"Where Ignorance is Bliss, 'tis Folly to be Wise": Transparency and Welfare in Contests*

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Abstract

We study situations where two parties vie to capture some scarce resource. While one party's valuation is common knowledge, the other's is private information. Is the right policy to mandate the disclosure of valuations? When competition occurs via a noisy all-pay auction, the answer is no. Under mild conditions, decentralizing the disclosure decision produces less wasteful competition and more efficient outcomes than mandating disclosure. Often the parties agree on whether to disclose information – in other words the incentives for information acquisition and disclosure are aligned. Our results have implications for transparency policy in lobbying, electoral competition and international relations among others.

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JEL-Classification: D72, D82, L12

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1 Introduction

Transparency is widely seen as a remedy for agency problems. Transparency laws are relatively cheap for the policy maker and easy to understand. They are very popular with politicians as well as the public. As the New York Times states "...the ideal of transparency has become as patriotic as apple pie in the post-Enron era" (The New York Times (2006)). Hence it is important to understand the implications of transparency policy. Typically, transparency works by holding the responsible actors accountable for their actions, thus making undesirable behavior less likely. Examples abound. Banking transparency and disclosure of bank activities are suggested to prevent future banking crises, money laundering, tax evasion, and other fraud. Transparency of CEO and top management wages is supposed to stop firms from making secret deals and overpaying their managers. In politics, transparency is supposed to impede selfish and corrupt behavior by politicians. But accountability is not the only implication of transparency. In this paper we identify an aspect of transparency that is often neglected in the public debate. We show how transparency in competitive environments can have bad consequences for society – it can sharpen wasteful competition while at the same time reducing efficiency.

Consider some examples of competitive environments in which transparency policy is an issue: political campaigning, international relations, firm competition and lobbying, especially in form of rent-seeking. In the U.S., transparency in political campaigning is regulated by the Federal Election Campaign Act (FECA). It requires candidates to disclose sources of campaign contributions and campaign expenditure quarterly. The United States Supreme Court recently ruled in *Citizens United vs. Federal Election Commission* that corporate funding of political broadcasts in elections cannot be limited under the First Amendment, thus further increasing transparency. Not only the public opinion is affected by contributions disclosure but also the campaigners themselves. Disclosure of campaign contributions conveys information about the (future) financial support of a candidate and this in turn influences the outcome of the election.

Another competitive setting where transparency policy matters is international relations. Take for example transparency about nuclear armament. The amount of nuclear arms a country possesses is an indicator of its military potential, which in turn is a determinant of its bargaining power on the international stage. Recently the Obama administration formally disclosed the size of the U.S. Defense Department's stockpile of nuclear weapons: 5113 warheads as of September 30, 2009 (The Federation of American Scientists (2010)). Other countries like Israel, China or Pakistan prefer a policy of opacity.

Now consider competition between firms. In the U.S., the Securities and Exchange Commission (SEC) as well as the Federal Accounting Standards Board (FASB) regulate firm's disclosure of financial information. This information is not only accessible by stakeholders of a firm but also by its competitors, which has implications for competition between firms if private information is revealed. Our results shed light on how mandatory disclosure influences competition in winner-take-all markets, or more generally markets where competition can be represented by a contest. This is for example the case in advertising intensive markets, like the market for softdrinks.

Finally, transparency policy has also received a lot of attention in lobbying. In the U.S., lobbyists are required to disclose their client's lobbying expenditures quarterly by the Lobbying Disclosure Act of 1995 and its 2007 amendment. On the other hand, lobbying disclosure in the European Union works solely on a voluntary basis. Lobbyists can choose to register with the EU register of interest representatives, follow their code of conduct and disclose their expenditures annually. Many firms and organizations actually do report their lobbying expenditures voluntarily. There is some evidence that average reported expenditures are lower in the EU than in the U.S.[1] We offer an explanation which is consistent with these facts.

Our main results are:

- Mandating disclosure in a competitive environment can be a poor policy. We identify conditions where it leads to increased competition and less efficient outcomes.

- Decentralizing information disclosure is often beneficial. We identify conditions where competing groups will agree to transparency decisions, benefiting both the competitors and society at large.

- As the outcome of the contest becomes more sensitive to contest expenditures (e.g. luck and outside factors become less important), decentralized agreement becomes less likely. In these circumstances, a laissez-faire transparency rule is not optimal either.

Our main results may be illustrated in the following simple setting: Two groups are vying for some prize. One of these groups (the rival) has a known valuation for the prize while the valuation of the other group is (potentially) unknown, and may be either high or low. The key intuition underlying all of the results stems from the following observation: Competition is fiercest when the two rivals have similar valuations and milder when valuations diverge. Thus, if the disclosing group faces a strong opponent, competition will be fierce if it discloses a high valuation and mild when its value is revealed to be low. Since not disclosing leads to an intermediate level of competition, low valuation groups prefer to reveal while high valuation groups do not. The reverse is true when the disclosing group faces a relatively weak opponent: high valuation groups prefer disclosure while low valued groups prefer opacity. How does this translate into a group's *ex ante* disclosure policy? A group's expected payoffs are dominated by how it fares when it has a high valuation since this raises both the benefits and chances of

[1]Friends of the Earth Europe (2010) show that 60% of the 50 largest firms disclosed voluntarily in 2008 and that they were reporting on average more lobbying expenditures in the U.S. than in their home market.

winning the contest. As a result, the optimal policy is to disclose when the rival is relatively weak and to remain opaque when the rival is relatively strong.

Now, let us consider the opposite situation—the decision of the rival to acquire information. While better information helps the rival to choose an optimal effort level, if the decision to acquire information is revealed, then its opponent will also respond. When the rival is relatively strong, it is better off not acquiring information since, if this information reveals that its opponent has a high valuation, competition is sharpened while if the opponent is revealed to have a low valuation, then the rival can no longer credibly commit to deter its opponent through overinvestment. Thus, information acquisition is unambiguously bad. On the other hand, when the rival is relatively weak, acquiring information reduces the efforts of the opponent regardless of valuation—in the case of high valuation, it stems from the revealed divergence of values while in the case of low valuation, it stems from discouragement.

A central insight to emerge from this analysis is that, despite the fact that the two sides are competing, there is broad agreement on disclosure/acquisition: sharing information is favored by both sides when the rival is relatively weak and favored by neither when the rival is relatively strong. While the two sides differ as to who should receive the prize, they both agree that competition benefits neither party. Since information sharing affects the degree of competition, there is scope for agreement. What is perhaps more surprising is that reduced competition also leads to greater efficiency in allocating the prize. When information sharing is optimal, it results in greater separation in the efforts of the two parties and, as a result, the prize is awarded to the higher valued group more often. Likewise, when information sharing is not optimal, it again results in greater separation of efforts. Thus, endogenous information sharing leads to *ex ante* Pareto gains. In this circumstance, mandatory disclosure policies merely serve to increase wasteful competition and distort prize allocations.

The paper is organized as follows. Next we survey the related literature. Section 2 introduces the model. Section 3 studies information acquisition and section 4 disclosure incentives separately while section 5 puts the two decisions together. Section 6 considers a more general contest success function and section 7 draws conclusions for the desirability of mandatory disclosure policy. Section 8 studies the robustness of our findings with respect to the discriminatoryness of the competition. Section 9 concludes.

Literature Review

The nearest antecedent to our paper is Kovenock, Morath, and Münster (2010), who study information disclosure between firms when the contest outcome is very sensitive to contest expenditures. Our concerns are with both information disclosure and acquisition and how they relate to the sensitivity of the contest outcome to expenditures. Baik and Shogren (1995) study the effects of spying and information acquisition in contest games. To gain tractability, they abstract away from strategic considerations in the expenditures themselves – essentially, the contest game is decision-theoretic. Our analysis, however, highlights the importance of the strategic interaction between acquisition/disclosure and contest expenditures. Indeed, our main result is that acquisition changes the behavior not just of the party gaining new information but also the party whose information was disclosed.

Information transmission from lobbies to the policy maker through lobbying has been studied for example by Potters and van Winden (1992), Lagerlöf (2007) and Grossman and Helpman (2001). The focus of this literature is on the welfare implications of lobbying when lobbyists have private information which is relevant to the policy maker and the policy maker attempts to learn by observing lobbying expenditures. In contrast we focus on information transmission between lobbyists and its implications for welfare and efficiency, and highlight consequences for disclosure policy.

One of our main results is to show that it can be optimal for a lobbying group or firm to remain ignorant about the valuation its rival places on "winning" the contest. The strategic value of ignorance has also been shown in the context of agency theory. A principal may benefit from ignorance as it alters the agent's incentives to exert effort. The agent may benefit as well, as ignorance may make it harder for the principal to extract rents. Papers highlighting these effects are for example Dewatripont and Maskin (1995), Barros (1997) and Kessler (1998). While this literature focusses on vertical relationships between two distinct parties, in our model the focus is on competing parties who are essentially identical.

Information disclosure has also been studied in the context of goods markets, e.g. Jovanovic (1982), Milgrom (2008) and Daughety and Reinganum (2008), where the focus is on whether markets lead to optimal incentives for firms to disclose information about the quality of their goods. This literature revolves around the trade-off that disclosure is beneficial for the consumer but costly to the seller. In contrast, we show that mandatory disclosure can be harmful even without direct monetary costs, purely through its strategic effect.

Asymmetric information in contests has also been much studied (e.g. Hurley and Shogren (1998), Katsenos (2009) and Moldovanu and Sela (2001)), although this literature has mainly ignored voluntary information disclosure and acquisition and the consequences for mandatory disclosure policy. Also the role of commitment in contests has received ample attention, see for example Dixit (1987), Baik and Shogren (1992), Morgan (2003), Morgan and Várdy (2007), Yildirim (2005) and Fu (2006), though the form of commitment typically consists of committing to a sequence of moves. In contrast we study contests where players are able to commit to certain informational regimes.

2 The Model

While we couch the model in the context of lobbying, it is easily translated into other competitive situations. See footnote 3 for an example. Consider two lobbying groups $i = A, B$ who vie for favorable legislation to be passed. Success yields lobby i a value v_i while failure yields zero. To affect the chances of success, each group chooses lobbying effort x_i. The chance that i is successful depends on the contest success function (CSF):

$$p_i(x_i, x_j) = \frac{x_i}{x_i + x_j}. \tag{1}$$

If both groups choose zero lobbying effort ($x_i = 0$) a coin toss determines success. Lobbyists are risk-neutral with a constant marginal cost of effort normalized to one. While each lobbying group knows its own valuation for success, information about the other party differs. In particular, the valuation of group A is commonly known while group B has private information about its value. One can think of this situation arising when group A is an "incumbent" who has engaged in many past fights over related issues while group B is a newcomer or, alternatively, where publicly available information makes it easy to estimate A's value while B's value, perhaps being more subjective, is harder for outsiders to estimate. For simplicity, we assume that B's value is binary—it is either low, $v_B = v_L$, with probability q or high, $v_B = v_H$, with the complementary probability.[2] The payoff functions are equal to

$$\begin{aligned}
\pi_B &= \frac{x_B}{x_B + x_A} v_B - x_B \\
\pi_A &= \left(q \frac{x_A}{x_{BL} + x_A} + (1-q) \frac{x_A}{x_{BH} + x_A} \right) v_A - x_A.
\end{aligned}$$

We focus on the case where there is uncertainty as to the identity of the higher valued lobbying group, i.e., when $v_A \in [v_L, v_H]$. Otherwise the efficient policy is obvious. Furthermore we assume that the policy is valuable enough for all lobbying groups to choose strictly positive lobbying effort.[3]

[2] In the appendix, we show that qualitatively similar results are obtained when B's distribution of values occurs on a continuum.

[3] We can easily reframe our model in terms of another introductory example – political campaigns. Two politicians $i = A, B$ are campaigning for a political office. The political office yields i a value v_i while failure yields a value normalized to zero. To affect the chances of success, each politician chooses some amount of campaign expenditures x_i. The chance that i is successful depends on the contest success function (CSF) defined in equation 2. The talent of the incumbent politician is more or less common knowledge and hence his value for office v_A is known. For the newcomer we assume the value is low with probability q and high else.

3 Information Disclosure

In the European Union, 60% of the top 50 European companies voluntarily disclosed their lobbying expenditures in the EU register of interest representatives in the year 2008[4]. This information enables other lobbyists to infer something about their opponent's valuation for the legislation at stake. Instead of making a decision about lobbying expenditures under uncertainty about the opponent's valuation, a lobbying group can then decide on expenditures knowing the valuation of its opponent. Hence it can make a better decision as to its optimal lobbying strategy. Since lobbying is a competitive activity giving one's opponent an advantage is not desirable. So why do lobbyists disclose information voluntarily?

To keep the analysis simple and focus on our main point we assume that lobbyists can choose to directly disclose their valuations before the contest starts. In the appendix we extend the analysis to a richer dynamic model, where expenditures can be disclosed in an ongoing competition. We show how disclosure can be very profitable in certain situations.

Let us assume that lobbying group B can choose to credibly disclose its valuation to lobbying group A before the contest, either before or after it learns its valuation for the legislation at stake. Even though disclosure enables the opponent to make a more informed decision, this does not necessarily mean that the disclosing group is hurt by this. For example if the opponent learns that the group has a very high valuation it will optimally react by lowering its expenditures, as its chances of success are so slim, and this is beneficial for both groups. On the other hand, if the opponent learns the lobbying group has a very low valuation, it might also find it beneficial to lower its expenditures, as not much is needed for success.

We find that whether lobbying group B knows its valuation or not, information is only disclosed when B faces a relatively weak group A. Formally,

Proposition 1. *a) Assume lobbying group B does not know its value yet. If lobbying group B expects to be relatively weak compared to lobbying group A ($\sqrt{v_L v_H} < v_A$) it strictly prefers not to disclose its valuation and votes against mandatory disclosure. On the other hand, a lobbying group B with a high expected valuation ($\sqrt{v_L v_H} > v_A$) always votes in favor of mandatory disclosure.*

b) After lobbying group B learns its valuation and given the chance to send a costly signal before the contest to group A, only a high-value lobbying group credibly reveals its valuation. This is only profitable in a situation where group A is relatively weak ($\sqrt{v_L v_H} > v_A$). Otherwise no information is disclosed.

Proof. See appendix. □

[4] The EU register of interest representatives can be found online at: https://webgate.ec.europa.eu/transparency/regrin/welcome.do?locale=en.

To make the intuition behind Proposition 1 clearer let us first look at the incentives of a high- and a low-value lobbying group B separately. A high-value lobbying group B will prefer disclosure if it can discourage lobbying group A from expending lobbying effort. This is the case whenever it is relatively strong, or $v_A < \sqrt{v_L v_H}$. For $v_A \geq \sqrt{v_L v_H}$ disclosing makes A more aggressive, as it learns that its opponent is quite similar. The opposite is true for a weak lobbying group B. When facing a strong group A it prefers to disclose its valuation, as A will react with lower lobbying effort. If A is weak on the other hand, revealing its valuation makes competition stronger, as A learns that it is facing a similarly strong opponent. The weak and the strong lobbying group B's incentives are never aligned. If disclosing is beneficial for one, it is harmful to the other. From an ex-ante point of view, before learning its valuation, the strong lobbying groups' interests always dominate though. The reason is that an increase in success probability in case the value is high is worth more than in case the value turns out to be low. This intuition carries over to the second part of Proposition 1 as well. A lobbying group with a high valuation stands to gain more from a decrease in A's lobbying effort. This means that it is willing to expend more signaling effort than a low-value group. If it is in its interest, it will always be able to imitate a low-value group's signal so that no information can be credibly disclosed. Hence against a strong group A information will never be disclosed because it is detrimental to the high-value group, while against a weak group A the high-value group is willing to credibly disclose its valuation through the costly signal.

4 Information Acquisition

Instead of waiting for an opposing lobbying group to disclose its valuation, a lobbyist might be tempted to acquire this information itself. In terms of our model, suppose that it were costless for group A to acquire a credible report as to B's valuation. One might be tempted to draw an analogy with a bargaining situation. In effect, A and B are negotiating (through their efforts) on who will receive the valuable legislative prize. The usual advice in such situations is to "know thy enemy." That is, group A should gather as much information as possible about group B, including its valuation. This information will enable it to make the best possible decision regarding its negotiation strategy, which can now be type-specific. Since information gathering is costless, it seems obvious that the optimal strategy is complete information gathering.

Where the analogy breaks down is in the form of the "negotiation" between the two parties. Here, success will be determined by performance in an imperfectly discriminating contest; thus, there is an integrative as well as distributive aspect to the "negotiation." In particular, both lobbying groups benefit if lobbying efforts are more muted and, since only relative lobbying efforts determine the outcome, equilibrium success probabilities would be unaffected if both sides could agree to scale down their efforts.

But how can ignorance enable the lobbying groups to scale down effort? Consider a lobbying group A which has a valuation above the average of lobbying group B. If it knew for sure it faces a strong group B, competition between the similarly strong groups would be very intense. But the chance to encounter a much weaker group B diminishes A's investment incentive, and hence also the strong group B's reaction. On the other hand, A overinvests against a weak group B to increase its chances in case its opponent turns out to be strong. The weak group B will react to this discouragement by lowering its investment. By optimally choosing to remain ignorant about lobbying group B's valuation, A can on the one hand discourage a weaker rival and on the other hand appease a stronger rival, thereby softening the competition between the two lobbies. Thus, unlike a decision-theoretic or negotiation context, rent-seeking competition between the two parties creates a value to ignorance.

A sharp illustration of this intuition may be seen for the case where group A has diffuse priors (i.e. $q = 1/2$). Here we show that, when group A is strong compared to B, it prefers to remain ignorant while when it is weak, it seeks information to mitigate this disadvantage. Formally,

Proposition 2. *If lobbying group A is relatively strong compared to group B ($v_A > \sqrt{v_L v_H}$) it strictly prefers not to acquire any information about B's value while a relatively weak lobbying group A ($v_A < \sqrt{v_L v_H}$) always acquires costless information about group B.*

Proof. See appendix. □

Notice that the conditions for information disclosure/withholding in Proposition 1 are identical to those in Proposition 2 when group A is determining whether to pursue this information. That is, despite competing with one another, both groups agree on information revelation. We formalize this observation in Proposition 3 below. Figure 1 illustrates the intuition behind the value to ignorance graphically. It shows the best response functions of both groups when A knows the valuation of group B. Optimal lobbying expenditures under full information are given where the best response functions intersect. If group A's value is above average, its lobbying effort under ignorance (vertical line) is lower than under full information in case it faces the high value opponent (panel a)), while the opposite is true against the low value opponent (panel b)). We can directly see that this benefits A by decreasing both its opponents' lobbying efforts.[5]

Softening competition through ignorance does not always work. If group A's valuation is below average, ignorance worsens competition. A weak group A invests very little when facing a much stronger group B while it fights hard against the just slightly weaker group B, where

[5]Technically speaking, our results are due to the non-monotonicity of reaction functions. This implies that efforts are strategic complements for the favorite while they are strategic substitutes for the underdog, where in our set-up the favorite is the group with the higher valuation.

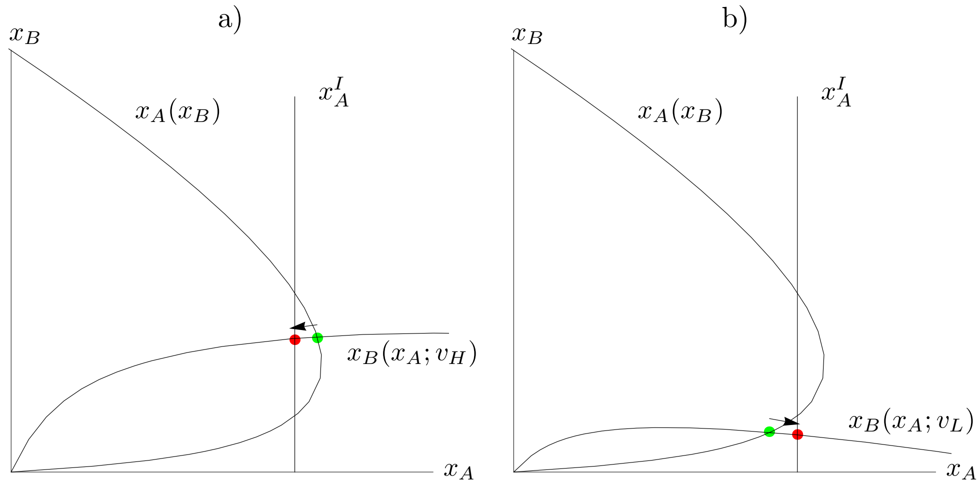


Figure 1: Panel a) shows the full-information best response functions when lobbying group A faces a strong opponent, panel b) when it faces a weak opponent. x_A^I denotes the lobbying effort of A under ignorance. Under ignorance (red dot) both types of B expend less than under full information (green dot).

competition is more equal. By staying ignorant A finds itself overinvesting in case it faces the stronger group B, which reacts to this threat with an increase in investment. At the same time it underinvests in case it faces the weak group B, which also reacts with an increase in investment, sensing a good opportunity. A weak lobbying group A always acquires costless information.

5 Information Transmission

So far we have analyzed the lobbying groups' disclosure and acquisition decisions separately. Now we combine these analyses to find out, how lobbying groups exchange information voluntarily. In a later section we then compare our findings to lobbying under mandatory disclosure policy. The game proceeds as follows: Prior to the start of lobbying, each lobbying group engages in information disclosure/acquisition decisions; that is, group A decides whether to pursue credible information about B's valuation while group B decides its disclosure policy. Following information acquisition/disclosure, both lobbying groups simultaneously choose lobbying efforts and payoffs are resolved. Figure 2 illustrates the flow of the game.

From now on, we assume that lobbying group B has not learned its valuation when deciding on the issue of information disclosure.[6] Then if both lobbying groups agree that information should be exchanged (B prefers disclosure and A acquisition) A will learn the value of group B. If on the other hand both lobbying groups agree not to disclose (B prefers non-disclosure and A ignorance), no information is transmitted. What is not so clear is what happens if A and B do

[6] In Proposition 1 we showed that our results extend to the case where B has learned its valuation and has the possibility to send a costly signal to group A.

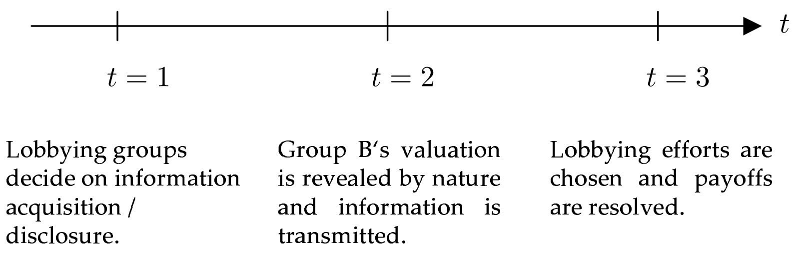


Figure 2: Sequence of moves

not agree. For example A might want to acquire information about B's value, but B might not be willing to disclose it. Or B might want to disclose its value while A does not want to acquire it. We assume that in both cases A does not learn the value of B, even though most of our results do not depend on this assumption. We will discuss the implications of this assumption in the relevant places.

First consider the case with group A having diffuse priors (i.e. $q = 1/2$). Then the lobbying groups always agree on information transmission between them. Formally,

Proposition 3. *If lobbying group B expects to be relatively weak compared to lobbying group A ($\sqrt{v_L v_H} < v_A$) both lobbying groups agree not to transfer any information while if lobbying group B expects to have a high valuation compared to A ($\sqrt{v_L v_H} > v_A$) both agree on disclosure.*

Proof. Follows from the proof of Propositions 1 and 2. □

Surprisingly, we find the lobbying groups' incentives to be always aligned. The reason for this is that there exist gains from coordination in the form of reduced competition. By coordinating, both parties can save on lobbying expenditures.[7] This is in a way similar to a finding in Baik and Shogren (1992) and Leininger (1993), who analyze the choice of the order of moves in sequential rent-seeking contests. Lobbying groups try to coordinate on the equilibrium where the least lobbying efforts are expended, which is possible if it is profitable for both. They find that both groups always prefer the weak group to go first. It chooses a low lobbying effort and the strong group reacts with lower lobbying effort as well. Even though the weak group ends up winning less often, it is compensated by lower lobbying costs. When choosing whether to disclose a similar logic applies. Staying ignorant can have a similar effect as moving first, if it enables A to move closer to its Stackelberg point. As we have shown, this is the case for a relatively

[7]Another example where voluntary exchange of information can be found, is armed conflict. As Thomas Schelling (1960) pointed out in his seminal work, "*[t]he ancients exchanged hostages, drank wine from the same glass to demonstrate the absence of poison, met in public places to inhibit the massacre of one by the other, and even deliberately exchanged spies to facilitate transmittal of authentic information*". Our analysis provides a rationale for this: exchanging authentic information decreases fierceness of conflict, something that is good for both parties.

strong lobbying group A. By staying ignorant it can credibly reduce its investment against the high-valuation lobbying group B who will react by reducing its expenditures as well. In the appendix we show that we can get a analogous result to Proposition 3 in a dynamic model of expenditure disclosure.

6 More General Contest Success Function

So far we have assumed that the lobbying process can be represented by a simple lottery contest. In order to show the robustness of our results, in this section we assume the political process can be represented by a more general CSF of the following form:

$$p_i(x_i, x_j) = \frac{f(x_i)}{f(x_i) + f(x_j)} \tag{2}$$

where $f' > 0$ and $f'' \leq 0$.[8]

As we have seen in the previous section, whether ignorance is bliss for lobbying group A is determined by whether or not its value is above the average of group B's valuations. Proposition 2 shows though, that it is not the arithmetic average; rather the decision to acquire information turns on the geometric mean of B's value. Next we show that such a critical value of lobbying group A, let us denote it by $\widehat{v}_A$, exists more generally.

Lemma 1. *For every q, there exists a value $\widehat{v}_A$ such that, if $v_A = \widehat{v}_A$, lobbying group A is indifferent between acquiring information or not, and lobbying group B is indifferent between disclosing information or not.*

Proof. See appendix. □

To illustrate the intuition for the proof of this lemma, assume A knows its opponent. When A faces a weak opponent B, a small lobbying effort will basically guarantee success for A. With an increase in B's value, A increases its optimal lobbying effort until both groups have an equal value. Here competition is at its fiercest. Now an increase in B's value will start to discourage A from investing, until at one point B becomes so strong that A invests barely anything. This logic implies that there will always be two possible values of group B, one larger than A's, one smaller, such that A expends exactly the same lobbying effort. If group B has exactly these values, v_L and v_H, A's behavior will be unchanged whether it knows B's value or not.

It is tempting to reason from Lemma 1 that Propositions 1 and 2 hold for more general prior probabilities of B's values v_L and v_H and more general lobbying technologies. Indeed, we can generalize Propositions 1 and 2 locally around the critical value $\widehat{v}_A$. For information disclosure we get:

[8] This is a standard contest success function, see Skaperdas (1996) for an axiomatization.

Proposition 4. *In a neighborhood of the critical value $\widehat{v}_A$, if lobbying group B expects to be relatively weak compared to lobbying group A ($v_A > \widehat{v}_A$) it strictly prefers not to disclose its valuation and votes against mandatory disclosure. On the other hand, a lobbying group B with a high expected valuation ($v_A < \widehat{v}_A$) always votes in favor of mandatory disclosure.*

Proof. See appendix. □

Exactly as with a lottery contest, information will be disclosed if lobbying group B is relatively strong. For information acquisition, we find:

Proposition 5. *In a neighborhood of the critical value $\widehat{v}_A$, if lobbying group A is relatively strong compared to group B ($v_A > \widehat{v}_A$) it strictly prefers to stay ignorant about lobbying group B's value, while a relatively weak lobbying group A ($v_A < \widehat{v}_A$) always acquires this information. Furthermore, when there is a unique $\widehat{v}_A$ satisfying Lemma 1, then the result holds globally.*

Proof. See appendix. □

But what is the reason that Proposition 5 only holds locally? The critical value $\widehat{v}_A$ for Lemma 1 is not necessarily the only critical value for A. Take for example a very strong lobbying group A with a value close to v_H and assume that the probability of facing a strong group B is small. Then group A's lobbying effort under ignorance is similar to the lobbying effort knowing it is facing a weak group B. But if B happens to be strong and A were ignorant, it would underinvest by a large amount. Even though this leads the strong group to reduce its effort, this is not optimal for group A. In fact, there is an optimal degree of underinvestment against a stronger opponent, the so-called "Stackelberg point". If A had the opportunity to precommit lobbying effort, this would be the effort it would optimally choose. Ignorance enables lobbying group A to move closer to this optimal point in certain situations. In other situations A will surpass the Stackelberg point, like in the example above, or move away from it as with a below-average valuation. In these situations acquiring information is the optimal strategy.

Putting Propositions 4 and 5 together, we get the generalized results on information transmission:

Proposition 6. *In a neighborhood of $\widehat{v}_A$, if lobbying group B expects to be relatively weak compared to lobbying group A ($\widehat{v}_A < v_A$) both lobbying groups agree not to transfer any information while if lobbying group B expects to have a high valuation compared to A ($\widehat{v}_A > v_A$) both agree on disclosure.*

Proof. Follows from the proof of Propositions 4 and 5. □

7 Mandatory Disclosure Policy

Typically the lobbying groups agree on whether to disclose information between themselves. But how do we evaluate their decision from a societal point of view? Society is interested in keeping (at least partially wasteful)[9] lobbying expenditures low as well as improving the probability that the most beneficial policy is chosen. Given the lobbyists' joint decision we now ask, whether there is need for a policy intervention to achieve these goals. Can the government increase welfare by making disclosure of lobbying expenditures mandatory? Let us first assume that the policy maker is concerned with keeping the expected wastefulness of the lobbying process low and it is irrelevant for society which lobbying group is successful. This is typically the case in rent-seeking contests. We then get the following result.

Proposition 7. *Aggregate effort is lower under*

- *information disclosure if lobbying group A is relatively weak ($v_A \leq \sqrt{v_H v_L}$),*
- *asymmetric information if lobbying group A is relatively strong ($v_A > \sqrt{v_H v_L}$).*

Proof. See appendix. □

As foreshadowed in section 5 we find that if the uninformed lobbying group is relatively strong, mandatory information disclosure makes the lobbying process more wasteful; in other words, transparency is detrimental to society. In addition, in a majority of situations the lobbying groups would voluntarily agree not to transfer any information, as we have shown in Propositions 3 and 6. In these cases decentralization is an optimal policy. If we assume that information can only be transferred when at least lobbying group B agrees to disclose her information, we can conclude the following.

Corollary 1. *If the policy maker is interested in keeping lobbying expenditures low a laissez-faire policy is always preferable to a policy of mandatory disclosure.*

Many policies are not purely of a redistributive nature and it is desirable that the policy with the highest cost-benefit ratio is chosen. Hence a policy maker should also be concerned about the allocative efficiency of mandatory disclosure policy. We define efficiency as the probability that the lobbying group with the highest valuation wins the lobbying contest.[10] Without the noisiness of the political process, transparency is clearly beneficial for efficiency. Only if it is

[9] Of course lobbying expenditures are only a transfer from lobbyists to the politician and hence not wasted in a narrow sense. On the other hand, lobbying draws financial and human resources which would otherwise have been used productively, for example for R&D. This misallocation of resources is a loss to society. For a discussion see for example Congleton (1988).

[10] Our results are robust to using an efficiency measure which weighs the probabilities with the respective valuation of the winner.

known which policy is the best, can it be chosen. When the political process is noisy though, transparency will influence the balance of power of the lobbying groups, sometimes favoring the weaker, sometimes the stronger one. This can lead to undesirable side-effects of transparency policy.

Proposition 8. *Efficiency is greater under*

- *information disclosure if lobbying group A is relatively weak ($v_A \leq \sqrt{v_H v_L}$),*
- *asymmetric information if lobbying group A is relatively strong ($v_A > \sqrt{v_H v_L}$).*

Proof. See appendix. □

What is the intuition for this finding? As we already discussed in section 4, asymmetric information enables the uninformed lobbying group to act similar to a Stackelberg leader when it is sufficiently strong relative to the informed lobbying group. Morgan (2003) finds that sequential rent-seeking contests dominate simultaneous ones in terms of efficiency. Hence if asymmetric information enables A to get closer to its Stackelberg point, which is true for $v_A > \sqrt{v_H v_L}$, it will also improve efficiency. Together with the results in Propositions 3, 6 and 7 we find the following.

Corollary 2. *Assume the policy maker is interested in increasing efficiency and keeping wastefulness of the lobbying competition low. Then a laissez-faire policy is always weakly superior, independent of the relative weights the policy maker places on the two goals. Mandatory disclosure policy is in many cases strictly dominated from a welfare perspective.*

Bringing transparency to lobbying is advertised as an important goal of many governments around the world, as for example the U.S. and the EU. We show how transparency, in the form of mandatory disclosure policy, affects the lobbying competition, making it more wasteful and less efficient. Even though it would seem at first glance that the lobbyists' and society's goals are very different it turns out that, in terms of information structure, their interests are in fact aligned. At the same time, our result has the potential to explain the emergence of mandatory disclosure policies, even though shown to be inefficient. A politician interested in maximizing his rent-seeking revenues always weakly prefers mandatory disclosure to voluntary disclosure.

8 Uncertainty about the Decision Maker and the Scope for Agreement

So far we have implicitly assumed that policy makers are not basing their decision solely on lobbying expenditures. By spending more in the contest a lobbying group can increase its chances to succeed, but there always remains some uncertainty. Put differently, the lobbying group with the lower expenditures still has a non-zero chance of success – the lobbying process is at least somewhat noisy. For example, policy makers may have preferences over political outcomes unknown to the lobbying groups. Also, policy makers may face imperfectly observable constraints, for example they might have to toe the party line. A member of a green party is unlikely to pass a bill prolonging the use of nuclear power plants. Another reason for a noisy lobbying process from the lobbying groups' perspective is that lobbying efforts are only imperfectly observable by the policy maker. This could be due to the complexity of the subject so that it is difficult for lobbyists to communicate their concerns properly, or because it is not clear ex-ante what the best strategy to approach a political decision maker is and which consequences of the favored bill to highlight.

We have captured this uncertainty by using a non-deterministic CSF of the ratio form, as defined in equation (2). We now consider a CSF which can be interpreted as the limiting case when noise vanishes completely and therefore the contest is perfectly discriminatory, the all-pay auction. It represents a situation where the political process is very sensitive to lobbying effort and where the lobbying group with the highest expenditure wins with certainty.[11] This higher sensitivity implies higher marginal returns of lobbying effort and therefore increases the fierceness of the competition. It is interesting to consider this situation as a limiting case, because it is implicitly assumed that politicians do not have any private preferences about the political outcomes, do not face any constraints and the process of communication between the lobbying groups and the policy maker is free of misunderstandings and noise. We show now how noisiness influences the incentives to coordinate on information transmission.

Proposition 9. *In the limit, as the the noisiness of the political process vanishes,*

1. *disclosing information is weakly dominated for lobbying group B,*
2. *staying ignorant is weakly dominated for lobbying group A,*
3. *the lobbying groups' incentives are never aligned and therefore they will never agree on transferring information voluntarily.*

Proof. See appendix.[12] □

This result reveals that the contest's degree of sensitivity to rent-seeking efforts influences when the lobbying groups agree on information transmission. In contrast to ratio form contests, in a fully discriminating contest the lobbying groups' incentives are never aligned. The informed

[11] The standard references analyzing the all-pay auctions are Hillman and Riley (1989), Baye, Kovenock, and de Vries (1993, 1996), and Krishna and Morgan (1997).

[12] A proof for part 2 of the Proposition has first been given in Kovenock, Morath, and Münster (2010) for two-sided asymmetric information and a continuous distribution of types.

group never discloses its information while the uninformed group always takes the opportunity to acquire information. Because of the extreme fierceness of competition there is no scope for agreement left.

Let us consider the lobbying groups' incentives separately. Why does lobbying group B never benefit from disclosing its valuation? Under a noisy political process, by disclosing its value, a strong group B discourages a weak group A from investing. This does not work when the political process is fully discriminating. By disclosing information, a strong lobbying group will only secure itself a payoff equal to the difference in valuations between itself and its opponent. All other rents are dissipated through competition. With asymmetric information competition is less fierce and it can in addition earn informational rents. In fact, it can secure itself the exact same payoff with one-sided asymmetric information (by marginally overbidding group A's valuation) and might even do better. Technically speaking, in all-pay auctions both reaction functions are monotonically increasing until the valuation of the weakest lobbying group so there will be no discouragement effect in the relevant range.

Why is there no value to ignorance? Lobbying group A never benefits from ignorance because, as politicians become perfectly responsive to lobbying expenditures, there is no advantage to moving first[13]. In fact, the low-valuation lobbying group is indifferent with respect to timing and the group with the higher value prefers to follow. In short, when lobbying groups know their opponents' value, payoffs are exactly the same, whether groups move sequentially or simultaneously. Hence the advantage from ignorance highlighted under an imperfectly discriminating political process does not apply in a setting where policy makers are perfectly responsive to lobbyists' influence. The disadvantage of making a suboptimal decision - in form of an only "on average" best response - does still apply. Since there are only costs to ignorance, lobbying group A always acquires information.

What are the consequences for disclosure policy? First of all, Proposition 9 shows that lobbying groups don't agree on disclosure and hence it is no longer clear what happens under a laissez-faire transparency rule. Furthermore, a reduction in aggregate effort and an increase in efficiency, the policy maker's two objectives, are no longer necessarily compatible. Aggregate effort is typically smaller under full information when A's value is not too close to either v_H or v_L and under asymmetric information else. Efficiency is typically greater under asymmetric information except if v_A is relatively small and q is relatively large. Figure 3 illustrates this for $v_L = 1$ and $v_H = 2$. In darkgray regions full information is optimal while in lightgray regions asymmetric information is preferred. So decreasing aggregate effort often implies decreasing efficiency. We can draw the following conclusions regarding mandatory and voluntary disclosure policy.

[13] This was shown for example in Konrad and Leininger (2007).

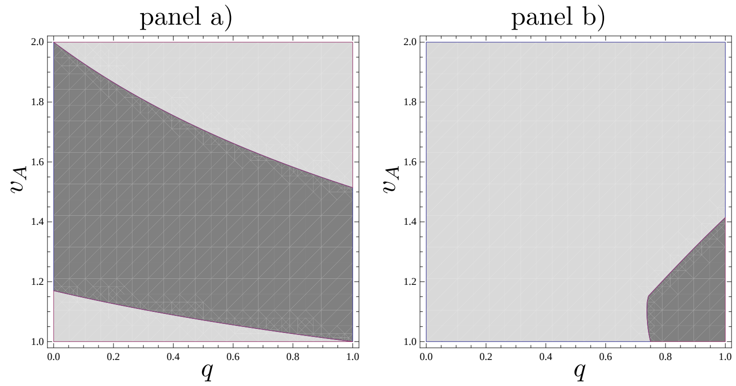


Figure 3: Aggregate effort (panel a)) and efficiency (panel b)).

Corollary 3. *Policy makers who are very responsive to the influence of lobbyists make decentralized agreements unlikely. In these circumstances, neither a laissez-faire transparency rule nor mandated disclosure is optimal. Furthermore, achieving an increase in efficiency and a decrease in aggregate effort through disclosure policy becomes unlikely as these two goals are typically in conflict.*

Asymmetric information has two effects on efficiency when the policy maker is perfectly responsive to lobbying expenditures. On the one hand it stratifies the range of efforts of lobbying group B. A low-valuation group chooses its investment from an interval of the form $[0, \underline{x}]$ while the high-valuation group chooses from $[\underline{x}, \overline{x}]$. In contrast, under full information they choose from the interval $[0, \overline{x_i}]$, $i = H, L$. This is beneficial for efficiency. On the other hand we showed that lobbying group B benefits from informational rents. Especially when A is very likely to face a low-valuation opponent and v_A is close to v_L, this becomes important for efficiency. B's informational advantage will lead to a low-valuation type winning too often, decreasing efficiency. In theses cases the detrimental effect of asymmetric information dominates and efficiency is higher under full information.

Summarizing our results, we find, as the contest becomes perfectly discriminating, the possibility to discourage an opposing lobbying group vanishes and hence the possibility to coordinate on information disclosure to reduce competition. As the strategic effect of information highlighted in the imperfectly discriminating contest becomes irrelevant, information only serves to make a better decision. As the contest becomes perfectly discriminating, the value to ignorance is lost.

9 Conclusion

A central insight to emerge from our analysis is that, despite the fact that parties are competing, there is broad agreement on disclosure/acquisition of private information. We find that sharing information is favored by both sides when the rival is relatively weak and favored by neither when the rival is relatively strong. The reason is that information sharing affects the degree of competition, and because both parties dislike fierce competition there is scope for agreement. We show that when the parties agree on information sharing, it also leads to greater efficiency in allocating the prize. Thus, the possibility of endogenous information sharing leads to ex ante Pareto gains.

Our results have important implications for disclosure policy. We identify how in competitive environments, as for example lobbying or political campaigning, mandatory disclosure policies increase wasteful competition and distort prize allocations. In terms of information disclosure the competing groups' and societies' interests are often aligned and voluntary disclosure reduces wastefulness and increases efficiency. Our results may help explain why the European Commission has resisted calls to adopt mandatory disclosure laws for EU lobbying.

We have highlighted an important mechanisms underlying information transmission in contests. Since we mostly abstract away from dynamics to focus on the role of information, future research should further explore the implications of transparency in more dynamic settings. For example if information is revealed through expenditures, a trade-off between taking early leadership by investing heavily and investing cautiously to be able to react to new information becomes important. Another interesting extension of our analysis would be to allow for common values. This can be relevant in many settings. In our lobbying example the lobbyists might posses relevant information about the value of the policy at stake, as for example when lobbying for a monopoly position and each firm has done market research. Lobbying groups learn not only about their opponent's interest, but also about their own. Furthermore sabotage might be a concern in these kinds of environments and this will influence the incentives for voluntary disclosure.

Appendix

A Proof of Propositions 1 and 2

A.1 Equilibrium under Full- and Asymmetric Information

Equilibrium efforts, probability of success and utility under full information are equal to (see Nti (1999))

$$\begin{aligned} x_i^{FI}(v_i, v_j) &= \frac{v_i^2 v_j}{(v_i+v_j)^2} \\ p_i^{FI}(v_i, v_j) &= \frac{v_i}{v_i+v_j} \\ u_i^{FI}(v_i, v_j) &= \frac{v_i^3}{(v_i+v_j)^2}. \end{aligned} \tag{3}$$

It is easily verified that A will invest more against a high-value opponent than against a low-value one iff $v_A > \sqrt{v_H v_L}$. Under one-sided asymmetric information effort, probability of success and utility in an interior solution are

$$\begin{aligned} x_A^{AI}(v_A, v_L, v_H) &= \frac{v_L v_H v_A^2 \left((1-q)\sqrt{v_L} + q\sqrt{v_H}\right)^2}{\left(v_H v_L + v_A\left((1-q)v_L + q v_H\right)\right)^2} \\ x_H^{AI}(v_A, v_L, v_H) &= \frac{\left((1-q)\sqrt{v_L} + q\sqrt{v_H}\right) v_A v_H \sqrt{v_L v_H}}{\left(v_H v_L + v_A\left((1-q)v_L + q v_H\right)\right)^2}\left(\sqrt{v_H} v_L + q v_A\left(\sqrt{v_H} - \sqrt{v_L}\right)\right) \\ x_L^{AI}(v_A, v_L, v_H) &= \frac{\left((1-q)\sqrt{v_L} + q\sqrt{v_H}\right) v_A v_L \sqrt{v_L v_H}}{\left(v_H v_L + v_A\left((1-q)v_L + q v_H\right)\right)^2}\left(\sqrt{v_L} v_H - (1-q) v_A\left(\sqrt{v_H} - \sqrt{v_L}\right)\right) \\ p_A^{AI}(v_A, v_L, v_H) &= \frac{v_A\left((1-q)\sqrt{v_L} + q\sqrt{v_H}\right)^2}{\left(v_H v_L + v_A\left((1-q)v_L + q v_H\right)\right)} \\ p_H^{AI}(v_A, v_L, v_H) &= 1 - \frac{v_A\left((1-q)\sqrt{v_L} + q\sqrt{v_H}\right)}{\left(v_H v_L + v_A\left((1-q)v_L + q v_H\right)\right)}\sqrt{v_L} \\ p_L^{AI}(v_A, v_L, v_H) &= 1 - \frac{v_A\left((1-q)\sqrt{v_L} + q\sqrt{v_H}\right)}{\left(v_H v_L + v_A\left((1-q)v_L + q v_H\right)\right)}\sqrt{v_H} \\ u_A^{AI}(v_A, v_L, v_H) &= \frac{v_A^3\left(q\sqrt{v_H} + (1-q)\sqrt{v_L}\right)^2\left(q v_H + (1-q)v_L\right)}{\left(v_A\left(q v_H + (1-q)v_L\right) + v_L v_H\right)^2} \\ u_L^{AI}(v_A, v_L, v_H) &= \frac{\left(v_L^{3/2}(v_A(1-q) + v_H) - (1-q)v_A\sqrt{v_H}v_L\right)^2}{(q v_A(v_H - v_L) + v_L(v_A + v_H))^2} \\ u_H^{AI}(v_A, v_L, v_H) &= \frac{\left(q v_A v_H\left(\sqrt{v_H} - \sqrt{v_L}\right) + v_H^{3/2} v_L\right)^2}{(q v_A(v_H - v_L) + v_L(v_A + v_H))^2}. \end{aligned} \tag{4}$$

A.2 Disclosing Information

To see whether group B prefers to disclose or not it is sufficient to look at group A's effort difference between full and asymmetric information. If A invests more under full information against B, B will clearly prefer asymmetric information. The difference in A's effort is equal to

$$
\begin{aligned}
\Delta x_{AH} &= \frac{v_A^2 v_H}{(v_A+v_H)^2} - \frac{v_L v_H v_A^2 \left((1-q)\sqrt{v_L}+q\sqrt{v_H}\right)^2}{\left(v_H v_L + v_A\left((1-q)v_L+qv_H\right)\right)^2} \\
&= \frac{q v_A^2 v_H^{3/2}\left(\sqrt{v_H}-\sqrt{v_L}\right)\left(v_A-\sqrt{v_H}\sqrt{v_L}\right)}{(v_A+v_H)^2\left(v_H v_L + v_A\left((1-q)v_L+qv_H\right)\right)^2} \\
&\quad \times \left(q v_A\sqrt{v_H}\sqrt{v_L} + q v_A v_H + 2(1-q)v_A v_L + q v_H^{3/2}\sqrt{v_L} + (2-q)v_H v_L\right) \\
\Delta x_{AL} &= \frac{v_A^2 v_L}{(v_A+v_L)^2} - \frac{v_L v_H v_A^2 \left((1-q)\sqrt{v_L}+q\sqrt{v_H}\right)^2}{\left(v_H v_L + v_A\left((1-q)v_L+qv_H\right)\right)^2} \\
&= -\frac{(1-q) v_A^2 v_L^{3/2}\left(\sqrt{v_H}-\sqrt{v_L}\right)\left(v_A-\sqrt{v_H}\sqrt{v_L}\right)}{(v_A+v_L)^2\left(v_H v_L + v_A\left((1-q)v_L+qv_H\right)\right)^2} \\
&\quad \times \left((1-q)\left(v_A\sqrt{v_H}\sqrt{v_L} + v_A v_L + \sqrt{v_H}v_L^{3/2}\right) + 2q v_A v_H + q v_H v_L + v_H v_L\right).
\end{aligned}
$$

At $v_A = \sqrt{v_L v_H}$ A's effort is identical, while for $v_A > \sqrt{v_L v_H}$ A underinvests against a high-value opponent and overinvests against a low-value one under asymmetric information. The opposite holds true for $v_A < \sqrt{v_L v_H}$. Hence it follows that for $v_A > \sqrt{v_L v_H}$ a high-value B prefers not to disclose, while a low-value one prefers disclosure and vice versa for $v_A < \sqrt{v_L v_H}$. Now let us consider the ex-ante expected utility of group B when it has not yet learned its value.

$$
\begin{aligned}
&E[\Delta u_B] = q\Delta u_L + (1-q)\Delta u_H = \frac{-(1-q)q v_A\left(\sqrt{v_H}-\sqrt{v_L}\right)^2\left(v_A-\sqrt{v_H}\sqrt{v_L}\right)}{(v_A+v_H)^2(v_A+v_L)^2\left(q v_A(v_H-v_L)+v_A v_L+v_H v_L\right)^2} \\
&\times \Big(\left(v_H^2-v_L^2\right) q v_A^2\left(v_A^2+v_A\sqrt{v_H v_L}+4v_H v_L\right) + q v_A\left(2v_A^2 v_H v_L + 2v_A v_H^{3/2}v_L^{3/2} + 2v_H^2 v_L^2\right)(v_H-v_L) \\
&+v_A^4 v_L^2 + v_A^3\left(2v_H^{3/2}v_L^{3/2} + 2v_H^2 v_L + \sqrt{v_H}v_L^{5/2} + 4v_H v_L^2 + 2v_L^3\right) + v_A\left(4v_H^3 v_L^2 + 6v_H^2 v_L^3 + 3v_H^{5/2}v_L^{5/2}\right) \\
&+v_A^2\left(2v_H^{5/2}v_L^{3/2} + 4v_H^{3/2}v_L^{5/2} + 2v_H^3 v_L + 7v_H^2 v_L^2 + 6v_H v_L^3\right) + 2v_H^3 v_L^3 + 2q v_A^3\left(v_H^3 - v_L^3\right)\Big)
\end{aligned}
$$

Hence for $v_A = \sqrt{v_L v_H}$ group B is also indifferent in expectation whether to disclose or not, while for $v_A > \sqrt{v_L v_H}$ it prefers not to disclose and for $v_A < \sqrt{v_L v_H}$ disclosure is optimal.

A.3 Signaling of Valuation

Now lobbying group B has the possibility to expend money before the contest in order to signal its valuation. Katsenos (2009) is the first to analyze costly signaling in a lottery contest with two-sided asymmetric information and two possible types of valuations, v_H and v_L. He finds that separating equilibria only exist, when the probability to face a strong opponent is sufficiently low. Instead, we analyze signaling with one-sided asymmetric information.

First we show that there cannot be a separating equilibrium when $v_A > \sqrt{v_H v_L}$. We have shown above that in this case H prefers non-disclosure or even being mistaken for a low-value group while L prefers disclosure. So let us assume L signals its type by expending some amount of costly signaling effort s_L while H spends s_H. s_H can only be zero, as for H it is the worst possible case that A believes him to be strong with certainty. Incentive compatibility requires that L's utility from signaling its type is larger than its utility from imitating H and vice versa. The respective utility differences are

$$\begin{aligned}
\Delta u_L &= -s_L - \frac{v_A^2 v_H}{(v_A+v_H)^2} + 2v_A\sqrt{\frac{v_H v_L}{(v_A+v_H)^2}} - \frac{v_L v_A^2 + 2v_A v_L^2}{(v_A+v_L)^2} \geq 0 \\
\Delta u_H &= s_L - \frac{v_A^2 v_L}{(v_A+v_L)^2} + 2v_A\sqrt{\frac{v_H v_L}{(v_A+v_L)^2}} + \frac{v_H^3}{(v_A+v_H)^2} - v_H \geq 0
\end{aligned}$$

and hence we require

$$\begin{aligned}
-\frac{v_A^2 v_H}{(v_A+v_H)^2} + 2v_A\sqrt{\frac{v_H v_L}{(v_A+v_H)^2}} + \frac{v_L^3}{(v_A+v_L)^2} - v_L &\geq s_L \\
\frac{v_A^2 v_L}{(v_A+v_L)^2} - 2v_A\sqrt{\frac{v_H v_L}{(v_A+v_L)^2}} - \frac{v_H^3}{(v_A+v_H)^2} + v_H &\leq s_L
\end{aligned}$$

which, is easily shown, can never be fulfilled at the same time. Hence there does not exist a separating equilibrium for $v_A > \sqrt{v_H v_L}$ and no information is credibly disclosed. On the other hand for $v_A < \sqrt{v_H v_L}$ H prefers disclosure while L prefers non-disclosure. Because now for L full-information is the worst case, it will never spend a positive amount of money to signal its type and $s_L = 0$, $s_H > 0$. The incentive compatibility constraint becomes

$$\begin{aligned}
\Delta u_L &= s_H - \frac{v_A^2 v_H}{(v_A+v_H)^2} + 2v_A\sqrt{\frac{v_H v_L}{(v_A+v_H)^2}} - \frac{v_L v_A^2 + 2v_A v_L^2}{(v_A+v_L)^2} \geq 0 \\
\Delta u_H &= -s_H - \frac{v_A^2 v_L}{(v_A+v_L)^2} + 2v_A\sqrt{\frac{v_H v_L}{(v_A+v_L)^2}} + \frac{v_H^3}{(v_A+v_H)^2} - v_H \geq 0.
\end{aligned}$$

It is easily shown that there always exists a $s_H > 0$ such that both incentive compatibility constraints are satisfied. There always exists a separating equilibrium for $v_A < \sqrt{v_H v_L}$ and information is disclosed.

A.4 Acquiring Information

Let us consider lobbying group A's incentives to acquire information. The difference in expected utility is equal to

$$
\begin{aligned}
D_A \quad = \quad & \frac{(1-q)qv_A^3\left(\sqrt{v_H}-\sqrt{v_L}\right)^2\left(v_A-\sqrt{v_H}\sqrt{v_L}\right)}{(v_A+v_H)^2(v_A+v_L)^2(qv_A\left(v_H-v_L\right)+v_Av_L+v_Hv_L)^2} \\
& \times\Big(\left(v_H-v_L\right)q\left(v_A^3-3v_A^2\sqrt{v_Lv_H}-v_Av_Hv_L-v_H^{3/2}v_L^{3/2}\right) \\
& -2qv_A\sqrt{v_Lv_H}\left(v_H^2-v_L^2\right)+v_A^3v_L-3v_A^2\sqrt{v_H}v_L^{3/2}-4v_Av_H^{3/2}v_L^{3/2} \\
& -v_Av_H^2v_L-2v_A\sqrt{v_H}v_L^{5/2}-2v_Av_Hv_L^2-v_H^{5/2}v_L^{3/2}-2v_H^{3/2}v_L^{5/2}-2v_H^2v_L^2\Big)
\end{aligned}
$$

For $v_A < \sqrt{v_Hv_L}$ A clearly prefers to acquire information, while for $v_A = \sqrt{v_Hv_L}$ it is indifferent. For v_A slightly larger than $\sqrt{v_Hv_L}$ it prefers ignorance while for v_A approaching v_H it might prefer to acquire information again. This implies we have to be careful about staying in an interior solution, in other words we need $v_L \geq \frac{(1-q)^2v_A^2v_H}{((1-q)v_A+v_H)^2}$ or $v_A \leq \frac{v_H\sqrt{v_L}}{(1-q)\left(\sqrt{v_H}-\sqrt{v_L}\right)}$.

Let $q=\frac{1}{2}$. Then the difference in utility for group A between full-information and asymmetric information is equal to

$$
\begin{aligned}
D_A \quad = \quad & \frac{v_A^3\left(\sqrt{v_H}-\sqrt{v_L}\right)^2\left(v_A-\sqrt{v_H}\sqrt{v_L}\right)}{2(v_A+v_H)^2(v_A+v_L)^2(v_Av_H+v_Av_L+2v_Hv_L)^2} \\
& \times\Big(\left(v_H+v_L\right)\left(v_A^3-3v_A^2\sqrt{v_H}\sqrt{v_L}-3v_Av_Hv_L-3v_H^{3/2}v_L^{3/2}\right) \\
& -2v_A\sqrt{v_H}\sqrt{v_L}\left(v_H^2+4v_Hv_L+v_L^2\right)-4v_H^2v_L^2\Big)
\end{aligned}
$$

We can show that this is unambiguously positive for $v_A < \sqrt{v_Lv_H}$ and negative for $v_A > \sqrt{v_Lv_H}$ given that we are in an interior solution. For $v_H > 9v_L$ the condition for an interior solution is binding. So for $v_H < 9v_L$ v_A can be as high as v_H. Let us plug this into the expression in brackets: $v_H^4 - 5v_H^{7/2}\sqrt{v_L} - 14v_H^{5/2}v_L^{3/2} - 5v_H^{3/2}v_L^{5/2} - 2v_H^3v_L - 7v_H^2v_L^2$. This is clearly strictly negative for all $v_H < 9v_L$. For $v_H > 9v_L$ we insert the highest possible v_A into the expression in brackets carries the sign of: $-\left(4v_H^{3/2} - 7v_H\sqrt{v_L} + v_L^{3/2}\right)$ which is always negative for $v_H > 9v_L$.

B Proof of Lemma 1

Proof. To see this, first note that (i) reaction functions are hump-shaped and (ii) reach a maximum where $x_A = x_B$, i.e. where the reaction function crosses the 45 degree line (for a proof see Yildirim (2005)). Moreover, we find an equilibrium on this line exactly when $v_A = v_B$, i.e. when the game is symmetric. Let us denote full-information symmetric efforts for $v_A = v_L$ by x_L and for $v_A = v_H$ by x_H. Keeping the valuation of the opponent fixed, a group's effort is strictly increasing in its own valuation. So let v_A increase from v_L to v_H. Then the effort of the L-value type is strictly decreasing (strategic substitute) and the effort of the H-value type is strictly increasing (strategic complement). If the opponent is of the L-value type, x_A increases from x_L to some $x_{HL} > x_L$. To the contrary, if the opponent is of the H type x_A increases from some $x_{LH} < x_L$ to x_H. Note that $x_H > x_{HL} > x_L > x_{LH}$, i.e. if the opponent is of the H-value type A's effort is at the beginning lower and at the end higher compared to the L-value type. Accordingly, by continuity there has to be some $\widehat{v}_A \in (v_L, v_H)$ for which efforts against both types of the other group are identical and equal to $\widehat{x}_A$.

If $v_A = \widehat{v}_A$ group A will spend the same lobbying effort in the full information games and in the asymmetric information game in equilibrium. Accordingly, both types of group B will choose the same effort independent of the informational environment, implying A's costs and winning probabilities are identical and thus A is indifferent between both information regimes. $\square$

C Proof of Proposition 4

At $v_A = \widehat{v}_A$ group B is exactly indifferent whether it discloses its information or not, ex-ante as well as interim, as group A always chooses the same lobbying effort. Let us increase v_A marginally from there. The derivative of the difference in the expected utility of player B between full information and asymmetric information (which we denote by D_B) with respect to v_A at $\widehat{v}_A$ can also be written as

$$\begin{aligned}\frac{\partial D_B}{\partial v_A}|_{v_A=\widehat{v}_A} &= (1-q)\left(v_H\left(-\frac{\partial p_H}{\partial x_A}\left(\frac{\partial x_{AH}^{FI}}{\partial v_A}-\frac{\partial x_A^{AI}}{\partial v_A}\right)-\frac{\partial p_H}{\partial x_H}\left(\frac{\partial x_H^{FI}}{\partial v_A}-\frac{\partial x_H^{AI}}{\partial v_A}\right)\right)-\left(\frac{\partial x_H^{FI}}{\partial v_A}-\frac{\partial x_H^{AI}}{\partial v_A}\right)\right)\\ &+ q\left(v_L\left(-\frac{\partial p_L}{\partial x_A}\left(\frac{\partial x_{AL}^{FI}}{\partial v_A}-\frac{\partial x_A^{AI}}{\partial v_A}\right)-\frac{\partial p_L}{\partial x_L}\left(\frac{\partial x_L^{FI}}{\partial v_A}-\frac{\partial x_L^{AI}}{\partial v_A}\right)\right)-\left(\frac{\partial x_L^{FI}}{\partial v_A}-\frac{\partial x_L^{AI}}{\partial v_A}\right)\right)\\ &= \left((1-q)v_H\left(\frac{\partial x_A^{AI}}{\partial v_A}-\frac{\partial x_{AH}^{FI}}{\partial v_A}\right)+q\,v_L\left(\frac{\partial x_A^{AI}}{\partial v_A}-\frac{\partial x_{AL}^{FI}}{\partial v_A}\right)\right)\frac{1}{\widehat{v}_A},\end{aligned}$$

using $p_i = \frac{f(x_A)}{f(x_A)+f(x_i)}$ and $x_i = x_B^i$, $i = H, L$ to shorten the exposition. We know that $v_A > 0$, $0 < q < 1$. $\frac{\partial p_H}{\partial x_A} = \frac{\partial p_L}{\partial x_A} = \frac{1}{v_A}$ and $\frac{\partial p_L}{\partial x_L} = -\frac{1}{v_L} < \frac{\partial p_H}{\partial x_H} = -\frac{1}{v_H} < 0$ follow from the first order conditions of the two groups.

The relevant equilibrium comparative statics are

$$\begin{aligned}\frac{\partial x_{AH}^{FI}}{\partial v_A}|_{v_A=\widehat{v}_A} &= \frac{-\frac{\partial^2 p_H}{\partial x_H^2}}{\left(\frac{\partial^2 p_H}{\partial x_A^2}\frac{\partial^2 p_H}{\partial x_H^2}-\left(\frac{\partial^2 p_H}{\partial x_A \partial x_H}\right)^2\right)v_A^2} > 0\\ \frac{\partial x_A^{AI}}{\partial v_A}|_{v_A=\widehat{v}_A} &= \frac{-\frac{\partial^2 p_H}{\partial x_H^2}\frac{\partial^2 p_L}{\partial x_L^2}}{\left(\frac{\partial^2 p_L}{\partial x_L^2}(1-q)\left(\frac{\partial^2 p_H}{\partial x_H^2}\frac{\partial^2 p_H}{\partial x_A^2}-\left(\frac{\partial^2 p_H}{\partial x_A \partial x_H}\right)^2\right)+\frac{\partial^2 p_H}{\partial x_H^2}q\left(\frac{\partial^2 p_L}{\partial x_L^2}\frac{\partial^2 p_L}{\partial x_A^2}-\left(\frac{\partial^2 p_L}{\partial x_A \partial x_L}\right)^2\right)\right)v_A^2} > 0\\ \frac{\partial x_{AL}^{FI}}{\partial v_A}|_{v_A=\widehat{v}_A} &= \frac{-\frac{\partial^2 p_L}{\partial x_L^2}}{\left(\frac{\partial^2 p_L}{\partial x_A^2}\frac{\partial^2 p_L}{\partial x_L^2}-\left(\frac{\partial^2 p_L}{\partial x_A \partial x_L}\right)^2\right)v_A^2} > 0.\end{aligned}$$

Using these in our derivative

$$\frac{\partial D_B}{\partial v_A}|_{v_A=\widehat{v}_A} = \frac{\left(\frac{\partial^2 p_H}{\partial x_H^2}\left(\left(\frac{\partial^2 p_L}{\partial x_A \partial x_L}\right)^2 - \frac{\partial^2 p_L}{\partial x_L^2}\frac{\partial^2 p_L}{\partial x_A^2}\right) + \frac{\partial^2 p_L}{\partial x_L^2}\left(\frac{\partial^2 p_H}{\partial x_H^2}\frac{\partial^2 p_H}{\partial x_A^2} - \left(\frac{\partial^2 p_H}{\partial x_A \partial x_H}\right)^2\right)\right)}{\left(\frac{\partial^2 p_L}{\partial x_A^2}\frac{\partial^2 p_L}{\partial x_L^2} - \left(\frac{\partial^2 p_L}{\partial x_A \partial x_L}\right)^2\right)\left(\frac{\partial^2 p_H}{\partial x_A^2}\frac{\partial^2 p_H}{\partial x_H^2} - \left(\frac{\partial^2 p_H}{\partial x_A \partial x_H}\right)^2\right) v_A^3} \times$$
$$\frac{\left(\frac{\partial^2 p_H}{\partial x_H^2} v_H\left(\left(\frac{\partial^2 p_L}{\partial x_A \partial x_L}\right)^2 - \frac{\partial^2 p_L}{\partial x_A^2}\frac{\partial^2 p_L}{\partial x_L^2}\right) + \frac{\partial^2 p_L}{\partial x_L^2} v_L\left(\frac{\partial^2 p_H}{\partial x_A^2}\frac{\partial^2 p_H}{\partial x_H^2} - \left(\frac{\partial^2 p_H}{\partial x_A \partial x_H}\right)^2\right)\right) q(1-q)}{\left(\frac{\partial^2 p_L}{\partial x_L^2}(1-q)\left(\frac{\partial^2 p_H}{\partial x_H^2}\frac{\partial^2 p_H}{\partial x_A^2} - \left(\frac{\partial^2 p_H}{\partial x_A \partial x_H}\right)^2\right) + \frac{\partial^2 p_H}{\partial x_H^2} q\left(\frac{\partial^2 p_L}{\partial x_L^2}\frac{\partial^2 p_L}{\partial x_A^2} - \left(\frac{\partial^2 p_L}{\partial x_A \partial x_L}\right)^2\right)\right)} < 0,$$

where we use $\frac{\partial^2 p_L}{\partial x_A^2} < 0$, $\frac{\partial^2 p_H}{\partial x_A^2} < 0$, $\frac{\partial^2 p_H}{\partial x_H^2} > 0$ and $\frac{\partial^2 p_L}{\partial x_L^2} > 0$ which follow from the shape of the CSF. $\frac{\partial^2 p_L}{\partial x_A x_L} > 0$ and $\frac{\partial^2 p_H}{\partial x_A x_H} < 0$ come from the fact that at $v_A = \widehat{v}_A$ A is an underdog against an opponent with valuation v_H but a favorite against an opponent with valuation v_L and

$$\frac{\partial^2 p_H}{\partial x_H^2}\left(\left(\frac{\partial^2 p_L}{\partial x_A \partial x_L}\right)^2 - \frac{\partial^2 p_L}{\partial x_L^2}\frac{\partial^2 p_L}{\partial x_A^2}\right) + \frac{\partial^2 p_L}{\partial x_L^2}\left(\frac{\partial^2 p_H}{\partial x_H^2}\frac{\partial^2 p_H}{\partial x_A^2} - \left(\frac{\partial^2 p_H}{\partial x_A \partial x_H}\right)^2\right) > 0.$$

Intuitively this term relates $\frac{\partial x_{AH}^{FI}}{\partial v_A}|_{v_A=\widehat{v}_A}$ to $\frac{\partial x_{AL}^{FI}}{\partial v_A}|_{v_A=\widehat{v}_A}$. For $\frac{\partial x_{AH}^{FI}}{\partial v_A}|_{v_A=\widehat{v}_A} > \frac{\partial x_{AL}^{FI}}{\partial v_A}|_{v_A=\widehat{v}_A}$ it will be positive and for $\frac{\partial x_{AH}^{FI}}{\partial v_A}|_{v_A=\widehat{v}_A} < \frac{\partial x_{AL}^{FI}}{\partial v_A}|_{v_A=\widehat{v}_A}$ it will be negative. For our CSF given in equation 2 it will always be positive. This means that starting at $x_A^L = x_A^H$ a slight increase in v_A will lead to a relatively higher increase in effort on the part of group A against the high-type opponent. Hence we find that at $v_A = \widehat{v}_A$ the derivative of D_B is strictly negative. □

D Proof of Proposition 5

We showed in Lemma 1 that if $v_A = \widehat{v}_A$ group A will be indifferent between ignorance and full-information. To prove the proposition we show that the derivative of the difference of utilities of A (which we denote by D_A) with respect to v_A is non-zero at $v_A = \widehat{v}_A$, which implies that for some valuations v_A slightly below (above) $\widehat{v}_A$ group A prefers to stay ignorant (acquire information) or the other way around. The derivative of D_A at $\widehat{v}_A$ is equal to

$$\begin{aligned}\frac{\partial D_A}{\partial v_A}|_{v_A=\widehat{v}_A} &= \left((1-q)\left(\frac{\partial p_H}{\partial x_A}\left(\frac{\partial x_{AH}^{FI}}{\partial v_A} - \frac{\partial x_A^{AI}}{\partial v_A}\right) + \frac{\partial p_H}{\partial x_H}\left(\frac{\partial x_H^{FI}}{\partial v_A} - \frac{\partial x_H^{AI}}{\partial v_A}\right)\right)\right. \\ &+ \left. q\left(\frac{\partial p_L}{\partial x_A}\left(\frac{\partial x_{AL}^{FI}}{\partial v_A} - \frac{\partial x_A^{AI}}{\partial v_A}\right) + \frac{\partial p_L}{\partial x_L}\left(\frac{\partial x_L^{FI}}{\partial v_A} - \frac{\partial x_L^{AI}}{\partial v_A}\right)\right)\right)\widehat{v}_A - \left((1-q)\frac{\partial x_{AH}^{FI}}{\partial v_A} + q\frac{\partial x_{AL}^{FI}}{\partial v_A}\right) + \frac{\partial x_A^{AI}}{\partial v_A}.\end{aligned}$$

We use $p_i = \frac{f(x_A)}{f(x_A)+f(x_i)}$ and $x_i = x_B^i$, $i = H, L$ to shorten the exposition. We know that $v_A > 0$, $0 < q < 1$. $\frac{\partial p_H}{\partial x_A} = \frac{\partial p_L}{\partial x_A} = \frac{1}{v_A}$ and $\frac{\partial p_L}{\partial x_L} = -\frac{1}{v_L} < \frac{\partial p_H}{\partial x_H} = -\frac{1}{v_H} < 0$ follow from the first order conditions of the two groups. The derivative simplifies to

$$\frac{\partial D_A}{\partial v_A}|_{v_A=\widehat{v}_A} = -\left(\frac{(1-q)}{v_H}\left(\frac{\partial x_H^{FI}}{\partial v_A} - \frac{\partial x_H^{AI}}{\partial v_A}\right) + \frac{q}{v_L}\left(\frac{\partial x_L^{FI}}{\partial v_A} - \frac{\partial x_L^{AI}}{\partial v_A}\right)\right)\widehat{v}_A.$$

This derivative will only be zero, if a change in v_A induces the same effect on B's full-information effort as on its asymmetric information effort, or if they just offset each other for the two types weighted by the probability q and their valuation.

To find out we totally differentiate the system of first order conditions for full information and asymmetric information and use Cramer's rule to get equilibrium comparative statics regarding v_A, taking into account the previously mentioned first order conditions at $v_A = \widehat{v}_A$.

$$
\begin{aligned}
\frac{\partial x_H^{FI}}{\partial v_A}|_{v_A=\widehat{v}_A} &= \frac{\frac{\partial^2 p_H}{\partial x_A \partial x_H}}{\left(\frac{\partial^2 p_H}{\partial x_A^2}\frac{\partial^2 p_H}{\partial x_H^2} - \left(\frac{\partial^2 p_H}{\partial x_A \partial x_H}\right)^2\right) v_A^2} > 0 \\
\frac{\partial x_H^{AI}}{\partial v_A}|_{v_A=\widehat{v}_A} &= \frac{\frac{\partial^2 p_H}{\partial x_A \partial x_H}\frac{\partial^2 p_L}{\partial x_L^2}}{\left(\frac{\partial^2 p_L}{\partial x_L^2}(1-q)\left(\frac{\partial^2 p_H}{\partial x_H^2}\frac{\partial^2 p_H}{\partial x_A^2} - \left(\frac{\partial^2 p_H}{\partial x_A \partial x_H}\right)^2\right) + \frac{\partial^2 p_H}{\partial x_H^2} q \left(\frac{\partial^2 p_L}{\partial x_L^2}\frac{\partial^2 p_L}{\partial x_A^2} - \left(\frac{\partial^2 p_L}{\partial x_A \partial x_L}\right)^2\right)\right) v_A^2} > 0 \\
\frac{\partial x_L^{FI}}{\partial v_A}|_{v_A=\widehat{v}_A} &= \frac{\frac{\partial^2 p_L}{\partial x_A x_L}}{\left(\frac{\partial^2 p_L}{\partial x_A^2}\frac{\partial^2 p_L}{\partial x_L^2} - \left(\frac{\partial^2 p_L}{\partial x_A \partial x_L}\right)^2\right) v_A^2} < 0 \\
\frac{\partial x_L^{AI}}{\partial v_A}|_{v_A=\widehat{v}_A} &= \frac{\frac{\partial^2 p_L}{\partial x_A \partial x_L}\frac{\partial^2 p_H}{\partial x_H^2}}{\left(\frac{\partial^2 p_L}{\partial x_L^2}(1-q)\left(\frac{\partial^2 p_H}{\partial x_H^2}\frac{\partial^2 p_H}{\partial x_A^2} - \left(\frac{\partial^2 p_H}{\partial x_A \partial x_H}\right)^2\right) + \frac{\partial^2 p_H}{\partial x_H^2} q \left(\frac{\partial^2 p_L}{\partial x_L^2}\frac{\partial^2 p_L}{\partial x_A^2} - \left(\frac{\partial^2 p_L}{\partial x_A \partial x_L}\right)^2\right)\right) v_A^2} < 0.
\end{aligned}
$$

$\frac{\partial^2 p_L}{\partial x_A^2} < 0$, $\frac{\partial^2 p_H}{\partial x_A^2} < 0$, $\frac{\partial^2 p_H}{\partial x_H^2} > 0$ and $\frac{\partial^2 p_L}{\partial x_L^2} > 0$ follow from the shape of the CSF. $\frac{\partial^2 p_L}{\partial x_A x_L} > 0$ and $\frac{\partial^2 p_H}{\partial x_A x_H} < 0$ come from the fact that at $v_A = \widehat{v}_A$ A is an underdog against an opponent with valuation v_H but a favorite against an opponent with valuation v_L. Using this, the derivative of the difference in utilities equals

$$
\begin{aligned}
\frac{\partial D_A}{\partial v_A}|_{v_A=\widehat{v}_A} = & -\frac{\left(\frac{\partial^2 p_L}{\partial x_L^2}\left(\frac{\partial^2 p_H}{\partial x_H^2}\frac{\partial^2 p_H}{\partial x_A^2} - \left(\frac{\partial^2 p_H}{\partial x_A \partial x_H}\right)^2\right) + \frac{\partial^2 p_H}{\partial x_H^2}\left(\left(\frac{\partial^2 p_L}{\partial x_A \partial x_L}\right)^2 - \frac{\partial^2 p_L}{\partial x_L^2}\frac{\partial^2 p_L}{\partial x_A^2}\right)\right)}{\left(\frac{\partial^2 p_L}{\partial x_A^2}\frac{\partial^2 p_L}{\partial x_L^2} - \left(\frac{\partial^2 p_L}{\partial x_A \partial x_L}\right)^2\right)\left(\frac{\partial^2 p_H}{\partial x_A^2}\frac{\partial^2 p_H}{\partial x_H^2} - \left(\frac{\partial^2 p_H}{\partial x_A \partial x_H}\right)^2\right) v_A\, v_H\, v_L} \times \\
& \frac{\left(\frac{\partial^2 p_L}{\partial x_A \partial x_L} v_H \left(\frac{\partial^2 p_H}{\partial x_A^2}\frac{\partial^2 p_H}{\partial x_H^2} - \left(\frac{\partial^2 p_H}{\partial x_A \partial x_H}\right)^2\right) + \frac{\partial^2 p_H}{\partial x_A \partial x_H} v_L \left(\left(\frac{\partial^2 p_L}{\partial x_A \partial x_L}\right)^2 - \frac{\partial^2 p_L}{\partial x_A^2}\frac{\partial^2 p_L}{\partial x_L^2}\right)\right) q\,(1-q)}{\left(\frac{\partial^2 p_L}{\partial x_L^2}(1-q)\left(\frac{\partial^2 p_H}{\partial x_H^2}\frac{\partial^2 p_H}{\partial x_A^2} - \left(\frac{\partial^2 p_H}{\partial x_A \partial x_H}\right)^2\right) + \frac{\partial^2 p_H}{\partial x_H^2} q \left(\frac{\partial^2 p_L}{\partial x_L^2}\frac{\partial^2 p_L}{\partial x_A^2} - \left(\frac{\partial^2 p_L}{\partial x_A \partial x_L}\right)^2\right)\right)}
\end{aligned}
$$

which has the sign of

$$
\text{Sign}\left[\frac{\partial D_A}{\partial v_A}|_{v_A=\widehat{v}_A}\right] = \text{Sign}\left[-\left(\frac{\partial^2 p_L}{\partial x_L^2}\left(\frac{\partial^2 p_H}{\partial x_H^2}\frac{\partial^2 p_H}{\partial x_A^2} - \left(\frac{\partial^2 p_H}{\partial x_A \partial x_H}\right)^2\right) - \frac{\partial^2 p_H}{\partial x_H^2}\left(\frac{\partial^2 p_L}{\partial x_L^2}\frac{\partial^2 p_L}{\partial x_A^2} - \left(\frac{\partial^2 p_L}{\partial x_A \partial x_L}\right)^2\right)\right)\right].
$$

Intuitively this term relates $\frac{\partial x_{AH}^{FI}}{\partial v_A}|_{v_A=\widehat{v}_A}$ to $\frac{\partial x_{AL}^{FI}}{\partial v_A}|_{v_A=\widehat{v}_A}$. For $\frac{\partial x_{AH}^{FI}}{\partial v_A}|_{v_A=\widehat{v}_A} > \frac{\partial x_{AL}^{FI}}{\partial v_A}|_{v_A=\widehat{v}_A}$ it will be negative and for $\frac{\partial x_{AH}^{FI}}{\partial v_A}|_{v_A=\widehat{v}_A} < \frac{\partial x_{AL}^{FI}}{\partial v_A}|_{v_A=\widehat{v}_A}$ it will be positive. For our CSF given in equation 2 it will always be negative. This means that starting at $x_A^L = x_A^H$ a slight increase in v_A will lead to a relatively higher increase in effort on the part of group A against the high-type opponent.[14] Hence we find that at $v_A = \widehat{v}_A$ the derivative of D_A is strictly negative. Thus there exist some valuations $v_A > \widehat{v}_A$ where ignorance is bliss. □

E Proof of Propositions 7 and 8

Expected aggregate effort with contest success function $p_i = \frac{x_i}{x_i + x_j}$ under full information is equal to

$$E\left[\sum_{i=\{A,B\}} x_i^{FI}\right] = \frac{v_A\left(\left(\left(1-q\right)v_H + qv_L\right)v_A + v_L v_H\right)}{\left(v_A+v_H\right)\left(v_A+v_L\right)},$$

while expected aggregate effort under one-sided asymmetric information is equal to

$$E\left[\sum_{i=\{A,B\}} x_i^{AI}\right] = \left(\left(1-q\right)\sqrt{v_H} + q\sqrt{v_L}\right)\frac{\left(\left(1-q\right)\frac{1}{\sqrt{v_H}} + q\frac{1}{\sqrt{v_L}}\right)}{\left(\frac{1}{v_A} + \left(\frac{(1-q)}{v_H} + \frac{q}{v_L}\right)\right)}.$$

Their difference is equal to

$$\begin{aligned} E\left[\sum_{i=\{A,B\}} \Delta x\right] &= \frac{v_A\left(\left(\left(1-q\right)v_H + qv_L\right)v_A + v_L v_H\right)}{\left(v_A+v_H\right)\left(v_A+v_L\right)} - \left(\left(1-q\right)\sqrt{v_H} + q\sqrt{v_L}\right)\frac{\left(\left(1-q\right)\frac{1}{\sqrt{v_H}} + q\frac{1}{\sqrt{v_L}}\right)}{\left(\frac{1}{v_A} + \left(\frac{(1-q)}{v_H} + \frac{q}{v_L}\right)\right)} \\ &= \frac{\left(1-q\right)qv_A\left(\sqrt{v_H}-\sqrt{v_L}\right)^2\left(v_A - \sqrt{v_H v_L}\right)\left(v_A\left(\sqrt{v_H v_L} + v_H + v_L\right) + v_H v_L\right)}{(v_A+v_H)(v_A+v_L)(qv_A(v_H-v_L) + v_L(v_A+v_H))}. \end{aligned}$$

It is easily observed that this is positive for $v_A > \sqrt{v_H v_L}$ and negative otherwise hence proving Proposition 7.

Efficiency implies that the informational regime should be chosen to maximize $q\frac{x_A}{x_A+x_L} + (1-q)\frac{x_H}{x_A+x_H}$ as we assume $v_L \leq v_A \leq v_H$. We get

$$\Delta\left(q\frac{x_A}{x_A+x_L} + (1-q)\frac{x_H}{x_A+x_H}\right) = -\frac{(1-q)qv_A(v_H-v_L)\left(v_A^2 - v_H v_L\right)}{(v_A+v_H)(v_A+v_L)(qv_A(v_H-v_L)+v_L(v_A+v_H))},$$

which is positive for $v_A < \sqrt{v_H v_L}$ and negative else. □

[14] Note that for more general CSF the opposite case can arise and A increases its effort more against the low-type opponent. Then there will be a value of ignorance for $v_A < \widehat{v}_A$.

F Proof of Proposition 9

Full information strategies for a match with valuations $v_i > v_j$ are given by the bidding distribution functions

$$\begin{aligned} F_j(x; v_j, v_i) &= \frac{v_i - v_j}{v_i} + \frac{x}{v_i} \\ F_i(x; v_i, v_j) &= \frac{x}{v_j}, \end{aligned}$$

for $x \in [0, v_j]$. In the following we stick to the notation that $F_i(x; v_j)$ indicates the bidding distribution of group i facing another group j and we will denote the corresponding density function by $f_i(x; v_j)$. The ex-ante expected full information payoffs are

$$\begin{aligned} \pi_H^{FI} &= v_H - v_A \\ \pi_L^{FI} &= 0 \\ \pi_A^{FI} &= q\,(v_A - v_L)\,. \end{aligned}$$

Those results are standard and the proofs can be found for example in Hillman and Riley (1989) or Baye, Kovenock, and de Vries (1996). Using the equilibrium strategies it is easily verified that expected aggregate effort is equal to

$$\begin{aligned} X^{FI} &= q \int_0^{v_L} \left(f_A(x; v_L) + f_L(x; v_A)\right) x\, dx + (1-q) \int_0^{v_A} \left(f_A(x; v_H) + f_H(x; v_A)\right) x\, dx \\ &= q \int_0^{v_L} \left(\frac{x}{v_L} + \frac{x}{v_A}\right) dx + (1-q) \int_0^{v_A} \left(\frac{x}{v_A} + \frac{x}{v_H}\right) dx \\ &= \frac{q}{2}\left(\frac{v_L^2}{v_A} + v_L\right) + \frac{(1-q)}{2}\left(v_A + \frac{v_A^2}{v_H}\right) \end{aligned}$$

and that efficiency (the ex-ante probability that the player with higher valuation wins) equals

$$\begin{aligned} EF^{FI} &= q \int_0^{v_L} F_L^{FI}(x; v_A)\, f_A^{FI}(x; v_L)\, dx + (1-q) \int_0^{v_A} F_A^{FI}(x; v_H)\, f_H^{FI}(x; v_A)\, dx \\ &= q \int_0^{v_L} \left(\frac{v_A - v_L}{v_A} + \frac{x}{v_A}\right) \frac{1}{v_L}\, dx + (1-q) \int_0^{v_A} \left(\frac{v_H - v_A}{v_H} + \frac{x}{v_H}\right) \frac{1}{v_A}\, dx \\ &= (1-q)\left(1 - \frac{v_A}{2v_H}\right) + q\left(1 - \frac{v_L}{2v_A}\right). \end{aligned}$$

Under one-sided asymmetric information consider first the case where v_A is relatively small, $v_A \leq \tilde{v}_A \equiv \frac{v_L}{q + \frac{v_L}{v_H}(1-q)}$. We then find that A's bidding/effort distribution function has a mass point at zero. The groups' equilibrium strategies are given by the distribution functions

$$\begin{aligned}
F_A^{AI}(x;v_L,v_H) &= \begin{cases} \frac{v_H-(1-q)v_A}{v_H} - \frac{qv_A}{v_L} + \frac{x}{v_L} & \text{for} \quad x \in [0, qv_A] \\ \frac{v_H-v_A}{v_H} + \frac{x}{v_H} & \text{for} \quad x \in [qv_A, v_A] \end{cases} \\
F_L^{AI}(x;v_A) &= \frac{x}{qv_A} \text{ for } x \in [0, qv_A] \\
F_H^{AI}(x;v_A) &= \frac{x-qv_A}{(1-q)\,v_A} \text{ for } x \in [qv_A, v_A].
\end{aligned}$$

That those distribution functions indeed characterize an equilibrium is easily verified and we leave this to the reader (a proof is available upon request). Equilibrium payoffs in this case are

$$\begin{aligned}
\pi_A^{AI} &= 0 < \pi_A^{FI} = q\,(v_A - v_L) \\
\pi_H^{AI} &= v_H - v_A = \pi_H^{FI} \\
\pi_L^{AI} &= v_L \frac{v_H - (1-q)\,v_A}{v_H} - qv_A > \pi_L^{FI} = 0.
\end{aligned}$$

A prefers full information while B ex-ante prefers asymmetric information, which is the case because the L-type is better off while the H-type is indifferent.

Expected aggregate effort is equal to

$$\begin{aligned}
X_{v_A \leq \tilde{v}_A}^{AI} &= q \int_0^{qv_A} \left(f_A^{AI}(x;v_L,v_H) + f_L^{AI}\right) x\,dx + (1-q) \int_{qv_A}^{v_A} \left(f_A^{AI}(x;v_L,v_H) + f_H^{AI}\right) x\,dx \\
&= \int_0^{qv_A} \left(\frac{x}{v_A} + \frac{x}{v_L}\right) dx + \int_{qv_A}^{v_A} \left(\frac{x}{v_A} + \frac{x}{v_H}\right) dx \\
&= \frac{v_A\,\left(q^2 v_A(v_H - v_L) + v_L(v_A + v_H)\right)}{2v_H v_L}
\end{aligned}$$

and efficiency is equal to

$$\begin{aligned}
EF_{v_A \leq \tilde{v}_A}^{AI} &= q \int_0^{qv_A} F_L^{AI}(x;v_A) f_A(x;v_L)\,dx + (1-q) \int_{qv_A}^{v_A} F_A^{AI}(x;v_H) f_H(x;v_A)\,dx \\
&= q \int_0^{q\,v_A} \frac{x}{q\,v_A} \frac{1}{v_L}\,dx + (1-q) \int_{qv_A}^{v_A} \left(\frac{v_H - (1-q)v_A}{v_H} - \frac{qv_A}{v_L} + \frac{x}{v_L}\right) \frac{1}{(1-q)v_A}\,dx \\
&= \frac{q^2 v_A v_H - (q-1)v_L[(q-1)v_A + 2v_H]}{2v_H v_L}.
\end{aligned}$$

Now consider $v_A > \tilde{v}_A = \frac{v_L}{q + \frac{v_L}{v_H}(1-q)}$. Here only L's effort distribution has a mass point, which is at zero.

$$\begin{aligned}
F_A^{AI}(x; v_L, v_L) &= \begin{cases} \frac{x}{v_L} & \text{for} \quad x \in [0, \underline{x}] \\ \frac{x}{v_H} + \left(1 - \frac{(1-q)v_A}{v_H}\right)\left(1 - \frac{v_L}{v_H}\right) & \text{for} \quad x \in [\underline{x}, \overline{x}] \end{cases} \\
F_L^{AI}(x; v_A) &= \frac{x}{qv_A} + 1 - \frac{v_L}{qv_A} + \frac{v_L(1-q)}{qv_H} \text{ for } x \in [0, \underline{x}] \\
F_H^{AI}(x; v_A) &= \frac{x}{(1-q)\,v_A} + \frac{v_L}{v_H} - \frac{v_L}{(1-q)\,v_A} \text{ for } x \in [\underline{x}, \overline{x}],
\end{aligned}$$

where $\underline{x} = v_L - (1-q)\,v_A \frac{v_L}{v_H}$ and $\overline{x} = v_L + (1-q)\,v_A\left(1 - \frac{v_L}{v_H}\right)$. The corresponding expected equilibrium payoffs are

$$\begin{aligned}
\pi_A^{AI} &= qv_A - v_L + \frac{(1-q)\,v_A v_L}{v_H} < \pi_A^{FI} = q(v_A - v_L) \\
\pi_H^{AI} &= v_H - v_L - v_A(1-q)\left(1 - \frac{v_L}{v_H}\right) > v_H - v_A = \pi_H^{FI} \\
\pi_L^{AI} &= 0 = \pi_L^{FI}.
\end{aligned}$$

B prefers asymmetric information, since the H-type is better off while the L-type is indifferent, whereas A prefers full information. Ex-ante expected aggregate effort is equal to

$$\begin{aligned}
X_{v_A > \tilde{v}_A}^{AI} &= \int_0^{\underline{x}} \left(f_A^{AI}(x; v_L) + f_L^{AI}(x; v_A)\right)\, x\, dx + \int_{\underline{x}}^{\overline{x}} \left(f_A^{AI}(x; v_L) + f_L^{AI}(x; v_A)\right)\, x\, dx \\
&= \frac{\frac{v_L(v_A+v_L)((q-1)v_A+v_H)^2}{v_A} + (q-1)(v_A+v_H)((q-1)v_A(v_H-2v_L) - 2v_Hv_L)}{2v_H^2}
\end{aligned}$$

and efficiency equals

$$\begin{aligned}
EF_{v_A > \tilde{v}_A}^{AI} &= q\int_0^{\underline{x}} F_L^{AI}(x; v_A)\, f_A(x; v_L)\, dx + (1-q)\int_{\underline{x}}^{\overline{x}} F_A^{AI}(x; v_L)\, f_H(x; v_A)\, dx \\
&= \frac{v_A v_H\left(\left(q^2-1\right)v_A + 2v_H\right) - v_L((q-1)v_A + v_H)^2}{2v_A {v_H}^2}.
\end{aligned}$$

□

G A Dynamic Model of Expenditure Disclosure

Assume lobbying is dynamic and takes place over two periods. Lobbyists decide whether to voluntarily disclose their first stage lobbying expenditures x_i^1 before the second stage of lobbying begins. After period two, aggregate lobbying expenditures, $x_i^1 + x_i^2 = X_i$, determine the chance to enact the preferred legislation. The CSF is now given by

$$p_i\left(x_i^t, x_j^t\right) = \frac{x_i^1 + x_i^2}{x_i^1 + x_i^2 + x_j^1 + x_j^2} = \frac{X_i}{X_i + X_j}. \tag{5}$$

Payoffs are

$$\begin{aligned} \pi_B &= \frac{X_B}{X_B + X_A} v_B - X_B \\ \pi_A &= \left(\sigma \frac{X_A}{X_L + X_A} + (1-\sigma) \frac{X_A}{X_H + X_A}\right) v_A - X_A, \end{aligned}$$

where σ stands for the belief of lobbying group A that B is of a low valuation. We focus on the existence of two kinds of equilibria: one in which aggregate expenditures for each group correspond to the full information expenditures and one where they correspond to the asymmetric information expenditures in the valuation disclosure game. In the first case lobbying group B is sending a signal in period 1 regarding its valuation while in the latter case both types of group B expend the same lobbying effort and group A does not learn anything about its opponent's value. We show that there exists an equilibrium of this dynamic expenditure disclosure game in which aggregate lobbying expenditures for each lobbying group correspond to those in the valuation disclosure game. In addition, if lobbying groups can decide on voluntary expenditure disclosure we show that there exists an equilibrium where expenditures are disclosed if group A is relatively weak and they are not disclosed when group A is relatively strong. [15] In this sense the valuation disclosure model can be seen as a refinement or reduced form of the dynamic expenditure disclosure model, giving us a unique equilibrium prediction.

Proposition 10. *a) If lobbying group A is relatively weak ($v_A < \sqrt{v_L v_H}$) there exists a separating equilibrium in the expenditure disclosure game where both lobbying groups choose to disclose their expenditures. Aggregate expenditures of each lobbying group correspond to those in the valuation disclosure game.*

b) If lobbying group A is relatively strong ($v_A \geq \sqrt{v_L v_H}$) there exists a pooling equilibrium where both lobbying groups abstain from disclosure and hence no information is revealed. Aggregate expenditures of each lobbying group correspond to those in the valuation disclosure game.

Proof. First consider the game with observable expenditures. Let us prove the existence of a separating equilibrium for $v_A \leq \sqrt{v_L v_H}$. Start by conjecturing equilibrium expenditures of this game to be $x_A^1 = x_A^{FI}(v_H)$, $x_H^1 = x_H^{FI}$, $x_L^1 = x_L^{FI}$, $x_A^2(v_L) = x_A^{FI}(v_L) - x_A^{FI}(v_H)$ and $x_A^2(v_H) = x_H^2 = x_L^2 = 0$. The superscript FI stands for one-shot full-information equilibrium

[15] Typically multiple equilibria will exists, reflecting "leadership" by one or the other lobbying group. The characterization of all equilibria of this game is work in progress.

efforts while AI for one-shot asymmetric information equilibrium efforts. These equilibrium efforts are given in equations 4 and 5. We need to check if there is any profitable deviation in order to verify our assumption of equilibrium. Let us start in the second stage. The unique equilibrium strategies after separation in the second stage are given in Yildirim (2005).

Lemma 2. *(Yildirim (2005) Lemma 2) Given (x_i^1, x_j^1), the following strategy profiles constitute the unique equilibrium in the second period:*

$$\widehat{x}_i^2(x_i^1, x_j^1) = \begin{cases} 0, & \text{if } x_i^1 \geq R_i(x_j^1) \text{ and } x_j^1 \geq R_j(x_i^1), \\ x_i^{FI} - x_i^1, & \text{if } x_i^1 \leq x_i^{FI} \text{ and } x_j^1 \leq x_j^{FI}, \\ 0, & \text{if } x_i^1 \geq x_i^{FI} \text{ and } x_j^1 \leq R_j(x_i^1), \\ R_i(x_j^1) - x_i^1, & \text{if } x_i^1 \leq R_i(x_j^1) \text{ and } x_j^1 \geq x_j^{FI}. \end{cases}$$

Given that A invested $x_A^{FI}(v_H)$ and since $x_A^{FI}(v_H) < x_A^{FI}(v_L)$ (see appendix A) we are in case 2 and it is optimal for both H and L to respond with $x_i^2 = x_i^{FI} - x_i^1$, which is $x_H^2 = x_L^2 = 0$. Given that $x_H^1 = x_H^{FI}$ and $x_L^1 = x_L^{FI}$ also A's optimal reaction is to expend $x_A^2 = x_A^{FI}(v_L) - x_A^1 = x_A^{FI}(v_L) - x_A^{FI}(v_H)$ against an L-type and $x_A^2 = x_A^{FI}(v_H) - x_A^1 = 0$ against an H-type.

Consider now the first stage expenditures. Is there a profitable deviation? Let us consider each lobbyist in turn. When group A decreases its expenditures in stage 1 it only substitutes them with higher expenditures in period 2, aggregate expenditures stay the same by Lemma 2. An increase in expenditures on the other hand decreases its utility, as it cannot induce lower expenditures from its opponent and it will be above its optimal reaction. What about group B? The exact same arguments imply that lowering first period expenditures is not profitable for either group L or H as they will be exactly offset by higher second period expenditures. Increasing expenditures is detrimental for group H as they will not induce a decrease in the opponent's expenditures, who already invests zero in period 2. It is also detrimental for group L. It is the underdog against A and hence an increase in expenditures will make A even more aggressive. The last possible deviation is imitation of the other groups expenditures. We have two possible deviations. Either H imitates and L and expends x_L^{FI} or L imitates H and expends x_H^{FI}. Since $x_A^1 = x_A^{FI}(v_H)$, H never benefits from imitation. It can only increase A's expenditures. We only need to check L's incentive constraint. In the potential signaling equilibrium its payoff is $u_L = \frac{v_L^3}{(v_L+v_A)^2}$ while a deviation brings a payoff of $u_L^D = \frac{v_H}{v_H+v_A}v_L - \frac{v_H^2 v_A}{(v_H+v_A)^2}$. It is easily verified that the latter is always smaller and hence deviating does not pay off. Note that the equivalent separating equilibrium with $x_A^1 = x_A^{FI}(v_L)$ does not exist for $v_A < \sqrt{v_H v_L}$. In this case $x_A^{FI}(v_H) > x_A^{FI}(v_L)$ and H has an incentive to imitate L. This is not costly to H because it can, in the second period, sill optimally react to A and increase its expenditures after deviating to x_L^{FI} to imitate L. Hence this separating equilibrium does not exist.

Next we prove existence of the pooling equilibrium for $v_A > \sqrt{v_H v_L}$. We conjecture that an equilibrium exists with expenditures $x_A^1 = x_A^{AI}$, $x_H^1 = x_L^1 = x_L^{AI}$, $x_A^2 = x_L^2 = 0$ and $x_H^2 = x_H^{AI} - x_L^{AI}$. If B's pool, A does not learn anything about their value and in the second period A plays an average best response $\widetilde{R}_A(X_L, X_H)$

$$\widehat{x}_A^2(x_A^1, x_B^1) = \begin{cases} x_A^{AI} - x_A^1, & \text{if } x_A^1 \le x_A^{AI} \text{ and } x_B^1 \le x_L^{AI}, \\ 0, & \text{if } x_A^1 \ge R_A(x_B^1) \text{ and } x_B^1 \ge R_H(x_A^1), \\ 0, & \text{if } x_A^1 \ge x_A^{AI} \text{ and } x_B^1 \le R_L(x_A^1), \\ R_A(x_B^1) - x_A^1, & \text{if } x_A^1 \le R_A(x_B^1) \text{ and } x_B^1 \ge x_H^{FI}, \\ x_A^{NS} - x_A^1, & \text{if } x_A^1 \le x_A^{NS} \text{ and } x_L^{AI} \le x_B^1 \le x_H^{FI}, \\ 0, & \text{if } x_A^1 \ge x_A^{NS} \text{ and } R_L(x_A^1) \le x_B^1 \le R_H(x_A^1), \end{cases}$$

and

$$\left(\widehat{x}_H^2, \widehat{x}_L^2\right) = \begin{cases} \left(x_H^{AI} - x_H^1, x_L^{AI} - x_L^1\right), & \text{if } x_A^1 \le x_A^{AI} \text{ and } x_B^1 \le x_L^{AI}, \\ (0,0), & \text{if } x_A^1 \ge R_A(x_B^1) \text{ and } x_B^1 \ge R_H(x_A^1), \\ \left(R_H(x_A) - x_H^1, R_L(x_A) - x_L^1\right), & \text{if } x_A^1 \ge x_A^{AI} \text{ and } x_B^1 \le R_L(x_A^1), \\ (0,0), & \text{if } x_A^1 \le R_A(x_B^1) \text{ and } x_B^1 \ge x_H^{FI}, \\ \left(x_H^{NS}(x_B^1) - x_H^1, 0\right), & \text{if } x_A^1 \le x_A^{NS} \text{ and } x_L^{AI} \le x_B^1 \le x_H^{FI}, \\ \left(x_H^{NS}(x_B^1) - x_H^1, 0\right), & \text{if } x_A^1 \ge x_A^{NS} \text{ and } R_L(x_A^1) \le x_B^1 \le R_H(x_A^1), \end{cases}$$

where $x_A^{NS}(x_B^1)$, $x_H^{NS}(x_B^1)$ are defined as the expenditure pair that solves $x_H^{NS} = R_H(x_A^{NS})$ and $x_A^{NS} = \widetilde{R}_A(x_B^1, x_H^{NS})$ The proof of the optimality of these second period strategy profiles follows the proof in Yildirim (2005) for the full-information case and can be received from the authors upon request. Given the first stage strategies we find that in fact it is optimal for A and L to invest zero and for H to invest $x_L^{AI} - x_H^{AI}$. Let us consider possible deviations in the first stage. Group A does not have an incentive to deviate. A decrease in expenditure will again be directly compensated by an increase in expenditure in stage 2 while an increase in first period expenditures leads to an increase in expenditure by group H and no decrease by L. To consider deviations by group B we need to specify out of equilibrium beliefs. In this case we need not restrict them, A can believe anything after a deviation by B. The reason is that a deviation can never lead to a decrease in expenditures, as A only expends in the first period. Hence B does not deviate and we have established the existence of a pooling equilibrium.

Now assume that lobbying groups can decide on expenditure disclosure after the first period. Since no information is revealed before this decision this is equivalent to lobbying groups choosing expenditures and disclosure at the same time. Let us start with the pooling equilibrium for $v_A > \sqrt{v_H v_L}$. We show that all groups deciding not to disclose and expend $x_i^1 = x_i^{AI}$, $x_i^2 = 0$,

$i = L, A$ and $x_H^1 = x_L^{AI}$, $x_H^2 = x_H^{AI} - x_L^{AI}$ is an equilibrium of this game. Given the first period decisions all groups can do no better than to reach their best response functions and hence $x_L^2 = x_A^2 = 0$ and $x_H^2 = x_H^{AI} - x_L^{AI}$. Consider the first stage decisions. Given the expenditures of group B, A has no incentive to deviate from expending $x_A^1 = x_A^{AI}$ and not disclosing. Disclosing its expenditures does not change anything as they are anticipated in equilibrium. Choosing a different expenditure does not increase its payoff either, no matter whether it discloses or not. Disclosing a higher expenditure would only be beneficial to discourage L, but L already invests x_L^{AI} in the first stage. Disclosing a lower expenditure results in exactly the same payoff as our proposed equilibrium. Not disclosing and expending less is exactly the same, while not disclosing and expending more yields a lower payoff. Consider L's first stage incentives. Expending more in the first period, no matter whether it discloses yields a lower payoff. Expending less on the other hand yields exactly the same payoff as it cannot induce A to reduce its expenditures which are already sunk in the first period. Lastly consider H. H cannot induce lower expenditures from A than x_A^{AI} which is already sunk and hence deviating to disclosure is not profitable. Not disclosing and investing something else is also weakly not profitable.

Consider now $v_A < \sqrt{v_H v_L}$. We want to show that in the proposed separating equilibrium lobbying groups have an incentive to disclose their expenditures. The equilibrium expenditures were $x_A^1 = x_A^{FI}(v_H)$, $x_H^1 = x_H^{FI}$, $x_L^1 = x_L^{FI}$, $x_A^2(v_L) = x_A^{FI}(v_L) - x_A^{FI}(v_H)$ and $x_A^2(v_H) = x_H^2 = x_L^2 = 0$. By the analysis above we only need to check whether there is a deviation to non-disclosure. As A can only make B expend more in the second period and it ends up on its reaction function, there is no profitable deviation. The same is true for H. We have already established that it is too costly for L to imitate H. Since L is the underdog it does not want to increase its expenditures either. Decreasing them does not change anything. □

H Continuous uniform distribution

Let us assume that B's value is distributed uniformly on $[a, b]$. The expected utility of lobbying group A if it does not know the value of group B is equal to

$$E[u_A] \quad = \quad \frac{1}{b-a} \int_a^b \frac{x_A}{x_A + x_B(v_B)} dv_B v_A - x_A.$$

Taking the derivative and setting it equal to zero

$$\frac{\partial E[u_A]}{\partial x_A} \quad = \quad \frac{1}{b-a} \int_a^b \frac{x_B(v_B)}{(x_A + x_B(v_B))^2} dv_B v_A - 1$$

we get A's first order condition. Plugging this into group B's reaction function $x_B(x_A) = \max\left\{\sqrt{x_A v_B} - x_A, 0\right\}$ we can solve for the equilibrium efforts. Focussing on interior solutions we get the following equilibrium efforts.

$$
\begin{aligned}
\frac{\partial E[u_A]}{\partial x_A} &= \frac{1}{b-a}\int_a^b \frac{\sqrt{x_A v_B} - x_A}{\left(x_A + \sqrt{x_A v_B} - x_A\right)^2} dv_B v_A - 1 \\
&= \frac{2v_A}{(b-a)\sqrt{x_A}}\left(\sqrt{b}-\sqrt{a}\right) - \frac{v_A}{b-a}\left(\ln[b] - \ln[a]\right) - 1 \overset{!}{=} 0 \\
\Leftrightarrow x_A^{AI} &= \left(\frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right) + (b-a)}\right)^2 \\
x_B^{AI} &= \sqrt{v_B \frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right) + (b-a)}} - \left(\frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right) + (b-a)}\right)^2
\end{aligned}
$$

A and B's equilibrium utility under one-sided asymmetric information is equal to

$$
\begin{aligned}
E[u_A^{AI}] &= \frac{\frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right)+(b-a)}}{b-a}\int_a^b \frac{1}{\sqrt{v_B}} dv_B v_A - \left(\frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right) + (b-a)}\right)^2 \\
&= \frac{\frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right)+(b-a)}}{b-a} 2\left(\sqrt{b}-\sqrt{a}\right) v_A - \left(\frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right) + (b-a)}\right)^2
\end{aligned}
$$

$$
\begin{aligned}
u_B^{AI} &= \frac{\sqrt{v_B x_A} - x_A}{\sqrt{v_B x_A}} v_B - \sqrt{v_B x_A} + x_A = v_B - 2\sqrt{x_A v_B} + x_A \\
&= v_B - 2\sqrt{\frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right) + (b-a)} v_B} + \left(\frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right) + (b-a)}\right)^2
\end{aligned}
$$

and B's expected utility before it learns its type

$$
E[u_B^{AI}] = \frac{b-a}{2} - \frac{4}{3}\left(b^{\frac{3}{2}} - a^{\frac{3}{2}}\right)\sqrt{\frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right) + (b-a)}} + \left(\frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right) + (b-a)}\right)^2
$$

If both lobbying groups know their respective valuations equilibrium efforts are

$$
x_i^{FI}\left(v_i, v_j\right) = \frac{v_i^2 v_j}{\left(v_i + v_j\right)^2},
$$

and utilities

$$
\begin{aligned}
E[u_A^{FI}] &= \int_a^b \frac{v_A^3}{(v_A+v_B)^2} dF(v_B) = \frac{1}{b-a}\left(\frac{v_A^3}{v_A+a} - \frac{v_A^3}{v_A+b}\right) \\
u_B^{FI} &= \frac{v_B^3}{(v_B+v_A)^2} \\
E[u_B^{FI}] &= \frac{\frac{v_A^3}{v_A+b} + 3v_A^2 \ln[v_A+b] - 2v_A b + \frac{b^2}{2} - \left(\frac{v_A^3}{v_A+a} + 3v_A^2 \ln[v_A+a] - 2v_A a + \frac{a^2}{2}\right)}{b-a}.
\end{aligned}
$$

Now we consider the incentives to disclose or acquire information. The difference in utilities for A and B is equal to

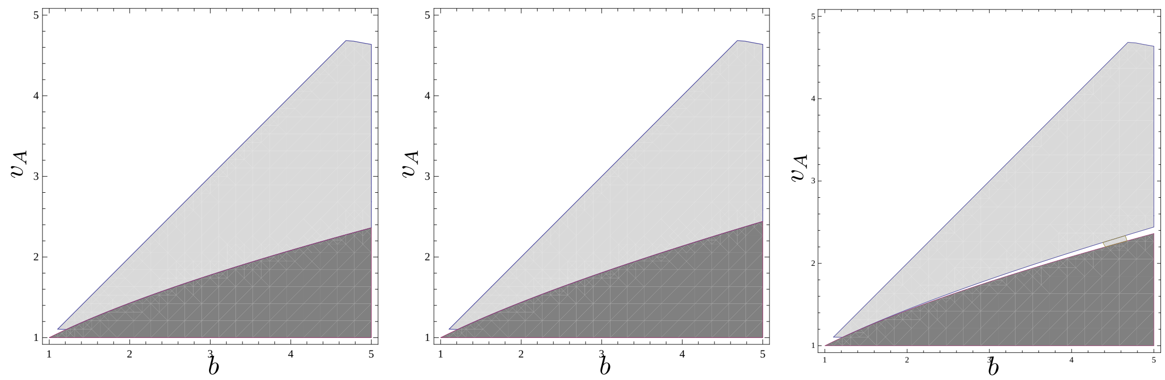
$$
\begin{aligned}
\Delta E[u_A] &= \frac{1}{b-a}\left(\frac{v_A^3}{v_A+a} - \frac{v_A^3}{v_A+b}\right) - \left(\frac{\frac{\left(2v_A\left(\sqrt{b}-\sqrt{a}\right)\right)^2}{v_A(\ln[b]-\ln[a])+(b-a)}}{b-a} - \left(\frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right)+(b-a)}\right)^2\right) \\
\Delta u_B &= \frac{v_B^3}{(v_B+v_A)^2} - v_B - 2\sqrt{\frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right)+(b-a)} v_B} + \left(\frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right)+(b-a)}\right)^2.
\end{aligned}
$$

Ex-ante, before B knows its valuation the difference in expected utility is equal to

$$
\begin{aligned}
\Delta E[u_B] &= \frac{\frac{v_A^3}{v_A+b} + 3v_A^2 \ln[v_A+b] - 2v_A b + \frac{b^2}{2} - \left(\frac{v_A^3}{v_A+a} + 3v_A^2 \ln[v_A+a] - 2v_A a + \frac{a^2}{2}\right)}{b-a} \\
&\quad - \frac{b-a}{2} + \frac{4}{3}\left(b^{\frac{3}{2}} - a^{\frac{3}{2}}\right)\sqrt{\frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right)+(b-a)}} - \left(\frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right)+(b-a)}\right)^2.
\end{aligned}
$$

Normalizing the lowest valuation to one, $a = 1$, we illustrate the difference in utility in figure 4. b is plotted on the abscissa while v_A is on the ordinate. We plot only valuation pairs for which an interior solution exists. In the lightgray regions the lobbying groups prefer ignorance/non-disclosure, while in the darkgray region the lobbying groups prefer to acquire/disclose information. If A is relatively weak, information disclosure is favorable for both players while if A is relatively strong both players prefer asymmetric information.

We find that players generally agree whether to disclose B's valuation. Only in a small region where A has an about average valuation, in other words v_A is close to $E[v_B]$, the players' preferences diverge. In these cases B prefers disclosure while A prefers to stay ignorant about B's value. This can be seen in figure 4 panel c).



panel a) panel b) panel c)

Figure 4: Difference in expected utility for lobbying group A (panel a)) and B (panel b)). Zone of agreement (panel c))

Expected aggregate effort under asymmetric and full-information is equal to

$$\begin{aligned} E[x^{AI}] &= \frac{\frac{2}{3}\left(b^{\frac{3}{2}}-a^{\frac{3}{2}}\right)}{b-a}\sqrt{\frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right)+(b-a)}} \\ E[x^{FI}] &= E\left[\frac{v_A^2 v_B}{(v_A+v_B)^2}+\frac{v_B^2 v_A}{(v_A+v_B)^2}\right] \end{aligned}$$

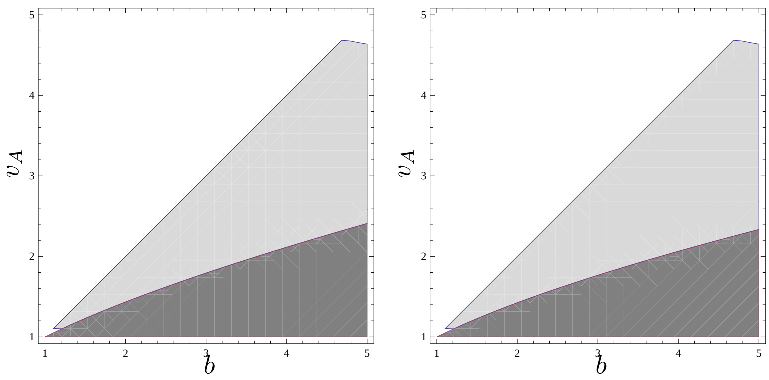
and their difference equals

$$\begin{aligned} E[x^{AI}] &= \frac{\frac{2}{3}\left(b^{\frac{3}{2}}-a^{\frac{3}{2}}\right)}{b-a}\sqrt{\frac{2v_A\left(\sqrt{b}-\sqrt{a}\right)}{v_A\left(\ln[b]-\ln[a]\right)+(b-a)}} \\ E[x^{FI}] &= E\left[\frac{v_A^2 v_B}{(v_A+v_B)^2}+\frac{v_B^2 v_A}{(v_A+v_B)^2}\right]. \end{aligned}$$

Figure 5, panel a) illustrates this difference. In the darkgray region disclosure leads to lower aggregate effort while in the lightgray region non-disclosure is preferable.

Lastly, consider efficiency in figure 5, panel b). In the darkgray region disclosure leads to higher efficiency while in the lightgray region non-disclosure is preferable.

Overall we find that our results under a continuous uniform distribution are remarkably similar to the ones under only two types of player B, v_H and v_L.



panel a) panel b)

Figure 5: Difference in aggregate effort (panel a)) and efficiency (panel b)).

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