Submission Number: PET11-11-00052

Information transmission and inefficient lobbying

Rafael C. Costa lima
University of São Paulo

Humberto Moreira
FGV

Abstract

In a seminal paper, Grossman and Helpman (1994) introduced a framework to understand how lobbying activities influence the choice of import/export tariffs. Although their analysis presumes perfect information, in many situations lobbies have private information regarding the impact of the policies available to the governments. In this paper we assume that the producers' competitiveness is lobbies' private information in a Grossman and Helpman lobby game. As a result, we can analyze the effects of information transmission within their model. Information transmission generates two information asymmetry problems in the political game. One refers to the cost of signaling the lobby's competitiveness to the policy maker and the other to the cost of screening the rival lobby's competitiveness from the policy maker. We show that information transmission may improve welfare through the reduction of harmful lobbying activity.

We thank Andrea Attar, Carlos da Costa, David Martimort, Emanuel Ornelas, Filipe Campante, François Salanié, Thierry Verdier and seminar participants at The Toulouse School of Economics, EPGE/FGV, EESP/FGV for useful comments. the usual disclamer applies.
Submitted: February 21, 2011.

Information transmission and inefficient lobbying

Rafael Costa Lima* Humberto Moreira†

February, 2011

Abstract

In a seminal paper, Grossman and Helpman (1994) introduced a framework to understand how lobbying activities influence the choice of import/export tariffs. Although their analysis presumes perfect information, in many situations lobbies have private information regarding the impact of the policies available to the governments. In this paper we assume that the producers' competitiveness is lobbies' private information in a Grossman and Helpman lobby game. As a result, we can analyze the effects of information transmission within their model. Information transmission generates two information asymmetry problems in the political game. One refers to the cost of signaling the lobby's competitiveness to the policy maker and the other to the cost of screening the rival lobby's competitiveness from the policy maker. We show that information transmission may improve welfare through the reduction of harmful lobbying activity.

*University of São Paulo.

†Fundação Getulio Vargas.

1 Introduction

Lobbying is a central element in the study of the policy-making process in many fields of economic literature such as trade, taxation and regulation. Yet, there is no consensus about the role of lobbies in the political process. One branch of the literature treats lobbies as groups that have privileged access to information which is relevant to the decision-making process. Although lobbies may improve the policy making by providing information they can also be harmful if they make strategic use of the information. Another branch views lobbies as rent-seeking groups that exercise influence by giving money contributions to swing the decision of an influenceable policy maker in their favor at the expense of the society's welfare.

Among the papers that focus on the rent-seeking aspect, Grossman and Helpman (1994) is one of the most important to capture the effect of lobbying. In their model, the political game takes place in a small economy and lobbies represent productive sectors that offer money contributions to the policy maker in order to receive tariff protection. A fraction of individuals in the economy is not represented by lobbies and does not participate in the political game. Therefore, the country's trade policy favors the sectors that lobby while the welfare cost of the tariff is borne by individuals who do not lobby. Grossman and Helpman (1994) - GH hereinafter - assume perfect information in the political game.

Potters and Van Winden (1992), Austen-Smith (1995), Krishna and Morgan (2001) and Esteban and Ray (2007), to name a few, investigate situations where lobbies are better informed than policy makers. In these papers, the lobby's preferences are not aligned with the policy maker's and she[1] can make strategic use of her private information to influence the policy maker's choice in her favor.

Our work stands in-between these two branches. We assume that the competitiveness of productive sectors in GH is the lobbies' private information. To be more precise, each lobby knows its own, but does not know the other sectors' competitiveness. The policy maker has no private information and does not observe the sectors' competitiveness. Therefore, this is a rent-seeking model where lobbies have more information regarding the impact of policies.

Under this information structure, two asymmetric information problems arise. The first one hinges on the fact that, facing the same tariff, more competitive lobbies ("high-types") substitute more imports than less competitive ones ("low-types"). Import substitution due to tariff generates inefficiency for the economy because home goods are produced with marginal costs above international prices. Since high-type sectors substitute more, they cause higher welfare loss than low-

[1] We will use feminine pronouns to identify lobbies and masculine pronouns in refering to the policy maker.

type sectors for a given tariff level. The information problem arises because the policy maker does not know the lobbies' true types. As result, high-type lobbies may pretend they are low-types in order to contribute less for the protection they receive. If both types offer the same contribution, the policy maker cannot learn their types and can only ask for an average compensation for protection. On the other hand, low-types do not want to be misidentified as high-types because the welfare cost of protection is lower for them. When they separate themselves, they pay the true welfare cost of their protection. Separation allows the policy maker to discern correctly lobbies' types through the received contributions, although low-type offers are distorted. We refer to these distortions as the signaling effect.

The second asymmetric information problem comes from the fact that, in our model, goods are substitutes and each lobby does not know the rival's type. When the lobby representing good 1 producers asks for more protection, the demand for the substitute good 2 shifts upward. In turn, the shift in the demand for good 2 gives the policy maker an increase in the import tariff revenue of good 2. This revenue increase is large if the tariff of good 2 is higher, and small if the tariff is lower. Under perfect information, the lobby (of sector) 1 can anticipate the tariff in market 2 and deduct the revenue increase from the contribution she gives to the policy maker. When lobby 1 does not know the protection in market 2, she cannot deduct this exact amount from the contribution she offers to the policy maker.

Although lobby 1 does not know the tariff that will be granted to lobby 2, the policy maker learns the lobbies' types when he receives the contributions (if they are separating). Hence, lobby 1 knows that the policy maker learns the rival's type before implementating policies and she is able to make conditional contributions and screen this information from him. Yet screening is costly and generates distortions in the political game. We refer to these distortions as the screening effect. Both asymmetric information problems constitute the information transmission problem.

In our model, contributions perform three tasks: buy influence; signal the lobby's type to the policy maker; and, screen the rival's type from the policy maker. The low-type lobby separates herself from the high-type by demanding less protection than she would under perfect information. Moreover, screening the rival's type makes the low-type lobby leave informational rents to the policy maker and also demand less protection. Finally, information transmission allows the policy maker to extract informational rents and also reduces the lobbies' influence, which dissipates some of the political rents. Thus, information transmission hinders the rent-seeking activity. As a consequence, tariffs decrease, imports increase, and the welfare of the society increases compared with the perfect information situation.

Hence, not only does the policy outcome but also the distribution of the political game's surplus differs significantly from that of GH. In GH, when lobbies are highly concentrated (the case we consider here) the policy maker receives his reserve utility and lobbies extract all the surplus. With privately informed lobbies, the policy maker has bargaining power against the lobbies, due to the screening effect, and is able to retain some rents. Also, since policies are no longer truthful, some of the political rents are dissipated. Both effects reduce the lobbies' rents.

Lobby games were also modeled as common agency games in Le Breton and Salanié (2003), Martimort and Semenov (2008), and Campante and Ferreira (2007). However, the first two papers consider the ideological uncertainty case, i.e., the policy maker's preference regarding contributions and welfare is his private information. In the first paper, individuals have the option of forming a lobby, which we do not consider here (as in GH, lobbies are assumed to exist.).

Our results are comparable to Martimort and Semenov (2008). They found that ideological uncertainty reduces the lobbies' influence and the outcome of the game is closer to the policy maker's preferred policy. This result is similar to ours, since we find that policies are closer to the free trade equilibrium, which in the GH model is the policy maker's "preferred policy".

Within the literature that focus on the informative role of lobbies, our paper is related to Esteban and Ray (2007). In their model, lobbies also represent producers that signal their productivity to the policy maker with contributions. However, their paper differs from ours in two key aspects. First, they assume that the policy maker is not influenceable. So, he only tries to allocate resources to more efficient producers. Second, there is wealth inequality and credit constraints, thus wealthy but unproductive lobbies may send the same signal as productive lobbies. As a result, inefficiencies arise because the policy maker cannot separate productive lobbies from unproductive but rich lobbies and allocates productive resources to both of them, leaving poor but productive firms without resources. In our model, inefficiencies are caused by the rent-seeking nature of the lobbying activity. Thus, the information asymmetry is welfare enhancing because it reduces the rent-seeking activity, while in Esteban and Ray (2007) the information asymmetry reduces welfare because it makes the well-intentioned policy maker allocate resources to the "wrong" producers.

The work of Bennedsen and Feldmann (2006) also is related to our paper. They analyze a common agency game where lobbies search for information about the state of the economy and make contributions to influence the policy maker's decision. They find that the ability to offer contributions reduces the lobby's willingness to search for information and that competition between lobbies favors those who abstain from searching. Their structure differs from ours because the information gathered does not affect the lobbies' preferences while in our model information transmission affects preferences directly. More importantly, our model is closer to the GH model which allows us to derive sharp results about welfare.

Our approach benefits from Martimort and Moreira (2010) who analyzed the divisible public good provision problem as a common agency game with privately informed contributors. In their model, contributors are privately informed about their preferences and give conditional money transfers to a common agent who produces the public good. Similarly we introduce private information on the lobbies' preferences and analyze a common agency game with privately informed principals. The screening effect found in our model is similar to that of the game developed their paper. However, our model is a common value model once the policy maker also cares about the social welfare which includes the lobbies' profits, while their model is a private value model since the agent is self-interested. Maskin and Tirole (1992) showed that informed principal models with common values have information distortions in the same spirit of signaling games (e.g., Spence, 1973). Thus, the nature of the signaling effect is directly related to the common value aspect of our model.

In the next section, we present the economy and the political game, and characterize the efficient policies as well as the equilibrium of the political game under perfect information. In Section 3, we present the informed lobby problem. We define and characterize the equilibrium of the political game in Section 4. We then compare this equilibrium with the equilibrium of the game under perfect information. Section 5 provides a discussion of the selected equilibrium of our model. Section 6 concludes.

2 The model

The basic model is similar to the GH model. We consider a small, competitive economy that faces fixed international prices (p^e). A political game takes place within the economy. Special interest groups (lobbies) offer contributions to the government in exchange for tariff protection, which is the only available policy instrument. Lobbies are privately informed about the true impact of tariff in this economy.

The economy has a size one population of consumers. These consumers have preferences for three goods (x^0, x^1 and x^2) represented by the following utility function:

$$u\left(x^0, x^1, x^2\right) = x^0 + \sum_n \left(\alpha - \beta x^n\right) x^n + \delta x^1 x^2,$$

where the superscript 0 denotes the numeraire and $n \in \{1, 2\}$ refers to the productive sector n.

The government's revenue from import tax is given by

$$TR = \sum_n \left(p^n - p^e\right)\left(x^n - y^n\right),$$

where $p^n - p^e$ is the import tariff of good n and the international price p^e is the same for x^1 and x^2. The home production of good x^n is y^n. This revenue is redistributed to the society through lump-sum transfers.

Good x^0 is not taxed and its international price is normalized to 1. It is produced only from labor with constant returns of scale with an input-output coefficient of 1. We assume that the labor supply is sufficiently large so that wages can be also normalized to 1.

The wages and the government transfers define the consumers' income which, together with preferences, allow us to find the market demands:

$$x^n = a - bp^n + dp^{-n},$$

where $b > 0$ and d is a parameter that defines whether goods are substitutes ($d > 0$) or complements ($d < 0$).

Assumption 1 *Goods x^1 and x^2 are substitutes ($d > 0$).*

Assumption 1 is without loss of generality because most of the results remains in the case of complementary goods. This is an important difference between our model and that of GH (where $d = 0$). When demands are interdependent, the tariff in one sector affects the welfare cost of tariff in the other sector. This key assumption is very important for the information problems in this model.

Substituting the demands into the utility function we can compute the indirect utility function, denoted by $u(p^1, p^2)$ with some abuse of notation that will not create confusion.

Goods are produced with sector specific inputs. Hence, the owners of these factors receive all the profit from production. Moreover, we assume that owners of productive factors are a negligible fraction of the population, thus the factor ownership is highly concentrated. We refer to the owners of the specific factor as producers.

The production technology of goods x^1 and x^2 is given by the following marginal cost function:

$$\frac{\partial c}{\partial y}(\theta, y) = \begin{cases} \frac{\gamma y}{\theta} \text{ if } y \leq \frac{\theta}{1-\gamma} \\ \infty \text{ if } y > \frac{\theta}{1-\gamma} \end{cases},$$

which implies that the marginal cost is positive and increasing, and producers face a capacity constraint. Notice that the elasticity of the supply function will be different depending on whether the optimal production is an interior or a corner solution. In the first case, production increases in response to an increase in home prices, while in the second, production is fixed. For simplicity, we only analyze two polar cases. In the first case ($\gamma = 0$), each sector produces exactly the capacity constraint. In the second case ($\gamma = 1$), the capacity is never reached[2]. As we shall see, these extreme cases result in different information transmission problems.

The profit function is given by $\theta\pi(p)$, where $\pi(.)$ is a convex function which depends on the value of γ. The supply function of good n is denoted by $y^n(\theta^n, p^n)$. By the Envelope Theorem, $y^n(\theta^n, p^n) = \theta^n \pi'(p^n)$.

The welfare is the sum of the government's revenues, and the consumers' as well as producers' surpluses in all markets:

$$W\left(\theta^1, p^1, \theta^2, p^2\right) = u\left(p^1, p^2\right) + \sum_n \left(p^n - p^e\right)\left(x^n\left(p^n, p^{-n}\right) - \theta^n \pi'\left(p^n\right)\right) + \sum_n \theta^n \pi\left(p^n\right).$$

Figure 1 presents the welfare effect of a tariff increase in market (of good) 1.

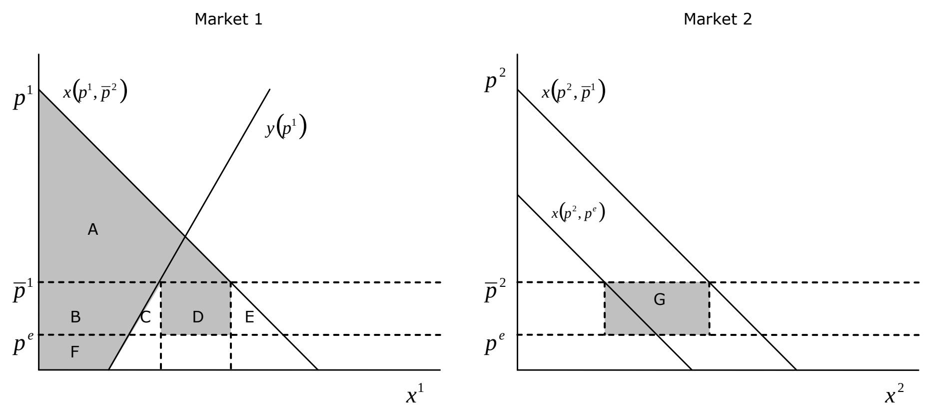

Figure 1 - The welfare impact of a tariff increase.

In market 1 the home price $\bar{p}^1$ is above the international price p^e due to the tariff. The downward sloping line is the home market demand and the upward sloping line is the home supply of good 1. The triangle A below the demand curve and above the home price is the consumers' surplus; B and F are the producers' surpluses; D is the tariff revenue; C and E are the deadweight loss of the tariff. The rectangle G in market 2 is an extra revenue due to substitutability and the increase of protection in market 1.

The impact of tariffs on welfare which is given by

$$\frac{\partial W}{\partial p^n} = -\left(b + \theta^n \pi''\left(p^n\right)\right)\left(p^n - p^e\right) + d\left(p^{-n} - p^e\right). \tag{1}$$

Notice that the area of triangle C is related to $b\left(p^1 - p^e\right)$ in (1) and represents the loss from the decrease in home consumption. The area E is related to $\theta^1 \pi''\left(p^1\right)\left(p^1 - p^e\right)$

[2]The results are essentially the same for different values of γ such that produticon does not reach the capacity constraint.

in (1) and represents the welfare loss due to import substitution. Finally, the area of rectangle G is related to the last term in (1).

The government's revenue, the market demands, the home supplies and the international prices define the economy in our model.

Political game

There are three players: two lobbies and one policy maker. Lobbies offer contributions, $C \in \mathbb{R}_+$, to the policy maker. Thus, they are the principals of the common agency game. We assume that consumers cannot lobby.

Each lobby represents the producers of her sector. They care about the profit of the sector they represent and dislike giving contributions to the policy maker. Their utility function is

$$V(\theta, p, C) = \theta\pi(p) - C.$$

Lobbies do not care about the consumer's surplus since the sectors' ownership is highly concentrated.

The policy maker is the common agent who chooses the home prices of the economy, $p^1, p^2 \in \mathbb{R}_+$, by imposing an import tariff.[3] Therefore, home prices are the only economic policy available to him. He cares about the social welfare (W) but also likes contributions. Therefore, he is willing to trade economic welfare for contributions. His preferences are represented by

$$U\left(\theta^1, p^1, C^1, \theta^2, p^2, C^2\right) = \sum_n C^n + \lambda W\left(\theta^1, p^1, \theta^2, p^2\right),$$

where $\lambda > 0$ is the relative preference between welfare and contributions.

Asymmetric information. The competitiveness parameter θ can take two values: θ_l and θ_h, where $\theta_h > \theta_l$. Its realization is private information of the lobby. The distribution of θ's is common knowledge, i.i.d. and z is the probability of $[\theta = \theta_h]$. Therefore, each lobby knows her type but does not know the rival's type, while the policy maker does not know their types.

We make the following assumption about the parameters to assure interior solutions of the lobbies' problems:[4]

[3] Using import tariff, the policy maker cannot set prices above the competitive price of a closed economy. However, we ignore this upper bound assuming that the policy maker can collect lump-sum taxes to buy the home good and export it. Thus, the home price can be above the competitive price of the closed economy.

[4] These assumptions are sufficient to obtain interior solutions. They greatly simplify our analysis since they rule out negative prices. Essentially, they ensure an interior solution for the "virtual utility" maximization problem.

Assumption 2

$$(1-z)b-d>0$$
$$(1+z)\,\theta_l \geq \theta_h$$

and if $\gamma=1$

$$(1-z)\,b-d>(1-z)\,\frac{(1-\lambda)}{\lambda}\theta_h.$$

The first inequality in Assumption 2 states that the substitutability of goods is not too large. The second inequality states that the difference between the asymmetric information parameters is moderate. The third has a similar role as the first one when $\gamma=1$.

Strategy space

We assume, for the sake of simplicity and realism, that lobbies can only demand protection for their own goods. Therefore, the contribution schedule (contract) of lobby n, $C^n(\theta^n,p^n)$, specifies the level of contribution C^n for each policy p^n and type θ^n.

Once the contribution is accepted, the policies are implemented and payments are made accordingly (we are then assuming commitment in the political game).

Since the political game is symmetric, we drop the superscript index, whenever this does cause any confusion.

Timing

(0) nature draws the lobbies' types and each lobby learns her type;

(1) each lobby non-cooperatively offers contribution schedules to the policy maker;

(2) the policy maker either accepts or rejects contracts; and,

(3) policies are chosen and, when contributions are accepted, payments are made accordingly.

The preferences of the lobbies and the policy maker, the information structure, the strategy space, and the timing define the political game.

This rent seeking model has two benchmarks that will help us to evaluate the effects of information transmission. The first one is the free trade equilibrium. It defines which policies arise if there is no political influence on the decision-making.

Free trade equilibrium

If the policy maker does not care about contributions, he chooses the home policies that maximize the society's welfare:

Definition 1 *The free trade equilibrium policies $\{\hat{p}_{ik}, \hat{p}_{ki}\}$ are defined by*

$$\{\hat{p}_{ik}, \hat{p}_{ki}\} \in \arg\max_{p_{ik}, p_{ki}} W\left(\theta_i, p_{ik}, \theta_k, p_{ki}\right),$$

where the first subscript index refers to the lobby's own type and the second index refers to the rival's type, where $i, k \in \{l, h\}$.

The first-order conditions of this problem are given by

$$\frac{\partial W}{\partial p^n}\left(\theta_i, \hat{p}_{ik}, \theta_k, \hat{p}_{ki}\right) = 0, \tag{2}$$

for all $n, k = 1, 2$ such that $k \neq n$.

From (1) we obtain that the free trade equilibrium is the welfare maximum for the society,[5] i.e., $\hat{p}_{ik} = \hat{p}_{ki} = p^e$. Therefore, any deviation from these tariffs reduces the welfare and, in particular, those resulting from lobby influence.

The second benchmark is the truthful equilibrium. It defines which policies arise from the political game under perfect information.

Truthful equilibrium

From Bernheim and Whinston (1986b) we know that when principals play truthful strategies,[6] the solution of the common agency game is the same as the solution of a centralized problem that maximizes the surplus of the political game. Hence, we have:

Definition 2 *The truthful equilibrium policies $\{\bar{p}_{ik}, \bar{p}_{ki}\}$ are defined by*

$$\{\bar{p}_{ik}, \bar{p}_{ki}\} \in \arg\max_{p_{ik}, p_{ki}} \theta_i \pi\left(p_{ik}\right) + \theta_k \pi\left(p_{ki}\right) + \lambda W\left(\theta_i, p_{ik}, \theta_k, p_{ki}\right).$$

The first-order conditions resulting from the truthful contribution schedules are

$$\theta_i \pi'\left(\bar{p}_{ik}\right) - \lambda \frac{\partial W}{\partial p^1}\left(\theta_i, \bar{p}_{ik}, \theta_k, \bar{p}_{ki}\right) = 0. \tag{3}$$

and a symmetric first-order condition for $\bar{p}_{ki}$.

They equalize the marginal benefit of the lobbies and the marginal welfare cost of the society. Compared to condition (2), (3) gives an extra weight to lobbies

[5] In this framework, the second-order condition implies that free trade is the welfare maximum whenever $b > d$, which trivially follows from Assumption 2.

[6] Given the model's primitives, truthful strategies are characterized by contribution schedules such that, $\frac{\partial C}{\partial p}\left(\theta, p\right) = \theta \pi'\left(p\right)$.

and, therefore, policies increase for lobbies and the welfare cost is borne by the rest of the society.

If $\gamma = 0$, the policies implemented by the truthful equilibrium are given by

$$\bar{p}_{ik} = \frac{\theta_i b + \theta_k d}{\lambda \left(b^2 - d^2\right)} + p^e \tag{4}$$

and if $\gamma = 1$, the policies are given by

$$\bar{p}_{ik} = \frac{\left[\theta_i \left(\lambda \left(b + \theta_k\right) - \theta_k\right) + \lambda d \theta_k\right] p^e}{\left(\lambda \left(b + \theta_k\right) - \theta_k\right)\left(\lambda \left(b + \theta_i\right) - \theta_i\right) - \lambda^2 d^2} + p^e. \tag{5}$$

Therefore, the free trade equilibrium defines the first-best solution and the truthful equilibrium defines the solution of the political game without asymmetric information. We will keep these two benchmarks in mind as we compare the qualitative properties of the political game with privately informed lobbies.

3 The informed lobby problem

In this section, we present the lobby's best reply problem which we will identify as the informed lobby problem. In the political game, lobbies simultaneously offer contribution schedules to the policy maker. Therefore, the offers maximize the lobby's utility taking as given the offer of the other lobby. We will focus on symmetric Perfect Bayesian Equilibria (equilibria, in short) of the political game.

Instead of trying to find which is the best response for every possible rival's strategy, we will discipline the lobby's conjecture by placing particular conditions on the rival lobby's offer. Then, we let the lobby choose her best reply and check that such conditions hold in our selected equilibrium.

We now present these conditions in detail. The rival's variables are presented in bold and, to simplify notation, we denote $C\left(\theta_i, p_{ik}\right)$ as C_{ik}. We then place the following:

Selection Criterion 1 *The rival's offer is separating and the policy is increasing in her type ($\mathbf{p}_{hi} \geq \mathbf{p}_{li}$).*

SC implies that the policy maker will learn the rival lobby's type from her offer. This is inspired by Maskin and Tirole (1992) who argued that a principal (lobby) has no incentive to withdraw information from the agent (policy maker) in informed principal problems with quasi-linear utility functions. SC also states that a high-type rival asks for more protection than a low-type lobby. This seems to be a reasonable condition since high-types have more resources available to influence the policy maker. Of course SC restricts the possible conjectures about the rival's offer. Thus, it works as an equilibrium selection criterion. In Appendix B we then present a more formal justification for SC.

The information problems along with SC are translated into a incentive compatibility constraint in the informed lobby problem. Since we focus on separating equilibrium and lobbies are privately informed, we must impose incentive compatibility constraints on the lobby. If not, one type of lobby may want to pretend she is a different type. When binding, these constraints will generate distortions in the same way of signaling games. The distortions coming from these constraints lead to the signaling effect.

The lobby's incentive compatibility constraint states that a type-$(-i)$ lobby does not want to offer the contribution schedule of a type-i lobby:

$$E\left[\theta_{-i}\pi\left(p_{-i.}\right)-C_{-i.}\right]\geq E\left[\theta_{-i}\pi\left(p_{i.}\right)-C_{i.}\right], \qquad (IC_{-}i)$$

where $-i\neq i$ is the rival's type. This constraint ensures that the policy maker can correctly learn the lobby's type from the contribution schedule.

The lobby's individual rationality constraint is given by

$$E\left[\theta_{i}\pi\left(p_{i.}\right)-C_{i.}\right]\geq\theta_{i}\pi\left(p^{e}\right). \qquad (IR_{i})$$

Once the rival's offer is separating, the policy maker will learn the rival's type when he receives her offer (before implementing the policy). In turn, the offer of the rival is valuable information for the lobby, thus, she has to screen this information from the policy maker. Screening requires incentive compatibility constraints for the policy maker in the informed lobby problem. These incentive compatibility constraints ensure that he chooses the level of protection according to the true type of the rival lobby. In other words, they ensure that the policy maker chooses the contribution associated with his true marginal cost of tariff:

$$C_{ik}+\boldsymbol{C}_{ki}+\lambda W\left(\theta_{i},p_{ik},\boldsymbol{\theta}_{k},\boldsymbol{p}_{ki}\right)\geq C_{i(-k)}+\boldsymbol{C}_{ki}+\lambda W\left(\theta_{i},p_{i(-k)},\boldsymbol{\theta}_{k},\boldsymbol{p}_{ki}\right), \qquad (ICP_{i}k)$$

where $-k\neq k$ is the rival's fake type.

Notice that constraint $(ICP_{i}k)$ leads to two different constraints in the type-i informed lobby problem (one for each possible k). The distortions coming from these constraints constitute the screening effect.

Finally, the policy maker's individual rationality constraint is given by:

$$C_{ik}+\boldsymbol{C}_{ki}+\lambda W\left(\theta_{i},p_{ik},\boldsymbol{\theta}_{k},\boldsymbol{p}_{ki}\right)\geq\lambda W\left(\theta_{i},p^{e},\boldsymbol{\theta}_{k},p^{e}\right). \qquad (IRP_{i}k)$$

This constraint ensures that the policy maker accepts the contributions that give at least his reserve utility.[7]

[7] More precisely, the individual rationality constraint should give the policy maker the utility he receives rejecting the contribution of one lobby and accepting the rival's. However, with substitute goods, this is the same as the utility he gets by rejecting both contributions.

The type-i informed lobby problem

$$\max_{\substack{p_{ih}, p_{il} \\ C_{ik}, C_{ki}}} E\left[\theta_i \pi\left(p_{i.}\right) - C_{ik}\right] \tag{6}$$

subject to (IC_i), (IRP_ik), (IR_i), (ICP_ik) and $C_{ik} \geq 0$ for all $-i$ and k.

The first task in solving this problem is to identify which ones of the constraints are binding at the optimal contract. Notice that, when goods are substitutes, the lobby's marginal cost of the policy is inversely proportional to size of the policy in the other markets, i.e., lobbies' policies are strategic complements. In other words, a lobby prefers to face a high-type opponent because the marginal welfare cost of protection is smaller.

Lemma 1 *If the contribution schedules satisfy SC, then the lobby's protection is increasing in the rival's type, i.e.,*

$$p_{ih} \geq p_{il}. \tag{7}$$

Lemma 1 suggests the direction of the policy maker's incentive compatibility constraints that should be binding. In the absence of proper incentives, the policy maker will be prompt to lie and choose the policy as if the rival is the low-type (i.e., high welfare cost) when she is truly the high-type. Hence, constraints (ICP_{ih}) and (IRP_{il}) are binding in the type-i informed lobby problem. Thus, we can eliminate contributions in problem (6) and optimize only with respect to the policies p_{ik} as in the tradition of the literature. However, we cannot say whether constraint (IC_i) is met. Moreover, we assume that constraint (IR_i) holds and so we must check it ex-post.

Lemma 2 *Suppose that contribution schedules satisfy SC such that constraints* (IR_{il}) *and* (ICP_{ih}) *are binding. Then the first-order conditions of the informed lobby problem are given by*

$$\theta_i \pi'\left(p_{ik}\right) - \lambda \frac{\partial W}{\partial p^1}\left(\theta_i, p_{ik}, \boldsymbol{\theta}_k, \boldsymbol{p}_{ki}\right) + \frac{\mu_{-i}}{1-\mu_{-i}} \Delta\theta_i \pi'\left(p_{ik}\right) + \lambda I\left(k\right) \frac{z}{\left(1-z\right)} d\left(\boldsymbol{p}_{li} - \boldsymbol{p}_{hi}\right) = 0, \tag{8}$$

along with usual slackness conditions for the (IC_{-i}) *constraint.* μ_{-i} *is the Lagrangian multiplier of* (IC_{-i}), $\Delta\theta_i = \theta_i - \theta_{-i}$ *and*

$$I\left(k\right) = \begin{cases} 1, & \textit{if } k = l \\ 0, & \textit{if } k = h \end{cases}.$$

The first two terms of (8) are the lobby's marginal benefit and the welfare cost of the policy, which are the driving forces of the truthful equilibrium characterization. The second term is related to the cost of separation; μ_{-i} is the shadow price of a marginal increase in the difference between the type-$(-i)$ lobby telling the truth and lying. It captures the necessary distortion to ensure separation. Notice that if $i = l$, $\Delta\theta_l < 0$, which means that if the high-type pretends to be the low-type, then the low-type has to demand less protection to separate herself.

The last term is due to the informational rent the lobby has to give to the policy maker in order to induce him to tell the truth. In order to save on the informational rent she demands less when facing a low-type rival, but this decreases her utility. This is the usual trade-off between allocative efficiency and rent extraction.

4 Information transmission and tariff protection

In this section, we define and characterize the equilibrium of the political game and discuss the effects of information transmission on the pattern of protection given to the lobbies. We divide the section into two parts (one for each value of γ) since the information effects are quite different for each value of γ. We begin by defining the equilibrium concept.[8]

Definition 3 *A symmetric Equilibrium of the political game that satisfies SC for each lobby is a pair of contribution schedules (one for each lobby) that simultaneously solves problem (6) for each type i.*

Therefore, the equilibrium is a fixed point of the best responses derived from the informed lobby problem for all possible types.

4.1 Binding capacity constraints ($\gamma = 0$)

When lobbies have binding capacity constraint θ, the home country supply curve is perfectly inelastic. In this case, the market has a vertical supply curve instead and triangle C in Figure 1 does not exist. This means that there is no import substitution so that different sectors generate the same welfare cost of protection for a given tariff. Thus, the welfare cost comes solely from the decrease in consumption (triangle E in Figure 1). Since the policy maker knows the demands, we have:

Lemma 3 *If contribution schedules satisfy SC, constraints (IC_i) are never binding.*

[8]Remember that we are focusing on equilibria that satisfy SC.

Lemma 3 states that there is no signaling effect in the political game when sectors have capacity constraints. Thus, only the screening constraints are binding.

Since demands are interdependent, the tariff in one market affects the demand in the other market. Therefore, once a lobby does not know her rival's type, she does not know the true welfare cost of protection. On the other hand, the policy maker receives contributions that reveal the lobbies' types before implementing the policy. Thus, the private information of the rival lobby becomes "private information" of the policy maker. The lobby has to screen the rival's information through the policy maker.

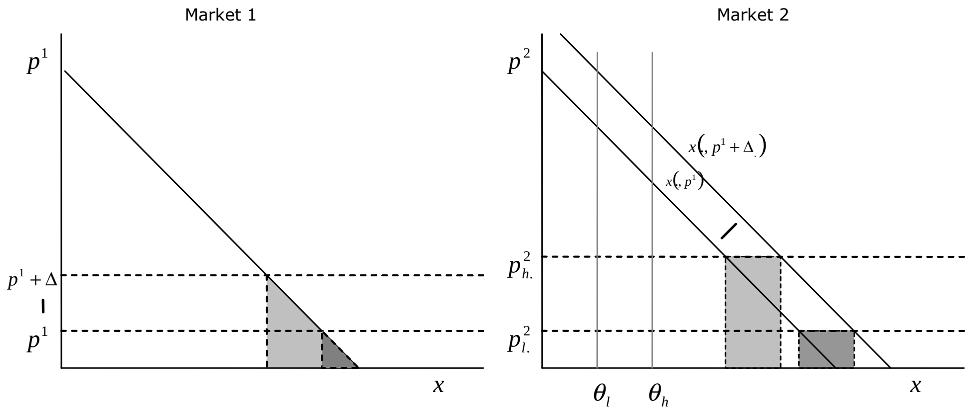

Figure 2 - The screening effect.

Figure 2 presents the effect of a tariff increase in both markets. For simplicity, we suppose that $p^e = 0$. Figure 2 shows a protection increase from p^1 to $p^1 + \Delta$ and the welfare losses in market 1 for each tariff (the darker triangle is the welfare loss of p^1 and the larger grey triangle is the welfare loss of $p^1 + \Delta$). A tariff increase in market 1 also shifts positively the demand in market 2, which gives the policy maker an additional tariff revenue equal to the grey rectangles. The larger rectangle corresponds to the additional revenue when there is high protection in market 2 and the smaller rectangle corresponds to the additional revenue when protection is small.

In order to have protection, a lobby has to compensate the policy maker for the welfare loss caused by the tariff increase. Therefore, the lobby discounts the revenue increase in the other market from the contributions she gives to the policy maker. The problem is that the lobby does not know the tariff in the rival market because she does not know the rival lobby's type. Since the policy maker will hold the rival's information, the lobby can only screen this information from the him.

This information problem exists because the lobby cannot observe the contribution of the rival lobby given that offers are simultaneous. Since the policy maker learns information that lobbies do not have, he can bargain with them. That is, the lobby's inability to observe the contributions of the rival gives the policy maker power to extract informational rents. As in traditional screening problems, the lobby distorts her demand for protection whenever she faces a low-type opponent in order to save informational rent she has to give to the policy maker. This explains:

Theorem 1 *There exists a symmetric separating pure strategy equilibrium of the political game with informed lobbies that satisfies SC for each lobby. The equilibrium policies are given by:*

$$\begin{aligned} p_{hh}^S &= \bar{p}_{hh}, \\ p_{hl}^S &= \bar{p}_{hl} - b\Psi, \\ p_{lh}^S &= \bar{p}_{lh} - d\Psi, \ \ \textit{and} \\ p_{ll}^S &= \bar{p}_{ll} - (b+d)\,\Psi, \end{aligned}$$

where $\bar{p}$ is given by (4), $\Psi > 0$ and the superscript S refers to the screening equilibrium policies. The equilibrium contributions are obtained from the binding constraints (ICP_{ih}) and (IRP_{il}).

Notice that policies decrease, except when both lobbies are high-types. The screening effect makes lobbies demand less protection than they do under perfect information.

One important question is how the screening equilibrium compares with the truthful equilibrium. First, the screening effect gives power to the policy maker so that lobbies have to pay informational rents. This informational rent makes lobbies distort downward their requested policies when compared to the truthful equilibrium. Since the latter maximizes the political rents, information transmission dissipates political rents. Moreover, once policies are above the free-trade level in the truthful equilibrium, decreasing them is welfare enhancing. Thus, information transmission increases welfare compared to the perfect information situation.

Corollary 1 *The welfare of the screening equilibrium in the political game with informed lobbies is higher than the welfare of the truthful equilibrium in the political game under perfect information.*

4.2 Linear marginal cost ($\gamma = 1$)

When $\gamma = 1$, the profit function is $\theta\pi(p) = \theta p^2/2$ and the home supply is $y(\theta, p) = \theta p$, which is more elastic the higher is θ. Different supply elasticities imply different welfare costs of protection as shown in Figure 3.

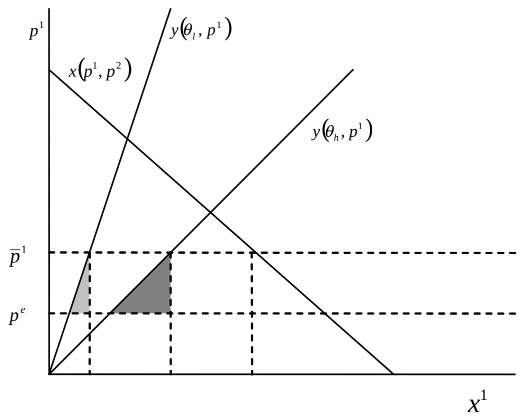

Figure 3 - The signaling effect.

Figure 3 shows that more competitive sectors generate higher welfare costs than less competitive ones. The policy maker, however, does not know the true value of θ. Therefore, high-type lobbies may wish to pretend they are low-types in order to give small contributions for the tariff increase. If both types of lobbies offer the same contribution, the policy maker cannot learn the lobbies' types and has to ask for a compensation for protection that is the average welfare cost. This leads to a signaling problem as the low-type lobby has to separate herself to allow the policy maker to learn her type. Then, she pays for the true cost of her protection, which is smaller than the average cost.

The more competitive the sectors, the higher the welfare cost for the same tariff protection because sectors substitute more imports for a given tariff. Import substitution is harmful because home consumers buy a good produced at a higher marginal cost than the international price. Since the high-type causes higher welfare costs, we have the following:

Lemma 4 *If contribution schedules satisfy SC, then constraint (IC_l) is never binding.*

Lemma 4 implies that only low-type lobbies may have to bear the cost of separation in equilibrium.

Pure Signaling

We begin looking at the simpler case of $d = 0$, for which the policy maker's preferences are separable and there is no screening effect. When $d = 0$ the lobby has no reason to condition her policy on the rival's type, hence $p_{ll} = p_{lh}$ and

$p_{hh} = p_{hl}$. This implies that the high-type protection solves (8) for $i = h$, and the low-type protection is found from the lobby's incentive compatibility constraint (IC_h). We then have:

Theorem 2 *If $d = 0$, there exists a separating Equilibrium*[9] *of the political game with informed lobbies. The equilibrium policies are given by*

$$p^*_{hh} = p^*_{hl} = \frac{\lambda (b + \theta_h)}{\lambda (b + \theta_h) - \theta_h} p^e = \bar{p}_{hh} = \bar{p}_{hl},$$

and

a) If $\Delta\theta_h \bar{p}_l \geq \lambda\theta_h (\bar{p}_h - p^e)$, then

$$p^*_{lh} = p^*_{ll} = \frac{\lambda (b + \theta_l)}{\lambda (b + \theta_l) - \theta_l} p^e = \bar{p}_{lh} = \bar{p}_{ll}.$$

b) If $\Delta\theta_h \bar{p}_l < \lambda\theta_h (\bar{p}_h - p^e)$, then

$$p^*_{lh} = p^*_{ll} = \frac{\lambda (b + \theta_l) - \theta_h \sqrt{\frac{\lambda\Delta\theta_h}{\lambda(b+\theta_h)-\theta_h}}}{\lambda (b + \theta_l) - \theta_h} < \bar{p}_{lh} = \bar{p}_{ll}.$$

where $\bar{p}$ is given in (5) and the superscript $*$ indicates the equilibrium policy. The equilibrium contributions are computed from the binding constraints (IRP_{il}).

Theorem 2 shows that if $\Delta\theta_h/\theta_h$ is relatively larger than λ, then separation is costless. Otherwise, the low-type lobby has to separate her type by demanding less protection. The intuition for this result is the following. The high-type lobby has more resources to influence the policy maker but also has to give him higher compensation for the marginal protection. When λ is relatively small, the marginal cost of protection is small. Thus, the high-type lobby does not pretend she is low-type. On the other hand, when λ is relatively large, the welfare cost of protection is large, thus the high-type lobby may pretend she is low-type. Then, the low-type lobby has to ask for separating policy.

As a consequence, the signaling effect distorts policies in the same direction as the screening effect. Both effects undermine the lobby's influence.

Signaling and Screening

[9] Notice that implicitly we are choosing the least cost separating equilibrium, i.e., the one that survives the Intuitive Criterion.

If $d > 0$, then both signaling and screening effects coexist. However, for relatively high values of d we cannot anticipate which of the policy maker's incentive compatibility constraints will be binding. Thus, the signaling effect may interfere with the screening effect making the tractability of the informed lobby problem much more difficult.

Nonetheless, we know that as long as protection is positive ($p_{ik} > p^e$ for all i and k) in equilibrium, the set of constraints that are binding is the same that we considered previously. We have:

Theorem 3 *If $d > 0$ is small enough, there exists a symmetric separating equilibrium of the political game with informed lobbies that satisfies SC for each lobby. Moreover, if the constraint (IC_h) is binding, the equilibrium policies are such that:*

$$\begin{aligned} p^*_{hh} &= \bar{p}_{hh}, \\ p^*_{hl} &< \bar{p}_{hl}, \\ p^*_{lh} &< \bar{p}_{lh}, \text{ and} \\ p^*_{ll} &< \bar{p}_{ll}, \end{aligned}$$

where $\bar{p}$ is given in (5) and the uppercase $*$ indicates the equilibrium policy. The equilibrium contributions are computed from the binding constraints (ICP_{ih}) and (IRP_{il}).

Thus the final characterization of the equilibrium policies displays a combination of the screening and signaling effects. Theorem 3 shows that the signaling effect reinforces the screening effect by reducing the protection for low-type lobbies; p^*_{hl} decreases due to the strategic complementarity and p^*_{hh} remains the same.

Corollary 2 *The welfare of the equilibrium with informed lobbies is higher than the welfare of the equilibrium under perfect information.*

Therefore, the existence of private information within the lobby groups generates two information problems in the political game that reduce the lobbies' influence on the policy maker. As a consequence, tariffs decrease, imports increase and the welfare of the society increases.

5 Equilibrium discussion

In the first part of this section we discuss the importance of key features of the model's primitives. In the second part, we compare some of the model's results with the literature. The third part discusses the equilibrium selection criterion implicit in our approach.

As indicated earlier, we introduced private information on the lobbies preferences and substitutability between goods in the GH model. Substitutability is a key feature in this model. Indeed, if $d = 0$ and $\gamma = 0$, the equilibrium policies would be the same as in the truthful equilibrium (because $\Psi = 0$ in Theorem 1) and the information asymmetry would not generate distortions in the political game. To be exact, when $d = 0$, the policy maker's preferences are separable in the policies. Therefore, private information about the lobbies' preferences only distorts the political game through the screening effect when the policy maker's preference is not separable.

Non-separability of the policy maker's preferences is not a feature of only our model. For example, consider a model where the policy maker has to decide to which firm allocate a scarce resource among (as in Esteban and Ray, 2007). Since the resource is scarce, one unit allocated to one sector reduces the resource available to other sectors. Consequently, the policy maker's preference is also non-separable. Therefore, the screening effect will also be present in different political games.

The signaling effect, on the other hand, comes from the information asymmetry between the lobby and the policy maker. Signaling plays a role in games where the principal's type enters directly into the agents' preferences, i.e., in common value games. Once the policy maker cares about the lobbies' profits, this is a common value game. However, if, for example, the lobby's private information related to the lobby's internal organization cost and not the sector's profit, there would be no signaling problem.

To be more specific, it is necessary that the lobby's type affects directly the marginal welfare cost of the policy. This requires $\gamma > 0$, which implies that the second derivative of the profit function depends on θ. On the other hand, when $\gamma = 0$, the marginal welfare cost of the policy does not depend on θ and there is no signaling effect.

Rent distribution and the qualitative properties of the equilibrium

One of the important differences between the equilibrium of the political game with informed lobbies and GH's truthful equilibrium concerns the distribution of the game's political surplus. In the GH model the policy maker does not extract any political rent when lobbies are highly concentrated. However, in our model, when a type$-i$ lobby faces a high-type rival she gives rents to the policy maker since, contributions are computed from the binding constraint (ICP_{ih}) in this state. Thus, when lobbies are concentrated but have private information, the policy maker is able to extract informational rents in some states of nature. Consequently, lobbies lose from the reduction of the overall political rents and from having to leave some of these rents to the policy maker when compared to GH. So the distribution of surplus in our model is clearly different from that of GH's model.

Another interesting result of our model is the fact that information asymmetry is welfare enhancing, as shown in Corollaries 1 and 2. This clearly contrasts with the results found by Esteban and Ray (2007). They have a model where a "well intentioned" policy maker fails to allocate productive resources efficiently to lobbying firms because of information asymmetry. We, however, show that information asymmetry may reduce the harmful lobbying and improve the payoff of the policy maker. Our results are different because of the policy maker's preferences. While they model the policy maker as a welfare minded agent, we model him as an agent who is willing to trade welfare for contributions. Therefore, in their paper lobbying is potentially positive, since it may reveal useful information to the policy maker who wants to make the right choice, while in our paper lobbying is essentially a rent-seeking activity.

This comparison stresses the nature of the results in Corollaries 1 and 2. Since we model lobbying as a rent-seeking activity, it is by construction a harmful activity for the society. Therefore, asymmetric information hinders an activity that harms the society's welfare.

Equilibrium properties

We now discuss the equilibrium selection that is implicit in our approach.

The Selection Criterion (SC) restricts the possible conjectures each lobby has about the contribution of her rival. Clearly this criterion helps us to select the most informative equilibrium for this game. By "informative" we mean the equilibrium where all players endogenously learn the information of the others. Therefore, the equilibrium that satisfies SC can be understood as a bound for the surplus that can be obtained in a game where players noncooperatively learn each other's information, i.e., a decentralized equilibrium where the information is fully transmitted.

What about other types of equilibria that can emerge in this political game? The first one we can think of is the pooling equilibrium where different types of lobbies offer the same contribution and ask for the same policy. In such a case, the policy maker would not learn the lobbies' types and would not be able to screen any information from them. However, in a pooling equilibrium different types of lobbies get the same policy. Thus, this policy cannot be optimal for both types since each has a different willingness to pay for protection. Hence, at least one type would like to separate herself by sending a signal that reveals her type to the policy maker and asking for a different level of protection. This would give her a higher payoff. Intuitively, this argument suggests that a pooling equilibrium would not survive the intuitive criterion. In Appendix B, we characterize the contribution schedules that are interim efficient in the informed lobby problem. In particular, no pooling contribution schedule would survive this criterion.

Another type of equilibrium that could arise is one where lobbies offer a "pile" of contribution schedules that are conditional on a signal they would send to the policy maker after the contribution is accepted. Delaying the information revelation could help the lobby relax the policy maker's incentive constraints, as shown by Maskin and Tirole (1990). In Appendix B, we show that such contributions would give the lobby the same payoffs as the contributions that reveal the lobby's information directly, like the ones considered in Section 3. Therefore, delaying information revelation does not give the lobbies any advantage compared to our selected equilibrium.

In sum, SC helps us to find the equilibrium contribution schedules that survive the intuitive criterion. They define a boundary for the political surplus that can be obtained in a fully separating equilibrium.

6 Conclusion

We modified the model presented in Grossman and Helpman (1994) by assuming that the technology of productive sectors is the private information of the lobbies. This new element introduces private information on the lobbies' preferences into the political game and allows us to analyze the information transmission effects in the political game.

The information transmission causes two asymmetric information problems. The first one is the screening problem. It comes from the fact that one lobby does not know how much protection her rival is going to receive and also from non-substitutability of the policy maker's preferences. This implies that the lobby does not know the marginal welfare cost of her protection. Thus, she has to screen the rival's type from the policy maker. Screening makes lobbies leave informational rents to the policy maker and also ask for less protection.

The second information problem is the signaling problem. The policy maker does not know the lobbies' types even though the cost of protection depends on this information. This provides the opportunity for sectors that have high welfare costs (the more competitive sectors) to pretend they are less competitive in order to give smaller contribution to the policy maker. Thus, the less competitive sectors have to separate their contributions in order to allow the policy maker to learn the true types based on the contributions he receives. Separation makes low-type lobbies ask for less protection.

Both information transmission effects reduce the lobbies' ability to influence. Thus, they demand less protection when compared to the perfect information game. Hence, information transmission reduces lobbying activity, which increases society's welfare since lobbying is a rent-seeking activity (as in GH). Moreover, information transmission allows the policy maker to extract informational rents, thus it also affects the division of surplus against the lobbies in the political game.

The results of this paper raise some questions. The first is about transparency. It is commonly argued that transparency in the relationship between governments and lobbies is good for the society, which sharply contrasts with the results found here. The arguments in favor of transparency traditionally are based on the accountability of politicians in elections (see Coate and Morris, 1995), something that we do not model in this paper. Nonetheless, we showed that the absence of information asymmetry can harm the society, which suggests a trade-off between better accountability versus less information transmission in political games.

A second question concerns the role of information transmission when policy makers use different policy instruments, such as non tariff barriers. With such instruments, the government does not have tariff revenue, thus the screening effect may be different. One important issue is that with such instruments, the amount of imports matters, in addition to the market elasticities, as pointed out by Maggi and Rodrigues-Clare (2000). Therefore, different instruments should generate different effects given the information transmission problem.

Acknowledgments

We thank Andrea Attar, Carlos da Costa, David Martimort, Emanuel Ornelas, Filipe Campante, François Salanié, Thierry Verdier and seminar participants at The Toulouse School of Economics, EPGE/FGV, EESP/FGV, LAMES 2008, NASM 2009, ESEM 2009 for useful comments. The usual disclaimer applies. We are grateful for the financial support from CNPq of Brazil.

References

Appendix A - Proofs

Proof of Lemma 1. If the contributions schedules satisfy SC, then they will satisfy constraints (ICP_{ik}) and (IRP_{ik}). Constraint (ICP_{ih}) is

$$C_{ih} + \boldsymbol{C}_{hi} + \lambda W(\theta_i, p_{ih}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}) \geq C_{il} + \boldsymbol{C}_{hi} + \lambda W(\theta_i, p_{il}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi})$$

which can be rewritten as

$$C_{ih} - C_{il} \geq \lambda \left[W(\theta_i, p_{il}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}) - W(\theta_i, p_{ih}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}) \right]. \tag{A.1}$$

Constraint (ICP_{il}) is

$$C_{il} + \boldsymbol{C}_{li} + \lambda W(\theta_i, p_{il}, \boldsymbol{\theta}_l, \boldsymbol{p}_{li}) \geq C_{ih} + \boldsymbol{C}_{li} + \lambda W(\theta_i, p_{ih}, \boldsymbol{\theta}_l, \boldsymbol{p}_{li})$$

which can be rewritten as

$$C_{ih} - C_{il} \leq \lambda \left[W(\theta_i, p_{il}, \boldsymbol{\theta}_l, \boldsymbol{p}_{li}) - W(\theta_i, p_{ih}, \boldsymbol{\theta}_l, \boldsymbol{p}_{li})\right]. \tag{A.2}$$

Putting (A.1) and (A.2) together, we get

$$W(\theta_i, p_{il}, \boldsymbol{\theta}_l, \boldsymbol{p}_{li}) - W(\theta_i, p_{ih}, \boldsymbol{\theta}_l, \boldsymbol{p}_{li}) \geq W(\theta_i, p_{il}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}) - W(\theta_i, p_{ih}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}).$$

This last inequality can be written as

$$\int_{p_{ih}}^{p_{il}} \frac{\partial W}{\partial p^1}(\theta_i, s, \boldsymbol{\theta}_l, \boldsymbol{p}_{li})\, ds - \int_{p_{ih}}^{p_{il}} \frac{\partial W}{\partial p^1}(\theta_i, s, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi})\, ds \geq 0$$

or as

$$\int_{p_{ih}}^{p_{il}} \left[\int_{\boldsymbol{p}_{hi}}^{\boldsymbol{p}_{li}} \frac{\partial^2 W}{\partial p^1 \partial p^2}(\theta_i, s, \boldsymbol{\theta}_l, \tilde{\boldsymbol{p}})\, d\tilde{\boldsymbol{p}} + \int_{\boldsymbol{\theta}_h}^{\boldsymbol{\theta}_l} \frac{\partial^2 W}{\partial \theta^2 \partial p^1}\left(\theta_i, s, \tilde{\boldsymbol{\theta}}, \boldsymbol{p}_{hi}\right) d\tilde{\boldsymbol{\theta}}\right] ds \geq 0.$$

From (1) we have that

$$\frac{\partial^2 W}{\partial \theta^2 \partial p^1}\left(\theta^1, p^1, \boldsymbol{\theta}^2, \boldsymbol{p}^2\right) = 0, \text{ and}$$
$$\frac{\partial^2 W}{\partial p^1 \partial p^2}\left(\theta^1, p^1, \boldsymbol{\theta}^2, \boldsymbol{p}^2\right) = d.$$

Since $\boldsymbol{p}_{hi} \geq \boldsymbol{p}_{li}$, $\int_{p_{ih}}^{p_{il}} \left[\int_{\boldsymbol{p}_{hi}}^{\boldsymbol{p}_{li}} \frac{\partial^2 W}{\partial p^1 \partial p^2}(\theta_i, s, \boldsymbol{\theta}_l, \tilde{\boldsymbol{p}})\, d\tilde{\boldsymbol{p}}\right] ds \geq 0$ if and only if $p_{ih} \geq p_{il}$, which proves the lemma. ■

Proof of Lemma 2. Provided that constraints (IRP_{il}) and (ICP_{ih}) are binding, the contributions are defined as

$$C_{il} = -\boldsymbol{C}_{li} - \lambda \left[W(\theta_i, p_{il}, \boldsymbol{\theta}_l, \boldsymbol{p}_{li}) - W(\theta_i, p^e, \boldsymbol{\theta}_l, p^e)\right] \tag{A.3}$$

and

$$C_{ih} = C_{il} - \lambda \left[W(\theta_i, p_{ih}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}) - W(\theta_i, p_{il}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi})\right]. \tag{A.4}$$

We plug these contributions into the lobby's utility function in (6) to get

$$\begin{aligned}
&\max_{p_{ih}, p_{il}} z \left\{\theta_i \pi(p_{ih}) + \lambda \left[W(\theta_i, p_{ih}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}) - \lambda W(\theta_i, p^e, \boldsymbol{\theta}_l, p^e)\right]\right\} \\
&+ (1-z)\left\{\theta_i \pi(p_{il}) + \lambda \left[W(\theta_i, p_{il}, \boldsymbol{\theta}_l, \boldsymbol{p}_{li}) - W(\theta_i, p^e, \boldsymbol{\theta}_l, \boldsymbol{p}^e)\right]\right\} \\
&- z\lambda \left[W(\theta_i, p_{il}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}) + W(\theta_i, p_{il}, \boldsymbol{\theta}_l, \boldsymbol{p}_{li})\right] + \boldsymbol{C}_{li} \\
&\text{s.t. } (IC_{-i}).
\end{aligned}$$

The first-order conditions of this problem are

$$\theta_i \pi' (p_{ih}) - \lambda \frac{\partial W}{\partial p^1} (\theta_i, p_{ih}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}) - \mu_{-i} \left[\theta_{-i} \pi' (p_{ih}) - \lambda \frac{\partial W}{\partial p^1} (\theta_i, p_{ih}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}) \right] = 0, \text{ and} \tag{A.5}$$

$$\begin{aligned} &\theta_i \pi' (p_{il}) - \lambda \frac{\partial W}{\partial p^1} (\theta_i, p_{il}, \boldsymbol{\theta}_l, \boldsymbol{p}_{li}) + \frac{z\lambda d}{1-z} [(\boldsymbol{p}_{li} - p^e) - (\boldsymbol{p}_{lh} - p^e)] \\ &- \mu_{-i} \left[\theta_{-i} \pi' (p_{il}) - \lambda \frac{\partial W}{\partial p^1} (\theta_i, p_{il}, \boldsymbol{\theta}_l, \boldsymbol{p}_{li}) \right] - \mu_{-i} \frac{z\lambda d}{1-z} [(\boldsymbol{p}_{li} - p^e) - (\boldsymbol{p}_{lh} - p^e)] = 0. \end{aligned} \tag{A.6}$$

We add and subtract the terms $\mu_{-i}\theta_i\pi'(p_{ih})$ and $\mu_{-i}\theta_i\pi'(p_{il})$ respectively in (A.5) and (A.6), and divide both by $(1-\mu_{-i})$ to get

$$\theta_i \pi' (p_{ih}) - \lambda \frac{\partial W}{\partial p^1} (\theta_i, p_{ih}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}) + \frac{\mu_{-i}}{1-\mu_{-i}} \Delta\theta_i \pi' (p_{ih}) = 0$$

and

$$\theta_i \pi' (p_{il}) - \lambda \frac{\partial W}{\partial p^1} (\theta_i, p_{il}, \boldsymbol{\theta}_l, \boldsymbol{p}_{li}) + \frac{\mu_{-i}}{1-\mu_{-i}} \Delta\theta_i \pi' (p_{il}) + \frac{z\lambda d}{1-z} (\boldsymbol{p}_{li} - \boldsymbol{p}_{lh}) = 0,$$

which imply condition (8)

Moreover, we have the usual Khun-Tucker conditions

$$\begin{aligned} E[\theta_{-i}\pi(p_{-i.}) - C_{-i.}] &\geq E[\theta_{-i}\pi(p_{i.}) - C_{i.}] \text{ for all } i, -i, \\ \mu_{-i} &\geq 0 \text{ for all } -i \\ \{E[\theta_{-i}\pi(p_{i.}) - C_{i.}] - E[\theta_{-i}\pi(p_{-i.}) - C_{-i.}]\}\, \mu_{-i} &= 0 \text{ for all } i, -i. \end{aligned}$$

■

Proof of Lemma 3. Let $p_{ik} = p(\theta_i, \boldsymbol{\theta}_k)$ and $C_{ik} = C_k(\theta_i, p(\theta_i, \boldsymbol{\theta}_k))$ be a solution of problem (6) satisfying SC.

We have to show that when $\gamma = 0$, constraints (IC_{-i}) are not binding. Therefore, the utility of the type-i lobby must be greater than the utility when she mimics type-$(-i)$:

$$E[V(\theta_i, p(\theta_i, .), C(\theta_i, p(\theta_i, .)))] \geq E[V(\theta_i, p(\theta_{-i}, .)), C(\theta_{-i}, p(\theta_{-i}, .))].$$

We will write this inequality artificially as if the lobby could lie to the policy maker and announce any type $\widetilde{\theta} \in [\theta_l, \theta_h]$. That is, we extend $\theta \in [\theta_l, \theta_h]$ to be a continuous variable, which greatly simplifies this proof.

The policies for the intermediate values of $\tilde{\theta}$ $\left(p\left(\tilde{\theta},.\right)\right)$ are computed by applying the implicit function theorem on a modified version of (8), and replacing θ_i by $\tilde{\theta}$, for the case $\mu_{-i}=0$. That is, we apply the implicit function theorem to:

$$\tilde{\theta}\pi'\left(p\left(\tilde{\theta},\theta_k\right)\right)-\lambda\frac{\partial W}{\partial p^1}\left(\tilde{\theta},p\left(\tilde{\theta},\theta_k\right),\boldsymbol{\theta}_k,\boldsymbol{p}_{ki}\right)+\lambda I\left(k\right)\frac{z}{\left(1-z\right)}d\left(\boldsymbol{p}_{li}-\boldsymbol{p}_{hi}\right)=0.$$

Notice that we can apply the implicit function theorem since, from Assumption 2, the program (6) is strictly concave.

The contribution when the rival lobby is the low-type, $\left(C_l\left(\tilde{\theta},p\left(\tilde{\theta},\boldsymbol{\theta}_l\right)\right)\right)$ is computed from (A.3) and the contribution when the rival is the high-type $(C_h\left(\tilde{\theta},p\left(\tilde{\theta},\boldsymbol{\theta}_h\right),p\left(\tilde{\theta},\boldsymbol{\theta}_l\right)\right))$ is computed from (A.4) by substituting p_{ik} with $p\left(\tilde{\theta},\boldsymbol{\theta}_k\right)$, for every k. It follows that $p\left(\tilde{\theta},.\right)$ is a differentiable function of $\tilde{\theta}$ and the contributions are differentiable functions of $\tilde{\theta}$ and $p\left(.,\boldsymbol{\theta}_k\right)$.

Thus, constraints (IC_{-i}) can be equivalently written as

$$E\left[\int_{\theta_{-i}}^{\theta_i}\frac{\partial V}{\partial\tilde{\theta}}\left(\theta_i,p\left(\tilde{\theta},.\right),C.\left(\tilde{\theta},p\left(\tilde{\theta},.\right),p\left(\tilde{\theta},.\right)\right)\right)d\tilde{\theta}\right]\geq 0, \qquad \text{(A.7)}$$

where the expectation is taken with respect to the rival's type. Notice that the announced type is different than the lobby's true type.

In turn, we have

$$\frac{\partial V}{\partial\tilde{\theta}}\left(\theta_i,p\left(\tilde{\theta},\boldsymbol{\theta}_h\right),C_h\right)=\left(\theta_i-\frac{\partial C_h}{\partial p^1}\right)\frac{\partial p}{\partial\tilde{\theta}}\left(\tilde{\theta},\boldsymbol{\theta}_h\right)-\frac{\partial C_h}{\partial\tilde{\theta}}-\frac{\partial C_h}{\partial p^2}\frac{\partial p}{\partial\tilde{\theta}}\left(\tilde{\theta},\boldsymbol{\theta}_l\right),\ \text{and}$$
$$\frac{\partial V}{\partial\tilde{\theta}}\left(\theta_i,p\left(\tilde{\theta},\boldsymbol{\theta}_l\right),C\right)=\left(\theta_i-\frac{\partial C_l}{\partial p^1}\right)\frac{\partial p}{\partial\tilde{\theta}}\left(\tilde{\theta},\boldsymbol{\theta}_l\right)-\frac{\partial C_l}{\partial\tilde{\theta}},$$

where we suppressed the arguments of the contribution function.

Since $p\left(\tilde{\theta},.\right)$ satisfies condition (8) for every $\tilde{\theta}$, when $\gamma=0$ we get that

$$\tilde{\theta}=\frac{\partial C_h}{\partial p^1}\left(\tilde{\theta},p\left(\tilde{\theta},\boldsymbol{\theta}_h\right),p\left(\tilde{\theta},\boldsymbol{\theta}_l\right)\right)=-\lambda\frac{\partial W}{\partial p^1}\left(\tilde{\theta},p\left(\tilde{\theta},\boldsymbol{\theta}_h\right),\boldsymbol{\theta}_h,\boldsymbol{p}_{hi}\right),\ \text{and}$$

$$\begin{aligned}\tilde{\theta}&=\frac{\partial C_l}{\partial p^1}\left(\tilde{\theta},p\left(\tilde{\theta},\boldsymbol{\theta}_l\right)\right)+\frac{z}{1-z}\frac{\partial C_h}{\partial p^2}\left(\tilde{\theta},p\left(\tilde{\theta},\boldsymbol{\theta}_h\right),p\left(\tilde{\theta},\boldsymbol{\theta}_l\right)\right)\\&=-\lambda\frac{\partial W}{\partial p^1}\left(\tilde{\theta},p\left(\tilde{\theta},\boldsymbol{\theta}_l\right),\boldsymbol{\theta}_l,\boldsymbol{p}_{li}\right)\\&\quad-\frac{z\lambda}{1-z}\left(\frac{\partial W}{\partial p^1}\left(\tilde{\theta},p\left(\tilde{\theta},\boldsymbol{\theta}_l\right),\boldsymbol{\theta}_l,\boldsymbol{p}_{li}\right)-\frac{\partial W}{\partial p^1}\left(\tilde{\theta},p\left(\tilde{\theta},\boldsymbol{\theta}_l\right),\boldsymbol{\theta}_h,\boldsymbol{p}_{hi}\right)\right).\end{aligned}$$

Hence, the derivatives of the lobby's utility with respect to the policy simplify to

$$\frac{\partial V}{\partial \tilde{\theta}}\left(\theta_i, p\left(\tilde{\theta}, \boldsymbol{\theta}_h\right), C_h\right) = \left(\theta_i - \tilde{\theta}\right)\frac{\partial p}{\partial \tilde{\theta}} - \frac{\partial C_h}{\partial \tilde{\theta}} - \frac{\partial C_h}{\partial p^1}\frac{\partial p}{\partial \tilde{\theta}}, \text{ and}$$
$$\frac{\partial V}{\partial \tilde{\theta}}\left(\theta_i, p\left(\tilde{\theta}, \boldsymbol{\theta}_l\right), C_l\right) = \left(\theta_i - \tilde{\theta}\right)\frac{\partial p}{\partial \tilde{\theta}} - \frac{\partial C_l}{\partial \tilde{\theta}} + \frac{z}{1-z}\frac{\partial C_h}{\partial p}\frac{\partial p}{\partial \tilde{\theta}}.$$

Substituting them back into condition (A.7) gives

$$E\left[\int_{\theta_{-i}}^{\theta_i}\left(\theta_i - \tilde{\theta}\right)\frac{\partial p}{\partial \tilde{\theta}}\left(\tilde{\theta}, .\right) - \frac{\partial C.}{\partial \tilde{\theta}} d\tilde{\theta}\right] \geq 0. \tag{A.8}$$

Moreover, when $\gamma = 0$, the welfare function is given by

$$W\left(\tilde{\theta}, p\left(\tilde{\theta}, \boldsymbol{\theta}_k\right), \boldsymbol{\theta}_k, \boldsymbol{p}_{ki}\right) = A - \frac{b}{2}\left(p\left(\tilde{\theta}, \boldsymbol{\theta}_k\right) - p^e\right)^2 + d\left(p\left(\tilde{\theta}, \boldsymbol{\theta}_k\right) - p^e\right)\left(\boldsymbol{p}_{ki} - p^e\right)$$
$$- \frac{b}{2}\left(\boldsymbol{p}_{ki} - p^e\right)^2 + \tilde{\theta} p^e + \boldsymbol{\theta}_k p^e,$$

where A is a constant that depends only on the parameters a, b, and d.

This implies that

$$\frac{\partial W}{\partial \tilde{\theta}}\left(\tilde{\theta}, p, \boldsymbol{\theta}_k, \boldsymbol{p}\right) = p^e. \tag{A.9}$$

Since contributions are computed from (A.3) and (A.4), equation (A.9) implies that $\frac{\partial C_l}{\partial \tilde{\theta}} = \frac{\partial C_h}{\partial \tilde{\theta}} = 0$.

Therefore, condition (A.8) becomes

$$E\left[\int_{\theta_{-i}}^{\theta_i}\left(\theta_i - \tilde{\theta}\right)\frac{\partial p}{\partial \tilde{\theta}}\left(\tilde{\theta}, .\right) d\tilde{\theta}\right] \geq 0.$$

The above inequality holds since $\theta_i > \theta_{-i}$ if and only if

$$E\left[\left(\theta_i - \tilde{\theta}\right)\frac{\partial p}{\partial \tilde{\theta}}\left(\tilde{\theta}, .\right)\right] \geq 0,$$

for all $\widetilde{\theta} \in [\theta_i, \theta_{-i}]$. Therefore, the lobby is always better off telling the truth and constraints (IC_{-i}) are not binding when $\gamma = 0$. ■

Proof of Theorem 1. When $\gamma = 0$, the first-order conditions of the type$-i$ informed lobby problem, computed in Lemma 2, simplify to:

$$\theta_i - \lambda\left[b\left(p_{il} - p^e\right) - d\left(\boldsymbol{p}_{li} - p^e\right)\right] + \frac{z}{1-z}\lambda d\left(\boldsymbol{p}_{li} - \boldsymbol{p}_{hi}\right) = 0, \text{ and} \tag{A.10}$$
$$\theta_i - \lambda\left[b\left(p_{ih} - p^e\right) - d\left(\boldsymbol{p}_{hi} - p^e\right)\right] = 0. \tag{A.11}$$

Equations (A.10) and (A.11), for lobbies 1 and 2 constitute a system of linear equations that can be written in a matrix form. We will solve this system for each state of nature, i.e., for each realization (θ_i, θ_k) of the lobbies' types. When both lobbies are high-types (state (θ_h, θ_h)), we have the following system:

$$\begin{bmatrix} -\lambda b & \lambda d \\ \lambda d & -\lambda b \end{bmatrix} \begin{bmatrix} p_{hh}^1 - p^e \\ p_{hh}^2 - p^e \end{bmatrix} = \begin{bmatrix} -\theta_h \\ -\theta_h \end{bmatrix}.$$

There is always a solution since the determinant of the coefficient matrix is $(\lambda b)^2 - (\lambda d)^2 > 0$ (remember that, by Assumption 2, $b(1-z) > d$).

Given the solution at state (θ_h, θ_h), we have a similar system of first-order conditions for the state (θ_h, θ_l) given by

$$\begin{bmatrix} -\lambda b(1-z) & \lambda d \\ \lambda d & -\lambda b \end{bmatrix} \begin{bmatrix} p_{hl}^1 - p^e \\ p_{lh}^2 - p^e \end{bmatrix} = \begin{bmatrix} -\theta_h(1-z) + z\lambda d\left(p_{hh}^s - p^e\right) \\ -\theta_l \end{bmatrix}$$

which has a positive determinant for the same reason as in the case of the previous system. We also have a symmetric system for state (θ_l, θ_h).

Given the solutions of the previous systems, we have the system of the first-order conditions for state (θ_l, θ_l) given by:

$$\begin{bmatrix} -\lambda b(1-z) & \lambda d \\ \lambda d & -\lambda b(1-z) \end{bmatrix} \begin{bmatrix} p_{ll}^1 - p^e \\ p_{ll}^2 - p^e \end{bmatrix} = \begin{bmatrix} -\theta_l(1-z) + z\left(p_{hl}^s - p^e\right) \\ -\theta_l(1-z) + z\left(p_{hl}^s - p^e\right) \end{bmatrix}.$$

The determinant of the coefficient matrix is given by $(\lambda(1-z)b)^2 - (\lambda d)^2 > 0$ (again by Assumption 2). Therefore, there exists a solution for the systems at states (θ_h, θ_l), (θ_h, θ_l), (θ_l, θ_h) and (θ_l, θ_l). To compute the expression of equilibrium policies we just have to solve the systems.

After some algebra, we get the expressions for the equilibrium policies presented in Theorem 1, where

$$\Psi = \frac{zbd\Delta\theta_h}{\lambda\left((1-z)b^2 - d^2\right)\left(b^2 - d^2\right)}.$$

The equilibrium contributions are given by (A.3) and (A.4) calculated at these equilibrium policies.

We now have to determine whether SC is satisfied for this equilibrium. First notice that the equilibrium policies are increasing in the lobby's own type since

$$p_{hk}^s - p_{lk}^s = \frac{b\Delta\theta_h}{\lambda\left(b^2 - d^2\right)} + \frac{zbd^2\Delta\theta_h}{\lambda\left((1-z)b^2 - d^2\right)\left(b^2 - d^2\right)} > 0, \quad \text{for all } k.$$

Thus, SC is verified in equilibrium.

Also, we have to determine whether any constraints other than (IRP_{il}) and (ICP_{ih}) are violated at the equilibrium. We begin by noticing that the policy maker's rents increases with the lobbies' types in equilibrium. This is so because the equilibrium contributions are computed from the policy maker's constraints. In state (θ_l, θ_l), (IRP_{ll}) is binding, and the policy maker receives his reserve utility. Since (IRP_{hl}) is binding, the policy maker also receives his reserve utility in states (θ_h, θ_l) and (θ_l, θ_h). Since constraint (ICP_{hh}) is binding, the policy maker receives some rent when both lobbies are high-types. Therefore, the policy maker's rent is increasing in the lobbies' types.

Therefore, we have:

$$U\left(\theta_i, p_{ih}, C_{ih}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}, \boldsymbol{C}_{hi}\right) - U\left(\theta_i, p^e, 0, \boldsymbol{\theta}_h, p^e, 0\right) \geq \\ U\left(\theta_i, p_{il}, C_{il}, \boldsymbol{\theta}_l, \boldsymbol{p}_{li}, \boldsymbol{C}_{li}\right) - U\left(\theta_i, p^e, 0, \boldsymbol{\theta}_l, p^e, 0\right).$$

This can be written as

$$C_{il} + \boldsymbol{C}_{hi} + \lambda\left[W\left(\theta_i, p_{il}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}\right) - W\left(\theta_i, p^e, \boldsymbol{\theta}_h, p^e\right)\right] \geq \\ C_{il} + \boldsymbol{C}_{li} + \lambda\left[W\left(\theta_i, p_{il}, \boldsymbol{\theta}_l, \boldsymbol{p}_{li}\right) - W\left(\theta_i, p^e, \boldsymbol{\theta}_l, p^e\right)\right]. \quad \text{(A.12)}$$

From constraint (ICP_{ih}), we have that

$$C_{ih} + \boldsymbol{C}_{hi} + \lambda\left[W\left(\theta_i, p_{ih}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}\right) - W\left(\theta_i, p^e, \boldsymbol{\theta}_h, p^e\right)\right] \geq \\ C_{il} + \boldsymbol{C}_{hi} + \lambda\left[W\left(\theta_i, p_{il}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}\right) - W\left(\theta_i, p^e, \boldsymbol{\theta}_h, p^e\right)\right] \quad (ICP_ih)$$

and, from constraint (IRP_{il}), we have that

$$C_{il} + \boldsymbol{C}_{li} + \lambda\left[W\left(\theta_i, p_{il}, \boldsymbol{\theta}_l, \boldsymbol{p}_{li}\right) - W\left(\theta_i, p^e, \boldsymbol{\theta}_l, p^e\right)\right] \geq 0. \quad (IRP_il)$$

From (A.12), (ICP_{ih}) and (IRP_{il}), we have that

$$C_{ih} + \boldsymbol{C}_{hi} + \lambda\left[W\left(\theta_i, p_{ih}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}\right) - W\left(\theta_i, p^e, \boldsymbol{\theta}_h, p^e\right)\right] \geq 0.$$

Therefore, the fact that the policy maker's rent is increasing, condition (A.12) together with (IRP_{il}), and the (ICP_{ih}) binding constraint collectively ensure that (IRP_{ih}) is satisfied in equilibrium.

Since (ICP_{ih}) is binding, condition (A.1) holds with equality which allows us to compute the contribution C_{ih}. Since (A.1) is binding and policies increase with the lobbies types, (A.2) holds with inequality, and thus (ICP_{il}) is not binding. Therefore, the set of binding constraints we postulated ex ante holds in equilibrium. ■

Proof of Corollary 1. We must compare the expected welfare at the screening equilibrium with the welfare at the truthful equilibrium. Since preferences are quasi-linear and concave, the distribution of contributions does not affect the size of society's welfare. Therefore, we need only compare the expected welfare evaluated at the equilibrium policies, that is, to compare $W(\theta_i, \bar{p}_{ik}, \theta_k, \bar{p}_{ki})$ with $W\left(\theta_i, p^S_{ik}, \theta_k, p^S_{ki}\right)$.

We will compare the welfare function evaluated at the truthful equilibrium with the welfare function evaluated at the screening equilibrium, state by state. In state (θ_h, θ_h) the policies are the same for both truthful and screening equilibria. Therefore, the welfare of the society is also the same. The policies in other states are such that

$$\begin{aligned} p^S_{hl} &= \frac{\theta_h b\left(\frac{(1-z)b-d}{b-d}\right) + \theta_l d}{\lambda\left((1-z)b^2 - d^2\right)} + p^e < \bar{p}_{hl}, \\ p^S_{lh} &= \frac{\theta_l b(1-z) + \theta_h d\left(\frac{(1-z)b-d}{b-d}\right)}{\lambda\left((1-z)b^2 - d^2\right)} + p^e < \bar{p}_{lh}, \text{ and} \\ p^S_{ll} &= \frac{\theta_l\left((1-z)b + d\right) - \theta_h d\left(\frac{zb}{b-d}\right)}{\lambda\left((1-z)b^2 - d^2\right)} + p^e < \bar{p}_{ll}. \end{aligned}$$

The maximum welfare for the society is given by the free trade equilibrium. In turn, this implies that $\frac{\partial W}{\partial p^n} < 0$ for all $p > p^e$. In states (θ_h, θ_l) and (θ_l, θ_h), policies of the screening equilibrium are such that

$$\begin{aligned} \bar{p}_{hl} &> p^S_{hl} > p^e, \text{ and} \\ \bar{p}_{lh} &> p^S_{lh} > p^e, \end{aligned}$$

i.e., they are below the truthful policies and above international prices (because $(1-z)b > d$). Therefore, the welfare at the screening equilibrium is higher than at the truthful equilibrium in these states.

In state (θ_l, θ_l), policies are also below the truthful policies, but they can fall below international prices as well. Thus, to show that the welfare of the political game in this state is greater than at the truthful equilibrium, we must compare the welfare of the two equilibria by directly looking at the expressions, that is,

$$W(\theta_l, \bar{p}_{ll}, \theta_l, \bar{p}_{ll}) \leq W\left(\theta_l, p^S_{ll}, \theta_l, p^S_{ll}\right).$$

Given our functional forms, the last inequality is equivalent to

$$(\bar{p}_{ll} - p^e)^2 - \left(p^S_{ll} - p^e\right)^2 \geq 0.$$

Since $p^*_{ll} < \bar{p}_{ll}$, we must have

$$(\bar{p}_{ll} - p^e)^2 \geq \left(p^S_{ll} - p^e\right)^2.$$

If $p^*_{ll} > p^e$ the above inequality holds. However, it is possible that $p^*_{ll} < p^e$, in which case the above inequality becomes

$$\bar{p}_{ll} - p^e \geq p^e - p^S_{ll}.$$

Replacing the policies by their closed form values, the inequality becomes

$$\frac{\theta_l\left(b+d\right)}{\lambda\left(b^2-d^2\right)} \geq -\frac{\theta_l\left(b+d\right)}{\lambda\left(b^2-d^2\right)} + \frac{zbd\left(\Delta\theta_h\right)\left(b+d\right)}{\lambda\left(\left(1-z\right)b^2-d^2\right)\left(b^2-d^2\right)},$$

which we can rewrite as

$$\frac{2\theta_l\left(b+d\right)}{\lambda\left(b^2-d^2\right)} > \frac{zbd\left(\Delta\theta_h\right)\left(b+d\right)}{\lambda\left(\left(1-z\right)b^2-d^2\right)\left(b^2-d^2\right)}.$$

After some algebra, the last expression simplifies to

$$\frac{\left(1-z\right)b^2-d^2}{zbd} > \frac{\Delta\theta_h}{2\theta_l},$$

which holds by Assumption 1. Therefore, in state (θ_l, θ_l) the welfare is greater than at the truthful equilibrium, which concludes the proof. ■

Proof of Lemma 4. Let $p_{ik} = p\left(\theta_i, \boldsymbol{\theta}_k\right)$ and $C_{ik} = C_k\left(\theta_i, p\left(\theta_i, \boldsymbol{\theta}_k\right)\right)$ be the solution to (6) satisfying SC.

We have to show that constraint (IC_l) is not binding. We will use the same approach used for the proof of Lemma 3, except that we now consider the case where $\gamma = 1$. What we have to show is that

$$E[V\left(\theta_l, p\left(\theta_l, .\right), C\left(\theta_l, p\left(\theta_l, .\right)\right)\right)] \geq E[V\left(\theta_l, p\left(\theta_h, .\right)\right), C\left(\theta_h, p\left(\theta_h, .\right)\right)]. \quad \text{(A.13)}$$

Again we compute policies $\left(p\left(\tilde{\theta}, .\right)\right)$ from (8) replacing θ_i by $\tilde{\theta} \in [\theta_l, \theta_h]$. The contributions when the rival is the low-type, $\left(C_l\left(\tilde{\theta}, p\left(\tilde{\theta}, \boldsymbol{\theta}_l\right)\right)\right)$ are computed from (A.3) replacing p_{ik} by $p\left(\tilde{\theta}, \boldsymbol{\theta}_k\right)$ and the contributions when the rival is the high-type, $C_h\left(\theta_h, p\left(\tilde{\theta}, \boldsymbol{\theta}_h\right), p\left(\tilde{\theta}, \boldsymbol{\theta}_l\right)\right)$ are computed from (A.4) again replacing p_{ik} by $p\left(\tilde{\theta}, \boldsymbol{\theta}_k\right)$. Moreover, all these functions are differentiable in their arguments. Thus, (A.13) can be expressed as

$$E\left[\int_{\theta_{-i}}^{\theta_i} \frac{\partial V}{\partial \tilde{\theta}}\left(\theta_l, p\left(\tilde{\theta}, .\right), C.\left(\tilde{\theta}, p\left(\tilde{\theta}, .\right), p\left(\tilde{\theta}, .\right)\right)\right) d\tilde{\theta}\right] \geq 0. \quad \text{(A.14)}$$

The derivatives of the lobby's utility are given by

$$\frac{\partial V}{\partial \tilde{\theta}}\left(\theta_l, p\left(\tilde{\theta}, \boldsymbol{\theta}_h\right), C_h\right) = \left(\theta_l p\left(\tilde{\theta}, \boldsymbol{\theta}_h\right) - \frac{\partial C_h}{\partial p}\right)\frac{\partial p}{\partial \tilde{\theta}}\left(\tilde{\theta}, \boldsymbol{\theta}_h\right) - \frac{\partial C_h}{\partial \tilde{\theta}} - \frac{\partial C_h}{\partial p}\frac{\partial p}{\partial \tilde{\theta}}\left(\tilde{\theta}, \boldsymbol{\theta}_l\right), \text{ and}$$
$$\frac{\partial V}{\partial \tilde{\theta}}\left(\theta_l, p\left(\tilde{\theta}, \boldsymbol{\theta}_l\right), C_l\right) = \left(\theta_l p\left(\tilde{\theta}, \boldsymbol{\theta}_l\right) - \frac{\partial C_l}{\partial p}\right)\frac{\partial p_{il}}{\partial \tilde{\theta}}\left(\tilde{\theta}, \boldsymbol{\theta}_l\right) - \frac{\partial C_{il}}{\partial \tilde{\theta}},$$

where we suppressed the arguments of the contributions.

Since the policies are computed from condition (8) for every $\tilde{\theta} \in [\theta_l, \theta_h]$, when $\gamma = 1$ we have that

$$\tilde{\theta} p\left(\tilde{\theta}, \theta_h\right) = -\frac{\partial W}{\partial p^1}\left(\tilde{\theta}, p\left(\tilde{\theta}, \boldsymbol{\theta}_h\right), \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}\right) = \frac{\partial C_h}{\partial p^1}\left(\tilde{\theta}, p\left(\tilde{\theta}, \boldsymbol{\theta}_h\right), p\left(\tilde{\theta}, \boldsymbol{\theta}_l\right)\right), \text{ and}$$

$$\begin{aligned}
\tilde{\theta} p\left(\tilde{\theta}, \theta_l\right) &= -\lambda\frac{\partial W}{\partial p^1}\left(\tilde{\theta}, p\left(\tilde{\theta}, \boldsymbol{\theta}_l\right), \boldsymbol{\theta}_l, \boldsymbol{p}_{li}\right) \\
&\quad - \frac{z\lambda}{1-z}\left(\frac{\partial W}{\partial p^1}\left(\tilde{\theta}, p\left(\tilde{\theta}, \boldsymbol{\theta}_l\right), \boldsymbol{\theta}_l, \boldsymbol{p}_{li}\right) - \frac{\partial W}{\partial p^1}\left(\tilde{\theta}, p\left(\tilde{\theta}, \boldsymbol{\theta}_l\right), \boldsymbol{\theta}_h, \boldsymbol{p}_{hi}\right)\right) \\
&= \frac{\partial C_l}{\partial p^1}\left(\tilde{\theta}, p\left(\tilde{\theta}, \boldsymbol{\theta}_l\right)\right) + \frac{z}{1-z}\frac{\partial C_h}{\partial p^2}\left(\tilde{\theta}, p\left(\tilde{\theta}, \boldsymbol{\theta}_h\right), p\left(\tilde{\theta}, \boldsymbol{\theta}_l\right)\right).
\end{aligned}$$

Hence, the derivatives of the lobby's expected utility simplify to

$$\frac{\partial V}{\partial \tilde{\theta}}\left(\theta_i, p\left(\tilde{\theta}, \boldsymbol{\theta}_h\right), C_h\right) = \left(\theta_i - \tilde{\theta}\right) p\left(\tilde{\theta}, \boldsymbol{\theta}_h\right)\frac{\partial p}{\partial \tilde{\theta}} - \frac{\partial C_h}{\partial \tilde{\theta}} - \frac{\partial C_h}{\partial p^1}\frac{\partial p}{\partial \tilde{\theta}}, \text{ and}$$
$$\frac{\partial V}{\partial \tilde{\theta}}\left(\theta_i, p\left(\tilde{\theta}, \boldsymbol{\theta}_l\right), C_l\right) = \left(\theta_i - \tilde{\theta}\right) p\left(\tilde{\theta}, \boldsymbol{\theta}_l\right)\frac{\partial p}{\partial \tilde{\theta}} - \frac{\partial C_l}{\partial \tilde{\theta}} + \frac{z}{1-z}\frac{\partial C_h}{\partial p}\frac{\partial p}{\partial \tilde{\theta}}.$$

Substituting these derivatives back into (A.14) gives

$$E\left[\int_{\theta_h}^{\theta_l}\left[\left(\theta_l - \tilde{\theta}\right) p\left(\tilde{\theta}, .\right)\frac{\partial p}{\partial \tilde{\theta}}\left(\tilde{\theta}, .\right) - \frac{\partial C_.}{\partial \tilde{\theta}}\right] d\tilde{\theta}\right]. \tag{A.15}$$

To find the expression of $\frac{\partial C_.}{\partial \tilde{\theta}}$ we have to look at the welfare. When $\gamma = 1$, the welfare is given by

$$\begin{aligned}
W\left(\tilde{\theta}, p\left(\tilde{\theta}, \boldsymbol{\theta}_k\right), \boldsymbol{\theta}_k, \boldsymbol{p}_{ki}\right) = A - &\frac{\left(b - \tilde{\theta}\right)}{2}\left(p\left(\tilde{\theta}, \boldsymbol{\theta}_k\right) - p^e\right)^2 + d\left(p\left(\tilde{\theta}, \boldsymbol{\theta}_k\right) - p^e\right)\left(\boldsymbol{p}_{ki} - p^e\right) \\
&- \frac{(b - \theta_k)}{2}\left(\boldsymbol{p}_{ki} - p^e\right)^2 + \frac{\tilde{\theta} + \theta_k}{2}\left(p^e\right)^2.
\end{aligned}$$

Hence, the derivatives of the welfare function are given by

$$\frac{\partial W}{\partial \tilde{\theta}}\left(\tilde{\theta}, p\left(\tilde{\theta}, \boldsymbol{\theta}_k\right), \boldsymbol{\theta}_k, \boldsymbol{p}_{kl}\right) = -p\left(\tilde{\theta}, \boldsymbol{\theta}_k\right)\left(\frac{p\left(\tilde{\theta}, \boldsymbol{\theta}_k\right)}{2} - p^e\right)$$

and

$$\frac{\partial W}{\partial \tilde{\theta}}\left(\tilde{\theta}, p^e, \theta_k, p^e\right) = \frac{\left(p^e\right)^2}{2}.$$

Therefore, we have that

$$\frac{\partial C_l}{\partial \tilde{\theta}} = \frac{1}{2}\left(p\left(\tilde{\theta}, \boldsymbol{\theta}_k\right) - p^e\right)^2.$$

Hence, condition (A.15) can be written as

$$E\left[\int_{\theta_h}^{\theta_l}\left[\left(\theta_l - \tilde{\theta}\right) p\left(\tilde{\theta}, .\right) \frac{\partial p}{\partial \tilde{\theta}}\left(\tilde{\theta}, .\right) - \frac{1}{2}\left(p\left(\theta, .\right) - p^e\right)^2\right] d\tilde{\theta}\right] \geq 0$$

or

$$E\left[\int_{\theta_l}^{\theta_h}\left[\left(\tilde{\theta} - \theta_l\right) p\left(\tilde{\theta}, .\right) \frac{\partial p}{\partial \tilde{\theta}}\left(\tilde{\theta}, .\right) + \frac{1}{2}\left(p\left(\tilde{\theta}, .\right) - p^e\right)^2\right] d\tilde{\theta}\right] \geq 0.$$

By the implicit function theorem we have that $\frac{\partial p}{\partial \tilde{\theta}}\left(\tilde{\theta}, .\right) \geq 0$. Therefore, since $\tilde{\theta} \geq \theta_l$, the above inequality holds. This implies that constraint (IC_l) is not binding.

Notice that for the high-type we have

$$E\left[\int_{\theta_l}^{\theta_h}\left[\left(\theta_h - \tilde{\theta}\right) p\left(\tilde{\theta}, .\right) \frac{\partial p}{\partial \tilde{\theta}}\left(\tilde{\theta}, .\right) - \frac{1}{2}\left(p\left(\tilde{\theta}, .\right) - p^e\right)^2\right] d\tilde{\theta}\right]$$

which clearly may not be positive since $p\left(\theta_h, .\right) - p^e > 0$ and $\frac{\partial p}{\partial \tilde{\theta}}\left(\tilde{\theta}, .\right) \geq 0$. ■

Proof of Theorem 2. In this proof we solve the informed lobby problem for the case where $\gamma = 1$ and $d = 0$. For this parameters' values, the system of best responses derived from problem (6) is simplified. The first simplification is that the constraints (ICP_{ik}) are identical to the constraints (IR_{ik}). The last ones are binding in all realization of the lobbies types. Also, for $d = 0$, the policy maker's preference is separable in the policies. As a consequence, a lobby's policy is invariant to her rival's type. Thus, we drop the second subscript index. The constraint (IC_h) may be binding.

These simplifications allow us to eliminate the multiplier μ_h from the first-order conditions derived in Lemma 2. The resulting system is given by:

$$\begin{aligned} \theta_h p_h - \lambda\left(b+\theta_h\right)\left(p_h - p^e\right) &= 0, && \text{(FOC high type)} \\ \theta_l p_l - \lambda\left(b+\theta_l\right)\left(p_l - p^e\right) &\geq 0, && \text{(FOC low type)} \\ V\left(\theta_h, p_h, C_h\right) - V\left(\theta_h, p_l, C_l\right) &\geq 0, && (IC_h) \\ \left[\theta_l p_l - \lambda\left(b+\theta_l\right)\left(p_l - p^e\right)\right]\left[V\left(\theta_h, p_h, C_h\right) - V\left(\theta_h, p_l, C_l\right)\right] &= 0, && \text{(A.16)} \end{aligned}$$

and the contributions are computed from the binding constraints (IRP_i).

The first two equations of the system are the informed lobby problem's first-order conditions. The low-type's first-order condition is an inequality because if she has to separate, this equation will not be binding. The third equation is the high-type lobby's incentive compatibility constraint (IC_h). The forth equation states that either the low-type's first-order condition or the (IC_h) is binding. That is, separation may or may not be costly.

Now, we must find the policies that solve equations (FOC high type)-(A.16). From (FOC high type), we get that

$$\bar{p}_h = \frac{\lambda\left(b+\theta_h\right)}{\lambda\left(b+\theta_h\right) - \theta_h} p^e,$$

which is the high-type's truthful policy.

If we assume that the low-type lobby's first-order condition is binding, we have

$$\bar{p}_l = \frac{\lambda\left(b+\theta_l\right)}{\lambda\left(b+\theta_l\right) - \theta_l} p^e.$$

Which is the low-type lobby's truthful policy.

On the other hand, if constraint (IC_h) is binding, we have

$$\frac{1}{2}\theta_h p_h^2 - \lambda\frac{\left(b+\theta_h\right)}{2}\left(p_h - p^e\right)^2 = \frac{1}{2}\theta_h p_l^2 - \lambda\frac{\left(b+\theta_l\right)}{2}\left(p_l - p^e\right)^2.$$

Replacing p_h by the expression of $\bar{p}_h$ gives, after some algebra, the following solution:

$$\check{p}_l = \frac{\lambda\left(b+\theta_l\right) - \theta_h\sqrt{\frac{\lambda\Delta\theta_h}{\lambda\left(b+\theta_h\right)-\theta_h}}}{\lambda\left(b+\theta_l\right) - \theta_h} p^e.$$

The issue now is to define when the constraint (IC_h) is binding. Suppose that $\check{p}_l \geq \bar{p}_l$, i.e., the policy that ensures separation is greater than the truthful policy. Then

$$V\left(\theta_h, \bar{p}_h, C_h\left(\bar{p}_h\right)\right) = V\left(\theta_h, \check{p}, C_l\left(\check{p}_l\right)\right) \geq V\left(\theta_h, \bar{p}_l, \bar{C}_l\left(\bar{p}_l\right)\right), \tag{A.16}$$

where the contributions $(C_i(p))$ computed from (IRP_i) are a function of the policies. Moreover, the first equality holds by the definition of $\check{p}_l$ and the following inequality holds because $V(\theta_h, p_l, C_l(p_l))$ is increasing in p_l, for all $p_l \in \left[0, \frac{\lambda(b+\theta_l)}{\lambda(b+\theta_l)-\theta_h}\right]$[10].

Therefore, $\bar{p}_h$ solves FOC high type, $\bar{p}_l$ solves FOC low type (with equality). From (A.16), the incentive compatibility constraint (IC_h) is not binding for $p_l = \bar{p}_l$. Equation (A.16) holds trivially since FOC low type hold with equality. Hence, $\bar{p}_h$ and p_l solve the system of equations (FOC high type)-(A.16) and are the equilibrium policies ($\bar{p}_h = p_h^*$ and $\bar{p}_l = p_l^*$). In particular, $\bar{p}_l$ solves (FOC low type), and from (A.16) we have that (IC_h) is not binding. Therefore, separation is achieved without cost.

On the other hand, if $\check{p}_l < \bar{p}_l$, we get from (FOC low type) that

$$\theta_l \check{p}_l - \lambda(b+\theta_l)(\check{p}_l - p^e) > 0.$$

Additionally, (IC_h) is binding by construction of $\check{p}_l$. Since (IC_h) is binding, (A.16) trivially holds. Therefore, $\bar{p}_h$ and $\check{p}_l$ solve the system of equations (FOC high type)-(A.16), i.e., $\bar{p}_h = p_h^*$ and $\check{p}_l = p_l^*$ are the equilibrium policies. Moreover, since (IC_h) is binding, separation is costly. Notice also that in both cases the expression for high type policy remains the same.

Now we will compute a threshold as a function of the parameters, in order to identify if whether $\bar{p}_l$ or $\check{p}_l$ is the equilibrium policy for the low type lobby.

We know that when $\check{p}_l < \bar{p}_l$, then $\check{p}_l$ is the equilibrium policy. From this inequality, we get that

$$\check{p}_l < \bar{p}_l \Longleftrightarrow \bar{p}_h - p^e > \frac{\Delta\theta_h}{\theta_h}\bar{p}_l^2,$$

In such case (IC_h) is binding and $\check{p}_l$ is the equilibrium policy for the low type lobby.

Otherwise, we have

$$\check{p}_l \geq \bar{p}_l \Longleftrightarrow \bar{p}_h - p^e \leq \frac{\Delta\theta_h}{\theta_h}\bar{p}_l^2,$$

then $\bar{p}_l$ is the equilibrium policy for the low-type lobby. This completes the proof.

One particular property of the equilibrium policies is that policies are greater than the international price p^e. This will be useful for the remaining proofs of this paper. Hence, we now show that this property holds. When $\bar{p}_h - p^e \leq \frac{\Delta\theta_h}{\theta_h}\bar{p}_l^2$, the equilibrium policies are the truthful policies. From Assumption 2 it is straight

[10] This results from the fact that $p_l = \frac{\lambda(b+\theta_l)}{\lambda(b+\theta_l)-\theta_h}$ maximizes $V(\theta_h, p_l, C_l(p_l))$ subject to (IRP_l).

foward to check that they are indeed greater than p^e. On the other hand, if $\bar{p}_h - p^e > \frac{\Delta\theta_h}{\theta_h}\bar{p}_l^2$, then $p_l^* = \check{p}_l < \bar{p}_l$. Assume, by contradiction that $\check{p}_l < p^e$, then, it must be that

$$V\left(\theta_h, \check{p}_l, C_l\left(\check{p}_l\right)\right) < V\left(\theta_h, p^e, 0\right),$$

because contributions are non-negative and $C\left(p^e\right) = 0$. But that gives

$$V\left(\theta_h, p^e, 0\right) > V\left(\theta_h, \check{p}_l, C_l\left(\check{p}_l\right)\right) = V\left(\theta_h, \bar{p}_h, C_h\left(\bar{p}_h\right)\right),$$

where the second equality follows from the definition of $\check{p}_l$. This is a contradiction because, from Assumption 2, in a truthful equilibrium the lobby gets rents and a positive policy. This gives her a greater utility than her reserve utility. Therefore, both equilibrium policies are greater than the international price. ■

Proof of Theorem 3. In this proof we characterize the equilibrium of the informed lobby problem for the case where $\gamma = 1$ and $d > 0$. In this case, the first-order conditions of the low-type informed lobby problem computed in Lemma 2 are given by

$$\theta_l p_{ll} + \lambda \frac{\partial W}{\partial p^1}\left(\theta_l, p_{lh}, \boldsymbol{\theta}_l, \boldsymbol{p}_{ll}\right) - \frac{\mu}{1-\mu}\Delta\theta_h p_{ll} + \lambda d \frac{z}{1-z}\left(\boldsymbol{p}_{ll} - \boldsymbol{p}_{hl}\right) = 0, \tag{A.17}$$

$$\theta_l p_{lh} + \lambda \frac{\partial W}{\partial p^1}\left(\theta_l, p_{lh}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hl}\right) - \frac{\mu}{1-\mu}\Delta\theta_h p_{lh} = 0, \tag{A.18}$$

$$\theta_h p_{hl} + \lambda \frac{\partial W}{\partial p^1}\left(\theta_h, p_{hl}, \boldsymbol{\theta}_l, \boldsymbol{p}_{lh}\right) + \lambda d \frac{z}{1-z}\left(\boldsymbol{p}_{hl} - \boldsymbol{p}_{hh}\right) = 0, \text{ and} \tag{A.19}$$

$$\theta_h p_{hh} + \lambda \frac{\partial W}{\partial p^1}\left(\theta_h, p_{hh}, \boldsymbol{\theta}_h, \boldsymbol{p}_{hh}\right) = 0. \tag{A.20}$$

Notice also that $\mu = \mu_h$ since, from Lemma 4, only constraint (IC_h) can be binding.

Equations (A.17) and (A.18) for lobbies 1 and 2 constitute a system of linear equations that can be written in a matrix form as in the proof of Theorem 1. For state (θ_h, θ_h), this system is given by

$$\begin{bmatrix} \theta_h - \lambda\left(b + \theta_h\right) & \lambda d \\ \lambda d & \theta_h - \lambda\left(b + \theta_h\right) \end{bmatrix} \begin{bmatrix} p_{hh}^1 - p^e \\ p_{hh}^2 - p^e \end{bmatrix} = \begin{bmatrix} -p^e\theta_h \\ -p^e\theta_l \end{bmatrix}.$$

This system has a solution because the coefficient matrix has a positive determinant since, by Assumption 2, $(1-z)\left(\lambda\left(b+\theta_h\right) - \theta_h\right) > \lambda d$.

Given the solution of the system in state (θ_h, θ_h), we have the following system of first-order conditions in state (θ_h, θ_l):

$$\begin{bmatrix} (1-z)\left(\theta_h - \lambda\left(b + \theta_h\right)\right) & \lambda d \\ \lambda d & \theta_l - \frac{\mu\Delta\theta_h}{(1-\mu)} - \lambda\left(b + \theta_l\right) \end{bmatrix} \begin{bmatrix} p_{hl}^1 - p^e \\ p_{lh}^2 - p^e \end{bmatrix} =$$

$$\begin{bmatrix} -(1-z)\,\theta_h p^e + z\left(p_{hh}^* - p^e\right) \\ -p^e\left(\theta_l - \frac{\mu\Delta\theta_h}{(1-\mu)}\right) \end{bmatrix}$$

and a symmetric system for state (θ_l, θ_h).

The determinant of this system is given by

$$(1-z)(\theta_h - \lambda(b+\theta_h))\left(\theta_l - \frac{\mu\Delta\theta_h}{(1-\mu)} - \lambda b(b+\theta_l)\right) - (\lambda d)^2 > 0$$

since $\mu \in [0,1)$ and $(1-z)(\lambda(b+\theta_l) - \theta_l) > \lambda d$ (by Assumption 2), the systems have solutions.

In turn, given the solutions of the systems in states (θ_h, θ_h), (θ_h, θ_l) and (θ_l, θ_h), we have the following system of best-responses in state (θ_l, θ_l):

$$(1-z)\begin{bmatrix} \theta_l - \frac{\mu\Delta\theta_h}{(1-\mu)} - \lambda(b+\theta_l) & \frac{\lambda d}{1-z} \\ \frac{\lambda d}{1-z} & \theta_l - \frac{\mu\Delta\theta_h}{(1-\mu)} - \lambda(b+\theta_l) \end{bmatrix}\begin{bmatrix} p_{ll}^1 - p^e \\ p_{ll}^2 - p^e \end{bmatrix} =$$
$$\begin{bmatrix} -p^e(1-z)\left(\theta_l - \frac{\mu\Delta\theta_h}{(1-\mu)}\right) + z(p_{hl}^* - p^e) \\ -p^e(1-z)\left(\theta_l - \frac{\mu\Delta\theta_h}{(1-\mu)}\right) + z(p_{hl}^* - p^e) \end{bmatrix}.$$

The determinant of the coefficient matrix is given by

$$\left[(1-z)\left(\theta_l - \frac{\mu\Delta\theta_h}{(1-\mu)} - \lambda b(b+\theta_l)\right)\right]^2 - (\lambda d)^2 > 0,$$

since $(1-z)(\lambda(b+\theta_l) - \theta_l) > \lambda d$ and $\mu \in [0,1)$, this system has a solution as well.

Therefore, this system has a unique solution for each given $\mu \in [0,1)$. However, for some values of d, the screening effect together with the signaling effect may turn the low-type lobby's policy smaller than p^e for some realization of the lobbies' types. In such a case, the policies and contributions that we computed may violate some of the constraints we assumed not to be binding.

Nonetheless, we know from Theorem 2 that for $d = 0$ the informed lobby problem has a solution that is separating with positive protection. If contributions and policies are continuous in d, for close to zero values of this parameter, the solution of the political game must also have positive protection.

In order to show that equilibrium policies are continuous in d, we will resort to the maximum theorem. Parameter d enters problem (6) through the welfare function (which is clearly continuous in this parameter). As a result, all constraints of problem (6) are continuous in d. Therefore, the correspondence that maps the set of possible d into the set of feasible policies and contributions (that satisfy the constraints of problem 6) is continuous. This, combined with continuity of the lobby's utility function, establishes the conditions to apply the maximum theorem. Therefore, the best responses of problem (6) are upper-hemi continuous. Moreover, existence of a fixed point in best responses was previously proved to exist.

Upper-hemi continuity ensures that, for a sequence of d's that tend to zero, there is a convergent sub-sequence of equilibrium policies that tends to the equilibrium policies for $d = 0$. Since the equilibrium policies for $d = 0$ are strictly greater than the international price, there exists a $\varepsilon > 0$ such that for $d < \varepsilon$, the equilibrium policies are also strictly greater than the international price. Provided the equilibrium policies are strictly greater than the international price, it is straight foward to verify that constraints (ICP_{hh}), (ICP_{lh}), (IRP_{hl}) and (IRP_{ll}) are binding, while (IC_h) may or may not be binding, as in Theorem 2. All the other constraints are not binding in equilibrium. ■

Proof of Corollary 2. We show that the welfare for the equilibrium of the political game when $\gamma = 1$ (that we found in Theorem 3) is greater than the welfare for the truthful equilibrium.

We know that the impact of policies on welfare is negative for all policies above p^e. Since the equilibrium policies are such that $\bar{p}_{ik} \geq p^*_{ik} > p^e$ (with at least one strict inequality) we have that

$$W(\theta_i, \bar{p}_{ik}, \theta_k, \bar{p}_{ki}) < W(\theta_i, p^*_{ik}, \theta_k, p^*_{ki}).$$

Therefore, the welfare of the political game with informed lobbies is greater than the welfare of the truthful equilibrium. ■

Appendix B - Equilibrium selection

Countervailing

The political game, as with most common agency games, has degrees of freedom in the determinacy of the division of the surplus between lobbies. We reduced this indeterminacy by looking for symmetric equilibria. However, symmetry does not account for the surplus division in non-symmetric states of nature (high versus low-types).

The flexibility in the division of surplus in non-symmetric states can generate equilibria with countervailing incentives. We now analyze this type of equilibria. If we look at individual rationality constraints (IR_{ih}) and (IR_{il}) from the point of view of type-i lobby that takes as given the rival's offer, we have

$$C_{ih} + \lambda W(\theta_i, p_{ih}, \theta_h, \mathbf{p}_{hi}) \geq \lambda W(\theta_i, p^e, \theta_h, p^e) - \mathbf{C}_{hi}, \text{ and}$$
$$C_{il} + \lambda W(\theta_i, p_{il}, \theta_l, \mathbf{p}_{li}) \geq \lambda W(\theta_i, p^e, \theta_l, p^e) - \mathbf{C}_{li}.$$

Notice that the reserve utilities depend on the contribution offered by the rival. Let a type-i lobby conjecture that her high-type rival will offer a small contribution.

This implies that the policy maker's reserve utility in this state has increased and may be above the reserve utility of the policy maker when the rival is the low-type. In this situation, it is possible that the binding constraints are no longer those we have assumed, i.e., there may be countervailing incentives in the type-i problem. For a detailed reference on countervailing incentives see Jullien (2000).

Countervailing incentives change the binding constraints in the informed lobby problem. Suppose, for example, that the binding constraints on the type-i informed principal problem are (ICP_{il}) and (IRP_{ih}) (which are the opposite of what we considered in the text). Then, the best-response policies and contributions are such that this lobby makes the same set of constraints bind for the rival's problem. As a consequence, distortions in the equilibrium policies due to screening are different from the ones computed in the text. When the lobby faces a high-type rival, she demands more protection than in the truthful equilibrium, but when she faces a low-type opponent, she demands the same as in the truthful equilibrium. Therefore, the welfare ranking of Corollary 1 would be reversed and the welfare ranking of Corollary 2 would be ambiguous. As an example, we present the policies of an equilibrium with countervailing incentives when $\gamma = 0$:

$$\begin{aligned} p^S_{hh} &= \bar{p}_{hh} + (b+d)\,\Psi, \\ p^S_{hl} &= \bar{p}_{hl} + d\Psi, \\ p^S_{lh} &= \bar{p}_{lh} + b\Psi, \text{ and} \\ p^S_{ll} &= \bar{p}_{ll}, \end{aligned}$$

where $\Psi = \frac{zbd(b+d)\Delta\theta_h}{\lambda((1-z)b^2-d^2)(b^2-d^2)}$.

Notice that the distortions change. Now policies are distorted upward because lobbies demand more protection in the efficient states (high-type rival) to prevent the policy maker from saying that the low-type rival is the high-type.

One way to rule out countervailing incentives is to impose more structure on conjecture about the rival's offer, for example, that the policy maker's rent is nondecreasing with the rival's type. This condition may seem arbitrary, but it implies that the difference in the utility between high and low-type rivals is not greater than the surplus increase in the political game across the two states.

Direct information revelation

Throughout the paper, we have focused on separating contribution schedules. However, different kinds of contributions schedules may lead to different equilibria. Thus, may have ignored other the possible equilibria of this game. There is one other possible type of contribution schedules we should consider. The lobby could offer a more complex type of separating equilibrium, where she offers a "pile" of contributions that are conditional on a message she would send later to the policy maker. Thus, the policy maker would not learn the lobby's type by the time he accepts the contracts. In this section we show that the lobby does not benefit from delaying the information revelation.

We rely on Maskin and Tirole (1992) for the discussion that follows.

We begin by assuming that the rival lobby offers a contribution schedule that is both separating and increasing in her type. Then, we show that the solution of program (6) is indeed the contribution schedule (CS henceforth) that maximizes the lobby's utility in the informed lobby problem. Program (6) is the counterpart of the Rothschild-Stiglitz-Wilson contribution schedule (RSW CS) from Maskin and Tirole (1992), adapted to the lobby's utility maximization in this model.[11] It maximizes the utility for each type of lobby, assuming that this lobby reveals her type to the policy maker.

Definition 4 (Rothschild-Stiglitz-Wilson CS) *Given a rival's offer that satisfies SC, a contribution schedule* $\left(\mathring{C}, \mathring{p}\right)$ *is a RSW CS if and only if, for all i,*

$$\left(\mathring{C}_{ik}, \mathring{p}_{ik}\right) \equiv \arg \max_{C_{ik}, p_{ik}} E\left[\theta_i \pi\left(p_{i.}\right) - C_{i.}\right]$$

subject to

$$\begin{aligned} E\left[\theta_i \pi\left(p_{i.}\right) - C_{i.}\right] &\geq E\left[\theta_i \pi\left(p_{-i.}\right) - C_{-i.}\right], \text{ for all } i, -i \\ U\left(\theta_i, p_{ik}, C_{ik}, \boldsymbol{\theta}_k, \boldsymbol{p}_{ki}, \boldsymbol{C}_{ik}\right) &\geq U\left(\theta_i, p^e, 0, \boldsymbol{\theta}_k, \boldsymbol{p}^e, \mathbf{0}\right), \text{ for all } k, \text{ and} \\ U\left(\theta_i, p_{ik}, C_{ik}, \boldsymbol{\theta}_k, \boldsymbol{p}_{ki}, \boldsymbol{C}_{ik}\right) &\geq U\left(\theta_i, p_{i(-k)}, C_{i(-k)}, \boldsymbol{\theta}_k, \boldsymbol{p}_{ki}, \boldsymbol{C}_{ik}\right), \text{ for all } k, -k. \end{aligned}$$

In general, the informed lobby problem may have many solutions different from the RSW CS. In some of these other solutions the lobby does not reveal her information directly. She delays the revelation of her private information until after the acceptance of the contract.

On the other hand, the RSW CS always belongs to the set of solutions, meaning that there always exist beliefs that support this CS as a solution. Moreover, if one type of lobby is worse off in a solution different from the RSW CS, she can always reveal her information and offer the RSW CS. Therefore, the RSW CS is a lower bound for the lobby's utility in the solution set. However, in some cases, delaying information revelation may increase the surpluses of both types of lobbies.

[11] In fact, the RSW CS is defined for a given reserve utility of the agent. In our model, the reserve utility is determined by the rival's offer.

The main theorem from Maskin and Tirole (1992) states that the solution of the informed principal problem with common values is the CS that weakly dominates the RSW CS and is also incentive compatible. Therefore, to characterize this solution we must define the best that can be achieved in the informed principal problem. We denote the beliefs the policy maker may have about the lobbies' type conditional on the CS he receives as $\bar{\Pi}$ (which is derived through the Bayes rule whenever possible) and we denote the prior belief (z) by Π.

We now can define:

Definition 5 (Interim Efficient CS) *A contribution schedule* $\left(\breve{C}, \breve{p}\right)$ *is interim efficient relative to belief* $\bar{\Pi}$ *and for positive weights* w_i *if and only if*

$$\left(\breve{C}_{ik}, \breve{p}_{ik}\right) \in \arg\max_{C_{ik}, p_{ik}} \Sigma_i w_i E\left[\theta_i \pi\left(p_{i.}\right) - C_{i.}\right] \tag{B.1}$$

subject to

$$E\left[\theta_i \pi\left(p_{i.}\right) - C_{i.}\right] \geq E\left[\theta_i \pi\left(p_{-i.}\right) - C_{-i.}\right], \tag{$IC_{\hat{i}^I E}$}$$

$$E^{\bar{\Pi}}\left[U\left(\theta_., p_{.k}, C_{.k}, \boldsymbol{\theta}_k, \boldsymbol{p}_{.k}, \boldsymbol{C}_{.k}\right)\right] \geq E^{\bar{\Pi}}\left[U\left(\theta_., p^e, 0, \boldsymbol{\theta}_k, \boldsymbol{p}^e, \boldsymbol{0}\right)\right], \text{ and} \tag{$IR_k^I E$}$$

$$E^{\bar{\Pi}}\left[U\left(\theta_., p_{.k}, C_{.k}, \boldsymbol{\theta}_k, \boldsymbol{p}_{.k}, \boldsymbol{C}_{.k}\right)\right] \geq E^{\bar{\Pi}}\left[U\left(\theta_., p_{.(-k)}, C_{.(-k)}, \boldsymbol{\theta}_k, \boldsymbol{p}_{.k}, \boldsymbol{C}_{.k}\right)\right], \tag{$ICP_k^I E$}$$

for all $i, -i, k, -k$, *where the expectation* $E\left[.\right]$ *is taken on the rival lobby's type and the expectation* $E^{\bar{\Pi}}\left[.\right]$ *is the expectation with the belief the policy maker has about the lobby's type.*

Now we can present the result from Maskin and Tirole (1992) restated in this structure.

Theorem 4 (Maskin and Tirole, 1992) *Suppose the RSW CS is interim efficient for some belief* $\hat{\Pi}$, *then the optimal CS of the informed lobby problem are such that*

$$E\left[\theta_i \pi\left(p_{i.}\right) - C_{i.}\right] \geq E\left[\theta_i \pi\left(p_{-i.}\right) - C_{-i.}\right],$$

$$E^{\Pi}\left[U\left(\theta_., p_{.k}, C_{.k}, \boldsymbol{\theta}_k, \boldsymbol{p}_{.k}, \boldsymbol{C}_{.k}\right)\right] \geq E^{\Pi}\left[U\left(\theta_., p^e, 0, \boldsymbol{\theta}_k, \boldsymbol{p}^e, \boldsymbol{0}\right)\right],$$

$$E^{\Pi}\left[U\left(\theta_., p_{.k}, C_{.k}, \boldsymbol{\theta}_k, \boldsymbol{p}_{.k}, \boldsymbol{C}_{.k}\right)\right] \geq E^{\Pi}\left[U\left(\theta_., p_{.(-k)}, C_{.(-k)}, \boldsymbol{\theta}_k, \boldsymbol{p}_{.k}, \boldsymbol{C}_{.k}\right)\right],$$

and

$$E\left[\theta_i \pi\left(p_{i.}\right) - C_{i.}\right] \geq E\left[\theta_i \pi\left(\mathring{p}_{i.}\right) - \mathring{C}_{i.}\right],$$

for all i *and* k, *where* Π *represents the prior belief.*

Theorem 3 states that all the incentive compatible CS that weakly dominate the RSW CS belong to the set of solutions of the informed lobby problem.

Corollary 3 *If the RSW CS is interim efficient for prior belief* Π*, then the equilibrium of the game is unique (i.e., the RSW CS is the equilibrium).*

Hence, if the RSW CS is interim efficient for some weights with respect to prior beliefs, then it is the unique solution of the informed lobby problem. This is exactly what we are going to show in this next theorem.

Theorem 5 *The RSW CS is interim efficient for the prior beliefs.*

Proof. Problem (B.1) is given explicitly by

$$\begin{aligned}\max_{p_{ik},C_{ik}} & w_h\left[z\left(\theta_h\pi\left(p_{hh}\right)-C_{hh}\right)+(1-z)\left(\theta_h\pi\left(p_{hl}\right)-C_{hl}\right)\right] \\ &+w_l\left[z\left(\theta_l\pi\left(p_{lh}\right)-C_{lh}\right)+(1-z)\left(\theta_l\pi\left(p_{ll}\right)-C_{ll}\right)\right]\end{aligned}$$

subject to

$$\begin{aligned}&z\left(\theta_h\pi\left(p_{hh}\right)-C_{hh}\right)+(1-z)\left(\theta_h\pi\left(p_{hl}\right)-C_{hl}\right)\geq \\ &\qquad z\left(\theta_h\pi\left(p_{lh}\right)-C_{lh}\right)+(1-z)\left(\theta_h\pi\left(p_{ll}\right)-C_{ll}\right), \quad (IC_h^IE)\end{aligned}$$

$$\begin{aligned}&z\left(\theta_l\pi\left(p_{lh}\right)-C_{lh}\right)+(1-z)\left(\theta_l\pi\left(p_{ll}\right)-C_{ll}\right)\geq \\ &\qquad z\left(\theta_l\pi\left(p_{hh}\right)-C_{hh}\right)+(1-z)\left(\theta_l\pi\left(p_{hl}\right)-C_{hl}\right), \quad (IC_l^IE)\end{aligned}$$

$$\begin{aligned}&z\left(C_{hh}+\boldsymbol{C}_{hh}+\lambda W\left(\theta_h,p_{hh},\boldsymbol{\theta}_h,\boldsymbol{p}_{hh}\right)\right)+(1-z)\left(C_{lh}+\boldsymbol{C}_{hl}+\lambda W\left(\theta_l,p_{lh},\boldsymbol{\theta}_h,\boldsymbol{p}_{hl}\right)\right)\geq \\ &\qquad z\lambda W\left(\theta_h,p^e,\boldsymbol{\theta}_h,p^e\right)+(1-z)\lambda W\left(\theta_l,p^e,\boldsymbol{\theta}_h,p^e\right), \quad (IR_h^IE)\end{aligned}$$

$$\begin{aligned}&z\left(C_{hl}+\boldsymbol{C}_{lh}+\lambda W\left(\theta_h,p_{hl},\boldsymbol{\theta}_l,\boldsymbol{p}_{lh}\right)\right)+(1-z)\left(C_{ll}+\boldsymbol{C}_{ll}+\lambda W\left(\theta_l,p_{ll},\boldsymbol{\theta}_l,\boldsymbol{p}_{ll}\right)\right)\geq \\ &\qquad zW\left(\theta_h,p^e,\boldsymbol{\theta}_l,p^e\right)+(1-z)\lambda W\left(\theta_l,p^e,\boldsymbol{\theta}_l,p^e\right), \quad (IR_l^IE)\end{aligned}$$

$$\begin{aligned}&z\left(C_{hh}+\boldsymbol{C}_{hh}+\lambda W\left(\theta_h,p_{hh},\boldsymbol{\theta}_h,\boldsymbol{p}_{hh}\right)\right)+(1-z)\left(C_{lh}+\boldsymbol{C}_{hl}+\lambda W\left(\theta_l,p_{lh},\boldsymbol{\theta}_h,\boldsymbol{p}_{hl}\right)\right) \\ &\geq z\left(C_{hl}+\boldsymbol{C}_{hh}+\lambda W\left(\theta_h,p_{hl},\boldsymbol{\theta}_h,\boldsymbol{p}_{hh}\right)\right)+(1-z)\left(C_{ll}+\boldsymbol{C}_{hl}+\lambda W\left(\theta_l,p_{ll},\boldsymbol{\theta}_h,\boldsymbol{p}_{hl}\right)\right), \\ &\qquad (ICP_h^IE)\end{aligned}$$

$$z\left(C_{hl}+\boldsymbol{C}_{lh}+\lambda W\left(\theta_h,p_{hl},\boldsymbol{\theta}_l,\boldsymbol{p}_{lh}\right)\right)+(1-z)\left(C_{ll}+\boldsymbol{C}_{ll}+\lambda W\left(\theta_l,p_{ll},\boldsymbol{\theta}_l,\boldsymbol{p}_{ll}\right)\right)$$
$$\geq z\left(C_{hh}+\boldsymbol{C}_{lh}+\lambda W\left(\theta_h,p_{hh},\boldsymbol{\theta}_l,\boldsymbol{p}_{lh}\right)\right)+(1-z)\left(C_{lh}+\boldsymbol{C}_{ll}+\lambda W\left(\theta_l,p_{lh},\boldsymbol{\theta}_l,\boldsymbol{p}_{ll}\right)\right). \quad (ICP_l^I E)$$

The arguments of Lemma 2 apply almost directly to this case. If constraints (ICP_{ih}) and (IR_l) are binding in problem (6), then constraints (ICP_h^{IE}) and (IR_l^{IE}) are binding in problem (B.1).

Then, the first-order conditions of problem (B.1) are given by:

$$z\theta_h\pi'\left(p_{hh}\right)w_h-z\gamma_{IRh}\lambda\left(b\left(p_{hh}-p^e\right)-d\left(\boldsymbol{p}_{hh}-p^e\right)\right)+z\gamma_{ICPl}\lambda\left(b\left(p_{hh}-p^e\right)-d\left(\boldsymbol{p}_{lh}-p^e\right)\right)-z\gamma_{ICl}\theta_l\pi'\left(p_{hh}\right)=0, \quad \text{(B.2)}$$

$$(1-z)\,\theta_h\pi'\left(p_{hl}\right)w_h-z\gamma_{ICPl}\lambda\left(b\left(p_{hl}-p^e\right)-d\left(\boldsymbol{p}_{lh}-p^e\right)\right)+(1-z)\,\gamma_{ICl}\theta_l\pi'\left(p_{hl}\right)=0, \quad \text{(B.3)}$$

$$-zw_h+z\gamma_{IRh}-z\gamma_{ICPl}+z\gamma_{ICl}-z\gamma_{ICh}=0, \quad \text{(B.4)}$$
$$-w_h\left(1-z\right)+z\gamma_{ICPl}+(1-z)\,\gamma_{ICl}-(1-z)\,\gamma_{ICh}=0, \quad \text{(B.5)}$$

$$z\theta_l\pi'\left(p_{lh}\right)w_l-(1-z)\,\gamma_{IRh}\lambda\left(b\left(p_{lh}-p^e\right)-d\left(\boldsymbol{p}_{hl}-p^e\right)\right)+(1-z)\,\gamma_{ICPl}\lambda\left(b\left(p_{hh}-p^e\right)-d\left(\boldsymbol{p}_{hh}-p^e\right)\right)-z\gamma_{ICh}\theta_h\pi'\left(p_{lh}\right)=0, \quad \text{(B.6)}$$

$$(1-z)\,\theta_l\pi'\left(p_{ll}\right)w_l-(1-z)\,\gamma_{ICPl}\lambda\left(b\left(p_{hh}-p^e\right)-d\left(\boldsymbol{p}_{hh}-p^e\right)\right)-(1-z)\,\gamma_{ICl}\theta_h\pi'\left(p_{ll}\right)=0, \quad \text{(B.7)}$$

$$-zw_l+(1-z)\,\gamma_{IRh}-(1-z)\,\gamma_{ICPl}+z\gamma_{ICh}-z\gamma_{ICl}=0, \text{ and} \quad \text{(B.8)}$$
$$-w_l\left(1-z\right)+(1-z)\,\gamma_{ICPl}+(1-z)\,\gamma_{ICh}-(1-z)\,\gamma_{IC_l}=0. \quad \text{(B.9)}$$

From (B.4), (B.5), (B.8), and (B.9) we can rewrite (B.2), (B.3), (B.6), and (B.7) as

$$\theta_h\pi'\left(p_{hh}\right)-\lambda b\left(p_{hh}-p^e\right)+\lambda d\left(\boldsymbol{p}_{hh}-p^e\right)+\frac{\gamma_{ICl}}{w_h-\gamma_{ICl}}\Delta\theta_h\pi'\left(p_{hh}\right)=0, \quad \text{(B.10)}$$

$$\theta_h\pi'\left(p_{hl}\right)-\lambda b\left(p_{hl}-p^e\right)+\lambda d\left(\boldsymbol{p}_{lh}-p^e\right)+\frac{z}{1-z}\lambda d\left(\boldsymbol{p}_{lh}-\boldsymbol{p}_{hh}\right)+\frac{\gamma_{ICl}}{w_h-\gamma_{ICl}}\Delta\theta_h\pi'\left(p_{hl}\right)=0, \quad \text{(B.11)}$$

$$\theta_l \pi'(p_{lh}) - \lambda b(p_{lh} - p^e) + \lambda d(\boldsymbol{p}_{hl} - p^e) - \frac{\gamma_{ICh}}{w_l - \gamma_{ICh}} \Delta\theta_h \pi'(p_{lh}) = 0, \text{ and} \quad (B.12)$$

$$\theta_l \pi'(p_{ll}) - \lambda b(p_{ll} - p^e) + \lambda d(\boldsymbol{p}_{ll} - p^e) + \frac{z}{1-z} \lambda d(\boldsymbol{p}_{ll} - \boldsymbol{p}_{lh}) - \frac{\gamma_{ICh}}{w_l - \gamma_{ICh}} \Delta\theta_h \pi'(p_{ll}) = 0. \quad (B.13)$$

Moreover, we have that

$$(1-z) w_h - z w_l + \gamma_{ICh} - \gamma_{ICl} = 0,$$

and when the policies are increasing in the lobbies' types, constraints (IC_h^{IE}) and (IC_l^{IE}) cannot both be binding at the same time. Therefore, if $\gamma_{ICl} > 0$ then $\gamma_{ICh} = 0$, while if $\gamma_{ICh} > 0$ then $\gamma_{ICl} = 0$. Hence,

$$\gamma_{ICl} = \max\{(1-z) w_h - z w_l, 0\},$$
$$\gamma_{ICh} = \max\{z w_l - (1-z) w_h, 0\}.$$

To show that the RSW CS is interim efficient, we have to show that the best response functions of the interim efficient program are the same as the RSW CS. Therefore, we must compare the first order conditions for the policies of the two programs.

The only difference between the system of equations (B.10)-(B.13) and the first-order condition (8) is the multiplier of the signaling effect (μ_{-i}). However, we know that, for any value of the multiplier (μ_{-i}) in the RSW problem, we can find w_h and w_l such that

$$\frac{\gamma_{IC-i}}{w_i^* - \gamma_{IC-i}} = \frac{\mu_{-i}}{1 - \mu_{-i}}.$$

This means that there exist weights w_h^* and w_l^* such that the policies that solve the RSW also are optimal in the interim efficient program (6). Moreover, the contributions from program (6) trivially make the constraints of the interim efficient hold. Therefore, the RSW CS is interim efficient. ■

Corollary 4 *If the RSW CS is interim efficient, it is the unique solution of the informed lobby problem that satisfies the intuitive criterion.*

Another possible type of equilibrium that could emerge is a pooling equilibrium where both lobbies offer the same contribution for whatever type they may be.

Corollary 5 *Any pooling equilibrium would not be interim efficient.*

The proof of Corollary 5 is trivial since in any pooling equilibrium, both high and low-type of lobbies offer the same contribution schedules and ask for the same policies, i.e., $p_{h.} = p_{l.}$. However, we know that the interim efficient policies are increasing in the lobbies' types.

References

[1] Austen-Smith, D. 1995. Campaign contribution and access. American Political Science Review, 89 (3), 566-581.

[2] Austen-Smith, D., Wright, J.R. 1992. Competitive lobbying for a legislature's vote. Social Choice and Welfare, 9 (3), 229-257.

[3] Bennedsen, M., Feldmann S.C. 2006. Information lobbying and political contributions. Journal of Public Economics, 90 (4), 631-656.

[4] Bernheim, D., Whinston, M. 1986a. Common agency. Econometrica, 54 (4), 923-942.

[5] Bernheim, D., Whinston, M. 1986b. Menu auctions, resource allocation, and economic influence. The Quarterly Journal of Economics, 101 (1), 1-31.

[6] Campante, F. Ferreira, F. 2007. Inefficient lobbying, populism and oligarchy. Journal of Public Economics, 91 (5), 993-1021.

[7] Cho, I-K., Kreps, D. 1987. Signaling games and stable equilibria. The Quarterly Journal of Economics, 102 (2), 179-221.

[8] Coate, S., Morris, S. 1995. On the form of transfers to special interests. The Journal of Political Economy, 103 (6), 1210- 1235.

[9] Dixit, A., Grossman, G., Helpman, E. 1997. Common agency and coordination: general theory and application to government policy making. Journal of Political Economy, 105 (4), 752-769.

[10] Esteban, J., Ray, D. 2006. Inequality, lobbying and resource allocation. American Economic Review, 96 (1), 257-279.

[11] Grossman, G., Helpman, E. 1994. Protection for sale. American Economic Review, 84 (4), 833-850.

[12] Grossman, G., Helpman, E. 2001. Special Interest Politics. MIT Press.

[13] Holmström, B., Myerson, B. 1983. Efficient and durable decision rules with incomplete information. Econometrica, 51 (6), 1799-1819.

[14] Jullien, B. 2000. Participation constraints in adverse-selection problems. Journal of Economic Theory, 93, 1-47.

[15] Krishna, V., Morgan, J. 2001. A model of expertise. The Quarterly Journal of Economics, 116, 747-775.

[16] Le Breton, M., Salanié, F. 2003. Lobbying under political uncertainty. Journal of Public Economics, 87, 2589-2610.

[17] Maggi, G., Rodrigues-Clare, A. 2000. Import penetration and the politics of trade protection. Journal of International Economics, 51, 287-304.

[18] Martimort, D. Moreira, H. 2010. Common Agency and Public Good Provision under Asymmetric Information. Theoretical Economics, 5 (2), 159-213.

[19] Martimort, D., Semenov, A. 2008. Ideological uncertainty and lobbying competition. Journal of Public Economics, 92, 456-481.

[20] Maskin, E., Tirole, J. 1990. The principal-agent relationship with an informed principal: the case of private values. Econometrica, 58 (2), 379-409.

[21] Maskin, E., Tirole, J. 1992. The principal-agent relationship with an informed principal, II: Common Values. Econometrica, 60 (1), 1-42.

[22] Myerson, R. 1983. Mechanism design with an informed principal. Econometrica, 51, 1767-1797.

[23] Potters, J., Van Winden, F. 1992. Lobbying and asymmetric information. Public Choice, 74, 269-292.

[24] Spence, M. 1973. Job market signaling. The Quarterly Journal of Economics, 87 (3), 355-374.