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IES Working Paper: 22/2014

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Bibliographic information:
Gregor M. (2014). "Access fees for competing lobbies" IES Working Paper 22/2014. IES FSV. Charles University.

Access Fees for Competing Lobbies

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July 2014

Abstract:

We model `money buys access' informational lobbying as a commitment from the policy-maker to observe a lobby's verifiable evidence only upon receiving an access fee. We specifically examine the policy-maker's optimal access fees in the presence of two strictly competing lobbies. Our novel method constructs bargaining surpluses in parallel bilateral bargaining problems in which a negative sign for the bilateral surplus implies a strategic access restriction. This approach easily identifies the equilibrium set of participating lobbies for any information structure and any timing for the lobbies' access. We explain the incomplete participation of lobbies and the resulting information and welfare distortion using the information and revenue complementarities of signals. We also show that a lower bias may be either a blessing or curse for a lobby depending on the information structure and timing. Finally, we demonstrate that promoting lobbying competition may be detrimental to welfare due to the policy-maker's revenue-information tradeoff.

Keywords: informational lobbying, access fee, persuasion, verifiable evidence
JEL: C72, C78, D72, D83

Acknowledgements:

Comments and suggestions are more than welcome. I would like to thank Jan Zápal and participants at EPCS 2013 in Züurich and CEPET 2014 in Udine for their useful comments. Financial support from the Grant Agency of the Czech Republic No. P402/12/G097 is gratefully acknowledged.

1 Introduction

Evidence and money are two primary instruments of influence in the toolkit of special interests. The way in which these two instruments are jointly used still remains an open question, with various traditions of lobbying models providing different answers. In this paper, we aim to contribute to the 'money buys access' tradition (Baron, 1989; Snyder, 1990; Austen-Smith 1995, 1998; Ball, 1995; Lohmann, 1995; Wright, 1996; Cotton 2009, 2012; Groll and Ellis, 2014) and particularly to the family of models that interpret access fees as 'message fees'. Namely, we study the properties of games in which the policy-maker establishes prices for meeting and communication, and a lobby either incurs the cost and communicates her private verifiable message or abstains.

Access fees that serve as message fees are attractive for the policy-maker for three primary reasons. First, in contrast to pure persuasion, the policy-maker may expropriate part of the lobby's gains, which emerge when the policy-maker learns new evidence and conducts a decision in favor of the lobby. Second, relative to other commitment devices such as implementation fees (Groll and Ellis, 2014), setting message fees involves only a commitment to 'not listen' to those who have not paid. The policy-maker does not restrict or even sell his policy; his actions are non-contractible and not restricted, and there are no ex post payments. The policy-maker affects policies only indirectly by constraining the amount of available information. Third, the policy maker may arrange access fees legally through campaign contributions. The idea that campaign contributions buy access is indeed an old one and is supported by evidence regarding the link between campaign contributions and lobbying outlays on the level of both donors and recipients (Ansolabehere et al., 2002; Esterling, 2007).

Access fee mechanisms generate predictions, which are often quite different from other lobbying models that either abstract from transfers (e.g., cheap talk or persuasion games) or include transfers ex post (Bennedsen and Feldman, 2006; Dahm and Porteiro, 2008). Consider asymmetric participation. Recent descriptive evidence suggests that lobbying participation is very asymmetric; Richter *et al.* (2009) show that only a small fraction of firms actually lobby, and lobbying expenditures follow a skewed, power-law distribution. Putting aside the entry barriers in the form of large upfront costs (Kerr *et al.*, 2014), common wisdom attributes the absence of informational lobbying to the lack of favorable evidence among the abstaining lobbies. More specifically, a classic persuasion game (Milgrom, 1981; Milgrom and Roberts, 1986; Bhattacharya and Mukherjee, 2013) attributes the absence of communication to the pooling of bad evidence with no evidence. In an access fee mechanism, in contrast, the absence of communication stems from the policy-maker's unwillingness to initiate communication with certain lobbies. In particular, the access fee mechanism explains asymmetric participation by the revenue externality of additional signals; for the policy-maker, an extra invitation may imply a revenue loss from the interaction with the other invited lobbies.

In this paper, we study informational lobbying through access fees given the *competition* *of two lobbies* who have state-independent and opposite (i.e., perfectly negatively correlated) preferences over a binary policy. Each lobby receives a private signal, and the policy-maker makes a non-contractible choice that accounts for the state-dependent effects external to the lobbies. This pure form of competition over policy in the presence of state-dependent spillovers represents situations in which a project or policy is either approved or rejected, with the direct stakeholders being organized and able to transmit verifiable evidence to the policy-maker and the indirect stakeholders being unorganized but represented by the policy-maker.

We admit two timings: Either the fees are charged before private signals are observed (ex ante access), or the fees are charged after private signals are observed (interim access). We cover all plausible information structures in the binary setting, which generates 20 different classes of access fee interactions. We employ a novel bargaining perspective to conveniently solve these models. Thereby, we obtain the equilibrium set of participants and the equilibrium payoffs for 14 out of 20 classes of models without additional parametrical calculations. For the remaining classes, we demonstrate how to calculate the equilibrium using the parameters.

We have four objectives. First, we examine whether both lobbies participate or not. In other words, we examine whether the revenue-information tradeoff motivates the policy-maker to impose a prohibitively large access fee to a lobby, manifested in the garbling of the available information. This step is especially important for assessing the welfare distortions of the mechanism: A non-garbled (completely informative) outcome in our environment is the first-best outcome, while any strategically garbled (incompletely informative) outcome involves a welfare loss.

For a single lobby, the revenue-information tradeoff materializes only under very special circumstances.[1] For two strictly competing lobbies, the nature of the policy-maker's tradeoff may be rather different: The policy-maker always meets at least one competing lobby because at least one lobby has a positive willingness to pay. The policy-maker may commit to 'not listen' to the second lobby if an extra meeting with the second lobby excessively reduces the revenues from the meeting with the first lobby. To further elucidate the revenue externality of an extra invitation, we examine the information and revenue complementarities of the signals and confirm the intuition that, broadly speaking, access restriction is associated with substitutabilities of the signals and non-restriction is associated with complementarities of the signals.

Second, we show that an increasing lobbying competition may deteriorate welfare in a special scenario: First, there is a single invited lobby with highly informative evidence. Then, a second lobby with less informative evidence enters the game (i.e., the opposite interest group gets organized and becomes able to meet the policy-maker). With two lobbies, the policy-maker invites the less informed lobby instead of the more informed lobby. As a consequence,

[1] Specifically, Gregor (2014) finds the tradeoff if and only if the fee that encourages a lobby to accept an experiment with both favorable and unfavorable outcomes is negative and sufficiently large (a prohibitively costly compensation).

having more competing lobbies reduces the quality of the evidence and, consequently, welfare. The detrimental welfare effect of competition in access fee models contrasts with the robust positive effect of competition in endogenous persuasion models without transfers (Gentzkow and Kamenica, 2011; for interim endogenous persuasion, Perez-Richet, 2014a).

Third, we examine the structure of asymmetric participation. A robust property of our access fee mechanism is the *curse of access*: If the equilibrium involves asymmetric participation, then the non-participant is always better off than the participant. We also identify who is more likely to be excluded from access and consequently benefits from abstention. In the access fee model of pure competition by Grossman and Helpman (2001), there is an inverse relationship between the bias of the lobby and participation. In our setting, timing is crucial. If access is early, the moderate (less biased) lobby has a very attractive outside option and is likely to not participate. If access is late in the game, this ex ante advantage for the moderate lobby diminishes. The attractive outside option of the moderate lobby under early access also implies that the moderate lobby prefers to establish a *long-term relationship* with the policy-maker in the form of early access fees.

Fourth, we examine the relative payoffs of the two competing lobbies. In a setting with noiseless evidence, which is a special (corner) case of our general setting, Cotton (2012) finds that a moderate lobby may be in the equilibrium more expropriated by the policy-maker and may end up worse off than an extreme lobby. The ex ante advantage of a small bias thus turns into an ex post disadvantage. This result largely contrasts with strategic communication in the absence of transfers, especially if messages are non-verifiable (Krishna and Morgan, 2001). The paradox of the ex post disadvantage generates many important and counterintuitive implications, especially in the context of endogenous persuasion, where it predicts that lobbies will strategically deteriorate the quality of their signals or even strategically burn own 'policy-related assets'. This paradox is also behind the counterintuitive prediction that contribution caps may be to the advantage of the richer lobbies (Cotton, 2012). In this paper, I demonstrate that this result indeed holds in the noiseless setting with interim access for any lobby characteristics, as long as artificial restrictions on the policy-maker's action space are lifted. However, the analysis for all information structures and alternative timings of access reveals that the paradox exists unambiguously in only one class of structures and does not exist in 13 out of 20 classes.

The paper proceeds as follows: Section 2 builds a benchmark for a noiseless information structure with interim access. This basic setting yields the paradox of the ex post disadvantage and zero welfare distortion. Section 3 introduces alternative information structures and applies the novel bilateral bargaining approach. Section 4 establishes the specific results for all information structures and for both timings. Section 5 concludes the paper.

2 Noiseless evidence

2.1 Setup

State of nature. The state of the world has two binary dimensions $\theta_i \in \{0,1\}, i = 1,2$. Prior beliefs $\pi_i := \Pr(\theta_i = 1) \in (0,1)$ are common knowledge. The priors are distributed independently, $\pi_i = \Pr(\theta_i = 1|\theta_{-i} = 0) = \Pr(\theta_i = 1|\theta_{-i} = 1)$.

Players, signals. There is a single policy-maker (the Receiver) and two lobbies (the Senders). The set of Senders is $\mathcal{S} = \{S_1, S_2\}$. Sender i privately observes a signal t_i. In the noiseless setting, t_i is perfectly correlated with θ_i. The signal has a form of verifiable/certifiable evidence that can be hidden but cannot be fabricated. We speak of a high-type (H-type) if $t_i = 1$ and a low-type (L-type) if $t_i = 0$.

Policies, objectives. The Receiver selects a policy $P \in \{P_1, P_2\}$. His policy is not contractible, and the set of implementable policies cannot be restricted. The valuations of the policies by the senders are perfectly negatively correlated (pure competition). Namely, Sender i's state-independent valuation of P_i is $v_i > 0$ and of P_{-i} is zero. In contrast, the Receiver's valuation is state-dependent. Following Cotton (2012), we introduce the Receiver's state-dependent policy loss function as

$$l(P_i, \theta_i, \theta_{-i}) = (1 - \theta_i)\theta_{-i}v_{-i}.$$

The idea behind this particular loss function is that the policy P_i is an incorrect (illegitimate) policy if and only if $\theta_i = 0$ and $\theta_{-i} = 1$. Otherwise, the policy is correct (legitimate) and the policy loss is zero. The size of the loss is normalized by v_{-i}, which expresses the policy valuation of the correct policy by Sender S_{-i}. Intuitively, the loss measures the unrealized (lost) legitimate benefits if an incorrect policy is selected.

For any pair of posterior beliefs (p_1, p_2), the expected loss of policy P_i is

$$L(P_i, p_1, p_2) := \sum_{\hat{\theta}_1=0}^{1} \sum_{\hat{\theta}_2=0}^{1} \Pr(\theta_1 = \hat{\theta}_1) \Pr(\theta_2 = \hat{\theta}_2) l(P_i, \hat{\theta}_1, \hat{\theta}_2) = (1 - p_i)p_{-i}v_{-i}. \quad (1)$$

Asymmetries. We introduce two parameters to capture asymmetries between the senders: *Valuation asymmetry* is captured by $\lambda := \frac{v_2}{v_1} \in R_+$. *Priors asymmetry* is reflected by $\mu := \frac{\pi_2}{1-\pi_2}\frac{1-\pi_1}{\pi_1} \in R_+$.

Indifference-breaking. The noiseless setting features two events when the expected losses are equal (zero) and the Receiver is ex post indifferent between the policies. We treat these two events from the Receiver's indifferences ($t_1 = t_2 = 0$ and $t_1 = t_2 = 1$) such that Receiver commits to *any feasible* pair of policies for the two events.

To describe the policy selected in the game, let $\psi(t_1, t_2)$ be a function that maps the signal realizations into the Receiver's policies. A (policy) outcome is then the matrix of the signal-specific policies,

$$O = \begin{pmatrix} \psi(0,0) & \psi(1,0) \\ \psi(0,1) & \psi(1,1) \end{pmatrix}.$$

By F, we denote an outcome that characterizes the Receiver's ex post *optimal policies* for all signal realizations. For that purpose, let us introduce the following quintuplet of outcomes:

$$F_0 := \begin{pmatrix} P_1 & P_1 \\ P_1 & P_1 \end{pmatrix}, F_1 := \begin{pmatrix} P_1 & P_1 \\ P_2 & P_1 \end{pmatrix}, F_2 := \begin{pmatrix} P_1 & P_1 \\ P_2 & P_2 \end{pmatrix}, F_3 := \begin{pmatrix} P_2 & P_1 \\ P_2 & P_1 \end{pmatrix}, F_4 := \begin{pmatrix} P_2 & P_1 \\ P_2 & P_2 \end{pmatrix}$$

In noiseless setting, the existence of the Receiver's two indifferences implies that the Receiver selects F from a quadruplet $\{F_1, F_2, F_3, F_4\}$.

Interim timing. In Stage 1, the Receiver commits to discriminatory (Sender-specific) access fees $c_i \in R, i = 1, 2$ and announces $F \in \{F_1, F_2, F_3, F_4\}$. The fee can be positive (payment for access) or negative (compensation for access). In Stage 2, each Sender i privately observes t_i. In Stage 3, each Sender i either pays the fee (participates) or abstains. In Stage 4, each participating Sender i reveals her signal t_i. In Stage 5, the Receiver selects the ex post optimal policy.

Our model differs from Cotton (2012) only in the treatment of indifferences: In Cotton (2012), F is selected exogenously and $F \in \{F_1, F_4\}$. Here, F is selected endogenously by the Receiver, where $F \in \{F_1, F_2, F_3, F_4\}$. The advantage of endogeneity is that the comparative statics are not affected by an exogenous constraint upon F. In any case, in a complete parametrical space for the noisy information structures, indifferences will be only knife-edge cases.

2.2 Equilibrium

The subgames defined by Stages 2–5 might exhibit multiple perfect Bayesian equilibria. Either the H-type separates from the L-type by revealing her type (skeptical Receiver's beliefs), or the H-type pools with the L-type by not revealing her type (non-skeptical Receiver's beliefs). Our approach is to impose skeptical beliefs and choose a separating equilibrium as long as it exists.

To find the equilibrium outcome O^*, we can classify the subgames along the set of participating (and signal revealing) Senders. The benefit of this classification is that the set of signals, the amount of information, and therefore also the policy outcome are constant within each class. Formally, let $\sigma \in 2^{\mathcal{S}}$ ($2^{\mathcal{S}}$ is the power set of $\mathcal{S}$) be the set of participating Senders.[2]

[2]Precisely speaking, for interim timing, only H-types participate, hence σ is the set of Senders for whom H-types participate.

Let $O(\sigma)$ be the outcome in any subgame with σ participants. Specifically in the noiseless setting, $O(S_1) = F_3$, $O(S_2) = F_2$, and $O(S_1, S_2) = F$.

To characterize the amount of information in a subgame, let the expected policy loss in any σ-subgame (called the *σ-loss*) be $\Lambda(\sigma)$. Clearly, $\Lambda(S_1, S_2) \leq \Lambda(S_i) \leq \Lambda(\varnothing)$ for any $i = 1, 2$. In the noiseless setting specifically, $\Lambda(S_1, S_2) = \Lambda(S_1) = \Lambda(S_2) = 0 \leq \Lambda(\varnothing)$.

To identify the equilibrium, notice that the Receiver imposing access fees effectively selects a set of participants σ out of four σ-classes of subgames. We can immediately eliminate the $\varnothing$-class as a candidate for the optimal set of participants because the non-informative outcome $O(\varnothing)$ with zero revenue is less valuable than any informative outcome with a non-negative revenue. Within each remaining σ-class, we identify the revenue-maximizing fees $c_i(\sigma), i = 1, 2$. These fees characterize the best σ-subgame. The Receiver's payoff in this best σ-subgame is $W(\sigma)$ and Sender i's payoff is $u_i(\sigma)$.

- Class $\sigma = \{S_i\}$. The Receiver's revenue-maximizing fee is $c_i(S_i) = v_i$. (The fee of a participating Sender i is set such that the H-type's incentive compatibility condition is just met. The fee $c_{-i}(S_i)$ is set prohibitively high so that the H-type of S_{-i} is not willing to participate.) The Receiver's expected payoff is

$$W(S_i) = \pi_i v_i - \Lambda(S_i) = \pi_i v_i. \tag{2}$$

- Class $\sigma = \{S_1, S_2\}$. Revenue-maximizing fees depend on F; hence, we calculate the revenue-maximizing fees for each F and obtain the expected payoff conditional on F:

$$W^F(S_1, S_2) = \begin{cases} \pi_1 \pi_2 v_1 + (1 - \pi_1)\pi_2 v_2 & \text{if } F = F_1, \\ \pi_2 v_2 = W(S_2) & \text{if } F = F_2, \\ \pi_1 v_1 = W(S_1) & \text{if } F = F_3, \\ \pi_1(1 - \pi_2) v_1 + \pi_1 \pi_2 v_2 & \text{if } F = F_4. \end{cases} \tag{3}$$

  Finally, $W(S_1, S_2) = \max_F\{W^F(S_1, S_2)\}$.

In the next step, we derive the σ-subgame (and the corresponding outcome $O(\sigma)$) that the Receiver prefers in Stage 1, which defines the equilibrium:

$$\sigma^* = \arg\max_{\sigma \in 2^{\mathcal{S}}} W(\sigma). \tag{4}$$

Given that the three best σ-subgames are informationally equivalent, $\Lambda(\sigma) = 0$, the comparison of $W(\sigma), \sigma \in 2^{\mathcal{S}}$, boils down to a comparison of revenues. By a straightforward comparison of the expected payoffs in (2) and (3), the Receiver's optimum depends on (λ, μ):

$$O^* = O(\sigma^*) = \begin{cases} F_1 & \text{if } \frac{1}{\mu} \leq \lambda \leq 1, \\ F_2 & \text{if } \lambda \geq \max\{1, \frac{1}{\mu}\}, \\ F_3 & \text{if } \lambda \leq \min\{1, \frac{1}{\mu}\}, \\ F_4 & \text{if } 1 \leq \lambda \leq \frac{1}{\mu}. \end{cases}$$

Notice that any outcome can be achieved by inviting both senders and announcing $F = O$.[3] Thus, the Receiver does not have to strategically restrict access in the noiseless interim setting to maximize her payoff; a revenue-information tradeoff is absent.

2.3 The curse of the ex ante advantage

We introduce two concepts related to the relative payoffs of senders.

Definition 1. *Sender i has an **ex ante advantage** if in the absence of communication ($\sigma = \varnothing$), her payoff is larger than the payoff of Sender $-i$, $u_i(\varnothing) > u_{-i}(\varnothing)$. Sender i has an **ex post advantage** if her equilibrium payoff is larger than the equilibrium payoff of Sender $-i$, $u_i(\sigma^*) > u_{-i}(\sigma^*)$.*

The Sender with the ex ante advantage is the sender for whom the *status-quo policy* generated by priors is the optimal policy. In Perez-Richet (2014b), this player is called a *strong player*. Intuitively, the strong sender is the player with an 'orthodox' (mainstream) opinion, whereas the weak sender holds a 'heterodox' (alternative) opinion.

The key result of the noiseless model is that an ex ante advantage is equivalent to an ex post disadvantage (*curse of the ex ante advantage*). By Proposition 1, the curse paradoxically holds in our benchmark setting for any pair of asymmetries (λ, μ). (The proofs are relegated to the Appendix.)

Proposition 1. *In the noiseless setting with interim access, $u_i(\varnothing) > u_{-i}(\varnothing) \iff u_i(\sigma^*) < u_{-i}(\sigma^*)$.*

The curse is most conveniently interpreted through the following two cases:

- Consider the ex ante advantage only in a larger prior (*pure priors asymmetry*). Then, because of the curse, the sender with a higher frequency of favorable signals paradoxically ends up worse off. Formally, if $v_1 = v_2$ and $\pi_i > \pi_{-i}$, then $u_i(\sigma^*) < u_{-i}(\sigma^*)$.
- Consider the ex ante advantage only in a larger valuation (*pure valuation asymmetry*). Then, the player with a larger stake (a richer player) paradoxically ends up worse off. Formally, if $\pi_1 = \pi_2$ and $v_i > v_{-i}$, then $u_i(\sigma^*) < u_{-i}(\sigma^*)$.

Another interesting result is *the curse of access*:[4] If Sender i is invited and Sender $-i$ is not invited, $\sigma = \{S_i\}$, then the *invited sender has an ex post disadvantage*,

$$u_i(S_i) < u_{-i}(S_i).$$

[3] More specifically, $O^* = F_3$ is achieved either by inviting only Sender 1 or equivalently by inviting both senders and announcing $F = F_3$. Similarly, the outcome $O^* = F_2$ is achieved either by inviting only Sender 2 or equivalently by inviting both senders and announcing $F = F_2$. The other outcomes are achieved only by inviting both senders.

[4] The curse of access in fact identifies a sufficient condition for the ex post advantage. This result is weaker than the curse of the ex ante advantage, which identifies both a sufficient and a necessary condition for the ex post advantage.

The importance of the curse of the ex ante advantage stands out once the Senders' characteristics are endogenous. The curse of the ex ante advantage has the potential to generate a 'race to the bottom' in terms of valuation and/or precision of the evidence. Example 1 illustrates specifically the incentive for the voluntary undervaluation of own stake. Such a strategic reduction of own stake may occur, among others, by strategically burning own policy-related assets.

Example 1. *Suppose each Sender i may strategically reduce her policy value below the initial level v_i. Given the curse, the Senders' payoffs are* ***non-monotonic*** *around $\lambda\mu = 1$. For example, Sender 1's payoff is first increasing in v_1 (i.e., for low values of v_1, $u_1 = (1-\pi_2)v_1 > 0$), and then it step-wise drops to zero (i.e., for large values of v_1, $u_1 = 0$). Therefore, for a large initial value v_1, Sender 1 is the strong sender who suffers from the curse and obtains zero payoff. She becomes better off by strategically reducing her value such that she becomes the weak sender with a positive payoff.*

3 Noisy evidence

3.1 Motivation

In this section, we consider all admissible conditionally independent signals. Through the analysis of noisy information structures, we aim to elucidate the nature of the *information-revenue tradeoff* of the Receiver. This tradeoff explains the strategic access restriction and consequently the non-participation or asymmetric participation in access-fee models of informational lobbying.

The previous Section 2 has shown that the tradeoff is absent in the noiseless information structure with interim access. In this special setting, the expected loss is *zero* independently of whether one or two senders are invited because a single signal is sufficient to generate zero expected policy loss. A consequence of the zero marginal informational value of the second signal is that the Receiver's tradeoff associated with a unilateral access restriction is purely in the revenue dimension. Yet, as we have seen in Section 2, the option of a strategic access restriction is then entirely irrelevant for maximization of revenues.

A completely different picture arises with noise.The Receiver compares the effects of access restriction on the amount of information and the amount of revenues. For some information structures, the access restriction decreases both amounts, and the tradeoff does not exist. The interesting information structures are such that the access restriction decreases the amount of information but increases the amount of revenues.

3.2 Assumptions

Pure priors asymmetry. We will solve the game only for asymmetry in priors. The lobbies' valuations are symmetric, $v_1 = v_2 = 1$ ($\lambda = 1$). Without loss of generality, $\pi_1 > \pi_2$

($\mu < 1$); Sender 1 is the strong player and Sender 2 is the weak player.

Signals. Let each signal $t_i \in \{0, 1\}$ be characterized by Type-I and Type-II errors. Namely, $\alpha = \Pr(t_1 = 0|\theta_1 = 1)$, $\beta = \Pr(t_1 = 1|\theta_1 = 0)$, $\gamma = \Pr(t_2 = 0|\theta_2 = 1)$, and $\delta = \Pr(t_2 = 1|\theta_2 = 0)$. Recall that priors are distributed independently and signals are conditionally independent. Consequently, any posterior belief about $\theta_i = 1$ is independent of the belief about $\theta_{-i} = 1$. To guarantee a natural meaning of the signals, we assume that t_i and θ_i are positively correlated. The H-type implies that the high state of the world is more likely than the L-type, $p_i(1) \geq p_i(0)$, which is equivalent to $\alpha + \beta \leq 1$ and $\gamma + \delta \leq 1$:

$$p_1(0) = \frac{\alpha\pi_1}{\alpha\pi_1 + (1-\beta)(1-\pi_1)} \leq \pi_1 \leq \frac{(1-\alpha)\pi_1}{(1-\alpha)\pi_1 + \beta(1-\pi_1)} = p_1(1)$$
$$p_2(0) = \frac{\gamma\pi_2}{\gamma\pi_2 + (1-\delta)(1-\pi_2)} \leq \pi_2 \leq \frac{(1-\gamma)\pi_2}{(1-\gamma)\pi_2 + \delta(1-\pi_2)} = p_2(1)$$

The frequencies of H-types are written as $f_1 := (1-\alpha)\pi_1 + \beta(1-\pi_1)$ and $f_2 := (1-\gamma)\pi_2 + \delta(1-\pi_2)$. Notice that in the presence of noise, almost any variable in the game depends on the noise parameters $(\alpha, \beta, \gamma, \delta)$. For brevity, our notation excludes the parameters from the arguments.

Indifference. We disregard information structures with the Receiver's indifferences; hence, F is unique. The reason for this choice is that if the noise parameters are drawn from a joint distribution function, then the event that the Receiver is indifferent at some signal realization is a measure-zero event. The existence of a unique F allows us to eliminate the announcement of F from the Receiver's strategy set.

Timing. The interim timing is identical to that in Section 2; only the announcement of F is left out. In ex ante timing, Stages 2 and 3 are switched. Specifically, in Stage 2, each Sender i either pays the fee (participates) or abstains. Then in Stage 3, each Sender i privately observes t_i. (Therefore, σ is the set of participating Senders for ex ante timing and the set of Senders with participating H-types for interim timing.)

Losses. We know that $l(P_i, \theta_i, \theta_{-i}) = 0$ if $\theta_1 = \theta_2 = 0$. As a result, only states of the world in which $\theta_1 \neq \theta_2$ are informationally relevant to the Receiver. Thus, the Receiver's minimization of the expected loss rewrites into a classic binary-binary (two relevant states and two actions) decision problem (c.f., Börgers et al., 2013). We now parametrically express the expected loss associated with policy P under signal realization (t_1, t_2). Using (1) and the conditional probabilities of the signal realizations,

$$L(P_1; p_1(t_1); p_2(t_2)) = (1 - p_1(t_1))p_2(t_2) = \beta^{t_1}(1-\beta)^{1-t_1}(1-\gamma)^{t_2}\gamma^{1-t_2}(1-\pi_1)\pi_2,$$
$$L(P_2; p_1(t_1); p_2(t_2)) = p_1(t_1)(1 - p_2(t_2)) = (1-\alpha)^{t_1}\alpha^{1-t_1}\delta^{t_2}(1-\delta)\gamma^{1-t_2}(1-\pi_2)\pi_1.$$

The *information gain from the policy switch* from P_i to P_{-i} under the signal realization (t_1, t_2) is simply measured by the difference in the posteriors,

$$L(P_i; p_1(t_1); p_2(t_2)) - L(P_{-i}; p_1(t_1); p_2(t_2)) = p_{-i}(t_{-i}) - p_i(t_i).$$

Welfare. The application of the utilitarian welfare criterion in a symmetric two-sender setting is considerably easier than in any asymmetric setting[5] because policy valuations of two pure competitors with symmetric values exactly cancel each other out. Additionally, given zero transaction costs for transfers, any transfer through an access fee is welfare-neutral. Thus, if C_i denotes the expected revenues from Sender i, the utilitarian welfare is

$$W + u_1 + u_2 = C_1 + C_2 - \Lambda(\sigma) + \Pr(P = P_1) - C_1 + \Pr(P = P_2) - C_2 = 1 - \Lambda(\sigma).$$

Clearly, the welfare is measured by the inverse of the Receiver's expected loss Λ (i.e., the equilibrium amount of information). Given the Receiver's non-contractible actions, the first-best outcome is thus achieved if access is not restricted, $\{S_1, S_2\} = \arg\min_\sigma \Lambda(\sigma)$. Vice versa, only strategic access restriction may create a wedge between the equilibrium outcome O^* and the first-best outcome $O(S_1, S_2) = F$.

3.3 Information structures

Because the power set of $\mathcal{S} = \{S_1, S_2\}$ has four elements, $\#2^{\mathcal{S}} = 4$, each information structure generates a quadruplet of outcomes $O(\sigma), \sigma \in 2^{\mathcal{S}}$. We now classify the information structures into classes, with each class defined by a generic quadruplet of outcomes. Thereby, we will identify 10 different classes of information structure.

3.3.1 F-characterization

The first part of the classification of information structures is along the F matrix. By definition, F characterizes the policy outcome if (t_1, t_2) is observed. The identification of F in the parametrical space requires a comparison $p_1(t_1) \gtreqless p_2(t_2)$ to be conducted for each out of four pairs of $t_1 \in \{0, 1\}$ and $t_2 \in \{0, 1\}$. For the sign of the inequality in (t_1, t_2), we introduce a binary indicator:

$$\phi^{t_1,t_2} := \mathbf{1}\{p_1(t_1) \geq p_2(t_2)\}.$$

$\phi^{1,0} = 1$ always holds. The remaining indicators are identified in the following way:

$$\phi^{0,0} = \mathbf{1}\{\alpha(1-\delta) \geq (1-\beta)\gamma\mu\}$$
$$\phi^{0,1} = \mathbf{1}\{\alpha\delta \geq (1-\beta)(1-\gamma)\mu\}$$
$$\phi^{1,1} = \mathbf{1}\{(1-\alpha)\delta \geq \beta(1-\gamma)\mu\}$$

[5] For examples of the utilitarian welfare criteria in a single-sender access-fee setting, see Gregor (2014).

The triplet of the binary indicators $(\phi^{0,0}, \phi^{0,1}, \phi^{1,1})$ admits eight combinations; however, not all are feasible. The implication $\phi^{0,0} = 0 \Rightarrow \phi^{0,1} = 0$ rules out the triplets $(0, 1, 0)$ and $(0, 1, 1)$. The implication $\phi^{1,1} = 0 \Rightarrow \phi^{0,1} = 0$ additionally rules out the triplet $(1, 1, 0)$. The remaining five admissible triplets characterize the support of F as $\{F_0, F_1, F_2, F_3, F_4\}$.

3.3.2 Informativeness indicators

The second part of the classification uses the informativeness of the signals. We call a signal t_i *informative* if, ceteris paribus, the Receiver sets $P = P_{-i}$ after observing $t_i = 0$ and $P = P_i$ after observing $t_i = 1$. We denote the informativeness indicator of the signal t_i as I_i. There are three indicators for each signal t_i depending on the other signal t_{-i}: (i) $I_i^{\varnothing}$ is for t_{-i} being unobserved; (ii) I_i^0 is for a low realization, $t_{-i} = 0$; and (iii) I_i^1 is for a high realization, $t_{-i} = 1$.

Informativeness indicators in the absence of the other signal, $I_i^{\varnothing} := \mathbf{1}\{p_i(0) \leq \pi_{-i} \leq p_i(1)\}$, write parametrically as

$$
\begin{aligned}
I_1^{\varnothing} &= \mathbf{1}\{\alpha + \mu\beta - \mu \leq 0\}, \\
I_2^{\varnothing} &= \mathbf{1}\{\mu\gamma + \delta - \mu \leq 0\}.
\end{aligned}
$$

The informativeness indicators in the presence of the other signal are as follows:

$$
I_i^k = \mathbf{1}\{p_i(0) \leq p_{-i}(k) \leq p_i(1)\}.
$$

Notice that each quadruplet $(I_0^0, I_0^1, I_1^0, I_1^1)$ defines a triplet $(\phi^{0,0}, \phi^{0,1}, \phi^{1,1})$. Additionally, notice that the triplet $(\phi^{0,0}, \phi^{0,1}, \phi^{1,1})$ is by definition interchangeable with F. Therefore, the additional classification brought about by the informativeness indicators rests only in the pair $(I_1^{\varnothing}, I_2^{\varnothing})$.

3.3.3 Classes of information structures

The classification is obtained by combining F and the informativeness indicators $(I_1^{\varnothing}, I_2^{\varnothing})$. Lemma 1 identifies 10 classes of structures.

Lemma 1. *There are 10 admissible information structures, defined in Table 1.*

As a next step, we characterize the outcomes $O(\sigma)$ based on the set of invited lobbies σ and the information structure. The *non-garbled outcome* is by definition $O(S_1, S_2) = F$. The *garbled outcome* in which no signal is observed is $O(\varnothing) = F_0$. (Recall that Sender 1 has the ex ante advantage.) The non-garbled outcome for $\sigma = \{S_i\}$ depends upon the indicator $I_i^{\varnothing}$:

$$
O(S_1) = \begin{cases} F_3 & \text{if } I_1^{\varnothing} = 1, \\ F_0 & \text{if } I_1^{\varnothing} = 0. \end{cases} \qquad O(S_2) = \begin{cases} F_2 & \text{if } I_2^{\varnothing} = 1, \\ F_0 & \text{if } I_2^{\varnothing} = 0. \end{cases}
$$

Table 1: The admissible information structures

Class	F-indicators			Informativeness						Outcomes		
	$\phi^{0,0}$	$\phi^{0,1}$	$\phi^{1,1}$	$I_1^{\varnothing}$	$I_2^{\varnothing}$	I_1^0	I_1^1	I_2^0	I_2^1	$\sigma = \{S_1, S_2\}$	$\sigma = \{S_1\}$	$\sigma = \{S_2\}$
C1	1	1	1	0	0	0	0	0	0	F_0	F_0	F_0
C2	1	0	1	0	0	0	1	1	0	F_1	F_0	F_0
C3	1	0	1	0	1	0	1	1	0	F_1	F_0	F_2
C4	1	0	1	1	0	0	1	1	0	F_1	F_3	F_0
C5	1	0	1	1	1	0	1	1	0	F_1	F_3	F_2
C6	1	0	0	0	1	0	0	1	1	F_2	F_0	F_2
C7	1	0	0	1	1	0	0	1	1	F_2	F_3	F_2
C8	0	0	1	1	0	1	1	0	0	F_3	F_3	F_0
C9	0	0	1	1	1	1	1	0	0	F_3	F_3	F_2
C10	0	0	0	1	1	1	0	0	1	F_4	F_3	F_2

Therefore, in the equilibrium, $O^* \in \{F_0, O(S_1), O(S_2), F\}$. Table 1 summarizes the garbled and non-garbled outcomes associated with each information structure. Each class of structures characterizes a unique quadruplet of admissible outcomes $O(\sigma), \sigma \in 2^{\mathcal{S}}$. The quadruplet also characterizes the quadruplet of σ-losses $\Lambda(\sigma), \sigma \in 2^{\mathcal{S}}$, and the σ-losses characterize the information complementarity properties of the signals (c.f., Börgers *et al.*, 2013).

Definition 2. *Let the signals be **information complements** if σ-losses satisfy*

$$\Lambda(S_1) + \Lambda(S_2) > \Lambda(\varnothing) + \Lambda(S_1, S_2). \tag{5}$$

With the opposite strict inequality, the signals are information substitutes.

3.4 σ-classes of subgames

As in the noiseless setting, the equilibrium is characterized by the Receiver's optimal fees (c_1^*, c_2^*), which induce the optimal set of participants σ^* and the optimal outcome $O(\sigma^*)$. The optimum is found in two steps: First, we derive the revenue-maximizing fees for each σ, $c_1(\sigma)$ and $c_2(\sigma)$. The fees induce a σ-subgame with the Receiver's expected value $W(\sigma)$. Second, we compare the Receiver's expected values $W(\sigma)$ and select the subgame with the highest value, as in (4).

The construction of the revenue-maximizing fees in a σ-class follows the following participation constraints:

- *Participants*: For any $S_i \in \sigma$, the fee $c_i(\sigma)$ is set such that the participant's after-payment value is *equal* to the value of the outside option (i.e., non-participation). As in principal-agent models, if the agent's value is below her outside option, the agent (Sender) deviates. If her value is above her outside option, the principal (Receiver) can increase the fee, transfer part of the value to himself, and still maintain a σ-subgame.

- *Non-participants*: For any $S_i \notin \sigma$, the fee $c_i(\sigma)$ is set prohibitively high such the non-participant's value of non-participation is *above* the value of the outside option (i.e., participation). The exact level is irrelevant because a fee imposed upon a non-participant is not paid.

3.5 Bargaining perspective

To identify σ^* requires us to make three pairwise comparisons between the values $W(\sigma)$. When conducting the pairwise comparisons, we adopt the following *bargaining perspective*: Through fees, the Receiver selects a σ-class of subgames, where σ describes each Sender i's participation. Either the fee c_i is acceptable and Sender i participates, or the fee is unacceptable and Sender i abstains. (We will alternatively say that the Receiver either *invites* Sender i or does *not invite* Sender i.)

The invitation of Sender i requires two participation conditions to be met: The Receiver's participation condition is defined by the Receiver's outside option of non-invitation. The Sender's participation condition is defined by the Sender's outside option of abstention. The existence of two players' participation conditions in which one player (the Receiver) gives an offer and the second player (the Sender) accepts or declines the offer constitutes a *bilateral bargaining problem*.

Therefore, we may interpret the equilibrium fees as the Receiver's bargaining offers in *two parallel bilateral bargaining problems*. When setting a particular offer for Sender i, the Receiver calculates both his partial gains from an invitation and Sender i's partial gains from an invitation. If the sum of the partial gains (*bilateral surplus*) is positive, both participation conditions can be met and the Receiver sets a fee c_i that indeed motivates Sender i to pay the fee and disclose the signal. If the surplus is negative, both participation conditions cannot be met at the same time and the Receiver sets a prohibitively large fee that discourages Sender i from disclosing the signal.

The key in the subsequent analysis is to derive the partial gains. For Sender i, the partial gain is the change in the frequency of the preferred policy P_i relative to her outside option. For the Receiver, the partial gains consist of an *informational gain* and the *revenue externality* upon the other parallel problem, both relative to his outside option of non-invitation. The informational gain is the decrease in the expected policy loss associated with observing an additional signal. The revenue externality is the change in the Receiver's revenues in the parallel bargaining problem. Simply, if the Receiver invites Sender i, he must take into account that he will charge a different access fee c_{-i} because the outside option of Sender $-i$ changes. Thus, each bilateral surplus has exactly three components: (i) The change in the frequency of the preferred policy, (ii) the reduction of the policy loss, and (iii) the revenue externality.[6]

[6]In a single-sender setting, the bilateral surplus has only two components (Gregor, 2014). The only difference

Each bilateral bargaining problem has a trivial bargaining protocol: The Receiver makes a single *take-it-or-leave-it offer* and the Sender agrees or disagrees. As a result, the Receiver has full bargaining power, extracts the full surplus, and leaves the Sender with the payoff at her outside option. (For convenience, we treat the Sender's indifference such that she always accepts the offer equal to her outside option.) An immediate corollary of the full bargaining power of the Receiver is that $c_i(\sigma)$ is *equal* to the partial gain from the participation of Sender i if $S_i \in \sigma$, and $c_i(\sigma)$ is *above* the partial gain from participation of Sender i if $S_i \notin \sigma$.

In Section 4, we will show in detail that the signs of the bilateral surpluses characterize two inequalities between the values $W(\sigma)$: The surplus for a participant is non-negative, $W(\sigma) - W(\sigma \setminus S_i) \geq 0$, and negative for a non-participant, $W(\sigma \cup S_i) - W(\sigma) < 0$. Therefore, the bargaining perspective generates two *easily applicable equilibrium conditions*: The bilateral surplus with a participant is non-negative, and the bilateral surplus with a non-participant is negative.

Because the bargaining perspective does not exhaust all of the Receiver's options, the two equilibrium conditions are necessary but not sufficient. In (4), the Receiver compares σ with three alternatives, whereas the bargaining perspective calculates only two surpluses and thereby conducts only two comparisons.[7] Nevertheless, Propositions 3 and 2 reveal that the surplus levels for our pure competition of two senders are in fact sufficient to characterize σ^*.

In the construction of the surpluses, it is important that the identity of the Receiver's bargaining partner depends on timing. For ex ante access, the Receiver's partner is the Sender as such. For interim access, the Receiver's partner is only Sender of H-type. Timing also affects whether the outside options of the two bargaining players constitute a single disagreement event or not. For ex ante timing, any player's non-participation results in the same disagreement event (namely, a different σ-subgame with an abstaining Sender). For interim timing, the Receiver's non-invitation results in a σ-subgame with an abstaining Sender, while the H-type's non-participation maintains the σ-subgame but the H-type is now interpreted as an L-type.

4 Results

4.1 Interim access

The Receiver's expected value in the revenue-maximizing σ-subgame is

$$W(\sigma) = \sum_{i=1,2} \mathbf{1}\{S_i \in \sigma\} f_i c_i(\sigma) - \Lambda(\sigma). \tag{6}$$

between a single-sender and a multiple-sender setting lies in the existence of the revenue externalities.

[7]The single missing equilibrium condition that is not captured by the bargaining perspective is $W(\sigma^*) \geq W(\neg\sigma^*)$, where $\neg\sigma^*$ is a complement to σ^*. More generally, for n Senders, the bargaining perspective examines n conditions and omits $2^n - n - 1$ conditions. The bargaining perspective is therefore useful for a low number of Senders.

The revenue-maximizing fees $c_i(\sigma), i = 1, 2$, are set as follows:

- $S_i \in \sigma$: The payoff of a participating H-type is $u_i^H(\sigma) = \Pr(P = P_i | O = O(\sigma), t_i = 1) - c_i$. Her outside option in a separating equilibrium is to pool with a non-participating L-type; hence, it is equal to the payoff of the non-participating L-type, $u_i^L(\sigma) = \Pr(P = P_i | O = O(\sigma), t_i = 0)$. We know that the Receiver exploits the separation and extracts all rents (partial gains) of the H-type, where the rents under interim access are always non-negative,

$$c_i(\sigma) = \Pr(P = P_i | O = O(\sigma), t_i = 1) - \Pr(P = P_i | O = O(\sigma), t_i = 0) \geq 0. \quad (7)$$

- $S_i \notin \sigma$: The payoff of a non-participating H-type is $u_i^H(\sigma) = \Pr(P = P_i | O = O(\sigma))$. Her outside option is a payoff associated with the revelation of $t_i = 1$, namely $\Pr(P = P_i | O = O(\sigma \cup S_i), t_i = 1) - c_i$. We know that the Receiver sets a prohibitively large fee to discourage participation,

$$c_i(\sigma) > \Pr(P = P_i | O = O(\sigma \cup S_i), t_i = 1) - \Pr(P = P_i | O = O(\sigma)).$$

Now, we construct the bilateral surpluses for interim access. Let $H_i^{\varnothing}$ be the bilateral surplus between the Receiver and the H-type of Sender i if Sender $-i$ does not participate. The surplus consists of an informational gain for the Receiver at $\sigma = \{S_i\}$ (his outside option is an informational gain in $\varnothing$-subgame) and of a partial gain for the H-type of Sender (her outside option is σ-subgame with the Receiver's posterior $t_i = 0$) multiplied by f_i. Given full bargaining power for the Receiver, we know that the partial gain of Sender i is the fee $c_i(S_i)$. To obtain the expected revenue in the interim setting, the partial gain of the H-type of Sender must be multiplied by the frequency of the H-type, f_i, because the Receiver's informational gain is always realized, whereas the Sender's partial gains are realized only in high realizations. Therefore,

$$H_i^{\varnothing} = \Lambda(\varnothing) - \Lambda(S_i) + f_i c_i(S_i) \geq 0. \quad (8)$$

Let H_i^e be the bilateral surplus between the Receiver and the H-type of Sender i if Sender $-i$ participates. The surplus is derived under $\sigma = \{S_1, S_2\}$ and consists of the two formerly analyzed partial gains plus a *revenue externality* from participation of S_i. More specifically, if S_i participates, she affects the parallel bargaining problem with S_{-i}. This participation changes the partial gains for the other H-type, which implies a revenue change from $f_{-i}c_{-i}(S_{-i})$ into $f_{-i}c_{-i}(S_1, S_2)$. In total, the surplus H_i^e is the sum of three components,

$$H_i^e = \Lambda(S_{-i}) - \Lambda(S_1, S_2) + f_i c_i(S_1, S_2) + f_{-i}c_{-i}(S_1, S_2) - f_{-i}c_{-i}(S_{-i}). \quad (9)$$

Now, by combining (6), (8) and (9), we find that the sign of the surplus is indeed equivalent to a comparison of the respective pair of $W(\sigma)$ and $W(\sigma \setminus S_i)$,

$$H_i^{\varnothing} = W(S_i) - W(\varnothing),$$
$$H_i^e = W(S_1, S_2) - W(S_{-i}).$$

Proposition 2 employs the bilateral surpluses to characterize the strategically restricted access.

Proposition 2. *For interim access, the Receiver restricts the access of Sender i if and only if* $H_i^e < 0$ *and* $H_i^{\varnothing} \leq H_{-i}^{\varnothing}$.

Next, we introduce the revenue complementarity of the signals for interim access and combine the revenue and information complementarity properties into a single property.

Definition 3. *For interim access, let the signals be* ***revenue complements*** *if*

$$f_1 c_1(S_1, S_2) + f_2 c_2(S_1, S_2) > f_1 c_1(S_1) + f_2 c_2(S_2). \tag{10}$$

For interim access, let the signals be ***access complements*** *if*

$$f_1 c_1(S_1, S_2) + f_2 c_2(S_1, S_2) - \Lambda(\varnothing) - \Lambda(S_1, S_2) > f_1 c_1(S_1) + f_2 c_2(S_2) - \Lambda(S_1) - \Lambda(S_2). \tag{11}$$

With the opposite strict inequality, the signals are revenue substitutes or access substitutes, respectively.

By inspection of (11), access complementarity determines the sign of $H_i^e - H_i^{\varnothing}$, which describes whether the bilateral surplus with one sender increases or decreases with the invitation of the other sender. In addition, the sign also characterizes the sign of the overall externality of participation of one sender upon bargaining with the other sender. (Exactly the same equivalence also applies in ex ante timing.) More specifically, notice that the invitation of S_{-i} generates two externalities on bargaining with S_i. The *informational externality* measures the change in the Receiver's informational gain, $[\Lambda(S_1, S_2) - \Lambda(S_{-i})] - [\Lambda(S_i) - \Lambda(\varnothing)]$, and the sign is positive if and only if the signals are information complements. The *revenue externality* measures the change in the Receiver's revenue, $f_i[c_i(S_1, S_2) - c_i(S_{-i})] - f_i[c_i(S_i) - c_i(\varnothing)]$, and the sign is positive if and only if the signals are revenue complements. The sum of both externalities is the *overall externality*; the overall externality is positive if the signals are access complements, and negative if the signals are access substitutes. Notice that all types of externalities (information, revenue, access) are *symmetric* for the Senders; an externality of Sender 1's participation upon bargaining with Sender 2 is identical to an externality of Sender 2's participation upon bargaining with Sender 1.

The fact that access complementarity determines whether the bilateral surplus with one sender increases or decreases with the invitation of the other sender is used in Corollary 1 to Proposition 2. The corollary identifies a useful special necessary condition for the strategic access restriction under interim timing.

Corollary 1. *For interim access, a necessary condition for the strategic access restriction is that signals are access substitutes.*

Equivalently, a sufficient condition for both Senders being invited is access complementarity. Moreover, in the applied analysis for particular information structures, it may be useful to see that from the definition of access substitutability, a sufficient condition for access substitutability is information substitutability and revenue substitutability. Similarly, we may use the fact that a sufficient condition for access complementarity is information complementarity and revenue complementarity.

4.2 Ex ante access

The Receiver's expected value in the revenue-maximizing σ-subgame is

$$W(\sigma) = \sum_{i=1,2} \mathbf{1}\{S_i \in \sigma\} c_i(\sigma) - \Lambda(\sigma). \tag{12}$$

The revenue-maximizing fees $c_i(\sigma), i = 1, 2$, are set as follows:

- $S_i \in \sigma$: The payoff of a participating Sender is $u_i(\sigma) = \Pr(P = P_i | O = O(\sigma)) - c_i$. Her outside option is a $\sigma \setminus S_i$-subgame in which she does not pay a fee, with a payoff of $u_i(\sigma \setminus S_i) = \Pr(P = P_i | O = O(\sigma \setminus S_i))$. We know that the Receiver extracts all rents of the participating Sender,

$$c_i(\sigma) = \Pr(P = P_i | O = O(\sigma)) - \Pr(P = P_i | O = O(\sigma \setminus S_i)). \tag{13}$$

- $S_i \notin \sigma$: The payoff of a non-participating Sender is $u_i(\sigma) = \Pr(P = P_i | O = O(\sigma))$. Her outside option is participation in a $\sigma \cup S_i$-subgame minus the required fee, $\Pr(P = P_i | O = O(\sigma \cup S_i)) - c_i$. We know that the Receiver sets a prohibitively large fee to discourage such participation,

$$c_i(\sigma) > \Pr(P = P_i | O = O(\sigma \cup S_i)) - \Pr(P = P_i | O = O(\sigma)).$$

Now, we construct the bilateral surpluses for ex ante access. Let $B_i^{\varnothing}$ be the bilateral surplus between the Receiver and Sender i if Sender $-i$ does not participate. The surplus consists of an informational gain for the Receiver at $\sigma = S_i$ (his outside option is $\varnothing$-subgame) and of a partial gain for the Sender (her outside option is also $\varnothing$-subgame). Given the full bargaining power of the Receiver, we know that the partial gain of the Sender is in fact $c_i(S_i)$. Consequently,

$$B_i^{\varnothing} = \Lambda(\varnothing) - \Lambda(S_i) + c_i(S_i). \tag{14}$$

Let B_i^e be the bilateral surplus between the Receiver and Sender i if Sender $-i$ participates. The surplus consists of the two formerly analyzed partial gains plus a revenue externality for participation of S_i upon the parallel bargaining problem with S_{-i}, evaluated at $\sigma = \{S_1, S_2\}$. In total, the bilateral surplus B_i^e is the sum of three components,

$$B_i^e = \Lambda(S_{-i}) - \Lambda(S_1, S_2) + c_i(S_1, S_2) + c_{-i}(S_1, S_2) - c_{-i}(S_{-i}). \tag{15}$$

Now, by combining (12), (14), and (15), we find that the signs of the surpluses are (exactly as in the case of interim timing) equivalent to a comparison of the respective pairs of $W(\sigma)$ and $W(\sigma \setminus S_i)$,

$$B_i^{\varnothing} = W(S_i) - W(\varnothing),$$
$$B_i^{e} = W(S_1, S_2) - W(S_{-i}).$$

Proposition 3 uses the surpluses to show that the weaker sender is always invited and the set of participants is characterized by a single condition.

Proposition 3. *The Receiver never restricts the access of the weak sender. The Receiver restricts the access of the strong sender if and only if* $B_1^e < 0$.

As a next step, we introduce the complementarity properties in the ex ante timing.

Definition 4. *For ex ante access, let the signals be* ***revenue complements*** *if*

$$c_1(S_1, S_2) + c_2(S_1, S_2) > c_1(S_1) + c_2(S_2). \tag{16}$$

For ex ante access, let the signals be ***access complements*** *if*

$$c_1(S_1, S_2) + c_2(S_1, S_2) - \Lambda(\varnothing) - \Lambda(S_1, S_2) > c_1(S_1) + c_2(S_2) - \Lambda(S_1) - \Lambda(S_2). \tag{17}$$

With the opposite strict inequality, the signals are revenue substitutes or access substitutes, respectively.

It is valuable to exploit (13) to discover that under ex ante timing, *all signals are revenue neutral*:

$$c_1(S_1, S_2)+c_2(S_1, S_2) = \Pr(P = P_1|O = O(S_1))+\Pr(P = P_2|O = O(S_2))-1 = c_1(S_1)+c_2(S_2). \tag{18}$$

Hence, the sign of access complementarity (and the overall externality) is determined only by the sign of information complementarity. This observation is used in Corollary 2 to Proposition 3.[8]

Corollary 2. *For ex ante access, a sufficient condition for the strategic access restriction is* $B_1^{\varnothing} < 0$*, and signals are information substitutes. A sufficient condition for both Senders being invited is* $B_1^{\varnothing} \geq 0$*, and signals are information complements.*

4.3 The curse of favorable evidence

In this section, we examine the robustness of the curse of the favorable evidence (a special case of the curse of the ex ante advantage for symmetric values) to information structures and timing of access. In other words, we ask if the weak sender has the ex post advantage as in the benchmark setting or not.

[8] The corollary is close to the analysis of optimal access fees for a single sender (Gregor, 2014), where the only reason to restrict access under ex ante timing is that the sender is strong and must be compensated for evidence disclosure, but the required compensation is prohibitively costly for the receiver.

4.3.1 Interim access

To start with, Sender i's expected payoff in σ-subgame with the revenue-maximizing fee $c_i(\sigma)$ under interim access is

$$u_i(\sigma) = \begin{cases} \Pr(P = P_i | O = O(\sigma)) - f_i c_i(\sigma) & \text{if } S_i \in \sigma, \\ \Pr(P = P_i | O = O(\sigma)) & \text{if } S_i \notin \sigma. \end{cases} \tag{19}$$

In the second step, we derive the revenue maximizing fee explicitly using (7):

$$c_i(S_i) = I_i^{\varnothing} \tag{20}$$

$$c_i(S_1, S_2) = I_i^0(1 - f_{-i}) + I_i^1 f_{-i}. \tag{21}$$

We now try to classify the relative payoffs depending on σ^*. (Recall that $\sigma^* \neq \varnothing$ because $H_i^{\varnothing} \geq 0, i = 1, 2$.) This classification immediately shows that we cannot reject either the benefit or the curse of favorable evidence in the general class of information structures.

- Consider $\sigma^* = \{S_i\}$. By Proposition 2, a necessary condition for the strategic access restriction of S_{-i} is $H_{-i}^e < 0$. From (9), a necessary condition is $c_i(S_i) > 0$, which from (20) requires $I_i^{\varnothing} = 1$. Consequently, $\Pr(P = P_i | O = O(\sigma)) = f_i$, and by (19),

  $$u_i(S_i) = 0 < 1 - f_{-i} = u_{-i}(S_i). \tag{22}$$

  Specifically, if $\sigma^* = \{S_1\}$, the outcome is $O^* = F_3$, and there is a curse of favorable evidence. If $\sigma^* = \{S_2\}$, the outcome is $O^* = F_2$, and there is a benefit from favorable evidence.

- Consider $\sigma^* = \{S_1, S_2\}$. Using (19) and (7),

  $$u_1(S_1, S_2) = \Pr(P = P_1 | O = F, t_1 = 0) = (1 - f_2)\phi^{0,0} + f_2\phi^{0,1},$$
  $$u_2(S_1, S_2) = \Pr(P = P_2 | O = F, t_2 = 0) = (1 - f_1)(1 - \phi^{0,0}) + f_1(1 - \phi^{1,0}).$$

  From Table 1, we use $\phi^{0,0} = 1 - I_1^0$ and $\phi^{0,1} = (1 - I_1^0)(1 - I_2^0)$. Also recall that $\phi^{1,0} = 1$ always holds. Imposing into the relative payoffs, we observe the curse of favorable evidence for $F \in \{F_3, F_4\}$ and the benefit of favorable evidence otherwise:

  $$(u_1(S_1, S_2); u_2(S_1, S_2)) = \begin{cases} (1, 0) & \text{if } F = F_0, \\ (1 - f_2, 0) & \text{if } F \in \{F_1, F_2\}, \\ (0, 1 - f_1) & \text{if } F \in \{F_3, F_4\}. \end{cases} \tag{23}$$

Proposition 4 summarizes and shows that the ex post advantage under interim access is characterized by the equilibrium outcome O^*.

Proposition 4. *For interim access, the strong sender has the ex post advantage if $O^* \in \{F_0, F_1, F_2\}$ and the ex post disadvantage if $O^* \in \{F_3, F_4\}$.*

4.3.2 Ex ante access

Sender i's expected payoff in σ-subgame with the revenue-maximizing fee $c_i(\sigma)$ under ex ante access is

$$u_i(\sigma) = \begin{cases} \Pr(P = P_i | O = O(\sigma)) - c_i(\sigma) & \text{if } S_i \in \sigma, \\ \Pr(P = P_i | O = O(\sigma)) & \text{if } S_i \notin \sigma. \end{cases} \tag{24}$$

Again, we explicitly derive the revenue-maximizing fees:

$$c_1(S_1) = I_1^{\varnothing}(f_1 - 1) \leq 0, \tag{25}$$

$$c_2(S_2) = I_2^{\varnothing} f_2 \geq 0. \tag{26}$$

We also classify the payoffs along σ^*. By Proposition 3, either the weak Sender 2 is invited or both Senders are invited.

- Consider $\sigma^* = \{S_2\}$. For the participating Sender 2, we know her payoff is equal to the outside option of $\varnothing$-subgame, $u_2(S_2) = u_2(\varnothing) = 0$. For the abstaining Sender 1, we use (24) to derive $u_1(S_2) = \Pr(P = P_1 | O = O(S_2)) = 1 - I_2^{\varnothing} f_2 \geq 0$. Thus, we observe the *benefit* of favorable evidence.
- Consider $\sigma^* = \{S_1, S_2\}$. Again, we use the fact that the payoff of each participating Sender S_i is equal to the outside option of the $\sigma \setminus S_i$-subgame: $u_i(S_1, S_2) = u_i(S_{-i})$. There is a curse of favorable evidence if and only if

  $$u_1(S_1, S_2) = u_1(S_2) < u_2(S_1) = u_2(S_1, S_2),$$

  which rewrites into a condition

  $$1 < I_1^{\varnothing}(1 - f_1) + I_2^{\varnothing} f_2. \tag{27}$$

  The inequality in (27) helps us to establish Proposition 5.

Proposition 5. *For ex ante access, the strong sender has the ex post disadvantage if and only if access is not restricted, $\sigma^* = \{S_1, S_2\}$, evidence of both Senders is informative, $I_1^{\varnothing} = I_2^{\varnothing} = 1$, and strong senders of H-type are less frequent than weak senders of H-type, $f_1 < f_2$.*

4.4 The curse of access

The curse of access can obviously be examined only in the equilibrium profiles with a strategic access restriction. We know that access is strategically restricted only under informative signals. Hence, we examine relative payoffs under outcomes $O(S_1) = F_3$ and $O(S_2) = F_2$.

- For interim timing, by Proposition 4, Sender 1 has the ex post disadvantage if she is invited alone, $O^* = O(S_1) = F_3$ and the ex post advantage if she is not invited, $O^* = O(S_2) = F_2$. Therefore, we observe the curse of access.

- For ex ante timing, the weak sender is always invited, and we investigate only $\sigma^* = \{S_2\}$. From the previous analysis, we know that the strong sender has the ex post advantage; hence, we again observe the curse of access.

In summary, *the curse of access holds for any timing and any information structure.* This result has very striking consequences for the organization of lobbies because it implies that the asymmetry in participation in an access fee mechanism under pure competition is to the relative benefit of non-participants.

Consequently, if a certain lobby faces lower costs of self-organization and enters the market first, it becomes asymmetrically exploited; given the curse of access, it then loses its initial cost advantage. In such a case, there is an *efficiency-equity tradeoff* in the comparison of incomplete and complete participation: While incomplete participation (asymmetric access) generates a welfare loss, it also 'levels the playing field' between the organized and unorganized lobbies.

4.5 Results for all information structures

In this section, we combine the general findings with the characterizations of the structures to build specific results for every admissible information structure. We will see which unambiguous results are attainable solely by the classification of the information structures.

To start with, Table 2 evaluates information, revenue, and access complementarities for every class of information structure and for both timings. By Corollaries 1 and 2, access complementarities typically motivate the Receiver to encourage both senders to participate, whereas access substitutabilities typically motivate the Receiver to discourage full participation. Thus, access complementarities are exploited to derive σ^* for those classes in which the results are unambiguous. In the second step, Table 2 applies Propositions 4 and 5 to identify the ex post advantages and disadvantages. Appendix B derives the results in detail.

Table 2: Detailed results for the information structures

Class	Complementarity/substitutability					Results			
	Information	Revenue		Access		σ^*		Benefit/curse	
Timing	Both	Ex ante	Interim	Ex ante	Interim	Ex ante	Interim	Ex ante	Interim
C1	0	0	0	0	0	S_1, S_2	S_1, S_2	B	B
C2	c	0	c	c	c	S_1, S_2	S_1, S_2	B	B
C3	c	0	0	c	c	S_1, S_2	S_1, S_2	B	B
C4	c	0	-	c	-	S_2	-	B	-
C5	-	0	s	-	-	-	-	-	-
C6	0	0	0	0	0	S_1, S_2	S_1, S_2	B	B
C7	s	0	s	s	s	S_2	-	B	-
C8	0	0	0	0	0	S_2	S_1, S_2	B	C
C9	s	0	s	s	s	S_2	-	B	-
C10	-	0	s	-	-	S_2	-	B	-

Notes: c = complementarity; s = substitutability; 0 = neutrality; B = benefit; C = curse; - = ambiguity

Table 2 reveals that the strong sender is more likely to have the final advantage if access is ex ante (a long lag between payment and access) than if access is interim (a short lag between payment and access). Intuitively, with a long lag, senders have better outside options (non-participation is interpreted only as unwillingness to 'run an experiment', not as evidence of a bad outcome for the experiment) and the Receiver's extractive capacity is lower. The outside option of the strong sender is particularly attractive. Therefore, the ex ante advantage of the strong sender is more likely to be preserved.

To sum up, the access fee model predicts that the strong (mainstream) sender typically prefers a *long-term relationship* in the sense of arranging access payments well ahead of the meetings. Early pre-payments prevent the strong senders from being strategically exploited later. In the context of lobbying, our model thus finds a novel incentive for establishing long-term relationships between a policy-maker and established interest groups. At the same time, notice that the existence of the curse of access implies that the strong sender avoids having exclusive access; the strong sender benefits from the free entry of the weak sender.

4.6 Competition may decrease welfare

In recent models with endogenous persuasion and costless communication, the introduction of additional senders cannot decrease the quality of the received information (Gentzkow and Kamenica, 2011). This finding also echoes the classic analysis of unilateral versus competitive persuasion (Dewatripont and Tirole, 1999). Our setting demonstrates that this result does not translate into exogenous persuasion and access fees because the Receiver faces a revenue-information tradeoff and may exploit the presence of an additional sender to generate more revenue at the cost of less information. As a consequence, extending the Receiver's opportunities to obtain information may result in worse information in the equilibrium.[9]

In this section, we analyze situations in which the introduction of the pure competitor *increases* the expected policy loss and consequently reduces welfare. Proposition 6 proves that more competition reduces welfare only in the following scenario:[10] Initially, there is one organized Sender i and one unorganized Sender $-i$. The organized Sender i is initially invited and the expected policy loss is $\Lambda(S_i)$. Then, the previously unorganized Sender $-i$ covers her organization costs and becomes a potential partner for the Receiver. The Receiver facing both Senders now invites only the newly organized Sender $-i$, and welfare decreases because the new evidence is less informative, $\Lambda(S_{-i}) > \Lambda(S_i)$.

Proposition 6. *Suppose a setting with a single Sender i. The introduction of an additional Sender $-i$ decreases welfare only if $H_i^{\varnothing} \geq 0, H_i^e < 0, H_{-i}^{\varnothing} \geq 0$ for interim access ($B_i^{\varnothing} \geq 0, B_i^e < 0, B_{-i}^{\varnothing} \geq 0$ for ex ante access, respectively), and $\Lambda(S_i) < \Lambda(S_{-i})$.*

We can briefly look into the details of the scenario to see that the welfare reduction of more competition requires *access substitutability.*

- Consider interim access. By Proposition 2, we require $H_i^e < 0$ and $H_{-i}^{\varnothing} > H_i^{\varnothing}$. The necessary conditions are $f_{-i} > f_i$ and, by Corollary 1, signals are access substitutes. Notice that welfare-reducing scenarios may exist with $i = 1$ or $i = 2$.

- Consider ex ante access. By Proposition 3, only a strong sender may be strategically restricted; hence, the welfare-reducing scenario may exist only for $i = 1$. The necessary condition for $\Lambda(S_1) < \Lambda(S_1) \leq \Lambda(\varnothing)$ is $I_1^{\varnothing} = 1$, which implies $B_1^{\varnothing} > 0$. The necessary condition for $B_1^e < 0$ in the presence of $B_1^{\varnothing} > 0$ is that signals are information (and access) substitutes. (Notice $B_2^{\varnothing} \geq 0$ always holds.)

5 Conclusions

This paper develops an informational lobbying game with two strictly opposed and privately informed lobbies and a single policy-maker, where the policy-maker charges discriminatory fees for access. A lobby may present her verifiable evidence only if she pays the fee. Access is pre-paid either before the private signal is observed (ex ante access) or after the private signal is observed (interim access). The policy-maker's commitment to 'not listen' to messages unless the fee is paid puts the game into the family of access fee (pay-and-lobby) models,

[9]It is well established that extending information in the presence of multiple players may have paradoxical effects on the equilibrium amount of information. The additional information is typically detrimental when it eliminates the equilibria without possibly generating new equilibria (Lehrer et al., 2013). Alternatively, extending the set of signal technologies may reduce the amount of information because the senders may strategically garble their advice (Elliott et al., 2014).

[10]The proposition expresses these necessary conditions explicitly for interim access. Identical conditions apply for ex ante access; only H_i is replaced by B_i.

which are mostly attributed to Austen-Smith (1995, 1998), Ball (1995) and Lohmann (1995) and are recently extended by Cotton (2009, 2012) and Groll and Ellis (2014). In particular, this paper is a significant generalization of the binary environment in Cotton (2012) to all admissible information structures and all timings.

The paper focuses on two primary questions. Firstly, because the policy-maker uses access fees to generate revenues and elicit information at the same time, the optimal fees may involve a tradeoff between amounts of information and revenues. We identify the circumstances under which this tradeoff materializes and information is sacrificed in favor of revenues. Generally speaking, the tradeoff is present only for certain information structures and also depends on the timing of access. Secondly, we elucidate the relative equilibrium payoffs of the lobbies, which is important for the analysis of the effects of access fee regulations (e.g., campaign contribution caps). We demonstrate that the paradoxical curse of favorable evidence, as in Cotton (2012), is largely sensitive to the timing and information structures. In fact, we confirm the curse unambiguously in only 1 out of 20 classes of structures. In 13 classes, we observe the standard benefit of favorable evidence, and in the remaining 6 classes, the results depend on the parameters.

Because our setting combines the disclosure of verifiable evidence by senders with access fees by a receiver, it is related to two literatures: The analysis of endogenous access fees and competitive persuasion through verifiable evidence (Bennedsen and Feldmann, 2006; Gul and Pesendorfer, 2012; Bhattacharya and Mukherjee, 2013). Among lobbying mechanisms, this model is distinctive in that it explains any lobby's participation by the sum of the sender's and the receiver's gains from participation. In other models, one-sided gains determine participation. For example, for exogenous signaling costs (Austen-Smith and Banks, 2000, 2002; Grossman and Helpman, 2001), only the sender's willingness to pay determines the incidence of lobbying. The other extreme is persuasion with exogenous evidence, where only the receiver's posterior determines whether it pays off for senders to submit evidence; hence, low types avoid participation because they account for the receiver's unwillingness to implement the preferred policy and prefer to pool the bad outcomes with the no-evidence outcomes (Bennedsen and Feldman, 2006; Dahm and Porteiro, 2008; Henry, 2009; Stone, 2011). This insight about the sum of the sender's and the receiver's gains (bilateral surplus) also explains why our bilateral bargaining perspective can be successfully applied to the analysis of lobbies' participation in access fee models.

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A Proofs

A.1 Proof of Proposition 1

Proof. W.l.o.g., the ex ante advantage of Sender 1 is equivalent to the Receiver preferring P_1 in the absence of evidence, $L(P_1, \pi_1, \pi_2) = (1 - \pi_1)\pi_2 v_2 < (1 - \pi_2)\pi_1 v_1 = L(P_2, \pi_1, \pi_2)$, which is equivalent to $\lambda\mu < 1$.

In the next step, we use simple comparative statics for the Senders' equilibrium payoffs in (λ, μ). The key is the inequality $\lambda\mu \lesseqgtr 1$.

- As we have derived, if $\lambda\mu < 1$, the Receiver selects either of the outcomes $O \in \{F_3, F_4\}$, and the Senders' payoffs are $u_1 = 0 < (1 - \pi_1)v_2 = u_2$. Sender 1 ends up relatively worse off even if she has an ex ante advantage in the better mix of valuation and priors $(\frac{1}{\lambda} \cdot \frac{1}{\mu} > 1)$.
- If $\lambda\mu > 1$, the Receiver selects either of the outcomes $O \in \{F_1, F_2\}$, and the Senders' payoffs are $u_1 = (1 - \pi_2)v_1 > 0 = u_2$. Sender 2 ends up relatively worse off even if she had an ex ante advantage in the better mix of valuation and priors $(\lambda\mu > 1)$.

To complete the proof, $\lambda\mu < 1$ is equivalent to the ex post disadvantage of Sender 1. □

A.2 Proof of Lemma 1

Proof. We seek all admissible combinations $(F, I_1^{\varnothing}, I_2^{\varnothing})$. First, we derive two restrictions. For Sender 1, $\phi^{0,0} = 0 \Rightarrow I_1^{\varnothing} = 1 \Rightarrow \phi^{0,1} = 0$, and for Sender 2, $\phi^{1,1} = 0 \Rightarrow I_2^{\varnothing} = 1 \Rightarrow \phi^{0,1} = 0$. We combine these restrictions with each F: $F = F^1 \Rightarrow I_1^{\varnothing} = I_2^{\varnothing} = 0$ (only 1 type for $F = F_1$); for $F = F_2$, no restriction (4 types); $F = F^3 \Rightarrow I_2^{\varnothing} = 1$ (2 types); $F = F^4 \Rightarrow I_1^{\varnothing} = 1$ (2 types for $F = F^4$); $F = F^5 \Rightarrow I_1^{\varnothing} = I_2^{\varnothing} = 1$ (only 1 type for $F = F_5$). In total, the restrictions admit 10 classes of information structures. □

A.3 Proof of Proposition 2

Proof. First, using $c_i(S_i) \geq 0$ under interim timing, we have $H_i^{\varnothing} \geq 0$. Consequently, $\sigma^* \neq \varnothing$. Second, we examine the three remaining candidate sets: (i) For $\sigma^* = \{S_1, S_2\}$, the necessary (and in our case of three sets, also sufficient) conditions are $H_i^e \geq 0, i = 1, 2$. (ii) The necessary condition for $\sigma^* = \{S_{-i}\}$ is $H_i^e < 0$. The only remaining condition to check this partition is $W(S_i) \leq W(S_{-i})$, which is equivalent to $W(S_i) - W(\varnothing) = H_i^{\varnothing} \leq H_{-i}^{\varnothing} = W(S_{-i}) - W(\varnothing)$. □

A.4 Proof of Corollary 1

Proof. By Proposition 2, a necessary condition for strategic access restriction of Sender i is $H_i^e < 0$. At the same time, $H_i^{\varnothing} \geq 0$ holds under interim access. If $H_i^e < 0$ and $H_i^{\varnothing} \geq 0$, then the overall externality of S_{-i} is negative, $H_i^e - H_i^{\varnothing} < 0$. Equivalently, the signals are access substitutes. □

A.5 Proof of Proposition 3

Proof. To begin, we examine the bilateral surpluses of the weak sender. (i) Because $\Pr(P = P_2 | O = F_0) = 0$, we have $c_2(S_2) \geq 0$ and consequently $B_2^{\varnothing} \geq 0$. (ii) We apply revenue neutrality in (18) to obtain $B_2^e = \Lambda(S_1) - \Lambda(S_1, S_2) + c_2(S_2)$, and using $c_2(S_2) = I_2^{\varnothing} f_1 \geq 0$, we obtain $B_2^e \geq 0$. Because $B_2^{\varnothing} \geq 0$ and $B_2^e \geq 0$, the weak sender is always invited. Next, because $S_2 \in \sigma^*$, we have only two candidate sets. To select from the two sets, we use a necessary condition for $\sigma^* = \{S_2\}$ is $B_1^e < 0$, and a necessary condition for $\sigma^* = \{S_1, S_2\}$ is $B_1^e \geq 0$. □

A.6 Proof of Corollary 2

Proof. If $B_1^{\varnothing} < 0$ and $B_1^e - B_1^{\varnothing} < 0$ (access/information substitutability), then $B_1^e < 0$. If $B_1^{\varnothing} \geq 0$ and $B_1^e - B_1^{\varnothing} > 0$ (access/information complementarity), then $B_1^e > 0$. Recall that by Proposition 3, a single condition $B_1^e < 0$ characterizes the strategic access restriction. □

A.7 Proof of Proposition 4

Proof. We only combine the relative payoffs $\sigma^* = \{S_i\}$ and $\sigma^* = \{S_1, S_2\}$ derived in the text. □

A.8 Proof of Proposition 5

Proof. By Proposition 3, $\sigma^* = \{S_2\}$ or $\sigma^* = \{S_1, S_2\}$. In the former case, we know from the previous analysis that the strong sender has the ex post advantage. In the latter case, we know that $u_1(S_1, S_2) < u_2(S_1, S_2)$ if and only if (27) holds. Because $1 - f_1 \leq 1$ and $f_2 \leq 1$, the necessary conditions are that both binary indicators are positive, $I_1^{\varnothing} = I_2^{\varnothing}$. In addition, we need $1 < 1 - f_1 + f_2$, which is $f_1 < f_2$. □

A.9 Proof of Proposition 6

Proof. We develop this proof through a series of contradictions. Let Λ' be the expected loss with a single Sender i. Welfare decreases if and only if $\Lambda' < \Lambda(\sigma^*)$.

- Suppose $H_i^{\varnothing} < 0$. Then, $\Lambda' = \Lambda(\varnothing) = \max_\sigma \Lambda(\sigma) \geq \Lambda(\sigma^*)$. Competition increases welfare, $\Lambda(\sigma^*) \leq \Lambda(\varnothing)$, which is a contradiction. Thus, $H_i^{\varnothing} \geq 0$, and consequently $\Lambda' = \Lambda(S_i)$.

- Suppose $H_i^e \geq 0$. Using $H_i^{\varnothing} \geq 0$, $S_i \in \sigma^*$. As a result, $\Lambda(\sigma^*) \leq \Lambda(S_i) = \Lambda'$. Competition increases welfare, which is a contradiction. Using $H_i^e < 0$ and recalling $\sigma^* \neq \varnothing$, we imply that $\sigma^* = \{S_{-i}\}$ and $\Lambda(\sigma^*) = \Lambda(S_{-i})$.

- To sustain $\sigma^* = \{S_{-i}\}$, a necessary condition is $H_{-i}^{\varnothing} \geq 0$.

- Finally, suppose that $\Lambda' = \Lambda(S_i) \geq \Lambda(S_{-i}) = \Lambda(\sigma^*)$; this implies that competition increases welfare, which is a contradiction. Therefore, $\Lambda(S_i) < \Lambda(S_{-i})$.

□

B Information structures

- Information complementarity (both timings). We use the fact that (5) can be written as two alternative inequalities. In the first step, we examine the inequality $\Lambda(S_2) - \Lambda(S_1, S_2) > \Lambda(\varnothing) - \Lambda(S_1)$: The sign of the LHS is $\max\{I_1^0, I_1^1\}$ and the sign of the RHS is $I_1^{\varnothing}$. If the pair of signs is $(0, 0)$, the signals are neutral. If the pair is $(0, 1)$, the signals are substitutes. If the pair is $(1, 0)$, the signals are complements. Finally, if the pair is $(1, 1)$, the result is ambiguous (denoted '-').

  In the second step, we examine the inequality $\Lambda(S_1) - \Lambda(S_1, S_2) > \Lambda(\varnothing) - \Lambda(S_2)$. We use the fact that the sign of the LHS is $\max\{I_2^0, I_2^1\}$ and the sign of the RHS is $I_2^{\varnothing}$. Then, we evaluate the signs identically as above.

- Revenue complementarity (interim timing). We calculate fees from (20) and (21) and impose the fees directly into (10). The only class in which the inequality cannot be evaluated unambiguously is the C4 class.

- Access complementarity (interim timing). If the signals are neutral in both properties (information and revenue), they are also access neutral. If a signal is a substitute in one property and a substitute or neutral in the other property, it is an access substitute. If a signal is a complement in one property and a complement or neutral in the other property, it is an access complement. We apply access complementarity for Corollary 1, which identifies classes in which access is not restricted, $\sigma^* = \{S_1, S_2\}$.

- Access complementarity (ex ante timing). Given revenue neutrality, the access property is equivalent to the information property of the signals. Second, we use $I_1^{\varnothing} = 0 \Rightarrow B_1^{\varnothing} = 0$. To sum up, in the C1, C2, C3, and C6 classes, we have $B_1^{\varnothing} = 0$ and access is not substitutable; hence by Corollary 2, the access is not restricted, $\sigma^* = \{S_1, S_2\}$.

  Additionally, we turn directly to Proposition 3. To evaluate the sign of B_1^e, we use the fact that B_1^e consists of the non-increase of the loss $\Lambda(S_2) - \Lambda(S_1, S_2)$ (the sign is $\max\{I_1^0, I_1^1\}$) and revenue $c_1(S_1)$ (the sign is $-I_1^{\varnothing}$). We obtain a negative sign for B_1^e in the C7 class. Hence, $\sigma^* = \{S_2\}$ in the C7 class.

  We proceed into an even more detailed calculation of B_1^e for the remaining classes. We explicitly calculate the decrease in the expected policy loss, $\Lambda(S_2) - \Lambda(S_1, S_2)$. This decrease in the loss is the weighted sum of the information gains in those realizations (t_1, t_2) where $O(S_1, S_2)$ differs from $O(S_2)$, multiplied by the probabilities of the realizations. (For example, in the C4 class, the difference is only for $(t_1, t_2) = (0, 0)$, where P_1 is replaced by P_2. Hence, the weighted information gain of the policy switch is $(1 - f_1)(1 - f_2)[p_2(0) - p_1(1)]$.) We apply the upper bound on each information gain, namely a switch from the $P_{-}i$ to the P_i policy is $p_i(t_i) - p_{-i}(t_{-i}) < 1$. This step generates an upper bound on B_1^e, denoted as $\bar{B}_1^e$. Finally, if $\bar{B}_1^e \leq 0$, then $B_1^e < 0$, and consequently $\sigma^* = \{S_2\}$.

- The ex post advantage (interim timing). By Proposition 4, we must identify O^*. In the C1, C2, C3 and C6 classes, $O^* = F \in \{F_0, F_1, F_2\}$. Thus, the strong sender has the ex post advantage (the benefit of favorable evidence). In the C8 class, $O^* = F = F_3$. Thus, the strong sender has the ex post disadvantage (the curse of favorable evidence).

- The ex post advantage (ex ante timing). By Proposition 5, the strong sender has the ex post advantage when access is restricted (C4, C7, C8, C9, and C10 classes) and when $\min\{I_1^{\varnothing}, I_2^{\varnothing}\} = 0$ (C1, C2, C3, and C6 classes).

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