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Receiver's access fee for a single sender

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Receiver's access fee for a single sender

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Abstract:
We study a game in which a sender with verifiable private information has to pay an access fee that is announced by a receiver to be able to convey her message to the receiver. The setting is motivated by the literature of pay-and-lobby politics, which finds that politicians decide to schedule informative meetings with lobbyists on the basis of their campaign contributions. We solve the game for all timings, prior beliefs, and noise and valuation parameters. We identify the receiver's tradeoff between the amount of information and the amount of revenue. At the tradeoff, the receiver decides to not receive an informative signal from the sender. Whether `burying one's head in the sand' increases or decreases welfare depends on the degree of the receiver's benevolence.

Keywords: disclosure, persuasion, hard evidence, access fee, lobbying

JEL: C72, C78, D72, D83

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1 Introduction

In games with strategic information transmission, a standard assumption is that all of a sender's messages are observed by a receiver (Milgrom, 1981; Milgrom and Roberts, 1986; Seidmann and Winter, 1997; Dewatripont and Tirole, 2005). In many real world situations, however, the receiver does not observe all messages and follows a pre-determined rule that selects the set of observable messages. A particularly interesting class of selection rules comprises rules that condition the observation of a message on a costly action of the sender.

In this article, we specifically examine the access-fee rule; a receiver (Receiver) announces an access fee that a sender (Sender) must pay if she wants to meet Receiver and convey her message. The size of the fee is independent on the content of the message, and revenues are accrued by Receiver. Receiver's motivation to use such a rule is to exploit part of Sender's gains that emerge when Receiver learns new information and makes a decision in favor of communicating Sender.

The use of an access fee that is optimally set by the receiver is motivated by the literature on informational lobbying with access fees (Austen-Smith 1995, 1998; Ball, 1995; Lohmann, 1995). The mechanism may explain the close links between campaign spending and lobbying. Indeed, a large body of literature on 'pay-and-lobby' or 'pay-to-play' politics argues that politicians allocate a significant part of their attention to listening to hard evidence delivered by special interest groups on the basis of their campaign contributions while striving to maintain a reputation of sticking to non-contractible actions (Baron, 1989; Snyder, 1990; Wright, 1996; Cotton, 2012). Empirically, the idea of 'money buys access' is supported by evidence on the link between campaign contributions and lobbying outlays on the level of both donors and recipients (Ansolabehere et al., 2002; Esterling, 2007).

In our setting, we consider only verifiable evidence. Hence, our setting is a classic persuasion game enriched by the receiver's commitment power to predetermine the message cost. All strategic variables have binary support, which allows us to solve the game in a complete parametrical space for both relevant timings: the payment of the fee may precede or follow the realization of the private signal.

We have two main objectives. First, we examine whether the receiver's optimal access fees exhibit a tradeoff between the amount of revenue and the amount of information. An understanding of the strategic access restriction may shed light on the receiver's incomplete participation in communicating with a sender. For example, in informational lobbying, a key question is why many stakeholders abstain from lobbying and do not provide verifiable evidence. Richter *et al.* (2009) show that only a small fraction of firms actually lobby and that lobbying expenditures follow a skewed, power-law distribution. Kerr *et al.* (2011) finds that lobbying status is persistent over time. The workhorse model of communication of verifiable evidence by biased senders, namely, the classic persuasion game (Milgrom, 1981; Milgrom and Roberts, 1986; Shin, 1994; Seidmann and Winter, 1997; Dziuda, 2011; Bhattacharya and

Mukherjee, 2013), attributes the absence of communication to pooling efforts of low types of senders hence to a lack of favorable evidence. By contrast, our model explains the absence of communication as a receiver's unwillingness to communicate with certain senders.

To analyze the information-revenue tradeoff, we tackle the access fee game as a non-cooperative bargaining game, with persuasion (or screening) games only as nested subgames. We show that the key factor in the determination of the sender's participation is the sign of the bargaining surplus that is defined in the bargaining game. If the sign is positive, the receiver sets the maximal feasible fee that meets the sender's participation condition. However, if the sign is negative, the receiver sets a prohibitively high fee to discourage the sender's participation.

To understand the point, consider the following scenario: Having only prior beliefs, Receiver selects an action that is optimal for Sender independently of the state of the world. Sender is invited to pay the fee before private information is learned. Under such circumstances, Sender is willing to pay the fee only if he or she can be compensated for the 'disclosure lottery' by means of a negative fee. If such a fee is prohibitively costly for Receiver, then Receiver may strategically decide to 'not listen'. We thus say that Receiver strategically restricts the access of Sender.

We find that the condition in which the information is sacrificed in favor of revenue is a single-sender setting that is exactly characterized by the example illustrated above. This result is an initial step in understanding the receiver's information-revenue tradeoff in more complex situations. With multiple senders, we may expect the tradeoff to materialize for a different reason; namely, the participation of one sender affects the level of bilateral surplus in bargaining with another sender. In other words, some senders are not invited to participate because the extra verifiable evidence of these uninvited senders would imply a revenue loss in the interactions with the invited senders. These external effects are absent in our setting with a single sender.

Our second main objective is to examine the welfare consequences of the strategic access restriction. We use two welfare measures that differ in the interpretation of the receiver's objective, and we reach two clear results: If Receiver is non-benevolent, then the access restriction implies a social gain. Intuitively, through an access-fee rule, Receiver circumvents the social problem of her non-contractible actions. In contrast, if Receiver has a mixed objective that involves benevolence and private benefits (c.f., Grossman and Helpman, 2001), then the access restriction implies a social loss. The welfare assessment is thus determined by the receiver's objective.

Since our setting combines access fees by the receiver and the provision of verifiable evidence by the sender, our study relates both to the analysis of endogenous access fees (Austen-Smith, 1998; Cotton 2009, 2012) and to the study of persuasion by means of verifiable evidence (Bennedsen and Feldmann, 2006; Bhattacharya and Mukherjee, 2013; Gul and Pesendorfer, 2012). Our model extends the family of access fee models in several respects: First, we consider exogenous and arbitrary noise structures; hence, we are not restricted to corner-type signals that naturally arise with endogenous noise, as in Austen-Smith (1998). Second, unlike Lohmann (1995), Ball (1995), and Austen-Smith (1995), we do not work with unverifiable evidence. This characteristic of our setting has important consequences with respect to the sender's willingness to lobby, since the credibility of the sender's message is not related to the sender's bias. Third, our setting allows us to directly compare results based on structurally different timings. Fourth, we provide results on access, revenue and payoffs as functions of noise structure and timing and hence generalize an entire class of potential access fee models.

Our setup also serves as a convenient toolkit for modeling persuasion with access fees under special classes of signals and thus aids research aiming to model the imperfect search for hard evidence, where bad-evidence models pool with empty-evidence models (Shavell, 1989; Bennedsen and Feldman, 2006; Dahm and Porteiro 2008; Dziuda, 2011). Our model may also be useful in various applications involving persuasion, including advocacy, testimonies, advertising, political campaigns, and research reporting (Dewatripont and Tirole, 1999, 2005; Anderson and Renault, 2006; Henry, 2009; Stone, 2011), as long as an access fee rule is available.

The paper proceeds as follows: Section 2 builds the setup and motivates the equilibrium refinements. Section 3 identifies the equilibrium and provides a comparative statics analysis. Section 4 makes a welfare assessment of the access restriction and the consequent information loss. Section 5 discusses the players' preferences regarding noise and the equilibrium when the refinements are relaxed. Section 6 concludes.

2 Setup

State of Nature and signal. Consider a binary state of Nature, $\theta \in \{0, 1\}$. The common prior belief is $\pi_\varnothing := \Pr(\theta = 1) \in [0, 1]$. There is a binary signal $s \in \{0, 1\}$ characterized by a pair of Type-I and Type-II errors, $\alpha \in [0, 1]$ and $\beta \in [0, 1]$, where $\alpha = \Pr(s = 0 | \theta = 1)$ and $\beta = \Pr(s = 1 | \theta = 0)$. The unconditional probability of high signal realizations is $f(\alpha, \beta, \pi_\varnothing) := \Pr(s = 1) = (1 - \alpha)\pi_\varnothing + \beta(1 - \pi_\varnothing)$.

Players. There is a sender (Sender) and a receiver (Receiver). Sender privately observes s. The signal contains hard (verifiable) evidence that cannot be fabricated but that may not be disclosed. We consider Sender to be a low type of sender if $s = 0$ and a high type if $s = 1$.

Strategies. Receiver announces access fee $c \in \mathbb{R}$. Receiver also selects a binary action $a \in \{0, 1\}$. Sender makes a decision regarding payment of the fee (entry/access/participation), $e \in \{0, 1\}$. If Sender participates, Sender subsequently makes a decision regarding disclosure or non-disclosure, $d \in \{0, 1\}$. Neither player's actions are contractible.

Objectives. Sender always prefers action $a = 1$. Her state-independent value of action $a = 1$ relative to action $a = 0$ is normalized to unity. Receiver prefers action $a = 1$ if $\theta = 1$ and prefers action $a = 0$ if $\theta = 0$. We let $L : \{0, 1\} \times \{0, 1\} \to \{0, V\}$ be the Receiver's *loss* when adopting action a in state θ, $L(a, \theta) := (\theta - a)^2 V$, where $V > 0$. The loss function is zero if $a = \theta$ and is equal to V if $a \neq \theta$; hence, the loss function is symmetric in both states of Nature. The *expected loss* $E : \{0, 1\} \times [0, 1] \to [0, V]$ is the expected value of Receiver's loss when adopting action a under beliefs π, $E(a, \pi) := (1 - \pi)L(a, 0) + \pi L(a, 1)$.

Signals. Without a loss of generality, let the high signal realization also yield a high posterior. Formally, the posteriors $\pi_s := \Pr(\theta = 1|s)$ satisfy $\pi_1 \geq \pi_\varnothing \geq \pi_0$, which is equivalent to

$$\alpha + \beta \leq 1. \tag{1}$$

Given symmetry in Receiver's loss function, Receiver's preferred action under belief π is determined easily. Namely, we use the equivalence of the inequality $E(0, p) \leq E(1, p)$ with $p \leq \frac{1}{2}$. We use this inequality in order to classify signals by a standard informativeness criterion. A signal is *uninformative* if Receiver selects identical actions after observing any signal realization. Otherwise, the signal is *informative*. The exact shape of the criterion depends on the prior:

- If $\pi_\varnothing \geq \frac{1}{2}$, then $\pi_1 \geq \frac{1}{2}$. Informativeness depends on $\pi_0 \leq \frac{1}{2}$ only. We introduce the indicator $I : [0, 1]^3 \to \{0, 1\}$:

$$I(\alpha, \beta, \pi_\varnothing) := \begin{cases} 0 & \text{if } \beta > 1 - \alpha \frac{\pi_\varnothing}{1 - \pi_\varnothing}, \\ 1 & \text{if } \beta \leq 1 - \alpha \frac{\pi_\varnothing}{1 - \pi_\varnothing}. \end{cases} \tag{2}$$

- If $\pi_\varnothing < \frac{1}{2}$, then $\pi_0 < \frac{1}{2}$. Informativeness depends on $\pi_1 \geq \frac{1}{2}$ only. We introduce the indicator $I' : [0, 1]^3 \to \{0, 1\}$:

$$I'(\alpha, \beta, \pi_\varnothing) := \begin{cases} 0 & \text{if } \beta > (1 - \alpha) \frac{\pi_\varnothing}{1 - \pi_\varnothing}, \\ 1 & \text{if } \beta \leq (1 - \alpha) \frac{\pi_\varnothing}{1 - \pi_\varnothing}. \end{cases} \tag{3}$$

Timing. In Stage 1, Receiver commits to access fee $c \in \mathbb{R}$. In Stage 2, Sender makes a decision regarding entry (access), $e \in \{0, 1\}$. In Stage 3, if Sender paid for access, Sender makes a decision regarding the disclosure of the evidence, $d \in \{0, 1\}$. In Stage 4, Receiver collects revenue ec and selects action $a \in \{0, 1\}$. Two timings of the signal realization are relevant: (i) Under *ex ante access*, the signal is realized between Stage 2 and Stage 3. The decision regarding access is previously made by Sender without private information. (ii) Under *interim access*, the signal is realized between Stage 1 and Stage 2. For this timing, the decisions regarding access are made by the two types of senders just after the signal is realized.

Sender's strategies. For any timing, disclosure is decided by the type of sender. We distinguish between low type of sender's disclosure $d_0 \in \{0,1\}$ and the high type of sender 's disclosure $d_1 \in \{0,1\}$. Under ex ante access, entry is decided by Sender, $e \in \{0,1\}$. Under interim access, entry is decided by the type of sender, and we distinguish between the low type of sender's entry $e_0 \in \{0,1\}$ and the high type of sender's entry $e_1 \in \{0,1\}$.

3 The relevant equilibrium

3.1 Two skeptic refinements

We will show that both timings can be solved in an identical way. For this purpose, we apply two standard refinements in the first step. The equilibria that do not comply with these standard refinements are analyzed in the extensions.

First, in the disclosure stage (Stage 3), we restrict ourselves to profiles for which both types of senders are willing to disclose their evidence. To determine these profiles safely, we set the out-of-equilibrium belief for non-disclosure $d = 0$ as the minimal posterior π_0. Intuitively, non-disclosure is interpreted to characterize a low type of sender. Under these beliefs, the low type of sender is indifferent between disclosure and non-disclosure because both induce an identical posterior from the receiver. This assumption complies with the intuitive criterion of Cho and Kreps (1987).

Assumption 1 (Disclosure)**.** *We select an equilibrium with full disclosure,* $(d_0, d_1) = (1, 1)$*, and set the out-of-equilibrium posterior* $\Pr(\theta = 1|d = 0) = \pi_0$*, if such an equilibrium exists.*

The next refinement applies to interim access only, where signaling subgames that begin with a private observation may involve two pure-strategy equilibria. In an equilibrium, either both types of senders are pooled, $(e_0, e_1) = (0, 0)$, or both types are separated, $(e_0, e_1) = (0, 1)$. In the spirit of the *unraveling argument* by Milgrom (1981), we focus on the separating equilibrium only, if separation exists.

Assumption 2 (Separation)**.** *Under interim access, we select a separating equilibrium,* $(e_0, e_1) = (0, 1)$*, if such an equilibrium exists.*

Both refinements intuitively mean that Receiver has skeptical beliefs. As a skeptic, Receiver interprets non-participation or non-disclosure to be a signal of the low type of sender, as long as such an equilibrium exists.

3.2 Bargaining perspective

The core message of the paper is that the game can be understood as a non-cooperative bargaining game between Receiver and her partner (Partner). There is agreement if Partner pays the fee and discloses evidence. There is disagreement if Partner does not pay the fee.

The *bargaining protocol* is a single take-it-or-leave-it offer: In Stage 1, Receiver makes an offer (by setting an acceptable or unacceptable fee). In Stage 2, Partner agrees or disagrees with the offer (by entry or non-entry).

Given that the values are transferrable between the players, the equilibrium is easily found as follows:

1. Calculate the (positive or negative) partial effects of the agreement regarding Receiver's and Partner's payoffs (referred to as the partial gains). The sum of the two partial gains defines the *bargaining surplus.*

2. If the surplus is negative, Receiver offers a prohibitively high fee, and Partner disagrees.

3. If the surplus is non-negative, Receiver offers a fee that exactly meets Partner's participation condition. Therefore, Receiver extracts the full surplus, and Partner is left with her outside option.

3.3 Bargaining surplus

Timing determines the identity of Partner. For *ex ante access*, Sender is the bargaining partner. For *interim access*, the high type of sender is the bargaining partner.[1] Timing also affects the outside option of Partner, the partial gains of Partner, the partial gains of Receiver, and the bargaining surplus.

Consider Receiver. Her outside option is independent of the timing of the signal realization. Namely, her outside option is described by her prior beliefs and the action corresponding to her prior beliefs, to be denoted $a_\varnothing(\pi_\varnothing)$. Clearly, we have $a_\varnothing(\pi_\varnothing) = \mathbf{1}_{\pi_\varnothing \geq \frac{1}{2}}$. At the outside option, Receiver's expected loss is $E_\varnothing(\pi_\varnothing) := E(a_\varnothing(\pi_\varnothing); \pi_\varnothing) = \min\{\pi_\varnothing, 1 - \pi_\varnothing\}V$.

If Partner agrees, Receiver learns new information, updates his beliefs, and may change his action. For an uninformative signal, there is no effect on Receiver's action. Therefore, Receiver's partial gain from communication is zero. For an informative signal, the expected loss drops from $E_\varnothing(\pi_\varnothing)$ to $E_e(\alpha, \beta, \pi_\varnothing) := [\alpha\pi_\varnothing + \beta(1 - \pi_\varnothing)]V$.

To obtain the remaining bargaining variables, we have to distinguish between the timings of the signal realization.

3.3.1 Ex ante access

Sender is the bargaining partner. The outside option of Sender is the status-quo action $a_\varnothing(\pi_\varnothing)$. For an uninformative signal, there is no effect on the action; hence, Sender's partial gain is zero. For an informative signal, the probability of favorable action $a = 1$ changes to $f(\alpha, \beta, \pi_\varnothing)$. Thus, the gain is $f(\alpha, \beta, \pi_\varnothing) - \mathbf{1}_{\pi_\varnothing \geq \frac{1}{2}} \lesseqgtr 0$.

[1] With skeptic beliefs, Receiver needs only one type of sender to participate. The participation condition of the low type of sender is more restrictive; hence, Receiver sets a fee to meets high type of sender's participation condition.

To use comfortable notation, we explicitly distinguish between low and high priors. The bargaining surplus for ex ante access, denoted as $S(\alpha, \beta, \pi_\varnothing)$, is:

$$S(\alpha,\beta,\pi_\varnothing) := \begin{cases} I(\alpha,\beta,\pi_\varnothing)[E_\varnothing(\pi_\varnothing) - E_e(\alpha,\beta,\pi_\varnothing) + f(\alpha,\beta,\pi_\varnothing) - 1] \gtreqless 0 & \text{if } \pi_\varnothing \geq \frac{1}{2}, \\ I'(\alpha,\beta,\pi_\varnothing)[E_\varnothing(\pi_\varnothing) - E_e(\alpha,\beta,\pi_\varnothing) + f(\alpha,\beta,\pi_\varnothing)] \geq 0 & \text{if } \pi_\varnothing < \frac{1}{2}. \end{cases} \tag{4}$$

3.3.2 Interim access

The high type of sender is the bargaining partner. By Assumption 2, the outside option of the high type of sender is *no longer* the status-quo option but rather is unfavorable action $a = 0$. The gain of participation is thus unity. Since the high type of sender occurs only f-times, her gain must be normalized by $f(\alpha, \beta, \pi_\varnothing)$. The bargaining surplus for interim access where only the high type of sender pays for access, denoted as $H(\alpha, \beta, \pi_\varnothing)$, is:

$$H(\alpha,\beta,\pi_\varnothing) := \begin{cases} I(\alpha,\beta,\pi_\varnothing)[E_\varnothing(\pi_\varnothing) - E_e(\alpha,\beta,\pi_\varnothing) + f(\alpha,\beta,\pi_\varnothing)] \geq 0 & \text{if } \pi_\varnothing \geq \frac{1}{2}, \\ I'(\alpha,\beta,\pi_\varnothing)[E_\varnothing(\pi_\varnothing) - E_e(\alpha,\beta,\pi_\varnothing) + f(\alpha,\beta,\pi_\varnothing)] \geq 0 & \text{if } \pi_\varnothing < \frac{1}{2}. \end{cases} \tag{5}$$

Under interim access, agreement is more likely, because

$$H(\alpha,\beta,\pi_\varnothing) = S(\alpha,\beta,\pi_\varnothing) + \mathbf{1}_{\pi_\varnothing \geq \frac{1}{2}} \cdot I(\alpha,\beta,\pi_\varnothing) \geq S(\alpha,\beta,\pi_\varnothing). \tag{6}$$

We use the surpluses to identify the necessary conditions for a negative value of the surplus, which is equivalent to a *strategic access restriction.*

Proposition 1 (Access restriction)**.** *Receiver sets a prohibitively high access fee only if access is ex ante, the status-quo action is the high action, $a_\varnothing = 1$, and the signal is informative, $I(\alpha, \beta, \pi_\varnothing) = 1$.*

Proof. Using the bargaining perspective, a sufficient condition for access restriction is negative surplus. To identify the negative surplus, we prove inequalities in (4) and (5). It is sufficient to recall that $f(\alpha, \beta, \pi_\varnothing) \geq 0$ and $E_\varnothing(\pi_\varnothing) \geq E_e(\alpha, \beta, \pi_\varnothing)$. The surplus is negative only in the first case of (4), where access is ex ante, the status quo represents a favorable policy for Sender, and the signal is informative. □

3.4 Noise and strategic access restriction

When the bargaining surplus is negative, Receiver cannot compensate Sender for his participation (and evidence disclosure) without making himself worse off. The source of the negative surplus lies in the attractiveness of Sender's outside option in the favorable action, which makes the agreement to disclose the evidence prohibitively costly. With the timing under ex ante access, the participation condition remains with the favorable status-quo action, because neither type of sender is able to screen the decision through an exogenous signal cost.

In this section, we focus in detail on the existence of the strategic access restriction in the parametrical space $(\alpha, \beta, \pi_\varnothing, V)$. By Proposition 1, it is sufficient to consider only the timing under ex ante access and the case of $\pi_\varnothing \geq \frac{1}{2}$, which implies favorable status-quo action $a_\varnothing(\pi_\varnothing) = 1$. We avoid the corner corner-type signals of the prior, and let $\pi_\varnothing \in (\frac{1}{2}, 1)$.

In the first step, we find that for any $V > 0$, a set of informative signals exists such that the access is strategically restricted. Such signals are found in the neighborhood of the informative signal with the maximal α-error and minimal β-error, $(\alpha, \beta) = (\frac{1-\pi_\varnothing}{\pi_\varnothing}, 0)$. This result occurs because the corresponding surplus with this signal is negative,

$$S(\tfrac{1-\pi_\varnothing}{\pi_\varnothing}, 0, \pi_\varnothing) = -2(1-\pi_\varnothing) < 0. \tag{7}$$

To understand the role of noise in more detail, we examine the iso-surplus curves. It can be observed that the iso-surplus curves are *linear* in the signal space (α, β), because the partial derivatives are independent of (α, β),

$$\frac{\partial S(\alpha, \beta, \pi_\varnothing)}{\partial \alpha} = -\pi_\varnothing(V+1) < 0, \tag{8}$$

$$\frac{\partial S(\alpha, \beta, \pi_\varnothing)}{\partial \beta} = -(1-\pi_\varnothing)(V-1) \lesseqgtr 0. \tag{9}$$

The key curve is the zero-surplus curve, $S(\alpha, \beta, \pi_\varnothing) = 0$. By simple algebra, the curve is defined by

$$\beta = 1 - \alpha \frac{\pi_\varnothing}{1-\pi_\varnothing} \frac{V+1}{V-1}. \tag{10}$$

The zero-surplus curve always crosses the informative signal with the maximal β-error and minimal α-error, $(\alpha, \beta) = (0, 1)$, because $S(0, 1, \pi_\varnothing) = 0$. The shape of the curve depends on $V \gtreqless 1$:

- Receiver's valuation exceeds Sender's valuation ($V > 1$): From (8) and (9), the iso-surplus curves move from NW to SE. Informative signals with low noise have a positive surplus, and informative signals with large noise have a negative surplus.

- Both valuations are identical ($V = 1$): The iso-surplus curves move from N to S. Hence, informative signals with $\alpha = 0$ have exactly a zero surplus. Any other informative signal features a negative surplus.

- Sender's valuation exceeds Receiver's valuation ($V < 1$): The iso-surplus curves move from NE to SW. All informative signals, except for the corner $(\alpha, \beta) = (0, 1)$, have a negative surplus.

Figure 1 illustrates. In the signal space, we thus recognize three types of signals:

- *Small noise*: The signal is informative, and the surplus is non-negative. In the equilibrium, access is permitted. For $V < 1$, the set shrinks into a singleton $(\alpha, \beta) = (0, 1)$.

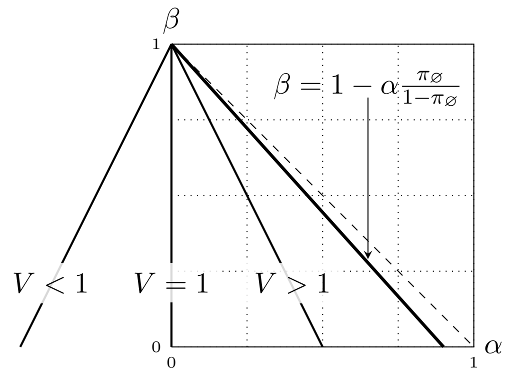

Figure 1: The shape of the zero-surplus curve for $\pi_\varnothing \geq \frac{1}{2}$

- *Moderate noise*: The signal is informative, but the surplus is negative. In the equilibrium, access is restricted. The set is non-empty.
- *Large noise*: The signal is uninformative, and the surplus is zero. In the equilibrium, the status quo is maintained.

The surplus is non-monotonic at a structural switch from an informative to an uninformative signal. Namely, at $\beta = 1 - \alpha\frac{\pi_\varnothing}{1-\pi_\varnothing}$, the negative surplus changes into a zero surplus. This non-monotonicity associated with a structural switch may be strategically relevant in the setting in which signals are endogenous to the players. (More details about player's preferences regarding noise follow in Section 5.)

4 Welfare

We apply two alternative normative analyses. In the first analysis (non-benevolent Receiver), we treat our model in a standard utilitarian framework. The players' utilities are independent, and the utilitarian welfare is maximized if the sum of Receiver's and Sender's utilities is maximized. In the second setting, we adopt a specification from common agency modeling (Grossman and Helpman, 2001) in which Receiver's objective contains welfare generated out of the actions (benevolent Receiver) and private gains from revenue.

We will observe two types of potential welfare distortions associated with two phenomena: (i) Receiver may neglect the *negative externality* of her action a on Sender. We will show that the negative externality is relevant only if Receiver is non-benevolent. (ii) There is an *information loss* associated with strategic access restriction resulting in a status-quo bias. We will show that the information loss is relevant only if Receiver is benevolent.

Given that the two settings generate two opposite welfare distortions, we will also find a completely opposite prediction for the effect of the access restriction on welfare. Our main result is that when Receiver is non-benevolent, the access restriction enhances welfare, whereas when Receiver is benevolent, the access restriction deteriorates welfare.

4.1 Non-benevolent Receiver

We represent Sender's objective as a loss function $l : \{0,1\} \to \{0,1\}$, where $l(a) = 1 - a$. The utilitarian objective minimizes the sum of Receiver's expected loss and Sender's expected loss. We first derive the first-best actions, (a_0^*, a_1^*). For a signal s and corresponding beliefs π_s, the first-best action is

$$a_s^* = \arg_{a\in A} \min\{E(a, \pi_s) + l(a)\} = \arg_{a\in A} \min\{\pi_s V + 1; (1 - \pi_s)V\}. \tag{11}$$

This expression can be reduced to

$$a_s^* = \begin{cases} 0 & \text{if } \pi_s \le \frac{V-1}{2V}, \\ 1 & \text{if } \pi_s \ge \frac{V-1}{2V}. \end{cases} \tag{12}$$

Notice that $\frac{V-1}{2V} < \frac{1}{2}$ is increasing in V up to $\lim_{V\to+\infty} \frac{V-1}{2V} = \frac{1}{2}$. It is equal to zero at $V = 1$. Next, since posteriors are non-decreasing in the sender's type, $\pi_1^* \ge \pi_0^*$, the optimal actions are also non-decreasing, $a_1^* \ge a_0^*$. Recall that the equilibrium actions are also non-decreasing in the sender's type, $a_1 \ge a_0$.

Therefore, we may expect two sources of welfare distortion:

- In her ex post decision, Receiver neglects the *negative externality* of a low action on Sender. Hence, Receiver is biased toward *low action* $a_s = 0$ for any signal realization. Nevertheless, the bias does not need to be strong enough to affect the action.

- In her ex ante decision, Receiver loses valuable information by *strategically restricting* the access and implementing $a_\varnothing = a_0 = a_1$. By Proposition 1, Receiver takes such action only if access is ex ante and $\pi_\varnothing \ge \frac{1}{2}$, i.e., $a_\varnothing = 1$. Consequently, $a_0 = a_1 = 1$. Hence, we expect an extra status-quo bias toward the *high action* $a_s = 1$ for any signal realization. This bias exists only under strategic access restriction.

The two biases move in the opposite directions. Hence, it is interesting to understand which bias dominates if *both biases are present at the same time*. The next proposition derives the key observation; the status-quo bias in fact exactly *corrects* for the negative externality and never generates a welfare distortion. Somewhat surprisingly, the information loss is associated with a welfare-improving action, not vice versa.

Proposition 2 (Access restriction, non-benevolent Receiver)**.** *If access is strategically restricted and Receiver is non-benevolent, then welfare is maximized.*

Proof. Consider $s = 1$. By Proposition 1, a necessary condition for access restriction is $a_\varnothing = 1$, which implies that $\pi_\varnothing \geq \frac{1}{2}$. Then, $\pi_1 \geq \pi_\varnothing \geq \frac{1}{2} > \frac{V-1}{2V}$, and consequently, $a_1^* = 1 = a_1$. There is no welfare distortion for the high signal realization $s = 1$.

Consider $s = 0$. If $a_0^* = 1$, then $a_0^* = 1 = a_0$, and there is no welfare distortion. If $a_0^* = 0$, then $\pi_0 \leq \frac{V-1}{2V}$, or equivalently,

$$\beta \leq 1 - \alpha \frac{\pi_\varnothing}{1-\pi_\varnothing} \frac{V+1}{V-1}. \tag{13}$$

However, (13) is inconsistent with the negative surplus, which is a necessary condition for access restriction. By the zero-surplus equation in (10), the negative surplus requires

$$\beta > 1 - \alpha \frac{\pi_\varnothing}{1-\pi_\varnothing} \frac{V+1}{V-1}. \tag{14}$$

□

Receiver's strategic restriction of access increases the welfare because the two distortions cancel each other out. Put more precisely, the status-quo bias serves as a check for the externality bias; it guarantees the first-best action independently of the size of the externality bias.

Through the access fee restriction, Receiver effectively decides to 'not listen'. Thus, we may interpret this decision to be a sort of bargaining whereby the two parties can 'agree to disagree'. Thus, Receiver ex ante improves the welfare relative to her ex post (non-contractible) actions. In other words, the access fee is not only an instrument to extract surplus from Sender but also a decision of Receiver by which Receiver may ex ante reduce the welfare distortion associated with her non-contractible ex post actions.

Finally, we can briefly discuss the equilibrium properties under conditions in which if access is not restricted. In terms of welfare, there are only three possibilities:

- No distortion: By Proposition 2, we know that the only distortion occurs toward the low action. Hence, if $(a_0, a_1) = (1, 1)$, then $(a_0^*, a_1^*) = (1, 1)$. This is one of the cases in which the equilibrium entails the first-best allocation. This equilibrium occurs if access is not restricted, the status-quo action is the high action, and the signal is uninformative.[2]

- Single distortion: For a single distortion, we must have the separating equilibrium, $(a_0, a_1) = (0, 1)$, and the first-best actions, $(a_0^*, a_1^*) = (1, 1)$. An example is the case of $\pi_1 > \frac{1}{2} > \pi_\varnothing > \pi_0 > \frac{V-1}{2V}$. These parameters guarantee that the access is not restricted and that the signal is informative.

- Double distortion: The existence of double distortion can be easily evaluated. Double distortion occurs if and only if $(a_0, a_1) = (0, 0)$ and $(a_0^*, a_1^*) = (1, 1)$. This equilibrium

[2]Notice that this case does not exhaust the full set of non-distorting equilibria.

occurs only if the signal is uninformative and $a_\varnothing = 0$ (or, equivalently $\pi_\varnothing < \frac{1}{2}$). To obtain high actions that are socially optimal, we must have $\pi_0 > \frac{V-1}{2V}$. Because the signal is uninformative, $\pi_1 < \frac{1}{2}$. To sum up, a necessary condition for double distortion is $\frac{1}{2} > \pi_1 \geq \pi_\varnothing \geq \pi_0 > \frac{V-1}{2V}$.

4.2 Benevolent Receiver with a mixed objective

Suppose the welfare measure is the sum of all players' expected losses from Receiver's actions. As in Grossman and Helpman (2001), Receiver's objective is mixed. On one hand, Receiver is benevolent and accounts for the total expected losses (welfare). On the other hand, Receiver values her private benefits.

To obtain explicit microfoundations for the welfare, assume that we have three agents. Only Agent 1 is organized and can be met and exploited by Receiver; hence, Agent 1 becomes a single sender. (i) Agent 1's loss function is $l_1(a) = 1 - a$. (ii) Agent 2's loss function is $l_2(a) = a$. (iii) Agent 3's loss function is $l_3(a, \theta) = L(a, \theta)$. Receiver has an action-independent loss function; alternatively, we may think of Receiver as being either Agent 2 or Agent 3.

By definition, the *total welfare loss* is $W(a, \theta) = l_1(a) + l_2(a) + l_3(a) - 1 = L(a, \theta)$. Hence, ex post, benevolent Receiver with a mixed objective and posterior π sets the welfare-maximizing action $a \in \{0, 1\}$ exactly as in the previous analysis, namely to minimize $E(a, \pi)$.

Ex ante, however, private gains matter. In Receiver's mixed objective, the parameter of benevolence is λ. Hence, Receiver's expected loss in signal realization s, is

$$U(a, s) := \lambda[(1 - \pi_s)W(a, 0) + \pi_s W(a, 1)] - (1 - \lambda)e_s c. \tag{15}$$

When setting the access fees, Receiver's objective is to minimize the ex ante loss, $(1 - f)U(a_0, 0) + fU(a_1, 1)$.

Finally, to keep our setting intact, the values of the fees must be identical for Sender (Agent 1) and Receiver. Receiver treats her private gains exactly as the welfare loss of Sender only if $\lambda = \frac{1}{2}$. Obviously, this assumption does not imply that Receiver is a genuine altruist who treats the private benefits of the other agents as being equal to her private gains. In fact, Receiver discriminates between the sources of the losses of the other agents: (i) The loss of any agent is fully accounted for only if it is associated with the action that disfavors the agent. (ii) In contrast, the loss of an agent stemming from a private transfer to receiver is not considered at all. This dichotomy is important for the construction and interpretation of the welfare properties of the equilibrium.

Clearly, in this setting, the welfare distortion arises only if the information available to benevolent Receiver in the final Stage 4 is incomplete. Proposition 3 builds a result that is parallel to Proposition 2.

Proposition 3 (Access restriction, benevolent Receiver)**.** *If access is strategically restricted and Receiver is benevolent, then welfare is not maximized.*

Proof. By Proposition 1, the signal is informative if access is restricted; hence, $(a_0^*, a_1^*) = (0, 1)$. However, under restricted access, we have $(a_0, a_1) = (1, 1)$. Hence, there is a single distortion at low signal realization, $a_0 \neq a_0^*$. □

The interpretation of the welfare loss in this setting is straightforward: Receiver faces a tradeoff between the amount of information (public benefits) and the amount of revenue (private benefits). Since the two types of benefits are weighted one to one and Receiver has full bargaining power, the typical scenario is as follows: Receiver encourages the disclosure of privately informed Sender, which maximizes the public benefits. To do so, Receiver compensates Sender for the potential adverse effect of disclosure on privately informed Sender (i.e., sets a negative fee) or exploits the potential beneficial effect of disclosure on Sender (i.e., sets a positive fee). The fee exactly restores Sender's outside option. Thus, Receiver can both maximize the public benefits and extract part of the public benefits to himself.

However, this scenario does not work if Sender's outside option is high and the extra public benefits are low. In such a setting, the compensation is prohibitively costly, and Receiver sacrifices increasing the public benefits for savings private costs. Put simply, achieving extra private benefits is prohibitively costly in terms of private costs. Unlike the previous setting, this setting with a mixed objective yields a genuine tradeoff between the amount of private benefits and the amount of public benefits, where disclosure is equivalent with the amount of public benefits.

Finally, notice that the access of Sender is equivalent to having maximal welfare. To understand this point, it is sufficient to show that allowing access implies no welfare distortion. There are two cases in which the access is allowed: (1) the signal is uninformative, and each status-quo action is the first-best action; or (2) the signal is informative, and each equilibrium action is the signal-dependent first-best action.

5 Extensions

5.1 Preferences regarding information structures (noise)

We first derive Partner's preferences regarding noise (α, β). The preferences depend primarily on the status-quo action:

- High (favorable) status-quo action, $a_\varnothing = 1$: Clearly, Partner prefers an *uninformative signal*, which implies that the surplus is zero and that Partner defends the high action.
- Low (unfavorable) status-quo action, $a_\varnothing = 0$: For both timings, Partner participates. Hence, Partner always obtains the payoff of her outside option, which is the value of the low action. Thus, Partner is *indifferent* regarding noise.

Receiver's preferences are given by the maximization of the level of surplus.[3]

- High (favorable) status-quo action, $a_\varnothing = 1$, and ex ante access: In Section 3.4, we observed that the shape of the iso-surplus curves depends on the relative valuation: (i) If $V \geq 1$, the surplus is maximized at *noiseless* signal $(\alpha, \beta) = (0, 0)$. (ii) If $V < 1$, then the surplus is maximized at an *uninformative* signal.

- Low (favorable) status-quo action, $a_\varnothing = 0$, or interim access: By inspection of (4) and (5), the iso-surplus curves have the same slope as that identified in Section 3.4. The only difference is that the surplus level is always non-negative because the surplus is *monotonic* in noise for the informativeness condition. Thus, the maximal surplus depends on the relative valuation: (i) If $V \geq 1$, the surplus is maximized at *noiseless* signal $(\alpha, \beta) = (0, 0)$. (ii) If $V < 1$, then the surplus is maximized at a *biased informative* signal $(\alpha, \beta) = (0, 1)$.

To sum up, the objectives of Partner and Receiver are perfectly aligned (both prefer an uninformative signal) if $V < 1$ and $a_\varnothing = 1$. In contrast, the objectives of Partner and Receiver are exactly opposite if $V > 1$.

5.2 Non-skeptic Receiver

Relaxing the assumption of full disclosure (Assumption 1) has no effect on the equilibrium payoffs as long as we maintain weak dominance.

- Consider the high type of sender. Non-disclosure ($d_1 = 0$) is weakly dominated by disclosure ($d_1 = 1$). The posterior belief under disclosure is π_1, while the posterior belief under non-disclosure for any mixed-strategy profile lies in the interval $[\pi_0, \pi_1]$. Sender's payoff is increasing step wise in the posterior; hence, the action that maximizes the posterior weakly dominates all other actions.

- Consider the low type of sender. The argument above shows that the high type of sender discloses evidence ($d_1 = 1$) under weak dominance. Thus, the posterior under non-disclosure, for any profile including a mixed-strategy profile, is equal to π_0. The posterior under disclosure is also π_0. Thus, Receiver's action a remains constant. The low type of sender is indifferent regarding any combination of disclosure and non-disclosure.

In contrast, allowing a pooling equilibrium under interim access (i.e., relaxing Assumption 2) may have an effect. The pooling profile is $(e_1, e_2) = (0, 0)$. The posterior belief for non-participation is now $\pi_\varnothing$, which implies status-quo action $a_\varnothing$. Thus, the outside option (participation condition) of the high type of sender is now characterized by the status-quo

[3] Notice that the surplus is identical under $a_\varnothing = 0$ or an uninformative signal and differs under $a_\varnothing = 1$ and an informative signal.

action, not the low action. As a result, the bargaining surplus for interim access under a pooling profile is

$$H_p(\alpha,\beta,\pi_\varnothing) := \begin{cases} I(\alpha,\beta,\pi_\varnothing)[E_\varnothing(\pi_\varnothing) - E_e(\alpha,\beta,\pi_\varnothing) + f(\alpha,\beta,\pi_\varnothing) - 1] \gtreqless 0 & \text{if } \pi_\varnothing \geq \frac{1}{2}, \\ I'(\alpha,\beta,\pi_\varnothing)[E_\varnothing(\pi_\varnothing) - E_e(\alpha,\beta,\pi_\varnothing) + f(\alpha,\beta,\pi_\varnothing)] \geq 0 & \text{if } \pi_\varnothing < \frac{1}{2}. \end{cases} \tag{16}$$

A pooling profile is an equilibrium only if the high type of sender does indeed *not* participate, $H_p(\alpha,\beta,\pi_\varnothing) < 0$. By comparing (16) and (4), we find that this profile is equivalent to the conditions for the strategic access restriction under ex ante access, $S(\alpha,\beta,\pi_\varnothing) = H_p(\alpha,\beta,\pi_\varnothing)$. (The comparative statics are captured in Section 3.4.) Thus, a pooling equilibrium with non-skeptic Receiver's beliefs exist under interim access if and only if access is strategically restricted under ex ante access.

6 Conclusions

This paper develops a persuasion game with a single sender and a single receiver, where the receiver charges for access before verifiable evidence can be presented. The model presented in the paper belongs into the family of access fee models that originated with Austen-Smith (1995, 1998), Ball (1995), and Lohmann (1995) and that were recently extended by Cotton (2009, 2012). In this class of lobbying models, payments to the receiver and informative messages to the receiver are defined as complements; payments are assumed to be pre-condition communications. This idea is corroborated by evidence on the group-level correlations between campaign contributions and lobbying expenditures (Ansolabehere et al., 2002; Esterling, 2007).

Our model has three main uses. First, we demonstrate that for any timing, noise, valuation, and beliefs, the game simply entails a non-cooperative bargaining game. The receiver makes a single take-it-or-leave-it offer, and her bargaining partner agrees or disagrees with this offer. The bargaining partner is either a sender (if access precedes the private signal) or a high type of sender (if access follows the private signal). The existence of the access restriction is equivalent to the negative sign of the bargaining surplus resulting from the participants' outside option. This model can be also applied in the analysis of multiple senders, where the bilateral surpluses are conditional on the set of participants.

A comparison to a classic persuasion game is noteworthy. The barrier to the transmission of verifiable information in persuasion games is that low types of senders typically do not participate in order to pool unfavorable evidence with a lack of evidence (Bennedsen and Feldman, 2006; Dahm and Porteiro, 2008; Henry, 2011). However, with endogenous fees, the incentive constraint of low types of senders can be met by providing sufficiently high compensation (i.e., a sufficiently low or even negative fee). The lack of an incentive for a sender to disclose verifiable information is thus attributed to the receiver's strategic decision to impose insufficient compensation (i.e., a prohibitively large fee).

Second, we show that the normative assessment of access restriction and the ensuing information loss crucially depends on the receiver's objective. If the receiver is non-benevolent, then the access restriction always improves the overall welfare, and the receiver's actions are the first-best actions. In contrast, if the receiver is benevolent, then the access restriction always deteriorates the overall welfare, and the receiver's actions are not the first-best actions. In other words, evidence regarding the receiver's objective is a pre-condition for the normative analysis of lobbying through access fees.

Third, we illustrate that preferences regarding signal noise can be perfectly aligned but also perfectly opposite between a sender and a receiver. Whenever the receiver's valuation of the policy exceeds the sender's valuation, we obtain a standard scenario: the receiver prefers noiseless evidence, whereas the sender prefers uninformative evidence. In contrast, the two players agree on uninformative evidence if the sender's valuation of the policy exceeds the receiver's valuation, and the status-quo policy is favorable for the sender. This scenario suggests, for example, that policy makers would not support the production of expertise in fields with a single mainstream interest group, even if under certain states of nature, they would ex post prefer a non-mainstream policy.

Our findings on preferences over signal noise contribute to the literature on optimal persuasion in which senders select a particular information structure and then play a subgame with exogenous evidence (Kamenica and Gentzkow, 2011; Gentzkow and Kamenica, 2011; Rayo and Segal, 2010). The literature on optimal persuasion also contains a broad family of models on the search for verifiable evidence. In such models, the sender determines the number of received signals, and if the search is unobservable, the sender discloses favorable signals only (Dur and Swank, 2005; Bennedsen and Feldmann, 2006; Brocas and Carillo, 2007; Dahm and Porteiro, 2008; Gul and Pesendorfer, 2012).

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