AN ENDOGENOUS POLICY MODEL
OF HIERARCHICAL GOVERNMENT†

Isidoro Mazza* and Frans van Winden**

* University of Catania, Department of Economics and Quantitative Methods, c.so Italia 55, 95129 Catania, Italy. E-mail: imazza@mbox.unict.it

** University of Amsterdam, CREED and Tinbergen Institute. Address: Faculty of Economics and Econometrics, Roetersstraat 11, 1018 WB Amsterdam, The Netherlands. E-mail: F.A.A.M.vanWinden@uva.nl

ABSTRACT

Endogenous policy models usually neglect that government policies are frequently the result of decisions taken at different tiers by different agents, each enjoying some degree of autonomy. In this paper, policies are the outcome of the choices made by two agents within a hierarchy. A legislator decides on the budget to be successively spent by a bureaucrat. Both agents are lobbied by one or two interest groups. The combination of sequential decisionmaking and lobbying implies that the interaction between the agent at one tier and the interest group(s) depends on the exchange between the same interest group(s) and the agent at the other tier. Our results concerning multi-tier lobbying and legislatorial oversight substantially qualify the conventional wisdom related to one-tier lobbying. In particular, the reaction of the legislator to lobbying at the bureaucratic tier may make lobbying wasteful even when there is no competition from other lobbies. Moreover, the legislator benefits from lobbying only when there is competition between interest groups at the upper tier. It is also shown that competition for influence at the bureaucratic tier may work as a perfect substitute for legislatorial oversight. Extensions of the model indicate its usefulness for the analysis of decisionmaking in other multilevel governance structures, like federations or firms. (JEL: D72, D73, D78, H39, H77).

Keywords: Multi-tier lobbying, endogenous policymaking, hierarchy, multilevel government, bureaucracy, fiscal federalism.

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1. INTRODUCTION

The theory of endogenous policy describes how self-interested agents influence government policies. Similarly, rent-seeking models describe how resources are expended by interest groups in the same quest for political favors.¹ Other models combine endogenous policy with rent-seeking outlays or focus on the use of campaign contributions to influence policy.² These different perspectives on interest groups and endogenous policy have in common that, in general, a single policymaker or level of government is portrayed as subject to influence. This assumption contrasts with the general observation that government is often organized in different levels of more or less autonomous decisionmaking. Think, for example, of a legislature and a bureaucracy, of central and local governments, or of a president and a parliament in a presidential democracy. A policy is in fact shaped by the different decisions taken at different political and/or administrative tiers. This offers multiple opportunities to interest groups to affect political decisionmaking. Also, efforts to influence a particular tier may depend on a lobby’s ability to affect decisionmaking at another tier.³ Moreover, competition among lobbies is not restricted to one tier but may extend across different tiers. Therefore, lobbying is a more complex activity than it is usually investigated. According to Richardson (1993, p.4): “pressure groups take account of (and exploit) the multiplicity of access points which is so characteristic of the American system of government – the presidency, the bureaucracy, both houses of Congress, the powerful congressional committees, the judiciary and state and local government”.

³ Multi-tiered lobbying investigated here differs from the case where interest groups try to influence more policymakers acting at a single decision stage, as e.g. in Groseclose and Snyder (1996).
In principle, the existence of multiple opportunities to influence decisionmaking need not be as advantageous for an interest group as it may seem at first sight. For example, a multi-tier process of decisionmaking could increase lobbying expenditures because a group might need to influence more agents in order to obtain a favorable policy. The outcome of lobbying is also more difficult to predict. Lobbying a policymaker may trigger responses by decisionmakers at other tiers whose behavior cannot be completely controlled through the policymaker that is lobbied.

This study aims at shedding some light on these and other related issues concerning multi-tier lobbying which involve strategic problems that interest groups commonly face in the presence of a divided government. We present a political economic model where policy discretion exists at two government levels. At the higher level, a legislator (‘L’) decides on the size of the tax revenue needed to finance two public goods, each of which is consumed by a different group of people. L is interested in the welfare of the different groups - as such, or for future electoral support – as well as in the contributions they can offer (in an attempt to influence L's decisions). Moreover, L has distinct preferences concerning the allocation of the budget across the public goods, but this is effectively decided at a lower level, by a bureaucrat (‘B’).\footnote{It is beyond the scope of this paper to investigate the reasons for the delegation of decision power to the bureaucrat. We only observe that, in reality, delegation is very common and can be justified in numerous ways such as: lack of expertise, reduction of implementation time, shift of responsibility, or to prevent time inconsistency problems concerning policy announcements of the legislator.} B can only disregard the preferences of L at a personal cost, for example, in terms of career prospects or loyalty. However, B may be compensated by contributions offered by the groups to affect the budget allocation. The realism of this setting is exemplified by the fact that legislators often decide on the budget for a particular policy program (such as defense, health care, education or agricultural subsidies), while bureaucrats have some discretionary power regarding the allocation of the budget within the program (e.g., the location of defense facilities, hospitals or schools, or the designation of the crops...}
for which agricultural subsidies are available). For simplicity, the hierarchical relationship between L and B is investigated in a reduced form, through the weight that B attaches to L’s objective. Lobbying is formalized using the menu-auction model of Bernheim and Whinston (1986). Their common agency model has been applied in many political economic studies [see e.g. Grossman and Helpman (2001, 2002)]. We contribute to this literature by focusing on sequential decisionmaking by different agents.

The main implication of introducing a sequence of decisionmaking and lobbying is that the interaction between L and the interest group(s) depends on the exchange between the same interest group(s) and B. The hierarchical link between the two decisionmakers can trigger strategic actions by the superior L to avoid lobbying at B’s level and/or to redirect lobbying expenditures towards L’s tier. It will be shown that these reactions make the impact of lobbying – for policymakers as well as interest groups – more ambiguous than in the traditional influence model of a unitary government. This ambiguity qualifies some conventional wisdom about lobbying and highlights the problematic nature of limiting the investigation of influence activities to a single decisionmaking level, if groups have in fact access to multiple tiers.

First, suppose that only one group is able to lobby. A standard tenet in the literature says that the policymaker cannot lose from lobbying, otherwise he/she would not accept it, while the monopsonist interest group benefits. However, our model shows that strikingly different results can be obtained once one allows for multi-tier lobbying. In fact, L is found to be worse off with lobbying than without. The reason is the cost for the interest group to lobby B. Nonetheless, L has an incentive to give access to lobbying provided that lobbying cannot be effectively excluded at B’s tier. Moreover two-tier lobbying can even become counterproductive for the interest group.

5 The latter goal is typically neglected in studies of bureaucratic capture by excluding the possibility that also the legislator is subject to lobbying [see Laffont and Tirole (1993)].
The intuition for this surprising result that the reaction of L to the capture of B leads to such a reduction of the stakes for the lobby - even with respect to the outcome under no lobbying at any stage – that it cannot be reverted by lobbying at L’s tier.

Another major finding concerns the case where all groups are organized. Competitive lobbying at the lower tier turns out to be a substitute for legislatorial control over bureaucracy. In fact, since lobbying follows the preferences of the groups, L’s authority cannot produce any policy improvement to the groups. However, an increase in the control of L over B does reduce the contributions transferred by the lobbies to B. Moreover, imperfect control does affect the budget, which is used by L as a second-best instrument of influence. So we find that an increase in the influence of a group at B’s tier can nonetheless have a negative impact on the amount of the public good that the group lobbies for, because of a cut in B’s budget.

The analysis presented here is related to different lines of research. Previous studies of multi-stage lobbying differ from the present one in that they do not offer a comprehensive analysis in terms of endogenous policy and lobbying expenditures. Hillman and Katz (1987), Katz and Tokatlidou (1996) and Gradstein and Konrad (1999) concentrate on rent dissipation in hierarchies of rent-seeking contests. Hoyt and Toma (1989) focus on the choice of groups of residents in allocating lobbying efforts between local and central policymakers, but they do not investigate the influence that lobbying at one level has on the policy decisions taken at the other level. Austen-Smith (1993) presents a model where one interest group can influence the decisionmaking of two legislative bodies (a committee and the House) via strategic information transmission. In his model lobbying expenditures are taken as given [see also Sloof (2000)].

This paper also relates to the growing literature on the separation of political powers, seen as a system to improve political accountability [Persson et al. (1997), Alesina and Rosenthal (1996,
This literature has so far paid little attention to the consequences of the separation of powers on lobbying and, vice versa, on the effects that lobbying may have on the policy outcome of a divided government.

More closely related is the recent work of Epstein and Nitzan (2002). They present a two-tier policymaking process where two groups, representing all the relevant interests in society, invest resources to support the approval or rejection of a proposal introducing a rent. In Epstein and Nitzan (2002) the proposal is made by a bureaucrat who takes into account the rent-seeking targeted at the legislator in view of the hierarchical relationship with the latter. The authors find that an increase in the politicization of the government (a larger weight given by the bureaucrat to lobbying expenditures) may actually improve the net welfare of the interest groups, through a higher gross expected welfare that more than compensates the larger lobbying contributions. Our study represents a generalization of that analysis, by adding a separate tier of lobbying activities directed at B. Therefore, the concept of politicization becomes more complex as it depends on the (relative) importance of lobbying transfers for each agent and the hierarchical influence of L on B. In this context, we show that a larger interest of B in the contributions received by L has a positive impact on the net welfare of the groups by reducing the cost of lobbying B. Finally, Epstein and Nitzan (2005) present a rent-seeking model where the policymakers act as principals of the lobbies, instead of the other way around as in menu-auctions models like ours. They show that this different assumption may lead to more extreme outcomes than those derived with policymakers being common agents. In our paper, the tendency of a policymaker to compromise may instead be hindered by the existence of lobbying at another decisional tier.

The paper is organized as follows. The basic model is introduced in section 2. Section 3 presents the equilibrium analysis and some comparative-statics results concerning the cases where
either one or two groups lobby the policymakers. This section also addresses the issue of legislatorial control. Section 4 concludes.

2. THE MODEL

Consider an economy where individuals are divided into two groups, of size $n_1$ and $n_2$. The members of each group derive utility (welfare) from disposable income and the consumption of a group-specific pure public good $G_i$ financed by a tax $t$ on gross income $y_i$: $\text{6} \quad u_i = (1-t)y_i + h_i(G_i)$ for $i=1,2$. The function $h_i$ is continuous and has a positive first-order and a negative second-order derivative, with $\lim_{G_i \to 0} \frac{dh_i}{dG_i} = \infty$ and $\lim_{G_i \to \infty} \frac{dh_i}{dG_i} = 0$. The supply of the public goods results from the policy choices made by two public agents, a legislator $L$ and a bureaucrat $B$, at different decisionmaking levels. $L$ chooses $t$ while $B$ determines the share $s$ ($1-s$) of the resulting tax revenue $R \equiv t \sum y_i = tY$ to be allocated for the production of $G_1$ ($G_2$). Public goods are produced through a linear transformation function: $G_1 = sR$ and $G_2 = (1-s)R$.

An organized interest group $i$ may decide to influence the decisionmaking of the public agents by submitting a ‘menu’ of policy contingent contributions, that is, a schedule $C_i(t)$ mapping every feasible tax rate into a contribution to $L$ and a schedule $E_i(s)$ of allocation contingent contributions to $B$. Contributions can be generally interpreted as something which is beneficial for the receiver and costly for the donor. $\text{7}$ Including lobbying expenditure in the individual utility

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$\text{6}$ Rents with group-specific public good characteristics are rather common in reality. Think of those resulting from regulation protecting the interests of groups of producers or consumers, or from the provision of local services [see Persson and Tabellini (2002)].

$\text{7}$ For example, favorable policies can be (implicitly) exchanged for future employment (‘revolving doors’), in-
function, and aggregating over the group members (defining $U_i \equiv n_i u_i$), we obtain the following net welfare function for group $i$:

$$V_i = U_i(s,t) - C_i(t) - E_i(s) \quad i = 1,2$$  \hspace{1cm} (1)$$

Regarding the objective functions of the decisionmakers, we assume that $L$ is interested both in contributions from the groups and in social welfare. Groups may differ in their ability of lobbying and in terms of their political relevance (think of future elections, for example). This leads to the following objective function, taken to be maximized over $t \in T = [0,1]$:  

$$P_L = \sum i l_i C_i(t) + l \sum i \theta_i V_i(s,t) \quad l_i, \theta_i, l > 0$$  \hspace{1cm} (2)$$

where $l_i$ reflects the ‘shadow price’ of lobbying $L$ faced by group $i$ [Hillman and Riley (1989)], while $l$ indicates the preference of $L$ for (weighted) social welfare relative to contributions, and $\theta_i$ denotes the political weight of group $i$. This weight can be the outcome of electoral competition, as in Coughlin et al. (1990) or Grossman and Helpman (1996). Lobbying requires a net benefit to $L$ of $(l_i l \theta_i) C_i \geq 0$, that is, the shadow price of lobbying should be sufficiently low ($l_i$ sufficiently high) compared to $L$’s interest in the group's welfare.

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kind services (e.g. ‘wining and dining’, perks, free rented cars, holidays, etc.), volunteer labor, or even plain bribes. Politicians, and occasionally bureaucrats, can also use contributions for funding political campaign, staff and/or party expenditures. For evidence on contributions affecting legislative decisions, see Potters and Sloof (1996). See also Baldwin and Magee (2000), Goldberg and Maggi (1999). The number of groups able to overcome collective action problems and become organized is exogenously determined.

$^8$ We assume that $L$ cares for the net welfare of the groups, for one thing because it seems rather intuitive to believe that the legislator would consider lobbying expenditures, in a complete information framework. A similar approach, of including net instead of gross utility in the social welfare aggregation, is adopted by Coate (2004), Epstein and Nitzan (2002), Lohmann (1998), and Rama and Tabellini (1998).

$^9$ Le Breton and Salanie (2003) introduce uncertainty about $l$. 
As for the bureaucrat B, we assume that the reality of highly incomplete contracts in the public sector leaves some room for opportunistic behavior, such as exchanges with lobbies. On the other hand, L’s objective is taken as a political constraint for B’s behavior [as in Epstein and Nitzan (2002)]. This may be related to bureaucratic loyalty, political affiliation or career concerns [see Peacock (1994)]. Formally, B chooses \( s \in S = [0,1] \) in order to maximize:

\[
P_B = \sum b_i E_i(s) + bP_L(s, t) \quad b_i, b > 0
\]

(3)

where \( b_i \) reflects the shadow price of lobbying B, \( b \) indicates the weight that B attaches to the objective of L or, put differently, the degree of (indirect) control of L over B. From (2) and (3) it follows that a group is only able to lobby B if \( b_i > b_i l_i \). One interpretation of (3), related to career concerns, is that \( E_i \) represents future earnings in the private sector (discounted by \( b_i \)) which are traded off against future earnings in the public sector (determined by \( P_L \), discounted by \( b \)). Of course, B may have an independent interest in social welfare. For simplicity it is assumed that (2) and (3) are common knowledge to L and B.

The sequence of events is as follows. Firstly, at the higher decisionmaking level, an interest group \( i (i=1,2) \) independently decides whether to lobby L with a contribution schedule \( C_i(t) \). Secondly, L chooses a tax rate maximizing (2) and obtains the corresponding monetary (equivalent) reward \( l_i C_i \geq 0 \) from the group. Then, the same group \( i \) decides whether to lobby B, offering a policy contingent schedule \( E_i(s) \). Finally, B chooses a budget allocation maximizing (3) and receives in return \( b_i E_i \geq 0 \).\(^{10}\) Note that if \( l_i < 1 \) or \( b_i < 1 \), lobbying implies a social cost. Furthermore, redistribution takes place both at B’s level (where it is a zero-sum game) and at L’s

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\(^{10}\) Common agency models of lobbying assume that policies and schedules are adhered to.
level (where the size of the public budget is chosen). The assumption that interest groups lobby the policymakers in succession reflects the typical budgetary process in public finance which is often separated into two main stages, with the determination of the budget being temporally and institutionally distinct from its allocation [see also Ferejohn and Krehbiel (1987)]. In addition, policymaking across governmental tiers is characterized by incomplete contracts. As a consequence, an interest group cannot simply restrict itself to lobbying the legislator to effectuate both a budget and an allocation.

For reference in the next section it is helpful to indicate the policies \((s^n, t^n)\) that result when lobbying is not possible. Solving backwards, the allocation \(s^n\) selected by B and the tax rate \(t^n\) selected by L are implicitly determined by \(\sum \theta_i U_i(s^n; t^n) = 0\) and \(\sum \theta_i U_i(t^n) = 0\), where the subscripts \(s\) and \(t\) denote partial derivatives.\(^{11}\)

### 3. TWO-TIER LOBBYING

In this section we analyze the cases where either only one group or both groups lobby at the two tiers of decisionmaking. The game is solved by backward induction, starting at the lower tier. To save space, the details of proofs are relegated to the Appendix.

**3.1. Monopsonistic lobbying**

\(^{11}\) The second-order condition for \(s^n\) is guaranteed by concavity. A sufficient condition for the optimality of \(t^n\) is that \(s^n + t^n (ds^n/dt)\) is sufficiently close to 1.
Suppose, first, that group 2, say, is unable to lobby because of a lack of organization or political access, implying \( C_2 = 0 \) and \( E_2 = 0 \) in (2) and (3), respectively. One could think of ‘particularistic’ policies that benefit only one lobby while the costs are so widely spread among the population that they do not elicit any opposition [see Baron (1994)]. This situation portrays a problem of direct control, in the sense that the lobby could implement, at each stage separately, any desired policy as long as it satisfies a participation constraint for the decisionmaker who should not be better off by refusing the offer made by the lobby [see Grossman and Helpman (1996)]. A subgame-perfect equilibrium entails at the lower tier a policy-contribution pair \((s^l_1, E^l_1)\) such that the interest group equates at the margin the cost of its contribution to the benefit of the policy change it induces, while the policy selected by \( B \) maximizes \( P_B \) given the contribution schedule offered by the lobby. It is easy to see that, for any given \( t \) and \( C_i \), the equilibrium policy \( s^l \) is implicitly determined by: \(^{12}\)

\[
b_1 U_{1d}(s^l_1) + b l \theta_2 U_{2d}(s^l_1) = 0
\]

(4)

The contribution \( E^l_1 \) corresponds to the minimum amount needed to induce \( s^l \) instead of the alternative \( s^o \) that would be optimal for \( B \) without any lobbying. This implies that \( P_B(s^l_1, E^l_1) = b[l \Sigma \theta_i U_i(s^o) + (l - l \theta_i) C_i] \) and thus, using (3):

\[
E^l_1 = \left[ 1/(b_1 - b l \theta_i) \right] b l \Sigma \theta_i [U_i(s^o) - U_i(s^l_1)]
\]

(5)

\(^{12}\)The policy \( s^l \) selected in equilibrium maximizes the joint welfare of the lobby and \( B \). Suppose in fact that \( B \) selects a policy \( s^o \) that does not maximize this joint welfare, and thus: \( P_B(s^o) + V_i(s^o) < P_B(s^l) + V_i(s^l) \), for some \( s^l \). Since \( V_i(s^l) - V_i(s^o) > P_B(s^o) - P_B(s^l) \) the lobby could then rearrange its schedule in a way that makes it profitable for \( B \) to choose \( s^l \) instead of \( s^o \) and leave the lobby with a higher welfare.
Eq. (4) shows that lobbying leads to the maximization of a weighted gross ‘political welfare function’ with the weight $b_1$ attached to the welfare of the lobbying group being larger than the weight $bl \theta_1$ its welfare would receive in case of no lobbying [see below (3)]. Consequently, and given the strict concavity of the utility function, lobbying improves its budget share ($1 > s^l > s^n > 0$). Moreover, from the definitions of $s^l$ and $s^n$ it follows that $E_i^l > 0$ and $[U_i(s^l) - E_i^l] - U_i(s^n) = [1/(b_1 - bl \theta_1)]\{b_1[U_i(s^l) - U_i(s^n)] + bl \theta_2[U_2(s^l) - U_2(s^n)]\} > 0$, showing that the interest group has an incentive to lobby B (for any $t$ and $C_j$ at the upper tier).

Solving next the game at the upper tier, taking $s^l$ and $E_i^l$ into account, L’s optimal policy $t^l$ is implicitly determined by:

$$l_1[U_1(t^l) - E_i^l(t^l)] + l_2U_2(t^l) = 0$$

(6)

Now, the lobby pays a contribution $C_j^l$ that leaves L indifferent between $t^l$ and the tax rate $t^n$ that would be optimal for L under no lobbying at L’s tier (but just at B’s tier). This implies that $P_L(s^l, t^l) = l\{\sum i \theta_i U_i(s^l, t) - \theta_1 E_i^l(t)\}$ for $i = 1, 2$, and thus, using (2):

$$C_j^l = [l/(l_1 - l_2)]\{l_1\theta_i[U_i(s^l, t^n) - E_i^l(t^n) + E_i^l(t^l)] + \theta_2[U_2(s^l, t^n) - U_2(s^l, t^l)]\}$$

(7)

From the definition of $t^n$ and $t^l$ it follows that $C_j^l > 0$ and $U_i(t^l) - E_i^l(t^l) - C_j^l > U_i(t^n) - E_i^l(t^n)$. Group 1 will not lose from lobbying L if also lobbies B. Equations (5) and (7) imply that, at each

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13 To reduce notation, from now on, we adopt the convention that $U_i(s^w(t), t) \equiv U_i(s^w, t) (i = 1, 2; w = l, n)$, $E_i^l(s^l(t), s^l(t), t) \equiv E_i^l(t)$ and $P_i(s^l, t, E_i^l(t), C_j^l) \equiv P_i(s^l, t^l)$.

14 Then, $t^n = \text{argmax}_{\in \mathbb{T}} \sum j \theta_j U_j(s^n, t) - \theta_1 E_i^l(t)$; to be distinguished from $t^n$ derived with $E_i = 0$ and allocation $s^n$.

15 Strict inequalities hold if $t^l \neq t^n$, which obtains unless $U_i(s^l, t) - E_i^l(t)$ happens to be maximized at $t^l$. 

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single tier, monopsonistic lobbying causes a ‘full capture’ of the respective policymaker by the interest group. It seizes the whole surplus generated by its influence, at the expenses of the unorganized group. However, the appraisal of the total impact of lobbying calls for a welfare comparison of lobbying versus no lobbying at both tiers, as presented in the following proposition.

**PROPOSITION 1.** Compared with the outcome obtained in the absence of lobbying, the impact of monopsonistic lobbying at both tiers is that: (i) L’s welfare decreases; (ii) B’s welfare may increase or decrease; (iii) the lobby’s welfare may increase or decrease; (iv) the unorganized group’s welfare may increase if the lobby’s welfare decreases, but decreases otherwise.

In contrast to the conventional wisdom, lobbying may be harmful to both policymakers. This is due to the way that lobbying contributions are determined at each tier. Although each decisionmaker is (just) compensated for giving in to the lobby, the fall-back outcome is changed by lobbying at the other tier. L can never gain from lobbying at the lower tier because both the contribution paid to B and the policy change it induces represent a net loss. In contrast, the effect of lobbying at the higher level on the welfare of B can be positive or negative, depending on its effect on the tax rate and the sign of the impact of the tax rate on the contribution $E_1$ paid to B.\(^\text{16}\)

Remarkably, the proposition further shows that an interest group may not benefit from its lobbying activity, even though it is the only one to lobby. The intuition is that the policy outcome depends on the choices made by two different agents, in a divided government, that are sequentially lobbied (two-tier lobbying). Because of the separation of powers and incompleteness

\(^\text{16}\) The outcome that a decisionmaker (here, B) may benefit from the capture of another decisionmaker, at a different tier, differs from previous results in the literature [e.g. Hillman and Katz (1987), Spiller (1990)] based on the assumption that a superior can simply seize part of the contributions received by a subordinate.
of contracts, the reaction of L to the lobbying of B is directed at reducing the stakes for lobbying at that tier by cutting the budget $R$. As a consequence, L’s policy choice may produce an overall outcome that is worse for the interest group than the outcome obtained without lobbying at all, while the latter outcome may now be too costly to induce through a contribution to L. Note that this result holds even though the interest group’s contribution $C_i$ to L takes into account the cost $E_i$ of lobbying B as well as the latter’s budget allocation [cf. (7)]. The problem is that the interest group cannot credibly commit to refrain from lobbying B. As we have seen above, lobbying is always profitable for the group when the second decisionmaking stage arrives. Therefore, the opportunity of sequential lobbying may be detrimental to the interest group.\footnote{If the interest group could commit not to lobby the bureaucrat B or if the legislator L’s control over bureaucracy were perfect, it can be shown that lobbying L is never detrimental. In the latter case, the interest group could simultaneously condition the contribution to L on the policies of L and B. However, incompleteness of contracts and lack of verifiability of information (like about lobbying) appear to be highly characteristic of the public sector, particularly across the legislation-bureaucracy divide.} Technically, this result is derived for $s'$ very close to $s''$ such that the change in the allocation of the budget is dominated by the change in its size (from $t''$ to $t'$). An additional outcome is that the reaction of L may actually compensate the unorganized group for the interest group’s lobbying (and may even make it better off), in some special cases.\footnote{As when the group 1 contributes for the most part to the budget and the allocation for group 2 is very small, also in the absence of lobbying. In this case the marginal decrease in the allocation for group 2, due to lobbying of group 1, can be compensated by the change in the tax rate.}

3.2. Competitive lobbying

In the competitive lobbying case, both groups lobby the decisionmakers in a non-cooperative fashion.\footnote{In the sequel, we assume ‘(globally) truthful strategies’ for the lobbies to avoid multiple solutions for the contribution schedules. This assumption, which is commonly made in menu-auction models, implies that the equilibrium contribution schedules reveal the willingness to pay for any policy (not just the equilibrium} In equilibrium, group $i$ ($i = 1,2$) offers contributions $E_i$ and $C_i$ which just compensate B
and L, respectively, for moving away from the policy that would be optimal if the group considered (i) would not lobby. Similar to the previous case, the equilibrium policies $s^*$ and $t^*$ are optimal for the respective policymaker and each interest group. Moreover, they entail again the implicit maximization of a weighted gross political welfare function, now through the following first-order conditions:

$$
\sum b_i U_i(s^*;t^*) = 0 \quad \text{and} \quad \sum l_i [U_i(t^*) - E_i^*(t^*)] = 0 \quad i = 1, 2
$$

(8)

Competitive lobbying clearly improves the situation of the common agents with respect to the monopsonistic case. In contrast to Proposition 1, now lobbying can be beneficial to both decisionmakers. On the other hand, only one group can benefit from competitive lobbying, compared with no lobbying, while both groups may actually lose. Their (still positive) contributions are completely ineffective. The interest groups are trapped in a prisoner’s dilemma, with lobbying being a dominant strategy at each tier.

3.3. Cross-tiers comparative statics of competitive lobbying

Changes in the political influence of a lobby

Changes in the influence of a group at one tier may have consequences for lobbying as well as policymaking at the other tier. Without further restrictions of our model, the complexity of the interactions between interest groups leads to generally ambiguous comparative-statics results. However, using the following simple specification for the utility derived from the group-specific public good: $h_i(G_i) = G_i^{1/2}$, some intuitive and empirically verifiable results can be obtained which policy). Theorem 1 of Bernheim and Whinston (1986) shows that truthful strategies do not imply a cost for the players because they are included in their best-response set.
have not been identified in the literature before. More particularly, only two cross-tiers effects will be highlighted because they are useful to compare our analysis with some previous studies focusing on a single tier: (a) the reaction of L to an increase in a group’s effectiveness in lobbying B, and (b) the reaction of a lobby to a larger influence of the other group on L.

First, an increase in the effectiveness of group $i$ in lobbying B ($b_i$), though increasing the budget share allocated to this group’s public good $G_i$, may nonetheless have an overall negative impact by reducing the level of $G_i$ through a negative effect on the total budget (determined by $t^*$). This result is obtained, for example, when group $i$ faces a relatively high cost for lobbying L (low $l_i$) but gains substantially from lobbying B (large difference $b_i - b\theta_i$) while the contrary holds for the opponent group $j$. By reducing the budget, L limits the transfer of resources from group $j$, with relatively more influence on L, to group $i$. This result qualifies the standard tenet that interest groups strive for improving their access to decisionmakers [Browne (1998)]. In a multi-tier decisionmaking process such an improvement at just one tier may not be useful as it may trigger a negative reaction at another tier.

Second, we find that an improvement of group $j$’s effectiveness in lobbying L (a larger $l_j$) induces group $i$ to shift resources to L’s tier (the ratio $C_i^*/E_i^*$ increases) if its own effectiveness in lobbying L is sufficiently higher (specifically, if $l_i > l\theta_i \geq l_j$). This lobbying ‘specialization’ is suggestive of counteractive lobbying [Austen-Smith and Wright (1994)]. There is also some similarity with Hirshleifer (1991). In this study two players, a rich and a poor, can invest resources either in increasing their aggregate income (production) or in a fight about the distribution of that income. The outcome is that the poor contender will find fighting relatively more attractive than the rich. This may explain why poorer combatants occasionally perform better than their richer

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20 Derivations of the results are available upon request.
opponents in a conflict. An important difference with respect to our model is that in Hirshleifer’s model there are no interacting policymakers to be influenced. There, the comparative advantage in one activity (fighting or producing) depends solely on the difference in initial endowments. In our model the comparative advantage depends on the ability of lobbying a player for a larger budget relative to that of lobbying another player for the budget allocation. And these two players have a hierarchical relationship.

*Changes in hierarchical influence*

A related issue concerns the effects of lobbying on the hierarchical relationship between L and B, and vice versa. Our main results are summarized in the following Proposition.

**PROPOSITION 2.** For any given $t$ and $C$, a stronger influence of L on B (larger $b$) has no effect on B’s policy but reduces lobbying expenditure ($E_1^* + E_2^*$). The latter result may be reversed through a positive effect of $b$ on $t^*$.

A glance at (8) shows that, under competitive lobbying, the allocation $s^*$ is unaffected by the degree of hierarchical influence (the parameter $b$), for given $t$ and $C$. The intuition is that L’s oversight cannot improve the result for the interest groups because the policy selected by B also maximizes their welfare.\(^{21}\)

This outcome has some important implications. In particular, it may provide a new intuition for the apparently contrasting results reported in the literature with respect to bureaucratic

\(^{21}\) This result does not depend on assumptions concerning the value of the weights or the form of the utility function. It also holds if L cares for gross instead of net social welfare, as long as the same weight ($\theta$) is assigned to the welfare of the groups, as in case of a utilitarian social welfare function. However, if not all groups can lobby B, hierarchical influence does affect the budget allocation.
discretion [cf. Krause (1996)]. On the one hand, the existence of direct as well as indirect legislatorial control over bureaucracy has found support in theoretical as well as empirical studies [see Wintrobe (1997)]. On the other hand, the evidence that bureaucratic agencies represent an important target for interest group lobbying\textsuperscript{22} suggests that they indeed enjoy substantial discretion in policymaking. Our analysis offers a potential explanation for these contrasting observations of a lack of monitoring activity, bureaucratic autonomy, and yet policymaking consistent with legislatorial objectives. When all politically relevant groups have access to lobbying and the competition among lobbies is sufficiently balanced (symmetric), the policy selected by B will perfectly match the preferences of L.

Even though stronger control may not influence the budget allocation of B, it nonetheless reduces the amount of lobbying expenditure \(E_i^*\), for any given \(t\). The intuition is that L’s influence will induce B to consider the loss for group \(i\) caused by the policy preferred by lobby \(j\). Therefore, group \(i\) needs to offer a smaller compensation for inducing a different allocation than in case of no hierarchical influence.

However, if we do not take the tax rate as given then account should be taken of the fact that \(b\) has a positive effect on \(t^*\), because it induces B to better regard the preferences of L. This result flies in the face of the conventional wisdom that it is bureaucratic discretion which boosts the size of the public sector [for empirical support, see Crain and Muris (1995)\textsuperscript{23}]. This positive effect of \(b\) on \(t^*\) may in turn boost lobbying expenditure \(E_i^*\). This happens if, compared with group \(j\), the electoral influence of group \(i\) is sufficiently small (\(\theta_i/\theta_j\) sufficiently small). Moreover,

\textsuperscript{22} Schlozman and Tierney (1986) report that two-thirds of the 175 politically active organizations represented in Washington that were interviewed "indicated that executive agencies are a very important focus of organizational activity; only 6 percent deemed it not too important" (p.330).

\textsuperscript{23} Examining data concerning state expenditures in the U.S. for the period 1982-1988, these authors find that revenues tend to be higher when a legislator choosing taxes has control over the way that funds are spent than in case the revenues and spending are controlled by two different authorities.
larger control of \( L \) over \( B \) may even induce a group to redirect lobbying expenditure to the subordinate agent, causing \( E_i^* \) to increase and \( C_i^* \) to decrease.

These results suggest that the effect of legislatorial oversight may manifest itself in the effort invested in lobbying bureaucracy, rather than the policy selected. This points at an alternative explanation for political supervision: legislatorial control may actually be stimulated by the lobbies themselves, because they may be willing to offer a share of what they can save in terms of lobbying expenditure.\(^{24}\)

4. CONCLUDING DISCUSSION

The main contribution of this paper concerns the analysis of lobbying activity in a divided government. The existence of different decisionmaking levels has substantial consequences, even in the simplest case of a single lobby. The allocation of influence activities now depends on the access to the different tiers and the institutional links between the policymakers. Lobbying at one tier leads to policy reactions at another tier. Clearly, competition between multiple lobbies further complicates the analysis, but it also appears to offer new insights. In addition, the objectives of the policymakers become more interdependent, opening up some new perspectives for the analysis of legislatorial control and the regulation of lobbying. More generally, the model presented in this study may be helpful for a better understanding of policymaking in a multi-level decisionmaking structure. We close with some applications regarding the political economic analysis of fiscal federalism and the firm.

\(^{24}\) See Mazza and van Winden (1998) for a proof.
In a fiscal federalism framework, the central government (L) may decide on a general grant (R) to be transferred to a local government (B) who then choose its allocation for the provision of local public goods. According to our model, a greater influence of an interest group on a local government may trigger a decrease in the general grant, when an opponent group is influential at the national level [see Oulasvirta (1997)]. A related application concerns the effects that decentralization and the subsidiarity principle in the EU have on the size of government. Persson and Tabellini (1994) show that central financing of state public goods will exacerbate free-riding. As a consequence, state lobbying will increase public expenditure beyond the level selected in a decentralized system. Mazza and van Winden (2002), however, obtain the opposite result by taking into account the existence of two relatively autonomous policymakers (the Council and the Commission) and including two-tier lobbying.

Furthermore, the institutional framework of our model may prove to be useful to investigate the issue of corporate control. A firm’s governance can be hypothesized to be in the hands of two policymakers acting at a different hierarchical level: the board of directors and an executive officer. Directors "have the power to set dividends, to hire, fire, and set compensation of the senior executives", but the latter "may have effective control of many of the decisions that are nominally controlled by the board" [Milgrom and Roberts (1992, pp.314-5)], although the board’s preferences may not be disregarded without cost. In our model, the board (L) would decide on the amount of profits to be reserved (R). Next, this amount is allocated over two different projects ($G_1$ and $G_2$) by the executive officer (B). On the ‘demand’ side, groups of powerful stockholders, banks or institutional investors (the principals), may have conflicting interests about the management strategy, for example concerning the distribution and allocation of profits. In addition to being influential over the directors, who are elected by them, the stockholders can offer reward
schemes to managers (e.g. approval of higher salaries, bonuses, jobs in other corporations, gifts, etc.). Our result for the competitive lobbying case, showing that lobbying may hardly affect decisionmaking, may provide an additional explanation for the little influence that shareholders frequently seem to have in a corporation. Moreover, according to the comparative-statics results, a stronger alliance between managers and directors (an increase in $b$) might have a positive effect on the share of re-invested profits ($t^*$).

**APPENDIX**

**PROPOSITION 1**

Denote with $P_B(s^1, t^1)$ and $P_L(s^1, t^1)$ the welfare obtained in equilibrium by B and L, respectively, when they are lobbied by group $I$, and with $P_B(s^n, t^n)$ and $P_L(s^n, t^n)$ when they are not lobbied.

(i) From (2), $P_L(s^n, t^n) > P_L(s^1, t^1)$ if and only if $l \sum \theta_i [U_i(s^n, t^n) - U_i(s^1, t^1)] > (l - l_1) C_1 - l_1 E_1(t^1)$ or, from (7), after rearranging: $\sum \theta_i [U_i(s^n, t^n) - U_i(s^1, t^1)] > 0$. The inequality is satisfied as the first term is nonnegative by the definition of $t^n$, while the other terms are strictly positive by the definition of $s^n (s^n \neq s^1)$ and $E_1(t^1) > 0$ for any $t \in T$.

(ii) From (3) and (7), $P_B(s^1, t^1) > P_B(s^n, t^n)$ if and only if: $b \sum \theta_i [U_i(s^n, t^n) - U_i(s^1, t^1)] > 0$. From (5): $b \sum \theta_i [U_i(s^n, t^n) - U_i(s^1, t^1)] > 0$. Thus: $P_B(s^1, t^1) > P_B(s^n, t^n)$ if and only if $b \sum \theta_i [U_i(s^n, t^n) - U_i(s^1, t^1)] > 0$.

To prove that lobbying (at both stages) may have an ambiguous effect on the welfare of B, comparing with the case of no lobbying, assume for the moment that $E_1(t^1)$ strictly increases with $t$. 


Assume \( t^i > t^l \). Then, \( E^{1}_i(t^l) < E^{1}_i(t^r) \) and \( P_B(s^l,t^l) < P_B(s^r,t^r) \), since \( \Sigma_i \theta[U_i(s^r,t^r) - U_i(s^l,t^l)] \geq 0 \) from the definition of \( t^r \). Assume instead \( t^l > t^r \). Using \((b_1-b_t)E^{1}_i(t^l) = b_1 \Sigma \theta[U_i(s^r,t^r) - U_i(s^l,t^l)]\),

we have that \( P_B(s^l,t^l) > P_B(s^r,t^r) \) if \( b_1[E^{1}_i(t^l)-E^{1}_i(t^r)] + b_1 \{ \theta_1[U_i(s^r,t^r)-E^{1}_i(t^r)] + E^{1}_i(t^r) + \theta_2[U_i(s^l,t^r)-U_i(s^l,t^r)+E^{1}_i(t^r)] > 0 \). The first term between brackets is positive by the initial assumption of \( E^{1}_i \) strictly increasing with \( t \), and the second term between brackets is nonnegative, because of the definition of \( t^r \) [see above (7)]. Thus, \( P_B(s^l,t^l) > P_B(s^r,t^r) \). To complete the proof, we verify the assumptions. This can be easily shown using a specific (gross) utility function which will prove to be useful also for showing further results, namely: \( h_1 = (sR)^{\frac{1}{2}} \) and \( h_2 = [(1-s)R]^{\frac{1}{2}} \). This function guarantees that \( E^{1}_i \) strictly increases in \( t \) and allows to show that \( t^r > t^l \) if \( (y_1/y_2) \) is sufficiently large and \( t^l > t^r \) if \( l \) and \( (y_1/y_2) \) are sufficiently small, establishing the proof. All the calculations in this appendix related to the specific example are available upon request.

(iii) For \( b_1 \) sufficiently larger than \( bl \theta_1 \), the increase of the budget share (from \( s^r \) to \( s^l \)) due to lobbying dominates the tax effect, leading to \([U_i(s^r,t^r)-E^{1}_i(t^r)] < U_i(s^l,t^l) \). However, the opposite result can be derived for \( b_1 \) sufficiently close to \( bl \theta_1 \) (such that \( s^l \to s^r \)) and both \( s^r \) and \( s^l \) near to one or zero, in which case \( h_2(s^l,t^l) \) tends to \( h_2(s^r,t^r) \) and the disposable income effect (which is linear) and the lobbying expenditures dominate. These results can be shown using the specific utility introduced above.

(iv) From (i): \( P_B(s^r,t^r) > P_B(s^l,t^l) \). Then, if group 1 profits from lobbying, the unorganized group 2 loses, because \( l \theta_2[U_i(s^r,t^r)-U_i(s^l,t^l)] > l \theta_1[U_i(s^r,t^l)-E^{1}_i(t^l)] - U_i(s^r,t^r) \) > 0. A necessary condition for group 2 benefiting [i.e. \( U_2(s^r,t^r) < U_2(s^l,t^l) \)] is that \( U_2(s^r,t^r) > U_2(s^l,t^l) \), since \( \Sigma \theta U_i(s^r,t^r) > \Sigma \theta U_i(s^l,t^l) \), by the definition of \( t^r \), and \( \Sigma \theta U_i(s^r,t^l) > \Sigma \theta U_i(s^l,t^l) \) by the definition of \( s^r \). Again, the specific example allows to verify that \( U_2(s^r,t^r) 
\leq U_2(s^l,t^l) \) is feasible.
Competitive lobbying (Subsection 3.2.)

LOWER TIER

The derivation of (8) follows the equilibrium definition used under monopsonistic lobbying. For any given \( t \in T \) and \( C_i \) \((i = 1,2)\), \( s^* \) maximizes B’s objective function (3) and also the joint welfare of the latter and each single lobby, for the reasons explained in Subsection 3.1. From (4) and (8): \( s^1 > s^* \), since \( b_1 > b l \theta_1 \). Equilibrium contributions \( E_1^* \) and \( E_2^* \) follow from the fact that it is optimal (cost minimizing) for group \( j \) to offer a contribution to B that leaves the latter with the same welfare B would get if only \( i \) \((i \neq j)\) lobbied, in which case B would choose \( s^i \) \((s^i \neq s^*)\) maximizing \( b_j U_j(s^i) + b l \theta_j U_j(s^i) \) [recall (4) for \( i=1 \)]. Thus:

\[
P_B(s^*) = P_B(s^i)
\]

(A.1)

In order to uniquely define the lobbying contributions, we restrict to globally truthful strategies, meaning that the equilibrium contribution schedules reveal the willingness to pay for any policy different from \( s^* \). From Bernheim and Whinston (1986), \( E_i^* \) represents a truthful strategy relative to \( s^o \) if and only if for all \( s \in S \): either \( U_i(s') - E_i^*(s) = U_i(s') - E_i^*(s^o) \) or \( U_i(s') - E_i^*(s) < U_i(s') - E_i^*(s^o) \) and \( E_i^*(s) = 0 \). The definition of \( s^i \) implies that \( U_i(s') > U_i(s^*) - E_i^*(s^*) \) and, by truthfulness, \( U_i(s^*) - E_i^*(s^*) = U_i(s') - E_i^*(s') \). This refinement of the contribution set leads to the following unique equilibrium pair of contributions, for any given \( t \in T \) and \( C_i \), from (A.1) and (3):

\[
E_1^*(s^*) = \left[ \frac{1}{(b_2 - b l \theta_2)} \right] \{ b_2 [U_2(s^2) - U_2(s^*)] + b l \theta_2 [U_2(s^2) - U_2(s^*)] \}
\]

and

\[
E_2^*(s^*) = \left[ \frac{1}{(b_2 - b l \theta_2)} \right] \{ b_2 [U_1(s^1) - U_1(s^*)] + b l \theta_2 [U_2(s^1) - U_2(s^*)] \}
\]

(A.2)
\(E_i^*(s^*) > 0\) from the definition of \(s^*\). Notice that contributions are still positive even in the case when \(s^* = s^0\), for \(b_i=0\), for all \(i\) (‘full capture’ by B). From now on we focus on the truthful Nash equilibrium \((E_1^*, E_2^*, s^*)\).

**UPPER TIER**

For expositional reasons, denote: \(\bar{U}_1(t) \equiv U_1(s^*;t)-E_1^*(s^*, s^2; t)\) and \(\bar{U}_2(t) \equiv U_2(s^*;t)-E_2^*(s^*, s^1; t)\). From (A.2): 
\[
\bar{U}_1(t) = \left(\frac{1}{b_1-\theta_1}\right) \left[\frac{\partial}{\partial s_1} \left(U_1(s^*; t) - U_1(s_2^*; t)\right) + b_2 \left(U_2(s^*; t) - U_2(s_1^*; t)\right)\right] + U_1(s_2^*; t)
\]
and
\[
\bar{U}_2(t) = \left(\frac{1}{b_2-\theta_2}\right) \left[\frac{\partial}{\partial s_2} \left(U_2(s^*; t) - U_2(s_1^*; t)\right) + b_1 \left(U_1(s^*; t) - U_1(s_1^*; t)\right)\right] + U_2(s_1^*; t).
\]
In line with the equilibrium derivation at B’s tier, L chooses \(t^*\) taking into account \((E_1^*, E_2^*, s^*)\), such that:
\[
\sum_i l_i \bar{U}_i(t^*) = 0.
\]
For the contributions offered to L, we take as a reference a tax rate \(t_i^*\) chosen when only group \(i\) lobbies L (but both groups lobby B) and implicitly defined by
\[
l_i \bar{U}_i(t_i^*) + l_j \bar{U}_j(t_i^*) = 0.
\]
Comparison with (8) shows that \(t^* \neq t_i^*\), if we exclude the extreme case where \(\bar{U}_j = 0\) at \(t^*\). A group \(j\) \((j \neq i)\) sets \(C_j^*\) such that L is left indifferent between \(t_i^*\) and the competitive lobbying outcome \(t^*\), i.e. \(P_L(s^*(t_i^*), t_i^*) = P_L(s^*(t^*), t^*)\). From truthfulness, we obtain:
\[
C_1^*(t^*) = \left(\frac{1}{l_1-l_0}\right) \left[\frac{\partial}{\partial t} \left(U_2(t^*) - \bar{U}_2(t^*)\right) + l_0 \left(\bar{U}_1(t^*) - \bar{U}_1(t^*)\right)\right]
\]
and
\[
C_2^*(t^*) = \left(\frac{1}{l_2-l_0}\right) \left[\frac{\partial}{\partial t} \left(U_1(t^*) - \bar{U}_1(t^*)\right) + l_0 \left(\bar{U}_2(t^*) - \bar{U}_2(t^*)\right)\right]
\]
(A.3)

\(C_i^*(t^*) \geq 0\), by the definition of \(t^*\) (and \(C_i^*(t^*) > 0\) for \(t^* \neq t_i^*\)).

To see that both decisionmakers can benefit from lobbying, denote with \(P_B(s^*, t^*)\) and \(P_L(s^*, t^*)\) their welfare with competitive lobbying and \(P_B(s^0, t^*)\) and \(P_L(s^0, t^*)\) their welfare in the case of no lobbying. From (3): \([P_L(s^*, t^*) > P_L(s^0, t^*)] \Rightarrow [P_B(s^*, t^*) > P_B(s^0, t^*)]\). After substituting for (A.3),
$P_L(s^*,t^*) > P_L(s^n,t^n)$ if and only if: $l_2[\tilde{U}_2(t^{*}) - \tilde{U}_2(t^{*})] + l_1[\tilde{U}_1(t^{*}) - \tilde{U}_1(t^{*})] + l_2[\tilde{U}_2(t^{n}) - \tilde{U}_2(t^{n})] > l_1[\tilde{U}_1(t^{n}) - \tilde{U}_1(t^{n})]$; then $P_L(s^*,t^*) > P_L(s^n,t^n)$ is possible for sufficiently small $l$ so that the difference between $t^*$ and $t^*$ is large enough to have $l_2[\tilde{U}_2(t^{*}) - \tilde{U}_2(t^{*})] + l_1[\tilde{U}_1(t^{*}) - \tilde{U}_1(t^{*})] > l_1[\tilde{U}_1(t^{n}) - \tilde{U}_1(t^{n})] > 0$ (clearly group prefers $i$ prefers $t^*$ to $t^*$). L could nonetheless be better off without any lobbying if this is wasteful at B’s tier and gives L little benefit as when $l_i \to l \theta_i$ for all $i (i=1,2)$.

As for the interest groups, lobbying activities at each stage offset each other when the shadow prices are the same ($b_1 = b_2$ and $l_1 = l_2$). Moreover, competitive lobbying can produce an outcome overall worse than no lobbying. Consider the case when $\theta_i = b_i$ for all $i$. Then $s_n = s^*$ but yet $E_i^* > 0$ since $s^i \neq s^n$ for $i = 1,2$ [see (A.2)]; in which case generally $t^i \neq t^*$ also for $\theta_i = l_i$; for all $i$. Using the specific utility function introduced in the proof of Proposition 1, $U_i(s^n,t)$ is strictly concave and it can be found a tax rate $t^i$ maximizing $U_i(s^n,t)$ for all $i$, such that $t^i \geq t^* > t^*$, implying $U_i(s^n,t^i) \geq U_i(s^n,t^*)$ for all $i$. Lobbying may however be beneficial for one group when the opponent is powerless at both stages and the outcome approaches that of monopsonist lobbying. On the other hand, both groups cannot benefit from lobbying. Assume this is not true and $U_i(s^*,t^*) - E_i^*(s^*,t^*) - C_i^*(s^*,t^*) > U_i(s^n,t^n)$ for all $i$. Then, $\sum \theta_i[U_i(s^*,t^*) - U_i(s^n,t^n)] + [U_i(s^*,t^*) - U_i(s^n,t^n)] > 0$; but the sign is not correct since both terms are not positive by the definition of $t^n$ and $s^n$.

Cross-tiers comparative statics of competitive lobbying (Subsection 3.3.)

Changes in hierarchical influence

PROPOSITION 2

To see the impact of $b$ on contributions at B’s tier, for any given $t \in T$ and $C_i$, assume a B only interested in contributions, i.e. $b = 0$. Since $s^*$ is unaffected by $b$, group 2 sets a contribution schedule such that [from (A.1)]: $b_jE_j^b(s=1) = \sum b_iE_i^b(s^*)$, where the superscript $-b$ denotes lack of
control. Similarly, group 1 sets a schedule such that \( b_2 E_2^{-b}(s=0) = \Sigma b_i E_i^{-b}(s^*) \). By truthfulness:

\[
E_1^{-b}(s=1) - E_1^{-b}(s^*) = U_1(s=1) - U_1(s^*)
\]

and

\[
E_2^{-b}(s=0) - E_2^{-b}(s^*) = U_2(s=0) - U_2(s^*)
\]

Thus, \( E_j^{-b}(s^*) = (b_j/b_j)[U_j(s^j)-U_j(s^*)] \) for \( i \neq j \), where \( s^{-b1} = 1 \) and \( s^{-b2} = 0 \). From (A.2): \( E_j^*(s^*) \geq E_j^{-b}(s^*) \) if and only if

\[
b_j[b_j[U_j(s^j)-U_j(s^*)] + bl\theta_d[U_j(s^d)-U_j(s^*)] \geq (b-bl\theta_d)[U_j(s^{-b1})-U_j(s^*)] + bl\theta_d[U_j(s^{-b1})-U_j(s^*)]
\]

Thus, \( E_j^{-b}(s^*) > E_j^*(s^*) \). The latter result can be reversed, and \( E_j \) may increase through the effect on \( t^* \), for \( \theta_d/\theta_i \) sufficiently low for example. Once more we use the specific example introduced earlier.

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