance (the status quo) is

$$\Pr(s) = \begin{cases} (1-e)[1-e_P^c(e)][1-e_F^f(e)] & \text{if } v_P^f(e) \leq v_F^f(e) \\ (1-e)[1-e_P^c(e)][1-e_F^f(e)] & \text{otherwise.} \end{cases} \quad (37)$$

Figure 5 plots these probabilities for  $u_g^f = 0.6$ . The probability that policy  $g$  (the socially optimal one by assumption) wins is high even at low levels of the government's information, highlighting the power of the government's informational rent.

Figure 5: Probability of policy implementation



## 4 Extension: Offensive Lobbying

Up til now, we assumed that the firm had more to lose from the consumers' policy ( $u_c^f = -2$ ) than the consumers had to lose from the firm's ( $u_f^c = -1$ ); it was in this sense that the firm was a “high-stakes” player. If this particular payoff structure was appropriate to capture situations such as glutamate monosodium, where consumers were campaigning over diffuse health hazards while the firm was struggling to keep a cash cow on the market, one may wonder whether this “defensive” posture is the reason underlying the firm's choice of full disclosure. It is thus important to explore whether full disclosure can remain optimal in a situation where the firm does not have much to loose from the consumers' policy but has much to gain from its own. Moreover, such a situation, which we call “offensive” lobbying, potentially characterizes many real-life circumstances where firms seek regulatory rents (from trade protection or other distortions to competitions) at the expense of the public at large.

Take the case of software Intellectual Property (IP) protection in Europe. Unlike in the U.S., where patent and copyright protection have been available for a long time to software developers, in Europe the doctrine was initially that software was not an invention and was consequently not patentable. However, things started to change in the 1990s under pressure from the industry. In 1998, the European Commission, lobbied by software firms, proposed a directive making “computer-implemented inventions” patentable. In reaction, a broad range of stakeholders, including software engineers, computer-science academics, and the open-source movement organized themselves around the Foundation for a Free Information Infrastructure (FFII), a German NGO, in order to lobby against the proposed directive, giving rise to an unprecedented grass-root movement in Europe. The FFII made available large amounts of documentation, legal arguments, talking points and promotional material to software activists.

All stakeholders knew what they wanted: The Commission wanted to encourage software innovation, the industry wanted barriers to imitation, and the FFFII wanted open access and free entry. However, as in our model, how best to promote these objectives was less clear. For instance, would a patent policy really foster the development of new software, or would it create entry barriers detrimental to innovation and to small or medium firms? A number of studies, mostly based on US data, were commissioned respectively by the software industry, the Commission and the open-source activists, with conflicting evidence. In July 2005, the Commission ended up adopting a middle-of-the-road directive that offered limited IP protection for software. Both parties claimed victory, the FFII because it had thwarted the adoption of a strict patent system, and the industry because free-for-all had been averted.

In such a setting, the appropriate payoff structure is one in which the firm gains disproportionately if it can convince the government to adopt a particular policy. One then expects it to search at a high intensity, not so much to avoid the policy preferred by consumers, but to have its own implemented. The question is whether this drastically affects the logic of our results in the sense of leading to likelier adoption of the firm's extreme policy, as predicted by the political-economy literature. In order to explore this, we modify the game's assumptions as follows:

$$A1' \quad u_f^f = 2; \quad u_i^i = 1 \quad \forall i \neq f; \quad u_j^i < 1 \quad \forall i \neq j;$$

$$A2' \quad u_f^c = -1; \quad u_c^f = -1;$$

$$A3' \quad 0 < u_f^g < u_c^g;$$

$$A4' \quad 1/2 < u_g^f < u_g^c;$$

$$A5' \quad 1 + u_c^g + u_f^g + \ell^g < 0;$$

Note that Assumptions A3'-A5' are unchanged from A3-A5; only A1' and A2' differ. The resulting payoff structure is shown in Table 3.

Table 3: Policy outcomes

Policy	Payoff to		
	<i>c</i>	<i>f</i>	<i>g</i>
<i>c</i>	1	-1	$u_c^g$
<i>f</i>	-1	2	$u_f^g$
<i>g</i>	$u_g^c$	$u_g^f$	1
<i>s</i>	0	0	0
<i>w</i>	$\ell^c$	$\ell^f$	$\ell^g$

Comparing Tables 1 and 3, there is no change in the payoff vectors of the consumers (first column) or the government (third column). The only change is in the first two elements of

the firm's payoff vector (second column): If the consumers win (first line), the firm's loss is now only -1 instead of -2 previously, whereas if the firm wins (second line), its gain is now 2 instead of 1. While payoffs change, the rules of the game remain the same.

#### 4.1 Full disclosure

The firm's payoff function (the only one affected by the change in the payoff structure) is now

$$v^f(e^c, e^f, e) = eu_g^f + (1 - e)[e^f u_g^f - e^c(1 - e^f)] - \frac{(e^f)^2}{2}. \quad (38)$$

Its cross-partial derivative is, as in section 3.2.1, non-positive:

$$\frac{\partial v^f}{\partial e^c} = -(1 - e)(1 - e^f) \leq 0 \quad (39)$$

and the firm's reaction function is

$$R^f(e^c, e) = \min \{(1 - e)(u_g^f + e^c); 1\} \quad (40)$$

which is, as before, upward-sloping:

$$\frac{\partial R^f}{\partial e^c} = (1 - e) > 0.$$

As the signs of both first- and second-order cross-partial derivatives of payoff functions are all unchanged from section 3.2.1, so are the timing game's equilibrium, which has the firm playing first and the consumers second, and the timing of disclosure. Keeping the notation of previous sections, equilibrium effort levels under full disclosure are now respectively

$$e_F^f = \frac{(1 - e)(u_g^f - 2e + 2)}{2(e - 2)e + 3} \quad (41)$$

and

$$e_F^c = \frac{(1 - e)(u_g^f(e - 1) + 1)}{2(e - 2)e + 3}. \quad (42)$$

#### 4.2 Partial disclosure

Under partial disclosure, the firm's payoff function is

$$v^f(e^c, e^f, e) = eu_g^f + (1 - e)[2(1 - e^c)e^f - e^c] - \frac{(e^f)^2}{2}, \quad (43)$$

with cross-partial derivative

$$\frac{\partial v^f}{\partial e^c} = -(1 - e)(2e^f + 1) < 0 \quad (44)$$

and reaction function

$$R^f(e^c, e) = \min \{2(1 - e)(1 - e^c); 1\}. \quad (45)$$

Again, the signs of both first- and second-order cross-partial derivatives of payoff functions are all unchanged from section 3.2.2, and so are the timing game's equilibrium, which has the firm playing first and the consumers second, and the timing of disclosure. Equilibrium search intensities are now

$$e_P^f = \begin{cases} [e(4 - 3e) - 1] / [4e(e - 2) + 5] & \text{if } e \geq 1/3 \\ 0 & \text{otherwise} \end{cases} \quad (46)$$

and

$$e_P^c = \begin{cases} [(1 - e)(e - 2)^2] / [4e(e - 2) + 5] & \text{if } e \geq 1/3 \\ 1 - e & \text{otherwise.} \end{cases} \quad (47)$$

### 4.3 Equilibrium outcomes

Using the notation of previous sections, i.e. letting  $\varphi(e) \in \{0; 1\}$  be the weight on full disclosure in the firm's strategy, we can now restate the equivalent of Proposition 3 as

**Proposition 4** *Under assumptions A1'-A5', there exists a new critical value of  $e$ ,  $\hat{e} > 0$ , such that  $\varphi(e) = 1 \forall e \leq \hat{e}$ .*

**Proof.** Expanding  $v_F^f$ , substituting from (7), which is unchanged, and simplifying,

$$v_F^f(e) = eu_g^f + (1 - e) \left[ e_F^f u_g^f - (1 - e)(e_F^f - 1)^2 \right] - \frac{(e_F^f)^2}{2}. \quad (48)$$

Similarly expanding  $v_P^f$ , substituting from (26), which is again unchanged, and simplifying,

$$v_P^f(e) = eu_g^f + (1 - e) \left[ e_P^f(3e - 1 - 2e_P^f(1 - e)) - (1 - e) \right] - \frac{(e_P^f)^2}{2}. \quad (49)$$

Subtracting (49) from (48) and simplifying,

$$\begin{aligned} \Delta v^f &= (1 - e) \left[ e_P^f(1 + 2e_P^f(1 - e) - 3e) + e_F^f(u_g^f + 2(1 - e) - e_F^f(1 - e)) \right] \\ &\quad - \frac{(e_F^f)^2 - (e_P^f)^2}{2}. \end{aligned} \quad (50)$$

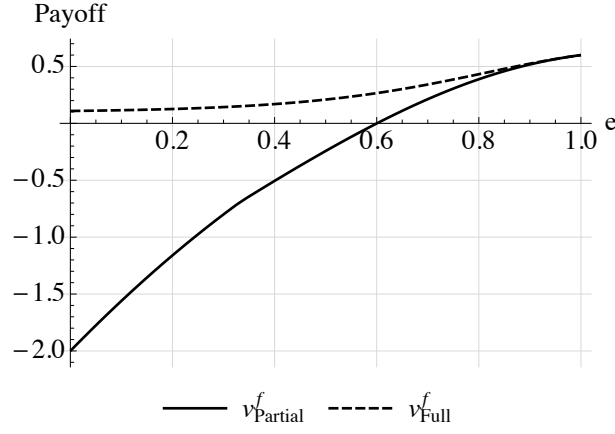
Again,  $e_F^f$  and  $e_P^f$  being continuous functions of  $e$  at  $e = 0$  by (41) and (46) respectively, so is  $\Delta v^f$ . Moreover, at  $e = 0$ , using (41),  $e_F^f = (e_g^f + 2)/3$ , whereas, using (46), the non-negativity constraint is again binding for  $e_P^f$ . Thus, (50) simplifies to

$$\Delta v^f|_{e=0} = \frac{(4 + u_g^f)(8 + 7u_g^f)}{50} > 0.$$

■

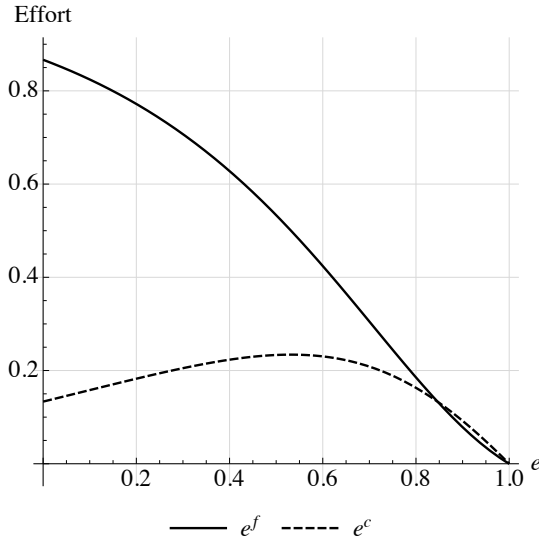


Figure 6: Firm's value functions



Proposition 4 is illustrated in Figure 6 for the usual  $u_g^f = 0.6$ . The story is qualitatively the same as under defensive lobbying.<sup>14</sup> Search intensities are plotted in Figure 7 and policy winning probabilities in Figure 8, also for  $u_g^f = 0.6$ .

Figure 7: Search intensities

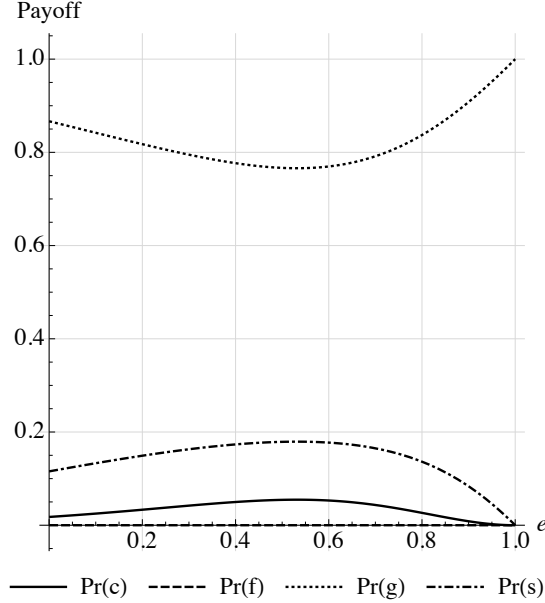


While jumps at the critical value of  $e$  now look larger for an identical parameterization, the overall logic remains unaffected, with the firm searching at a high intensity at low values of  $e$  while the consumers have a non-monotone search intensity. The equilibrium implementation probability of the government's policy remains disproportionately large in this new setting, even at low levels of  $e$ , while the probability that the firm's extreme policy is implemented

<sup>14</sup>No tractable analytical expression could be derived for  $\tilde{e} - \hat{e}$ , so we do not attempt to rank them.

is still relatively low.

Figure 8: Probability of policy implementation



## 5 Concluding remarks

The objective of our model was to extend the literature on informational lobbying to a setting with asymmetric preferences and stakes, in order to explore, in that setting, information aggregation by a benevolent government and information-production incentives by lobbies. We found a somewhat paradoxical result; namely, that socially optimal policies can emerge in equilibrium because the government extracts an informational rent primarily from the most extremist lobby, turning it into a truth-teller. The interest of our result stems from the fact that its logic is fairly general as long as information is verifiable and preferences are asymmetric. In any group of individuals, the one with the most extreme preferences is likely to suffer a “credibility gap” in the sense that information coming from him will be discarded in favor of information coming from more moderate members; to make up for that and avoid his (moderate) opponents’ opinion from winning, he may choose to disclose unbiased information, becoming the group’s truth-teller.

Formally, our result is derived in two distinct settings. Both share a set of common features, including an asymmetry of preferences and stakes (in a cardinal-utility sense), an informational structure where both lobbies need to spend real resources to search for information, and strategic information at two broad levels, information production and information disclosure. The difference between the two settings is in their payoff structures. In one, the firm (the high-stakes player) loses disproportionately from implementation of the consumers’ policy; we call this configuration one of “defensive lobbying” and use it to portray situations

where consumer groups lobby against a particular firm, say by demanding a ban on one of its core products. In the alternative, the firm gains disproportionately from implementation of its preferred policy; we call this configuration one of “offensive lobbying” and use it to portray situations of rent-seeking.

Our thought experiment consists of deriving comparative-statics results on the government’s parametric level of information, which we use as a proxy for its experience or analytical capabilities. The most intuitive interpretation of the comparative statics on government information is to think of it as an electoral cycle, with a fresh, inexperienced government arriving in power and accumulating experience over the cycle. In both settings, when the government is relatively uninformed (at the beginning of the cycle), the firm spends a large amount of resources searching for information, but it adopts a conservative disclosure policy where it feeds the government with unbiased information in order to neutralize the information conveyed by the consumer group. As the government gathers experience, it relies less and less on the information conveyed by lobbies, substituting its own. The incentive for costly information search shrinks for the lobbies, and equilibrium outcomes increasingly reflect the government’s preferences based on its own information. Thus, as in common-agency models, in our model lobby rivalry serves as a substitute for government information to pull policies toward the center.



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