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DISSERTATION

COMPETITIVE LOBBYING: THE MATTER OF NON-EGOISTIC BEHAVIOR IN REPEATED GAMES

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SUPERVISION:
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ABSTRACT

Interest groups play a crucial role in public policymaking. Providing information is often asserted to be the primary way to influence decision-makers. Although decision-makers recognize that interest groups do have specialized private information and high technical expertise, they are aware that there may be an incentive for such groups to attempt to bias their decisions by manipulating the information transmitted in their favor. In this sense, a concern arises about the negative impact such groups may have on the quality of democratic government or economic indicators.

In the opposite direction, this research is concerned with the extent to which private interest groups can consider the preferences of other agents when lobbying. With this purpose in mind, we develop a game-theoretical lobbying model in which two interest groups with different utility functions must interact with a decision-maker in order to influence its decision. On the one hand, the groups are assumed to have private information that is relevant to the decision-maker, whilst, on the other hand, the decision-maker is aware of the strategic incentives the groups have to report biased information. This situation is analysed by considering two scenarios: a proactive scenario, in which the interest groups act before the decision-maker reveals its utility function, and a reactive scenario, in which the groups' actions comes after the decision-maker reveals its utility function.

We show that in a setting of partially conflicting interests, there exists a rationale for a group to consider the preferences of other agents, even if it is to improve its own utility. Furthermore, the model reveals some interesting findings: interest groups lobby decision-makers with similar utility functions; lobbying messages may be informative even if there is a partial conflict of interest; and groups do establish credibility with the decision-maker.

KEYWORDS: Lobbying; Signalling; Game Theory.

JEL CODES: D72; D82; L51.

RESUMO

Grupos de interesse desempenham um papel fundamental na formulação de políticas públicas. O fornecimento de informações costuma ser considerado o principal meio de influenciar os decisores. Embora os decisores reconheçam que os grupos de interesse possuem informações privadas especializadas e grande conhecimento técnico, eles sabem que existe um grande incentivo para que tais grupos tentem influenciar as suas decisões através da manipulação da informação que é transmitida. Nesse sentido, surge uma preocupação com o impacto negativo que os grupos de interesse podem ter na qualidade do governo democrático ou de indicadores econômicos.

No sentido oposto, esta pesquisa preocupa-se com a importância que os grupos de interesse privado podem atribuir às preferências de outros agentes nas suas ações de *lobbying*. Com este propósito, desenvolveu-se um modelo baseado na teoria dos jogos no qual dois grupos de interesse com diferentes funções de utilidade devem interagir com um decisor a fim de influenciar a sua decisão. Por um lado, assume-se que os grupos possuem informação privada que é relevante para o decisor, enquanto que, por outro, o decisor está ciente dos incentivos que os grupos possuem para reportar informações enviesadas. Esta situação é analisada através de dois cenários: o proativo, no qual os grupos de interesse agem antes que o decisor revele sua função de utilidade, e o reativo, no qual a ação dos grupos ocorre depois do decisor revelar a sua função de utilidade.

Demonstra-se que, numa situação de interesses parcialmente conflituosos, existe uma racionalidade para que um grupo considere as preferências de um outro agente, ainda que isso seja com o propósito de melhorar a sua própria utilidade. Além disso, o modelo revela outros resultados interessantes: os grupos de interesse fazem *lobbying* com decisores que possuem funções de utilidade similares; as mensagens de *lobbying* podem ser informativas ainda que haja um conflito parcial de interesses; e grupos de interesse agem de forma a ganhar credibilidade junto aos decisores.

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COMPETITIVE LOBBYING: THE MATTER OF NON-EGOISTIC BEHAVIOR IN REPEATED GAMES

By Vanessa Santos Mello

1. INTRODUCTION

Providing information to regulators, policymakers, or legislators is often asserted to be the primary way to influence decision-makers. The ability of an interest group to provide relevant data in support of its position is an essential advantage in the run for influence. On the other hand, although decision-makers recognize that interest groups have specialized private information and high technical expertise, they are aware that there is an incentive for such groups to attempt to bias their decisions by manipulating the information transmitted in their favor.

It is a fact that interest groups play a crucial role in public policymaking. Sometimes they are faced as intermediaries between society and the government. More often, however, a concern arises about the negative impact such groups may have on the quality of democratic government or economic indicators. Undoubtedly, this concern refers to private interest groups, defined by Pereira (2008) as those in which the welfare of their members is improved at the expense of non-members. This definition is based on the assumption that all the actions of such groups are guided by egoistic behavior.

The concept of rationality in neoclassical economics is based on utility maximization, assuming that an economic agent decides to maximize his or her utility, and thus behaves in a purely selfish way. Rational choice is an adequate description of behavior in many real-life situations. However, there are several other situations where behavior reveals that individuals are not entirely selfish, but have social preferences, exhibit empathy, and are altruistic, as observed in the donation of resources or volunteer work, for example.

This dissertation aims to provide an answer to the following question: is there a rationale for a private interest group to consider the preferences of other players in a world of self-interested agents?

For this research, we develop a simple model of two interest groups lobbying based on the central premise that such activity is an exercise of strategic information

transmission. We assume that the groups possess information the decision-maker does not, and, at some point, such information is essential for the decision-maker in what the consequences of taking one action rather than another are concerned. However, given that the interests of the decision-maker do not necessarily coincide with those of the interest groups, the extent to which a group can persuade a decision-maker to act in its interest is questionable.

The present research demonstrates that, while interest groups seek to improve the welfare of their members, their actions are not motivated solely by selfishness and often incorporate benevolent aspects. Thus, the goal would be to increase the welfare of their members without necessarily implying a reduction in the welfare of non-members, which could remain constant or even increase. In other words, the action of the group could lead to improvements according to the Pareto criterion[1].

This behavior would be justified by increasing the influence power of the group over government, which would see it as an essential ally in strategic decision-making. In contrast, the interest group would see its chance of success grow and, even if its gains are lower than it is possible or desirable, it would have improved its initial position by increasing the welfare of its members.

Some observations regarding the action of interest groups in Brazil were the primary motivation for this research. The Brazilian oil and gas sectors are subject to sectoral regulation, and ever since the sectors were opened to the private initiative, different interest groups appeared, representing all interested parties of this activity. My observations are related to the action of one specific group that, on many occasions, has decided to defend a position that was not necessarily the best for its interests. This situation happens for many reasons. The importance that the group attributes to credibility is one of them. Considering that the interaction with the decision-maker is a continuous process, we have a situation of repeated interaction, which means that the group may seek to acquire a reputation for being benevolent or presenting trustable information early in the game. This behavior is relevant because the extent to which any information offered to alter or to influence beliefs is effective depends on the credibility of the lobbyist to the decision-maker in question.

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[1] See Varian (2017).

Secondly, assuming the government´s utility function is related to the political support it receives (its objective is to be reelected), the occurrence of previous discussions among organized groups of the sectors before sending a message to the decision-maker is common. The aim is to guarantee the maximum support to an idea in order to influence the decision-maker's beliefs more effectively. The rationale behind this strategy is easy to understand: if the government wants to assure political support from all groups, an idea defended by all the groups is more easily implemented than an idea advocated by only one group. Logically, if groups with partially different interests send the same message, at least one of them had to forgo its best choice.

Finally, an interesting behavior that we could observe is the commitment regarding the objectives defined by the decision-maker. Given that, every time the government signalizes a goal and requests information, the group makes the best of its efforts to attend the decision-maker's demand making sure the government will achieve its objective and its members will also receive an improvement on its welfare.

The plan for this dissertation is as follows. In Section 2, we relate this research to the literature - while the primary motivations for this study stem from the theory of regulation, it is relevant to approach the topic by considering the signaling literature. Section 3 presents the basic concepts for the construction of the model. In Section 4, we develop the basis of the model, while in Sections 5 and 6 we analyze two different scenarios: proactive lobbying and reactive lobbying, respectively. In Section 7, we conclude.

2. LITERATURE REVIEW

2.1. The Theory of Economic Regulation

The literature known as the theory of economic regulation had its beginning in Sigler (1971), and its principal characteristic is described as below:

> The most important element of this theory is its integration of the analysis of political behavior with the larger body of economic analysis. Politicians, like the rest of us, are presumed to be self-interested maximizers. This means that interest groups can influence the outcome of the regulatory process by providing financial or other support to politicians or regulators.
>
> In: Peltzman (1989), p. 1.

Some relevant versions of capture theory had appeared earlier than Stigler's seminal paper[2]. For this reason, his model could be interpreted as a refined version of capture theory, considering that he introduced an original aspect by accumulating evidence from empirical research within the discipline. It is unclear, however, whether the theory of economic regulation is a theory about interest groups lobbying in the regulatory process or it is a theory focused on demonstrating that regulation is intended to protect the regulated industry.

Stigler's model is shaped by two costs of obtaining legislation: information and organization. Stigler (1971, p.3) states that "regulation is acquired by the industry and is designed and operated primarily for its benefit". Groups with lower costs tend to be favored at the expense of groups with higher costs. Numerically large groups tend to be the losers in the regulatory process. The main conclusion is that producers' interests will always be victorious in the dispute over the services of a regulatory agency. More generically, in any similar political dispute between groups of different sizes, the more compactly organized interests will usually win. The conclusion stems directly from Olson (2009).

Additionally, Stigler (1971) specifies the objects of choice in the utility function of politicians in two aspects – votes and resources. The industry that seeks regulation must be prepared to pay with these two things.

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[2] See Bentley (1908) and Truman (1951).

The emphasis on political behavior, aimed at satisfying self-interest, and the costs of information and organization have become the touchstone of subsequent literature in regulation theory.

Posner (1974) argues that Stigler's theory is unsatisfactory and cannot be said to have substantial empirical support. He defends that regulation may be the product of coalitions between the regulated industry and customer groups, at the expense of unorganized groups.

Peltzman (1976) further elaborated on the analysis of the action of interest groups. The author defends that no economic interest captures the regulator in an exclusive way and that regulation is a process of wealth transfer. The main reason is that the regulator will seek a structure of costs and benefits that maximizes its political return. In other words, the regulator's choice problem is not limited to selecting the appropriate size of an interest group to benefit; it includes the selection of a proper structure of benefits and costs able to guarantee political support from all groups. For this reason, even if a single economic interest gets all the benefits of regulation, these must be less than the maximum result the group could obtain. He concludes that regulation usually tries to conciliate the interests of producers and consumers. The conclusion goes on the opposite direction of Stigler's idea that regulation exclusively protects the producers.

It is interesting to note that Peltzman (1976) indicates the possibility of a capture made by the regulator – a typical agency problem in which the decision-maker (principal) imposes its objective function over the agents. Stigler (1971) did not consider this aspect in his analysis.

Both Stigler (1971) and Peltzman (1976), however, ignore the fact that regulators are usually agents of an executive or legislature rather than agents seeking votes. They also disregard situations in which decision-makers need specialized private information in order to understand possible outcomes of their decisions. If that is the case, the decision-maker will be in the position of demander and may interact with interest groups to collect information.

Becker (1983) has a setup similar to Peltzman's: groups organize to exert pressure on the political process to obtain benefits. He assumes the capacity of a group to exert pressure is a function of the number of members and the resources spent by member for

maintaining the lobbying activity: pressure increases when expenditures increase. Even though popular support (voters) is said to be a relevant element in exerting pressure, the aspect was not incorporated in the function. Moreover, the author does not define what he means by "exerting political pressure", albeit he highlighted the relevance of the productivity of the groups' expenditures for this purpose. Therefore, there is some implicit evidence in the paper that indicates the distribution of relevant information for the decision-maker as a way of raising the influence of a group. The model does not examine aspects regarding the relevance of groups' credibility in increasing their influence.

In accordance with Becker's research, competition among groups can lead to efficient results, although cooperation is necessary to prevent the wasteful expenditures on political pressure that result from the competition for influence. In contrast, the author presents the political model as a zero-sum in influence – the increased influence of some groups decreases the influence of others by equal amounts – and, given that, cooperation is difficult to achieve.

The theory of economic regulation has two relevant limitations: it ignores both the principal-agent problem and the existence of information asymmetry (Laffont & Tirole; 1993). Considering the absence of such asymmetries, regulated firms would be incapable of extracting rent and, therefore, would have no incentive to lobby. Similarly, voters and legislators would be able to control their agents (politicians and agencies) that, hence, would not act in benefit of interest groups.

The school focuses on the "demand side," which implies a naive assumption that decision-makers' role in the political scenario is mainly to transmit the pressure of interest groups. It also disregards the differences between the objective functions of decision-makers and interest groups, ignoring that, under a context of information asymmetry, the rational and opportunistic behavior is present in all players.

2.**Erro! Autoreferência de indicador não válida.***2. Strategic Transmission of Private Information*

We should care about information transmission for two reasons. Decision-makers are usually choosing policies without complete information. For this reason, information becomes valuable and those who possess it are in the position to influence policies in their

favor. On the other hand, when agents' payoffs depend both on the better-informed agent's information and on the decision of the decision-maker, the latter is aware that the first has an incentive to attempt to bias its decision by manipulating the information transmitted.

In a seminal paper, Crawford and Sobel (1982) study the strategic information transmission in the context of an abstract sender-receiver game. There are two agents, one of whom has private information relevant for both. The Sender (S), the better-informed one, sends a signal based on his private information to the other agent, the Receiver (R). R then makes a decision that defines the payoff of both players, based on the information contained in the signal. Given that, S will include enough information in the signal to induce R to respond to it and will hold back enough so that his response is as favorable as possible. Variants of this model have been applied widely ever since.

Direct communication is more likely to play an important role the more closely related are agents' preferences (Crawford and Sobel, 1982; Potters and Van Winden, 1992; Austen-Smith, 1993). In the opposite direction, under a situation of conflicting preferences, Crawford and Sobel (1982) indicate that only no communication is consistent with rational behavior, and, for this reason, their model disregards issues related to reputation and credibility.

The most natural way to incorporate those aspects is to model the interaction as a repeated game. Sobel (1985) defines that credibility can only be communicated through actions and that an agent could become credible by providing accurate and relevant information or by acting responsibly. The model establishes that S and R will play the game a finite number of times and, at each stage: (a) R decides its action by accessing the credibility of S; and, (b) S can enhance its reputation by providing honest information to R. Sobel considers that, at some point, a group with opposed preferences to the decision-maker will take advantage by misleading him. When this happens, S loses all opportunities for deception in the future given that his reputation falls, and R believes nothing that he says. Aspects related to credibility were also considered by Kreps and Wilson (1982) and by Austen-Smith (1993).

Kreps and Wilson (1982) have studied the power of reputation on finitely repeated games. The model allows us to assert that reputation matters both in the context of

infinitely repeated games and on finite games with some uncertainty (incomplete information) as to the payoffs of each player. This paper and the research of Milgrom and Roberts (1982) were the first to present models in which players exploit uncertainty and take short-term losses seeking to build a reputation and make long-term gains.

Austen-Smith (1993) indicates that the extent to which any information offered to alter the beliefs of a decision-maker is effective depends on the credibility of the group. In his model, credibility is considered as an endogenous variable and depends on how closely the preferences of the interest group and the decision-maker are, and on how confident is the decision-maker that the group is informed. The author does not consider, however, that both agents interact through time, developing reputations.

Sobel (1985) defends that repeated plays allow the decision-maker to evaluate better the usefulness of a group's information (R prefers to deal with a single Sender for t periods rather than t Senders separately). Long-term arrangements are a useful tool to moderate the inefficiencies caused by incomplete information. In the same direction, Potter and Van Winden (1992) indicate that repeated communication is more costly to the interest group and that higher costs induce a more favorable response from the decision-maker because private information is signaled more persuasively.

Potters and Van Winden (1992) indicate that lobbying messages from an interest group to a decision-maker may be informative even if there is a substantial conflict of interest. In that sense, there is scope for informational lobbying if there is sufficient congruence in the agent's preferences.

Sobel (1985) and Potters and Van Winden (1992) assume the possibility of a no-transmission equilibrium, in which R takes the same action regardless of S's signal. In other words, R's response to lobbying is more favorable to S if R would already have made this favorable decision based on its prior beliefs.

Lobbying messages are more likely to occur if the interest group has 'good' information (informational signal) and if the costs of a message are small relative to the potential benefits. A rationale for costly lobbying exists if it induces a favorable change in the decision maker's behavior relative to its prior beliefs and if S believes that R expects to receive any information and will make a less favorable decision in case of silence (Potter and Van Winden; 1992). In what concerns this aspect, Austen-Smith

(1993) indicates that not lobbying can itself constitute an informative signal (if R is indifferent between the *status quo* and a new proposal, in the absence of any influential lobbying, R will choose the new proposal). This means there is always an informed interest group that decide not to send a signal.

2.3. Critical analysis and interpretation

By analyzing the literature, it is noted that interest groups typically use an influence function to represent the transformation of inputs (money, capital, and labor) into political influence (e.g., Becker, 1985; Tullock, 1980). However, a major criticism of such models is that the interaction underlying its transformation is lacking (Mitchell, 1990).

In fact, the orthodox view of the lobbying activity is that such expenditures help to reinforce or to shape decision-maker's positions (Matthews, 1960; Milbrath, 1960; Bauer, Poll and Dexter, 1963; Zeigler, 1964; Scott and Hunt, 1966; Dexter, 1969). Schlozman and Tierney (1986), Salisbury, Heinz, Laumann and Nelson (1987) and Berry (1989) state that the vast amount of money they spend on lobbying suggests that the interest groups' influence may be considerable. Actually, recent empirical studies have demonstrated that lobbying can yield significant dividends in political support (Smith, 1984; Fowler and Shaiko, 1987; Smith, 1988; Rothenberg, 1989; Smith, 1989; Wright, 1990).

In contrast with the theory of economic regulation, under the information transmission approach, the political agents are treated as players and one aspect of the interaction is explicitly modeled as information transmission. This comes at the cost of not incorporating any competition between interest groups. On the other hand, the theory of economic regulation does not consider issues regarding the credibility and reputation of interest groups.

For the purpose of this research, lobbying will be modeled as a game of strategic information transmission. It will be necessary, however, to consider the possibility of competition and cooperation between interest groups. This is relevant because there are situations that information provided by one interest group can be contradicted or affirmed by messages from another group. Additionally, we have substantial support in the theory of economic regulation to consider that under a scenario of competition between interest groups, each one will seek to raise its political influence through the support of other groups or interested parties.

Given the exposed so far, the model that will be developed in this research differs from principal-agent models (e.g., Grossman and Hart; 1983) since it is not assumed that the uninformed player (R) can commit itself to a message-response profile at the beginning of the game. It also differs from cheap talk games (e.g., Farrell and Rabin; 1996), in that it is not assumed that informational lobbying is costless (Austen-Smith; 1994). It will be assumed that there is no way for R to check the accuracy of S's message and players will be allowed to have different interests (contrary to, e.g., Crawford and Sobel, 1982). Also, we do not assume that lying is impossible (Milgrom, 1981). The model also differs from persuasion games (e.g., Bartlett, 1973; Calvert, 1985; Milgrom and Roberts;1986) since in these games the decision-maker and the interested parties interact only once so that issues regarding credibility and reputation does not arise. Furthermore, as Potter and Van Winden (1992), we assume that the cost of a signal is fixed, which means that it is independent of the content of the message and the private information of the sender. This assumption differs from a wide class of signaling games (e.g., Cho and Sobel, 1990).

3. BASIC CONCEPTS

That are two types of information that are germane to the lobbying context: the first one is technical, while the second one concerns intentions (Austen-Smith; 1992). Technical information is related to the information the decision-maker lacks regarding the consequences of choosing one action or another. On the other hand, verbal commitments and threats, or the coordination of actions, are examples of the second type of information (Banks and Calvert; 1990). This research focuses on technical information. Additionally, we are not concerned about the form of the message transmitted to the decision-maker. It is the informational content of the message that matters.

It should be clear from the exposed so far that lobbying is presumed to be strategic: an interest group chooses its political messages in an attempt to convince decision-makers to take one action rather than another. Logically, it is also expected that rational listeners are aware of the strategic nature of such messages.

We must also define a further restriction on our focus of attention. Potters and Van Winden (1992) consider that three incentive structures should be distinguished. In the first structure, there is no conflict of interest between the decision-maker and an interest group regarding the best action the decision-maker can take: the interest group has no incentive to provide bad information and there is no reason for the decision-maker to mistrust a message from this group. Hence, we say that this interest group is a Friend (F) of the decision-maker and has no incentive to lie or make an untruthful report on its private information given the congruence of interests between both agents. In the second structure, there is full conflict of interests between the decision-maker and an interest group. In this case, the group has an incentive to be dishonest and to misinform the policymaker, who will always interpret a message unfavorably for the group. No message will be sent under this scenario. Thirdly, there is a case of partial conflict of interests regarding the best action the decision-maker can take. We say that the interest group is an Enemy (E) of the decision-maker and may have incentives to lie or to make an untruthful report on its private information to influence its decision. The problem of the scope for information transmission is clearly most pertinent in this case.

It also is relevant to refer that, for the present research, we follow the model constructed by Austen-Smith (1994). The author states that assuming the existence of

organized groups on both sides of an issue, only the group whose interests the legislator will vote against in the absence of lobbying activity has incentives to devote resources to lobbying. The group whose interests the legislator is inclined to vote for *ex-ante* has no incentive to lobby if no other group does. However, if the group against the legislator decides to lobby, the second group must act in counteractive lobbying, that is, in providing information to offset any influence the initial group might exert.

Therefore, we will assume the existence of two interest groups competing for influence: one group has no conflict of interests with the decision-maker, F; and another group with partial conflict of interest with the decision-maker, E. We also consider two different approaches. An interest group may acquire information prior to, and independently of, the introduction of a legislative agenda; or it may acquire information only after the legislative agenda is revealed (Austen-Smith and Wright; 1992). In other words, a group may act proactively or reactively.

As such, an interest group acts in a proactive way if it decides to influence the decision-maker before it reveals its utility function. Consider a situation in which the decision-maker is satisfied with the current scenario but an interest group decides to persuade it into leaving the *status quo* by sending a lobbying message. It is logical to assume that this group believes it could improve its welfare in case the decision-maker takes action to leave the *status quo*. After this, an opponent group sends a lobbying message to reinforce or to counteract the rival. The lobbying messages are an attempt to inform or to misinform the decision-maker, but this decision-maker only discovers if the groups lied and whether they are an "enemy" or a "friend" after making the decision regarding the messages received.

In this case, we assume that in the absence of a lobbying message, the decision-maker prefers to take no action. This reflects the beliefs of the decision-maker regarding the preferences of its voters: if the *status quo* is maintained, the decision-maker believes it will not lose any political support from its voters (prior belief); however, depending on the lobbying messages received, the decision-maker may be willing to reevaluate its position.

The decision-maker wants to guarantee political support from all interest groups (Peltzman; 1976) and, therefore, the only way to persuade it into changing the *status quo*

is through the existence of consensus between the messages of both groups regarding the best action the decision-maker could take. We assume that the decision-maker believes it can increase its political support by taking an action that improves the welfare of both interest groups (potential voters) without losing anyone's support. Therefore, even though the decision-maker is not sure about the real motives behind a lobbying message from an interest group, if both groups transmit the same message, we assume the decision-maker prefers to believe in the messages in order to assure political support.

We model proactive lobbying as a sequential game. Only one interest group can start the process by sending a lobbying message, while the other group acts in the sequence. Considering that we have two rival groups competing for influence, we assume that one of them is F, while the other is E. Logically, F is more satisfied with the *status quo* than E, given that F's utility function is similar to the decision-maker's, who has no intention to take action to leave the *status quo* if no lobbying message is transmitted. For that reason, we expect that E will start the sequential game by sending the first lobbying message.

Assuming the existence of a second interaction between the interest groups and the decision-maker, its decision rule only remains unchanged if E tells the truth in the first stage of the game. If the decision-maker concludes that E had incentives to report biased information and chose not to, E gains reputation that assures the decision-maker will listen to its message in the second stage of the game. On the other hand, when E lies, it is penalized by not being credible enough to start a new lobbying process, given that the decision-maker has no incentive to believe him when the second interaction takes place.

In this case, it is safer for the decision-maker to maintain the *status quo* regardless of the messages received. This means that when E lies it loses reputation and its credibility becomes too low to start a second game and to persuade the decision-maker into changing the *status quo*.

Now, we shall consider the situation in which interest groups act after the decision-maker reveals its utility function: the groups involved observe how the decision-maker rank its preferences and then decide the lobbying messages they will send. We define this scenario as reactive lobbying.

Consider that the decision-maker is determined to leave the *status quo* by implementing a new public policy that affects the welfare of the two interest groups involved in the process. This decision refers to the beliefs of the decision-maker regarding the preferences of its voters. However, depending on the lobbying messages received, the decision-maker may be willing to reevaluate its position.

Again, we say that one of the groups is F while the other is E and that, after discovering that the decision-maker is willing to implement a new policy, they send lobbying messages to support the proposed policy or to try to persuade the decision-maker into implementing another policy. Suppose, for example, that lobbying messages are private information related to the possible outputs generated by implementing the proposed policy, and that, by considering its outputs, the decision-maker may be willing to reevaluate its position. Similar to the proactive lobbying, we say the decision-maker only discovers if the groups lied and whether they are an "enemy" or a "friend" after making the decision regarding the messages received.

In this scenario, we assume that in the absence of a lobbying message, the decision-maker implements its preferred public policy. Under this situation, we assume that both interest groups get an increase in their utility. F will be in a better situation than E given that F's utility functions are similar to the decision-maker's. E's welfare improves, but not as much as it would if the decision-maker had implemented E's preferred public policy. This is also true if the groups decide to send different messages: imagine that one group has decided to support the decision-maker's position while the other has decided to persuade the decision-maker into implementing another policy. Under this situation, it is expected that the decision-maker will act based on its prior beliefs guaranteeing political support from its voters and from the interest group that supported its decision. Logically, if both interest groups decide to send the same lobbying messages, we expect the decision-maker to believe that the information is an accurate report.

We model the reactive lobbying as a simultaneous-move game. After the decision-maker reveals its utility functions, we say that both groups will transmit their lobbying messages simultaneously because none of them had the proactive behavior of starting the process. The groups are merely reacting to the decision-maker's demands by answering to a request.

It is expected that F has no incentive to try to misinform the decision-maker, given that their interests are aligned. This is not true for E.

Assuming the existence of a second interaction between the interest groups and the decision-maker, its decision rule only remains unchanged if at least one of the groups chose to report truthful information on the first-stage. If one of the groups lied on the first stage of the game, it is expected that it will lose reputation. However, considering that the decision-maker is sure about which policy it prefers to implement, it is more concerned in securing some support from either of the groups regarding its position than in assuring support by both of them regarding another possible policy, especially if one of the groups has proved to be a liar. For this reason, even if F lies and the decision-maker discovers that this led the group to a worst situation, the decision-maker will consider the signal received if it supports its prior beliefs on the second stage of the game. The same is true for E, even if the lie placed it in a better situation. Finally, if we assume that both interest groups lie on the first stage, when the second stage of the game takes place, the decision-maker believes nothing they say and prefers to follow its prior beliefs by implementing its preferred policy – this happens because the lie of both groups at the first-stage of the game led the decision-maker to take a wrong decision.

The incorporation of the benefits and the losses associated to telling the truth or a lie in the model should also consider another relevant aspect: under the situations in which E has incentives to lie and chooses not to, E gets reputation that allows it to ensure incremental gains on the second stage of the game. This assumption derives from Peltzman's (1976) idea that decision-makers select the benefits structure that guarantee political support from all groups[3]. For example, imagine a debate about the implementation of a new policy that requires a high level of bureaucratic control by its executors, which we assume to be E and F. We say that F is favorable to the implementation of the proposed policy while E is contrary to it. When E informs the decision-maker about the possible outcomes of the policy, it can signal truthful information and, even if the policy is, in fact, implemented, E might get as a reward a reduction of the bureaucratic level initially proposed by the decision-maker, which would be contrary to F's interests. This situation would lead to incremental improvement of E's

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[3] See Section 2.

payoff. Logically, E would only be able to demand such incremental payoff if it is credible enough to influence the decision-maker. We assume that an increase in E's payoff leads to a decrease in F's payoff – not necessarily in the same proportion – and that reputation gains could also be reflected by the increment associated with small adjustments to the policy initially proposed by the decision-maker.

Under the situations in which E lies in the first stage of the game, it makes no sense to discuss incremental gains associated with the increase of the influence power over the government, considering that there are no reputation gains. In the same direction, for F, incremental gains make no sense due to its alignment with the government and its total disincentive to lie. Thus, the exposed understanding for the construction of the payoffs must be reflected in the situations in which E tells the truth expecting to be rewarded at the second stage of the game. This situation is, indeed, observed in many real situations. A policymaker may wish to impose a tax only in one group, for example, E. If both groups, E and F, have a good reputation and provide truthful information, the government may choose to implement the tax but to reduce the rate proposed initially.

4. THE BASIC MODEL

Considering the complexity that characterizes the political and regulatory environment, the lobbying model presented here is an attempt to incorporate all relevant aspects regarding strategic informational lobbying in a synthetic structure.

We model lobbying as a two-player, two-stage game. The players are two groups with conflicting interests who compete for influence, denoted by E and F. In each stage, the two groups aim at impelling a benevolent decision-maker, the government, to take action and implement one of two possible policies. Policies in the first stage of the game are denoted by $X^1 = \{x_1, x_2\}$ and policies in the second stage of the game are denoted by $X^2 = \{x_3, x_4\}$. If no policy is taken, the *status quo* (SQ) remains. The interest groups' payoffs reflect the policies chosen in both stages of the game.

The real impact of each policy is unknown to the government but known to the interest groups. We assume that policies x_1 and x_3 are welfare superior when compared to policies x_2 and x_4, respectively. Moreover, policy x_1 is preferred by group F and policy x_2 is preferred by group E in the first stage of the game; in the second stage, policy x_3 is preferred by group F and policy x_4 is preferred by group E[4].

The groups exercise influence by sending messages to the government. For simplicity, there are two possible messages available in the first stage of the game – message θ_1 aims at convincing the government to implement policy x_1, while message θ_2 favors policy x_2; likewise, there are two messages available in the second stage of the game – θ_3 supports policy x_3, while θ_4 favors policy x_4. Given the welfare effects of each policy, messages θ_1 and θ_3 are truthful, while messages θ_2 and θ_4 are biased.

Once messages are sent, the government processes the messages received and makes a decision by choosing one of the policies and thus setting the outcome for that stage. We assume that the government is primarily, but not necessarily, reelection seeker (Mayhew, 1974; Austen-Smith and Wright, 1992). As such, in the first stage of the game, in pursuing reelection, the government chooses the policy that carries support in case messages are identical.

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[4] Therefore, F's interests are aligned with those of the benevolent government, while E's are not. This justifies notation: F stands for "friend" and E stands for "enemy".

Once a policy is chosen at the end of the first stage, the government observes its real impact. The second stage of the game starts with the two interest groups sending messages θ_3 or θ_4 to the government, which triggers the government's reaction to set the outcome for the second stage. This time, the government's decision reflects reelection concerns but also penalizes the interest group that conveyed a biased message in the first stage, in case such a group exists.

5. PROACTIVE LOBBYING

5.1. The Sequential Game

Our first scenario is proactive lobbying. In each stage of the game, the two interest groups, E and F, play a perfect information, sequential game, where E moves first and is followed by F. In what the government is concerned, it discovers if the senders sent a truthful or a biased message in the first stage, at the end of this stage. Such knowledge conditions the government's decision in the second stage of the game, so that the interest groups – E in particular – may provide accurate and unbiased information in the first stage in order to take advantage of their reputation later[5].

As described in the previous section, the two interest groups have conflicting preferences over possible policies and the *status quo* (SQ). This is reflected in the following assumptions, where $U^i(p)$, $p = x_1, x_2, x_3, x_4$, SQ and $i = $ E, F denote the utility that interest group *i* derives from *p*.

Assumption A1. $U^F(x_1) > U^F(SQ) > U^F(x_2)$ and $U^F(x_3) > U^F(SQ) > U^F(x_4)$.

Assumption A2. $U^E(x_2) > U^E(x_1) > U^E(SQ)$ and $U^E(x_4) > U^E(x_3) > U^E(SQ)$.

Interest group *i*'s payoff, $i = $ E, F, is the sum of utilities obtained in the first and in the second stages of the game. Moreover, we assume that F's payoff when the government chooses not to take action is greater than that of E:

Assumption A3. $U^F(SQ) > U^E(SQ)$.

Assumption *A3* justifies the fact that E plays first in the sequential game, considering that it is less satisfied with the SQ than F and that every action taken by the government is better than the SQ. Following E, group F will play to reinforce or counteract the message sent by E.

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[5] See Hayes (1981). Having access is more important than winning. If a group forfeits access, it loses the benefit of being consulted and the opportunities of influence that go with it.

FIGURE 1. Sequence of decisions in the first stage of the proactive lobbying game
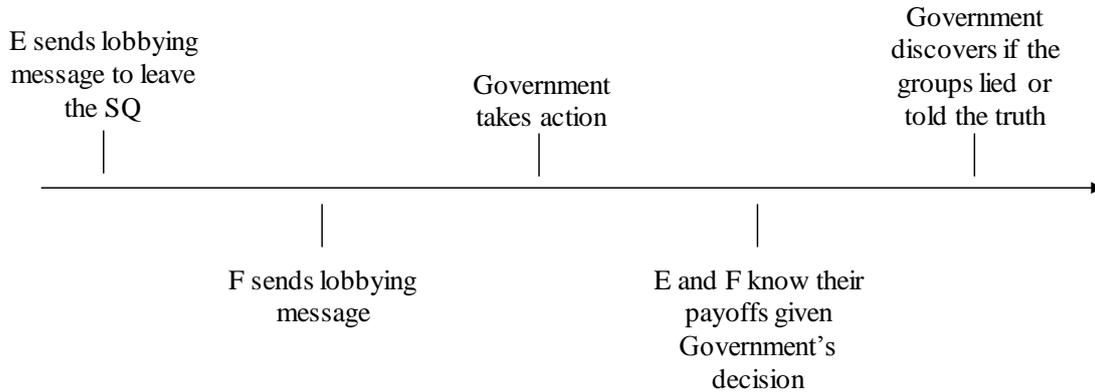
As mentioned in Section 4, we assume that groups know the true impact of each policy. Namely, policy x_1 is welfare superior to policy x_2 and policy x_3 is superior to x_4. Since the government is not aware of policies' welfare effects, the interest groups send messages that support one of the two possible policies in order to influence the government to take action. If a group chooses message $\theta = \theta_1$ ($\theta = \theta_3$), which favors the welfare superior policy x_1 (x_3), it is telling the truth; whereas if a group chooses $\theta = \theta_2$ ($\theta = \theta_4$), it is providing biased information to the government. For example, E may want to persuade the government into changing the SQ in order to improve its welfare by informing the government about the possible positive outcome of new regulations; being aware that F is also able to signal the true impact of such regulations, E decides whether to inform (tell the truth, say $\theta = \theta_1$ or $\theta = \theta_3$) or to misinform (lie, say $\theta = \theta_2$ or $\theta = \theta_4$) the government. Following E, group F plays and, after observing all the messages, the government decides to implement or not one of the new regulations. In the first stage of the game, strategic play additionally implies anticipating possible reputation effects from providing biased information.

In what concerns F, it has no incentive to try to mislead the government, given that both have similar preferences. For that reason, in case F chooses to lie, the government can only conclude that F was uninformed or committed a mistake.

Given the concepts presented in Section 3 regarding the utilities of the decision-maker, the following table lists all plausible actions taken by the interest groups and the government's decision for each combination of actions.

TABLE 1. Message profiles and corresponding outcomes for the proactive lobbying

Stage 1			Stage 2		
Behavior	Message (E, F)	Outcome	Behavior	Message (E, F)	Outcome
both tell the truth	θ_1, θ_1	x_1	both tell the truth	θ_3, θ_3	x_3
			E tells the truth, F lies	θ_3, θ_4	SQ
			E lies, F tells the truth	θ_4, θ_3	SQ
			both lie	θ_4, θ_4	x_4
E tells the truth, F lies	θ_1, θ_2	SQ	both tell the truth	θ_3, θ_3	x_3
			E tells the truth, F lies	θ_3, θ_4	SQ
			E lies, F tells the truth	θ_4, θ_3	SQ
			both lie	θ_4, θ_4	x_4
E lies, F tells the truth	θ_2, θ_1	SQ	both tell the truth	θ_3, θ_3	SQ
			E tells the truth, F lies	θ_3, θ_4	SQ
			E lies, F tells the truth	θ_4, θ_3	SQ
			both lie	θ_4, θ_4	SQ
both lie	θ_2, θ_2	x_2	both tell the truth	θ_3, θ_3	SQ
			E tells the truth, F lies	θ_3, θ_4	SQ
			E lies, F tells the truth	θ_4, θ_3	SQ
			both lie	θ_4, θ_4	SQ

5.2. Equilibrium

We use the concept of subgame perfect equilibrium to solve the lobbying game. A subgame perfect equilibrium is a Nash equilibrium of the game (i.e., a pair of strategies or plans of action of E and F that are best replies to each other) that induces a Nash equilibrium in every subgame of the original game. Since the game we describe is a perfect information game, subgame perfect equilibria can be obtained by backwards induction.

In the description of the subgame perfect equilibrium of this two-stage game, we assume that the game has payoffs as defined in Table 2[6].

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[6] Figure 2 below contains the tree of the sequential game.

TABLE 2. Payoffs of the Two-Stage Sequential Game

Message (E, F, E, F); Outcomes	Expected Senders' payoff (E; F)
$\theta_1, \theta_1, \theta_3, \theta_3; x_1, x_3$	$a_1; b_1$
$\theta_1, \theta_1, \theta_3, \theta_4; x_3, SQ$	$a_2; b_2$
$\theta_1, \theta_1, \theta_4, \theta_3; x_3, SQ$	$a_2; b_2$
$\theta_1, \theta_1, \theta_4, \theta_4; x_3, x_4$	$a_3; b_3$
$\theta_1, \theta_2, \theta_3, \theta_3; SQ, x_3$	$a_4; b_4$
$\theta_1, \theta_2, \theta_3, \theta_4; SQ, SQ$	$0; 0$
$\theta_1, \theta_2, \theta_4, \theta_3; SQ, SQ$	$0; 0$
$\theta_1, \theta_2, \theta_4, \theta_4; SQ, x_4$	$a_5; b_5$
$\theta_2, \theta_1, \theta_3, \theta_3; SQ, SQ$	$0; 0$
$\theta_2, \theta_1, \theta_3, \theta_4; SQ, SQ$	$0; 0$
$\theta_2, \theta_1, \theta_4, \theta_3; SQ, SQ$	$0; 0$
$\theta_2, \theta_1, \theta_4, \theta_4; SQ, SQ$	$0; 0$
$\theta_2, \theta_2, \theta_3, \theta_3; x_2, SQ$	$a_6; b_6$
$\theta_2, \theta_2, \theta_3, \theta_4; x_2, SQ$	$a_6; b_6$
$\theta_2, \theta_2, \theta_4, \theta_3; x_2, SQ$	$a_6; b_6$
$\theta_2, \theta_2, \theta_4, \theta_4; x_2, SQ$	$a_6; b_6$

Firstly, consider E's decision: E must decide whether to lie or not to the government in order to improve its utility. When there is more than one stage, E may supply useful information to the government at first to take advantage of its reputation later (Sobel; 1985). This means that E is aware that if the government discovers a lie in the first stage when the second stage takes place, it will not believe in anything E says. In other words, lying in the first stage leads E to lose reputation, which is reflected in the second stage of the game and, hence, on its payoff. Additionally, when deciding whether to lie or not, E is aware of F's payoffs.

Considering the decision rules established for the proactive game, for the first interaction, even though E prefers to induce the government into implementing policy x_2 by saying that $\theta = \theta_2$, if F chooses to signal that $\theta = \theta_1$, E prefers to tell the truth and guarantee some payoff. Therefore, if F tells the truth, E prefers to tell the truth. However, if F lies, E prefers to lie. Under this scenario, the only way E has to assure a payoff different from zero when it decides to lie on the first stage of the game is to make sure that F's message will also be a lie.

Now, consider F's decision: F must decide whether to reinforce or to counteract E's message. It is logical that F has incentives to always tell the truth in both stages of the game and E is aware of this fact. Again, when deciding whether to lie or not, F is informed about E's payoffs.

Before describing the equilibrium of the game, we shall state some relations between the expected payoffs.

If both E and F lie on the first stage of the game, the government implements policy x_2, which guarantees an increase in utility for E despite leaving F in a worse situation than it would be if the SQ were maintained. As discussed previously, once the government discovers that E lied, the second interaction will guarantee a null payoff for both groups, considering that E's message will not be credible enough to persuade the government to change the SQ. Under this scenario, the sum of the single-period payoff for both players is assumed to be a_6 for E while it is assumed to be b_6 for F. Logically, $b_6 < 0$, what confirms that the implementation of policy x_2 is a worse scenario for F than maintaining the SQ.

The situation in which E lies and F tells the truth on the first stage of the game leads the government to take no action (SQ) in both stages of the game. Under this scenario, the total payoff for both players would be zero.

If we consider that E decides to tell the truth and F to lie in the first stage, the government will take no action (SQ), in accordance with the previous scenario. However, considering that E chose not to lie, it earns reputation that assures the government will listen to its lobbying message when the second interaction takes place. Given that, if E and F choose the same message in the second interaction, the government will believe it. Logically, for E, the best situation would be if both groups decided to lie. If this is the case, we assume that E gets a payoff of a_5 while F gets b_5. However, we are aware that this would be a bad scenario for F. Hence, we expect that F tells the truth. We assume that if E and F tell the truth when the second interaction takes place, E gets a payoff of a_4 while F gets b_4. Evidently, $a_5 > a_4 > 0$ and $b_4 > 0 > b_5$. In fact, b_5 is the worst possible payoff for F since it represents a decrease in its utility associated with the fact that E assures reputation to persuade the government into starting a second interaction. This

means that $0 > b_6 > b_5$. In the opposite direction, if the groups send different messages, the SQ will be maintained for the second stage, guaranteeing a total null payoff for each player.

Finally, we shall analyze the situation when both E and F tell the truth in the first stage of the game and the government implements policy x_1, which yields utility for both groups. The utility F gets is higher than the utility granted for E. When the second interaction takes place, the government will believe in both signals and the SQ will be maintained only if the groups decide to send different messages. Under this situation, we assume that the sum of E's single-period payoff would be a_2 while F's would be b_2. Those values derive from the first stage of the game, considering that keeping the SQ for the second stage yields a null payoff for both players. On the other hand, in the case where the messages sent are equal, the government will implement policy x_3 if the messages are that $\theta = \theta_3$, which is the best scenario for F (policy x_1 implemented on the first stage and policy x_3 implemented on the second stage). We assume that this situation ensures a total payoff of b_1, F's highest possible payoff. For E, we assume that the payoff would be a_1. Since we assumed previously that policies x_1 and x_3 ensure some payoff for E, we can state that $a_1 > a_2 > 0$. Considering that both groups decide to lie in the second stage and the government implements policy x_4, E would get a_3 as total payoff and F would get b_3. In order to attend all the assumptions established so far, it is expected that $a_3 > a_1 > a_2$ and that $b_1 > b_2 > b_3$.

In order to establish the equilibrium, we must state additional comparison relations between the expected payoffs for E. We assume that $a_3 > a_6 > 0$ to illustrate that if E and F tell the truth on the first stage and then lie on the second stage, E will get a better payoff than it would if both of then lied on the first stage. More specifically, telling the truth enables E to start a new game in which the implementation of policy x_4 is a better scenario than the implementation of policy x_3; lying leads to the SQ in the second stage, which implies no increase of utility. For the same reason, we assume that $a_5 > a_6$. Finally, it is intuitive to assume that $a_1 > a_4 > 0$ since a_1 is associated with positive payoffs for the implementation of policy x_1 in the first stage and of policy x_3 in the second stage, while a_4 is associated with a positive payoff only for the implementation of action x_3 in the second stage.

Finally, given the relations between the expected payoffs, we obtain equilibria by using backwards induction. The extensive form of the proactive game is illustrated in Figure 2.

FIGURE 2. Tree of the sequential game
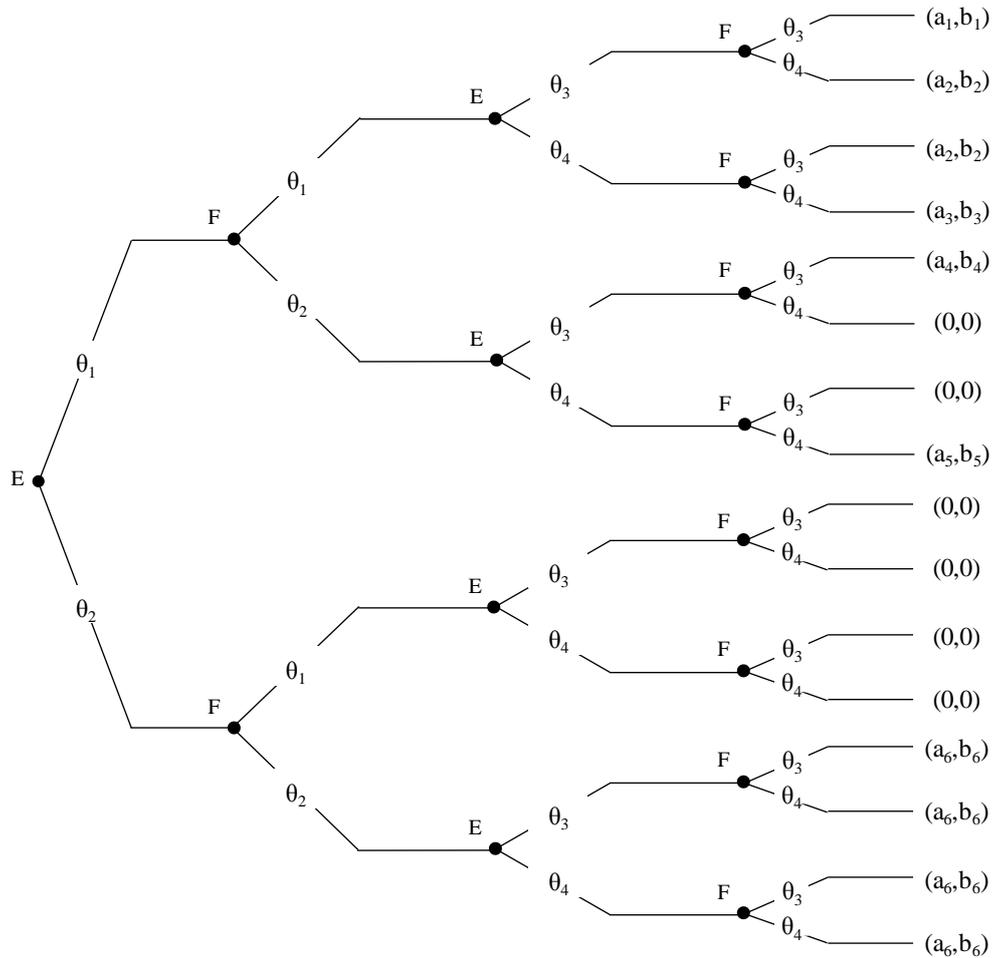
We begin the analysis by examining the final decision nodes of F, who has to choose whether or not to lie to the government in the second stage. At this point, F knows the whole story of the game. One way to narrow its choices is to observe what E chose in the first decision node (in the first stage of the game): if E tells the truth, F always tells the truth on the second stage ($b_1 > b_2 > b_3$ and $b_4 > 0 > b_5$), and, if E lies, F is indifferent between lying or telling the truth in the second stage of the game.

Now, move backward up the game tree to E's decision nodes in the second stage of the game. Again, we must observe E's choice at the first decision node and have in mind

that E is aware of F's incentives to tell the truth. If E tells the truth in the first stage, it always chooses to tell the truth in the second stage of the game ($a_1 > a_2$ and $a_4 > 0$). On the other hand, if E lies, it is indifferent between lying or telling the truth in the second stage of the game.

Again, moving backwards to the first set of decision nodes of F, we can see that this group always chooses to tell the truth independently of what E does in its first decision node ($b_1 > b_4$ and $0 > b_6$).

Finally, by analyzing the first decision node, we conclude that E chooses to tell the truth ($a_1 > 0$).

In conclusion, the subgame perfect equilibrium consists of both players telling the truth in order to induce government into implementing policy x_1 in the first stage and x_3 in the second stage of the game, which yields a payoff of a_1 for E and b_1 for F. This result yields a better payoff for both groups than remaining in the SQ.

6. REACTIVE LOBBYING

6.1. The Simultaneous-move Game

Our second scenario is reactive lobbying. In each stage of the game, the two interest groups E and F play imperfect information, simultaneous-move game. All aspects assumed for the construction of the sequential game apply to the simultaneous-move game. When this generalization fails, we will indicate it.

As described in Section 4, the two interest groups have conflicting preferences over two possible policies. This is reflected in the following assumptions, where $U^i(p)$, $p = x_1$, x_2, x_3, x_4 and $i =$ E, F denotes the utility that interest group i derives from p. In the reactive, the *status quo* is not a possibility given that the government necessarily implements a new public policy.

Assumption A1'. $U^E(x_2) > U^E(x_1)$ and $U^E(x_4) > U^E(x_3) > 0$.

Assumption A2'. $U^F(x_1) > U^F(x_2)$ and $U^F(x_3) > U^F(x_4) > 0$.

Additionally:

Assumption A3'. $U^F(x_1) > U^E(x_1)$ and $U^F(x_3) > U^E(x_3)$.

Assumption A4'. $U^F(x_2) < U^E(x_2)$ and $U^F(x_4) < U^E(x_4)$.

Assumptions A3' and A4' reflect the fact that the implementation of policy x_1 (x_3) yields more utility for F than for E. In the opposite direction, the implementation of policy x_2 (x_4) yields more utility for E than for F.

FIGURE 3. Sequence of decisions in the first stage of the reactive lobbying game
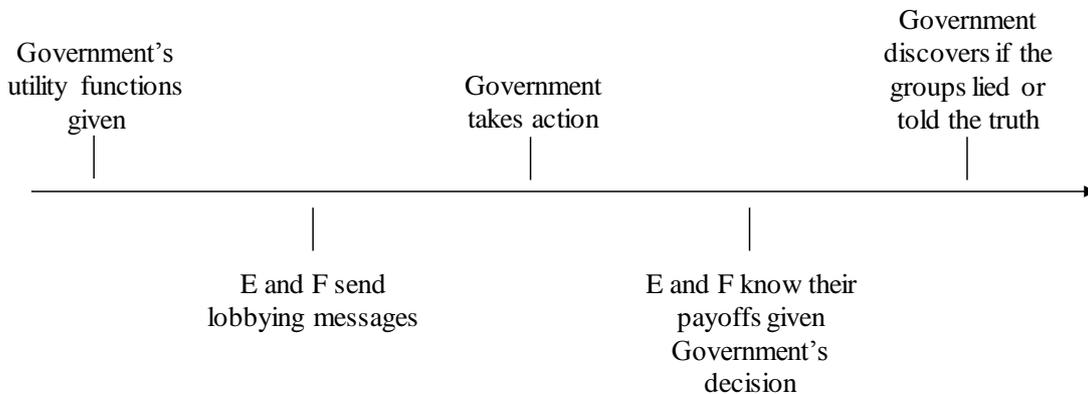
As mentioned in Section 4, we assume that groups know the true impact of each policy. Namely, policy x_1 is welfare superior to policy x_2 and policy x_3 is superior to x_4. Since the government is not aware of policies' welfare effects, the interest groups send messages that support one of the two possible policies in order to influence the government's action.

Given the concepts presented in Section 3 regarding the utilities of the government and the model presented in Sections 4 and 5, the following table lists all plausible actions taken by the interest groups and the government's decision for each combination of actions.

TABLE 3. Message profiles and corresponding outcomes for the reactive lobbying

Stage 1			Stage 2		
Behavior	Message (E, F)	Outcome	Behavior	Message (E, F)	Outcome
both tell the truth	θ_1, θ_1	x_1	both tell the truth	θ_3, θ_3	x_3
			E tells the truth, F lies	θ_3, θ_4	x_3
			E lies, F tells the truth	θ_4, θ_3	x_3
			both lie	θ_4, θ_4	x_4
E tells the truth, F lies	θ_1, θ_2	x_1	both tell the truth	θ_3, θ_3	x_3
			E tells the truth, F lies	θ_3, θ_4	x_3
			E lies, F tells the truth	θ_4, θ_3	x_3
			both lie	θ_4, θ_4	x_4
E lies, F tells the truth	θ_2, θ_1	x_1	both tell the truth	θ_3, θ_3	x_3
			E tells the truth, F lies	θ_3, θ_4	x_3
			E lies, F tells the truth	θ_4, θ_3	x_3
			both lie	θ_4, θ_4	x_4
both lie	θ_2, θ_2	x_2	both tell the truth	θ_3, θ_3	x_3
			E tells the truth, F lies	θ_3, θ_4	x_3
			E lies, F tells the truth	θ_4, θ_3	x_3
			both lie	θ_4, θ_4	x_3

6.2. Equilibrium

For the analysis of this two-stage game, we assume that the game has the payoffs as described in Table 4[7].

TABLE 4. Payoffs of the Two-Stage Simultaneous Game

Message (E, F, E, F); Outcomes	Expected Senders' payoff (E; F)
$\theta_1, \theta_1, \theta_3, \theta_3; x_1, x_3$	$c_1; d_1$
$\theta_1, \theta_1, \theta_3, \theta_4; x_1, x_3$	$c_2; d_2$
$\theta_1, \theta_1, \theta_4, \theta_3; x_1, x_3$	$c_3; d_3$
$\theta_1, \theta_1, \theta_4, \theta_4; x_1, x_4$	$c_4; d_4$
$\theta_1, \theta_2, \theta_3, \theta_3; x_1, x_3$	$c_5; d_5$
$\theta_1, \theta_2, \theta_3, \theta_4; x_1, x_3$	$c_6; d_6$
$\theta_1, \theta_2, \theta_4, \theta_3; x_1, x_3$	$c_7; d_7$
$\theta_1, \theta_2, \theta_4, \theta_4; x_1, x_4$	$c_8; d_8$
$\theta_2, \theta_1, \theta_3, \theta_3; x_1, x_3$	$c_9; d_9$
$\theta_2, \theta_1, \theta_3, \theta_4; x_1, x_3$	$c_9; d_9$
$\theta_2, \theta_1, \theta_4, \theta_3; x_1, x_3$	$c_9; d_9$
$\theta_2, \theta_1, \theta_4, \theta_4; x_1, x_4$	$c_{10}; d_{10}$
$\theta_2, \theta_2, \theta_3, \theta_3; x_2, x_3$	$c_{11}; d_{11}$
$\theta_2, \theta_2, \theta_3, \theta_4; x_2, x_3$	$c_{11}; d_{11}$
$\theta_2, \theta_2, \theta_4, \theta_3; x_2, x_3$	$c_{11}; d_{11}$
$\theta_2, \theta_2, \theta_4, \theta_4; x_2, x_3$	$c_{11}; d_{11}$

For the proactive model, we assumed that F could have negative payoffs. However, for the reactive model, this does not occur since both policies x_1 and x_2 (x_3 and x_4) lead to improvements in F's and E's utilities – unlike the proactive game, the reactive game has positive payoffs associated to the situations in which the groups send different lobbying messages.

Firstly, we consider E's decision: similar to the proactive game, E has to choose whether to lie or not to the government, aware that this choice impacts its reputation for the second stage of the game. However, under this scenario, E is aware of which policy the government is inclined to implement. Regarding F's decision, it is logical to suppose

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[7] Figure 4 below contains the tree of the simultaneous-move game.

that, knowing its preferences are similar to the government's, F has no incentive to misinform it.

Now we shall describe and analyze the relations between the payoffs associated with each action taken by E and by F in order to define the equilibrium of the game.

If both E and F lie on the first stage of the game, government implements policy x_2, which guarantees an increase in utility for E and F. In this case, E will gain a better payoff than F. As discussed previously, once the government discovers that both groups lied, it will act in accordance to its prior beliefs when the second stage of the game takes place. Even so, after the first stage is played, the government discovers that F has similar preferences. As such, even if the government doubts F due to the previous lie, a policy implemented in accordance with the government's prior beliefs improves F's payoff. Under this scenario, the sum of payoffs for the two periods is assumed to be c_{11} for E and d_{11} for F.

The situation in which E lies and F tells the truth in the first stage of the game leads the government to implement policy x_1. For the second stage of the game, the government implements action x_4 only if both groups decide to lie. In this case, the sum of payoffs for the two periods is assumed to be c_{10} for E and d_{10} for F. In every other situation, the government implements policy x_3. So, E gets a payoff of c_9 while F gets d_9. It is logical to note that it is expected that $c_{10} > c_9$, given that c_{10} is associated with the implementation of policy x_4, which is the policy preferred by E. This implies that $d_9 > d_{10}$. We also expect that $c_{11} > c_9$ and that $d_9 > d_{11}$ since c_{11} and d_{11} are related to the implementation of policy x_2 in the first stage of the game, while c_9 and d_9 are related to the implementation of x_1. For the same reason, $d_{10} > d_{11}$.

If we consider that E decides to tell the truth and F to lie in the first stage, the government implements policy x_1. In accordance with the previous scenario, for the second stage of the game, the government implements policy x_4 only if both players decide to lie. In this case, the sum of payoffs for the two periods is assumed to be c_8 for E and d_8 for F. In all other situations, the government implements x_3. We assume that if E and F tell the truth when the second interaction takes place, E gets a payoff of c_5, while F gets d_5; if E tells the truth and F lies in the second stage, E gets a payoff of c_6, while F

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gets d_6; and, if E lies and F tells the truth in the second stage, E gets a payoff of c_7, while F gets d_7. Evidently, $c_8 > c_7$ and $d_7 > d_8$, indicating that the implementation of x_4 in the second stage is preferred by E but not by F. In order to be consistent with all the assumptions and the rules defined for the construction of the payoffs, it is also expected that $c_6 \geq c_5$, since a lie of F in the second stage could ensure an incremental gain for E. In the opposite direction, we expect that $d_5 > d_6$, reinforcing that F has no incentive to lie. It is also relevant to verify that $c_7 > c_5$ since c_7 is related to possible incremental gains E may get by using its reputation in order to misinform the govern in the second stage. We let $c_7 \geq c_6$ for the same reason, the difference between both payoffs is that when E uses it reputation to lie in the second stage it can guide the government's decision more easily than when it is F who lies. Contrary to relations defined for E's payoffs, we expect that $d_5 > d_7$ and $d_6 \geq d_7$.

Finally, we shall analyze the situation in which both E and F tell the truth in the first stage of the game. Again, the government implements x_4 in the second stage only if both players decide to lie. Here, we assume that the sum of payoffs for the two periods of the game is c_4 for E and d_4 for F. We assume that if E and F tell the truth when the second interaction takes place, E gets a payoff of c_1, while F gets d_1. It is evident that d_1 is the best expect payoff for F given that it refers to the case in which both players tell the truth in the two stages and policies x_1 and x_4 are implemented. In addition, it is expected that $c_5 \geq c_1$ given that c_5 is associated with a lie of F in the first stage, which gives E an advantage in influencing the decision-maker. Now, considering that E tells the truth and F lies in the second stage, E gets a payoff of c_2, while F gets d_2; and, if E lies and F tells the truth in the second stage, E gets a payoff of c_3, while F gets d_3. Given the explanation in the previous paragraph regarding the incremental gains, it is easy to note that $c_4 > c_3 \geq c_2 > c_1$ and that $d_1 > d_2 \geq d_3 > d_4$.

In order to determine the equilibrium, we must state additional comparison relations between the expected payoffs for the players. Regarding F, we expect $d_3 > d_7$ given that both payoffs are related to the implementation of policy x_1 in the first stage of the game, but d_3 refers to a situation in which F lies and loses reputation. Regarding E, it is clear that c_8 is the best possible payoff the player could get: policy x_1 is implemented in the first stage and E gains reputation that allows him to influence the government into

implementing policy x_4 in the second stage of the game. Its second-best payoff is c_{11}, related to the implementation of policy x_2 in the first stage at the expense of its reputation and the implementation of policy x_3 in the second stage of the game. Finally, we expect that $c_3 > c_9$. Even though both payoffs refer to the implementation of policies x_1 and x_3, c_9 is related to a lie of E in the first stage, which leads the group to lose reputation for the second stage.

Given the relations between the expected payoffs, we determine the equilibria associated with this game using backwards induction. The extensive form of the reactive game is illustrated in Figure 4.

FIGURE 4. Tree of the simultaneous game
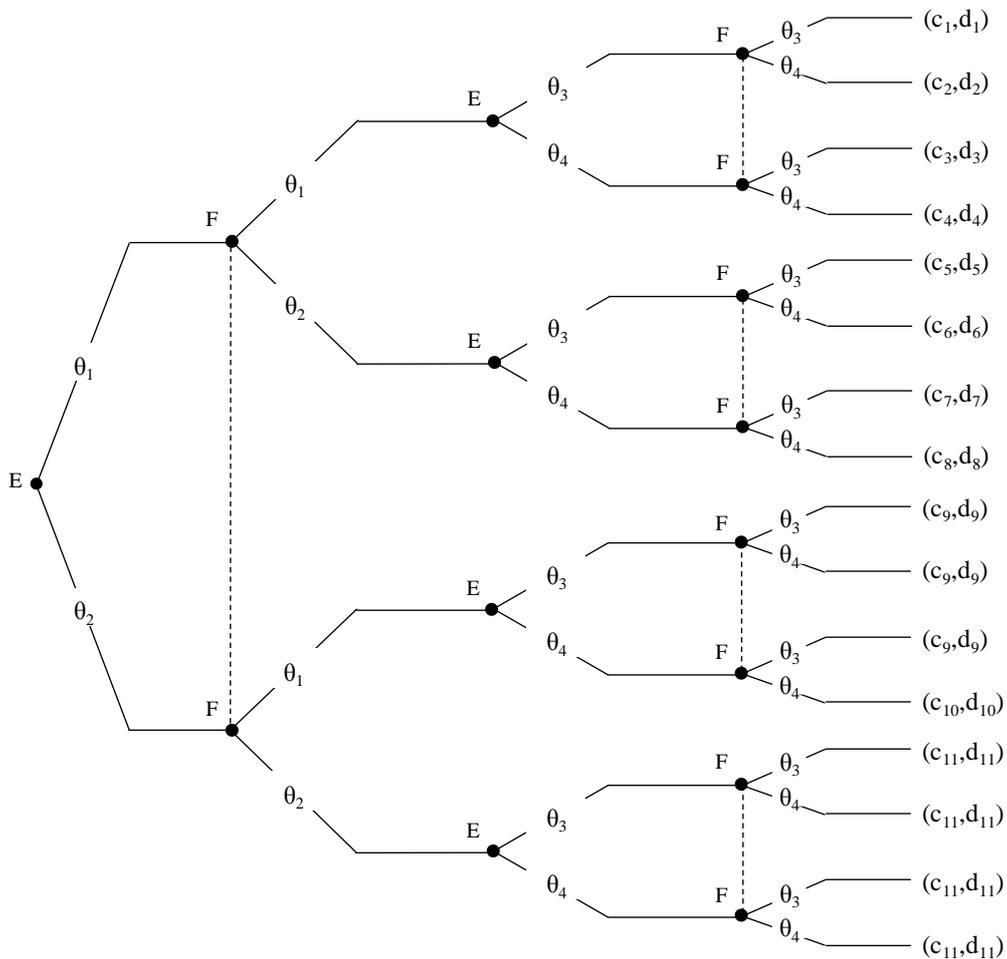
We begin the analysis by examining the final decision nodes of F, who has to choose whether or not to lie to the decision-maker without knowing from which node it will make

its decision. One way to narrow its choices is to observe what E chose in the first decision node. If E tells the truth in the first stage of the game, F always tells the truth in the second stage ($d_1 > d_2$ and $d_3 > d_4$ and $d_5 > d_6$ and $d_7 > d_8$). However, if E lies in the first stage, F makes different choices at different decision nodes. For this reason, we must move forward and observe F's action in the second level of decision nodes: if it reports a lie, F is indifferent between lying or telling the truth in the last decision nodes of the game; if it reports the truth, F chooses to tell the truth in its last decision node if E decides to lie again ($d_9 > d_{10}$) and F is indifferent between lying or telling the truth if E chooses to tell the truth in the third level of decision nodes of the game.

Now, move backwards to E's decision node in the second stage of the game. Again, we must observe E's choice in the first decision node and have in mind that E is aware of F's payoffs. If E tells the truth in the first stage, it always chooses to lie in the second stage of the game ($c_3 > c_1$ and $c_7 > c_5$). On the other hand, if E lies, it makes different choices in different decision nodes. So, we must move forward and observe F's action in the second decision node: if it reports a lie, E is indifferent between lying or telling the truth in the third decision node of the game; if it reports the truth, E chooses to lie ($c_{10} > c_9$).

Again, moving backwards to the first decision node of F we can see that the group always chooses to tell the truth independently of what E does in its first decision node ($d_3 > d_7$ and $d_{10} > d_{11}$).

Finally, by analyzing the first decision node, we conclude that E will choose to tell the truth ($c_3 > c_9$).

Given that the players maximize the sum of payoffs obtained in the two periods, we conclude that the equilibrium consists of F telling the truth in both stages of the game and E telling the truth in the first stage, but lying in the second stage of the game. This yields a payoff of c_3 for E and d_3 for F.

7. CONCLUSIONS

This research is concerned with the extent that private interest groups can consider the preferences of other agents when lobbying. In the real world, there are many interest groups, decision-makers, and sources of uncertainty. The model presented here is parsimonious in the extreme in these respects. For this reason, the results must be interpreted cautiously. Nevertheless, they are suggestive: interest groups do lobby decision-makers with similar utility functions; lobbying messages may be informative even if there is a partial conflict of interest; and, groups do invest in reputation when interacting with the decision-maker.

From the analysis, it appears that several aspects are crucial for persuading the decision-maker into changing its beliefs: (a) the credibility of the group that sends a lobbying message; (b) the decision-maker's willingness to change its prior beliefs; and, (c) the impact on other electors.

We have seen that the implementation of one policy rather than another cannot be explained solely in terms of group forces. This research points into the direction that groups are not merely service providers for decision-makers: groups do attempt to change decision-makers' beliefs in their favor and they do compete with one another for influence.

In this sense, we build two scenarios for the game-theoretical lobbying model. For the proactive scenario, we conclude that both groups have no incentive to misinform the decision-maker. For the reactive scenario, we conclude that the group with partial conflict of interests with the decision-maker has incentives to build a reputation by providing accurate information in order to take advantages in the future. However, in both scenarios, the group we call "enemy" is aware that the decision-maker interacts with another agent, the "friend": the decision-maker receives different lobbying messages, which may be contradictory, and this situation is an incentive for both groups not to present biased information (one group may end up denying information from another group). Additionally, given that the decision-maker wants to assure political support, the "enemy" group concludes its chance of success is higher when it considers the preferences of its rival group, "friend", when sending a lobbying message. For this reason, we can state that private interest groups may consider the preferences of other agents, even if it is with the

purpose of improving its own utility. This conclusion is similar to Peltzman's (1976) – communicating good information and defending a claim with other agents leads to an increased chance of success.

In the model presented we have assumed that both interest groups assume the position of "enemy" or "friend" statically. However, in real world situations, an interest groups might be a "friend" of the decision-maker for one specific issue and an "enemy" for another. This situation makes it more difficult for the decision-maker to decide whether to trust or not its interlocutor. For the purpose of this research we have disregarded the cost of sending lobbying messages and the possibility of interest groups not to send lobbying messages. Additionally, when analyzing lobbying in regulated sectors, we should consider that regulators are independent of the government and, therefore, they are not reelection seekers.

Considering that the relationship between lobbyists and decision-makers is not one way, it would be interesting to understand the role of the decision-maker into influencing interest groups to always report truthful information. Additionally, an interesting exercise would be to model the behavior of rival interest groups competing with unorganized voters. All this is left for future work.

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