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## Uncovered power : external agenda setting, sophisticated voting, and transnational lobbying

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# UNCOVERED POWER: EXTERNAL AGENDA SETTING, SOPHISTICATED VOTING, AND TRANSNATIONAL LOBBYING

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# UNCOVERED POWER: EXTERNAL AGENDA SETTING, SOPHISTICATED VOTING, AND TRANSNATIONAL LOBBYING

## Abstract

Where does the balance of power lie in a policy-making institution with an external agenda setter, legislators, and lobbies? In a multiple round majority rule game with sophisticated actors, we show that the agenda setter obtains its most preferred policy outcome even if all lobbies and legislators prefer the status quo to the proposal (i.e., the proposal lies in the covered set). A lobby with the ability to recruit supermajorities can counterbalance this power. If contributions are conditional on the entire voting profile, such a ‘transnational lobby’ can veto any proposal at no cost. If contributions are conditional on the votes of each recipient legislator, the transnational lobby has only to possess a greater willingness to pay than the median national lobby to achieve this result. We use our formal model to explain external tariff policies in the European Union following the creation of an internal market.

JEL Code: D02, C7, F1, N54.

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# Uncovered Power: External Agenda Setting, Sophisticated Voting, and Transnational Lobbying\*

Silvia Console Battilana<sup>†</sup>  
Job Market Paper

## 1 Introduction

This paper provides a game-theoretic demonstration that, in an institutional setting mirroring the European Union (EU) trade policy process,<sup>1</sup> an external (non-voting and fixed *a priori*) agenda setter has unlimited power when voting is according to majority rule and there exists no lobby organized across multiple voting districts (nations, in the case of the EU). We further show that this power can be eliminated by the adoption of unanimity voting or counterbalanced by a lobby capable of influencing multiple legislators.

Although potential applications and extensions are diverse,<sup>2</sup> our theoretical argument is motivated by a lingering empirical puzzle. With the implementation of the Single European Act (SEA) on December 31, 1992, the creation of an internal market within the EU was largely complete. At the time, little attention was paid by negotiators to the implications of the SEA for external trade policy. Many scholars, however, predicted the emergence of a "fortress Europe" that would erect heightened trade barriers against non-EU countries, particularly in light of the bleak macroeconomic context of the early 1990s EU. Instead, EU trade policy underwent dramatic liberalization. Why?

This paper argues that an explanation can be found in the particular form of the EU trade policy apparatus. This process was established by the Treaty of Rome in 1980, well

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<sup>1</sup>In referencing the European institutions that govern trade policy, the term "European Community" would be technically correct. However, we follow the vast majority of the literature in employing the "European Union" label.

<sup>2</sup>See, for instance, Bernheim and Console Battilana (2006); Console Battilana and Shepsle (2006); and Console Battilana (2006).

before the advent of common external tariffs. Under the Treaty, an external agenda setter (the Commission) must first propose changes to tariff policy. These proposals are then voted upon by legislators (the Council) representing individual states, subject to the efforts of lobbyists to sway decisions. We show game-theoretically that, under majority rule and absent a lobby organized across states (a "transnational lobby"), the external agenda setter will achieve its first-best policy. In line with the common perception (affirmed by extensive interviews with EU politicians, bureaucrats, lobbyists, and journalists in Brussels) that the Commission is biased in favor of liberalization, this first-best policy will be free trade.

Of course, this theoretical result must be reconciled with a substantial empirical caveat: namely, the fact that very high tariff peaks remain in certain European sectors. By extending the model to incorporate the possibility of unanimity decision making, we show that unanimity rule eliminates the agenda setter's advantage. Although the conditions under which unanimity rule is likely to be invoked (according to the "gentlemen's agreement" afforded by the Luxemburg Compromise) are complex and outside of our model, this result suggests a proximate explanation for the persistence of high tariffs in sectors that are politically important within individual countries (agriculture in France, for example). We further demonstrate that the presence of a transnational lobby can substantially dampen the agenda setter's power, even with majority rule and even if the transnational lobby is identical to each national lobby except with respect to its capability of lobbying multiple legislators. This finding provides a theoretical reason to expect, *ceteribus paribus*, higher tariffs in sectors, such as agriculture, chemicals, and automobiles that are organized transnationally; it also explains why lobby consultancy firms frequently advocate the formation of pan-European coalitions.

The paper proceeds as follows: In section 1.1 we briefly profile EU tariff policies following implementation of the SEA. In section 2 we construct a base model, reflective of EU institutions (but also of many other potential settings), and study outcomes under two rules: majority and unanimity. In section 3, we add one transnational lobby. We derive general conditions for approval or rejection of policies under two different strategy spaces: one in which contributions are conditional on the entire voting profile and one in which contributions are conditional only on the vote of the recipient legislator. We then derive results for a stylized multiple round application to trade policy. In section 4 we check the robustness of our main results to an extension with multiple legislators, each with personal preferences. Section 5 concludes. Complete proofs, as well as the formal model of section 4, are provided in the appendix.

## 1.1 Motivation: Storming "Fortress Europe"

Prevailing political science theories in the 1970s and 1980s predicted that heightened trade barriers would follow EU unification. One implication of the arguments of Taksacs (1981), Gallarotti (1985), Cassig, McKeown and Ochs (1986), Magee and Young (1987), and Wallerstein (1987) is that slow economic growth and high unemployment in the early 1990s European Union, combined with increased imports from outside the European Union, should have boosted the demand for and supply of protection. Yet despite greater import competition and the loss of six million jobs between 1991 and 1994, with average unemployment reaching 11 percent by 1994 (Hanson 1998, p. 59), "fortress Europe" did not succeed the creation of

a single market on December 31, 1992.

To the contrary, European trade policy became distinctly more liberal. EU tariffs fell sharply as a result of the Uruguay Round, along with quotas, subsidies, antidumping duties, and surveillance measures. The average manufacturing tariff decreased by 38 percent, while tariffs on many products were eliminated (World Trade Organization 1995, cited in Hanson 1998, p. 60). Hanson (1998) summarizes the post-unification trend: "recent EU trade policy has been marked by two characteristics: the erection of very few new protectionist trade barriers and a significant reduction in levels of protection for many industries...(I)ndustries that demanded and received increased trade barriers during periods of economic hardship in the past now face similar economic challenges but can no longer obtain the same levels of trade protection" (pp. 60-61). This synthesis is confirmed by 1997 EU tariff data compiled by Di Nino (2002, 2004). As discussed in Console Battilana (2006), these data reveal that EU tariffs are generally low and homogenous, and, when compared sector-by-sector, generally lower than tariffs in the United States. If one views trade policy as determined by a political-economic equilibrium of supply and demand, this outcome is surprising.

A partial resolution of this puzzle may be found in the confluence of the spread of trade agreements on the one hand and the apparent movement of the EU Commission toward support of free trade on the other. In addition to policy changes implemented as a result of multilateral negotiations in the Uruguay Round, the European Union signed twenty-six bilateral trade agreements between 1990 and 1996 (The Financial Times, 16 February 1996, cited in Hanson 1998, p. 60). As the body representative of the European Union in these negotiations, the Commission has played a central role in liberalization of EU trade policy. While protectionist notions may have held sway over the views of many Europeans (and arguably members of the European Commission) during the 1970s and 1980s, available evidence indicates that the Commission has since adopted distinctly liberal preferences with respect to trade.<sup>3</sup> Thus, one might argue that this simultaneous proliferation of trade agreements and free trade ideology has driven more liberal EU trade policy.

This explanation is very incomplete, however. For one, the Commission does not vote upon proposed changes to trade policy; the vote of the Council ultimately determines whether or not proposals are implemented. As pointed out by Hanson (1998), among others, we would expect representatives of member states to favor higher levels of protection for politically important industries, especially during periods of rising unemployment and import competition like the early 1990s. Second, very high tariff peaks remain in certain sectors. According to Di Nino's (2002, 2004) data elaborated in Console Battilana (2006), the 49

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<sup>3</sup>That the Commission favors free trade is supported by the author's interviews of July 2005. P.G. (DG Trade member) states, "*The Commission has chosen the liberal model. We believe that liberalization of markets is a necessary condition for growth. There is no closed economy that has experienced growth.*" M. B. (ex cabinet member of Pascal Lamy) notes, "*The Commission has historically had the role of managing the liberalization inside and outside markets.*" An anonymous Gplus consultant points out that "*The Commission is not necessarily free trade. However, the DG Trade is, (this) is its mission. The DG Trade runs the EU trade policy. They are economists.*" Further evidence that the Commission prefers freer trade is given by Meunier (2000): "*In the specific case of international trade negotiations, however, the Commission can be generally characterized as more liberal than the majority of the member states.*" Peter Mandelson (Trade Commissioner) stated the following at the European Parliament hearing of October 4th, 2000: "*As EU Trade Commissioner I want to promote prosperity and social justice through open, rules-based trade. The benefits of free and fair trade should be extended to all, especially the poorest.*"

highest EU tariffs in 1997 were all on agricultural products. In contrast to tariffs in most other sectors, tariffs on these products were much higher than comparable US tariffs. Furthermore, high tariffs remain in a number of non-agricultural sectors, including chemicals; textiles; automobiles and parts; bicycles; publishing and printing; and glass and ceramics. Thus, any explanation of post-unification EU trade policy must account not only for a general movement toward liberalization (despite the putative presence of greater demand for protection and the corresponding reluctance of those with direct voting authority, the Council, to lower trade barriers), but also for continued high levels of protection in a few sectors.

The remainder of the paper develops a game-theoretic framework capable of reproducing the above facts. Our results highlight the extreme power of an exogenously chosen, external agenda setter in an institutional setting reflective of that in the EU; they also suggest that this power can be eliminated or moderated by the application of unanimity (as opposed to majority) rule or the presence of a lobby organized across multiple states.

## 2 A Model of EU Policy Making with National Lobbies

We study a stylized decision making institution, modeled after the European Union, with one exogenously chosen, external agenda setter ("the Commission") that proposes modifications to a status quo policy; a voting body ("the Council") composed of three legislators, one per nation; and one lobby in each nation. All actors are sophisticated (forward-looking).

The policy space at any given time consists of three "national projects," one in each nation, each of which is either "on" or "off."<sup>4</sup> A national project could be any policy outcome that generates a net benefit for the respective national lobby and net costs for others. Here, we think of projects as tariffs. Imagine that each nation specializes in the production of one good not produced in other nations. Producers from each nation are organized in a respective national lobby and consume both the national good and the goods produced in other nations. While distributional effects of course depend on (at least) relevant supply and demand elasticities, in this setting it is likely that a tariff on a particular good would create a net benefit for the lobby representing producers of that good and a net loss for other lobbies.

We assume that the Commission prefers that all projects be off. In a trade policy setting, this is equivalent to assuming that the agenda setter prefers free trade.<sup>5</sup> The agenda setter's preferences do not align with those of national lobbies, since national projects generate net benefits for their respective lobbies and net costs for the agenda setter.

As in most extant formal models of lobbying (Grossman and Helpman 1996a; Helpman and Persson 2001; Groseclose and Snyder 1996; Grossman and Helpman 1996b), lobbies may

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<sup>4</sup>The assumption that national projects are binary variables is not crucial. The analysis that follows extends to a continuous policy space, since in this case the agenda setter merely faces more choices but can still reach its preferred policy. This intuition is formalized in Bernheim and Console Battilana (2006), who extend the set of choices to a generic policy space.

<sup>5</sup>This assumption is not crucial to the general result (derived below) that the agenda setter can achieve its first-best policy outcome. Application of our model to the task of explaining the empirical puzzle set forth above is not possible, however, without endowing the agenda setter with preferences. Thus, we opt for those preferences that appear to be most realistic with respect to trade policy.

attempt to influence policy outcomes by offering contributions to legislators. We further assume that lobbies cannot form coalitions and that each lobby can contribute only to its respective national legislator.<sup>6</sup>

Starting with a given status quo policy, the game proceeds through a finite number of rounds as follows: 1) At the beginning of each round, given a status quo, the agenda setter proposes a policy vector that specifies which projects will be on and which will be off in the next round. 2) Each lobby, given the status quo and the proposal, simultaneously and non-cooperatively offers a contribution schedule to its legislator. Contributions are conditional only on actions of the current round and on the current status quo.<sup>7</sup> 3) Legislators observe only the contribution schedules offered to them and simultaneously and non-cooperatively vote. The policy outcome at the end of each round becomes the status quo for the next round. Only the policy outcome at the end of the last round is implemented.

Legislators maximize the contributions of their respective lobbies. Given that each lobby can contribute only to their national legislator, this implies that each legislator will be willing to vote for the outcome preferred by their nation's lobby for an infinitesimally small contribution. Hence, we employ the following simplifying assumption:

**H1:** Since each legislator is only influenced by their national lobby and would vote as the lobby wishes for an infinitesimally small amount, we directly assume the legislator and the lobby are the same agent. Formally, we assume that each lobby can vote.<sup>8</sup>

We proceed by first proving that, under the institutional setting outlined above and with majority rule (as specified by Article 133), the agenda setter will achieve implementation of its first-best policy regardless of the preferences of lobbies and regardless of the initial status quo policy. In particular, we show that in a multiple round game, the agenda setter can propose its optimal policy (free trade) in the first round and all legislators will vote for it, even if all lobbies (and therefore legislators) prefer the status quo (protectionism).

This finding regarding the strategic advantage of the agenda setter is stronger than results from previous literature. While McKelvey (1976) and Schofield (1978) have shown that under sincere voting, myopic behavior and majority rule it is possible to 'wander anywhere'

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<sup>6</sup> These appear to be realistic assumptions for many lobbies, for several reasons. In reality contributions are not as a rule monetary, but instead take a variety of political forms. In order to be able to credibly promise increased political support for a legislator, a lobby must not only be connected to a local (intra-national) political network and have access to appropriate channels, but must also represent a political faction important within the legislator's nation. Here, lobbies representing different sectors have interests that directly conflict. Coalitions would not be sustainable across national lobbies because there would exist profitable deviations from possible agreements. In the next section we modify this assumption by adding a lobby that represents a sector present across all nations.

<sup>7</sup> Some might argue that lobbies could build a reputation that allows them to offer contributions conditional on outcomes in multiple rounds. However, such contribution schedules would greatly magnify the model's complexity with little increase in realism. Moreover, lobbies would not be able to build a reputation endogenously since this is not an infinitely repeated game. Furthermore, it is not clear that lobbies would choose to offer such contributions even if they could credibly commit to doing so. In any case, our intuition, developed in Bernheim and Console Battilana (2006), is that the agenda setter would still be able to obtain free trade even with more complex schedules.

<sup>8</sup> This hypothesis allows us to reduce notation and simplify the exposition. One could imagine that legislators care also about the well-being of their constituents, but place greater weight on their own political fortunes. In this case lobbies would still manage to have their legislator vote for their preferred outcome at some given (low) cost.



(for any points  $x$  and  $y$ , it is possible to find a sequence of proposals that takes voting outcomes from one point to the other), Shepsle and Weingast (1984) demonstrated that, if all legislators are sophisticated, there exists a finite agenda with  $y$  as the first element and  $x$  as the equilibrium outcome if and only if  $y$  does not cover  $x$  (Theorem 3).<sup>9</sup> In our model the agenda setter successfully proposes a policy that is in the covered set: even if all voters prefer the protectionist status quo, the Commission can propose free trade in the first round, and it will be majority approved. Our result is an implication of the hypothesis that the Commission adapts its proposals to the responses of other actors. We believe this is realistic. As Garrett and Tsabelis (1999) point out, the Commission typically alters its proposals several times to ensure adoption by the Council, and acts strategically in doing so. Bernheim and Console Battilana (2006) show that the present paper's result regarding the power of the agenda setter holds also for a generic policy space.

We next demonstrate that under unanimity rule the status quo is the unique equilibrium outcome. This result is consistent with intuition and may explain why agricultural tariffs tend to be much higher than in other sectors. Under the Luxemburg Compromise, an individual nation may veto a decision taken under majority rule if this decision affects "vital interests" of that country. The legal basis for doing so can be found in Article 228, which calls for unanimity rule "when the agreement covers a field for which unanimity is required for the adoption of internal rules." Examples of such fields include national security and national budgets. While the conditions under which unanimity rule may be invoked are vague and therefore outside of our formal model, we note that agriculture had very high tariffs before unification. Thus, the threat posed by potential reductions in tariffs to the "vital interests" of a country like France may be viewed as greater in the case of agriculture. The Commission knows that, if it proposes to reduce certain agriculture tariffs, one nation could demand the use of unanimity rule and reject the proposal. Hence we conclude that high peaks in agriculture can be partially explained by the threat and occasional use of unanimity rule.

## 2.1 Majority rule

Consider a stylized "union" with three nations,  $i = 1, 2, 3$ , a lobby in each nation and one exogenously chosen, fixed external agenda setter.<sup>10</sup> Productive factors in nation  $i$  is specialized in sector  $i$ , and that sector is organized as lobby  $i$ . For each nation, there is a project  $z_i \in \{0, 1\}$ , with  $z_i = 1$  indicating that project  $i$  is on (e.g., protectionism in sector  $i$ ) and  $z_i = 0$  indicating that it is off (e.g., free trade in sector  $i$ ). The policy space is given by  $Z = \{0, 1\}^3$ , an element of which is denoted as  $z = (z_1, z_2, z_3)$ . For example,  $(0, 1, 0)$  indicates that only project 2 is on. Notice that there are eight possible outcomes,  $|Z| = 8$ .

Project  $i$  provides net benefits of  $b_i > 0$  to lobby  $i$  at a cost of  $c_i > 0$  to each of the other lobbies and a cost of  $d_i > 0$  to the agenda setter. Assume that these costs and benefits are common knowledge and (without loss of generality) that  $d_1 > d_2 > d_3$ .<sup>11</sup> Benefits and costs

<sup>9</sup>The uncovered set was first defined by Miller: "a point  $y$  covers  $x$  if and only if the domination of  $x$  contains the domination of  $y$ " (1980, p. 72).

<sup>10</sup>As noted in Riboni (2005), another example of fixed agenda setter can be found in the European Central Bank.

<sup>11</sup>In the case in which  $d_1 = d_2 = d_3$  (if these costs are distributed according to some random distribution

are additive over projects. (So, for example, when projects 1 and 2 are on, lobby 1's payoff is  $b_1 - c_2$ , lobby 2's payoff is  $b_2 - c_1$ , lobby 3's payoff is  $-c_1 - c_2$ , and the agenda setter's payoff is  $-d_1 - d_2$ .) Assume that  $b_i > c_j + c_k$  for  $j, k \neq i$ , so that every lobby prefers having all three projects on to having all three projects off. The optimal outcome for each lobby  $i$  is  $z_i = 1$ ,  $z_j = 0$  for  $j \neq i$ . The agenda setter would like to have all projects off. Formally, we define  $I_i(z) = \begin{cases} 1 & \text{if project } i \text{ is adopted} \\ 0 & \text{o/w} \end{cases}$ . The utility functions of each agent are then as follows:

$$[I_i(z)b_i - \sum_{j \neq i} I_j(z)c_j]$$

for lobby  $i$  and

$$- \sum_i I_i(z)d_i$$

for the agenda setter.

We assume a finite number of legislative rounds,  $T \geq 3$ . The game proceeds as follows: At the start of each round  $t \in \{1, T\}$ , the agenda setter proposes an alternative  $z^t \in Z$  to the status quo  $z^{qt} \in Z$ . Under H1, each lobby observes  $z^t$  and  $z^{qt}$ , then votes for one or the other (lobbies cannot abstain). Lobbies act simultaneously and non-cooperatively and are unable to make credible commitments to each other. The policy receiving a majority of votes becomes the status quo for the next round. The game is repeated from round  $t = 1$  to  $t = T$ . The policy outcome of round  $T$  (defined as  $z^{T+1}$ ), and only this outcome, is implemented. We assume that all actors are sophisticated, in the sense that they forecast and attempt to influence the outcome of the final round. At time  $t$ , neither lobbies nor the agenda setter can commit to actions involving periods other than  $t$ . There are no adjournment possibilities.

### Equilibrium and Results

The equilibrium concept is pure strategy subgame perfect Nash.

**Proposition 1 Agenda power under majority rule.** *For  $T \geq 3$  and any  $z^{qt} \in Z$ : 1) the unique equilibrium outcome of round  $T$  is  $\hat{z}^{T+1} = (0, 0, 0)$ ; and 2) there exists an equilibrium in which the agenda setter proposes to turn off all projects in the first round and every subsequent round ( $\hat{z}^t = (0, 0, 0)$  for  $t = 1 \dots T$ ) and every proposal is majority approved.*

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over a continuous domain, and if we draw randomly from this population of costs, then this is a zero probability case), the agenda setter is indifferent among projects. When solving backwards, we find multiple equilibria. One possible equilibrium is the one in which the agenda setter breaks indifference by an inner ranking, i.e. always turns off project 1 first, then project 2, and then project 3. In these cases, our result regarding the final policy outcome holds. Another possible equilibrium is the one in which the agenda setter randomizes by turning off one project in each round, where this project is selected with equal probability from the remaining "on" projects. In this case, the agenda setter can drop only one project in the final round. In the unrealistic case that  $d_1 = d_2 = d_3$ , we choose to resolve indifference by arbitrarily assigning a ranking (i.e., we assign a different number to each project and then assume that the agenda setter always prefers to drop the project with a lower cardinal ranking).

The proof is given in Appendix A. We provide the intuition here. In the last round  $T$ , for any status quo, the agenda setter can successfully propose turning off at most one project (otherwise at least two lobbies would vote against the proposal). Thus, the agenda setter will propose turning off the project most costly to itself from among those currently on. The proposal will be majority approved since each lobby incurs a cost from projects that are on in other sectors. Hence two lobbies will be better off without the project of the other lobby. Given that lobbies are sophisticated, in any round  $t < T$ , the choice between the status quo  $z^{qt}$  and the proposal  $z^t$  is in essence a choice between the outcome that would arise at round  $T$  if the proposal was approved in round  $t$  versus the outcome that would arise at round  $T$  if the proposal was rejected in round  $t$ . We call the outcome at round  $T$  if a certain  $z$  wins round  $t$ , the ‘*dynamic sophisticated equivalent*’ of  $z$  at  $t$ , or  $\delta(z, t)$ . For example, suppose  $z^{qT-1} = (0, 1, 1)$  and  $z^{T-1} = (0, 0, 0)$ . Then  $\delta((0, 1, 1), T-1) = (0, 0, 1)$  because the agenda setter will successfully propose turning project 2 off in round  $T$  given  $z^{qT} = (0, 1, 1)$ . Likewise,  $\delta((0, 0, 0), T-1) = (0, 0, 0)$ . Since lobby 1 and 2 both prefer policy  $(0, 0, 0)$  to policy  $(0, 0, 1)$ , they will both vote for proposal  $z^{T-1} = (0, 0, 0)$ , even if they both prefer  $z^{qT-1}$  to  $z^{T-1}$ . With at least two rounds, the agenda setter can eliminate the two most costly projects, projects 1 and 2. Now suppose that in the third to last round the status quo was  $(1, 1, 1)$ . If the agenda setter proposes turning off all projects then this proposal will be majority approved, since  $\delta((0, 0, 0), T-2) = (0, 0, 0)$ ,  $\delta((1, 1, 1), T-2) = (0, 0, 1)$ , and both lobby 1 and lobby 2 prefer  $(0, 0, 0)$  to  $(0, 0, 1)$ . Both lobbies know they will not have their own projects implemented regardless of their vote and they know they would incur a cost  $c_3$  if they voted against the proposal. When facing the choice between  $(0, 0, 0)$  and  $(1, 1, 1)$  in round  $T-2$ , lobbies are in effect facing a choice between their dynamic sophisticated equivalents  $\delta((0, 0, 0), T-2) = (0, 0, 0)$  and  $\delta((1, 1, 1), T-2) = (0, 0, 1)$ . Thus, with three or more rounds, the agenda setter can successfully propose turning off all projects in the first round.

This result underscores the power of the agenda setter. Notice that the above proposition holds even in the case where all projects are on in the first round, and therefore all lobbies prefer the initial status quo to the final outcome. Even in this case, the agenda setter is able to induce each lobby to vote against a preferred alternative in the first round. In effect the agenda setter can create a prisoners’ dilemma for lobbies.

To our knowledge, this result does not exist in previous literature with sophisticated voting. Shepsle and Weingast (1986) and Miller (1980) have shown that the agenda setter could only reach outcomes in the uncovered set. However,  $(0, 0, 0)$  is covered by  $(1, 1, 1)$ . In our model the agenda setter can do more than reach its preferred outcome among those in the uncovered set. The agenda setter can reach any outcome.

This result follows from the structure of the agenda. In Shepsle and Weingast (1986) the amendment agenda is fixed (i.e., announced ahead of time) and not history contingent: in round  $t = 1$  the agenda setter announces all amendments  $(a_t)$  that will be proposed in each round and the sequence  $(a_1, a_2, a_3 \dots a_T)$  is not contingent on outcomes. Regardless of the status quo reached in round  $t$ , the given amendment  $a_t$  will be proposed. Instead, our agenda setter does not pre-committ to a non-contingent agenda ahead of time. Our agenda setter optimally chooses the proposal to pitch against the status quo of each round. Even if the agenda is not announced ahead of time, lobbies have full information on the agenda setter’s

preferences and therefore they can forecast the proposals that will be made at every possible node of the Nash tree. Note that, without an institutional constraint to prevent renegeing, our agenda setter could not credibly announce a non-contingent agenda  $(a_1, a_2, a_3 \dots a_T)$  in the first round, because this would not be optimal.

Bernheim and Console Battilana (2006) show that the agenda setter can still obtain its first-best policy with pre-committment, as long as proposals can be a function of the status quo of each period  $t$  (e.g.,  $(a_1(z^{q1}), a_2(z^{q2}), a_3(z^{q3}) \dots a_T(z^{qT}))$ ). Alternatively, the agenda setter can also obtain its first-best with a ‘symmetric amendment’  $(a_1, a_2, a_3 \dots a_T)$  (i.e., non-contingent) agenda like the one described in Shepsle and Weingast (1986) if the agenda setter can include adjournment provisions. Here, our agenda setter is not given the choice to announce an agenda (history contingent or otherwise) ahead of time and is still able to obtain its most preferred policy, even though all actors are sophisticated.

## 2.2 Unanimity rule

The setup is the same as in section 2.1, except that the voting rule is unanimity.

**Proposition 2 *Unanimity veto power.*** *Under unanimity rule, the initial status quo ( $z^{q1}$ ) is the unique outcome of every round ( $z^{q1} = z^{q2} = \dots z^{qT} = z^{T+1}$ ). An equilibrium exists in which the agenda setter proposes the status quo in every round and it is accepted by indifference.*

A simple argument suffices to prove the proposition: Suppose that the status quo of a certain round was  $z^{qt}$  and the final outcome  $z^{T+1}$ . The agenda setter must weakly prefer  $z^{T+1}$  to  $z^{qt}$ , otherwise proposing  $z^{qt}$  in every round would be a profitable deviation for the agenda setter. Furthermore, every lobby  $i$  must weakly prefer  $z^{T+1}$  to  $z^{qt}$ , otherwise lobby  $i$  would deviate to veto the proposal of every round. But only  $z^{T+1} = z^{qt}$  satisfies these conditions.

We are not addressing the question of when unanimity rule will be used. One could imagine, however, that prior to each round of the game, all actors know that certain proposals will result in the use of unanimity rule. If this is the case, then the agenda setter cannot successfully advance such proposals. Voting may still take place according to majority rule, but only if no such proposal is made. Therefore, the mere threat of unanimity rule may be sufficient to ensure that the status quo remains in effect.

Thus, threatened or actual application of unanimity rule may explain why high barriers to trade remain in certain sectors that are politically important within individual EU countries. While we do not formally address the obvious question of when unanimity rule is likely to be invoked under the Luxemburg Compromise, this result suggests a proximate explanation for high trade barriers in agriculture and opens the deeper question for future research.

## 3 Lobbying transnationally

*"Greatest weight was given to those actors who were prepared to establish ‘European identity’ through pan-European alliances." (Coen 1998, p. 78)*

The models presented in the previous section lend formal support to the idea that liberalization in the European Union can be explained by the presence of an external agenda setter and the application of majority rule. They also suggest that high agricultural tariffs persist because of the potential application of unanimity rule afforded by the Luxemburg Compromise. Yet tariff barriers remain in many non-agricultural sectors. In this section we show how lobbies that are unable to invoke (or threaten) a unanimity rule may succeed in retaining protection, despite the apparent free trade orientation of the EU Commission.

The previous section assumed that lobbies could contribute only to their respective national legislators and therefore that lobbies could be treated as voters (H1). Helpman and Persson (2001) employ the same assumption. Yet as more policies have devolved to the European Union, some lobbies have attempted to form transnational coalitions that allow political contributions to be made across national borders. Coen (1997a, 1997b, 1998) shows empirically that political activity shifted away from national and toward transnational channels between 1984 and 1994. In addition, lobby consultancy firms in Brussels often advise their clients to build alliances where possible. For example, in the Presentation of HGlatz at the Europaisches Forum Alpbach 2005, quoted in Greenwood 2005, the advice is: "Build alliances whenever possible". Likewise, Burson-Marsteller (2005), a lobby consultancy firm, suggests: "Search for allies, and build coalitions whenever possible. Ad hoc and temporarily issue specific coalitions can be just as influential as long standing partnerships". Coen (1998) notes that "the creation of the single market and the strengthening of European institutions has harmonized the firms' political activity across borders" (p. 75). This section provides an explanation for high tariffs in sectors represented by transnational lobbies.

We begin by adding a fourth sector, present in each country and represented in all countries by a single 'transnational lobby.' Note that the defining characteristics of the transnational lobby are two-fold: 1) this lobby represents producers of a good produced in every country and thus may contribute to legislators from every country; and 2) this lobby acts as a single coalition. When such a transnational lobby is present the agenda setter cannot fully exploit the self-interest of national lobbies (those that can contribute only to their national legislator), since the transnational sector can contribute directly to a majority of legislators.

With a fourth lobby present, legislators and lobbies can no longer be treated as identical actors; **H1** no longer applies.<sup>12</sup> Lobbies will condition their contributions on legislators' actions. We derive results under two alternative assumptions:

**H2:** Contributions are conditional on the entire voting profile; and

**H3:** Contributions are conditional only on the vote of the legislator receiving the contribution.<sup>13</sup>

Our results affirm the strategic advantage of transnational lobbying. Under H2, the

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<sup>12</sup>Hereafter, when using pronouns to refer to actors, we use "he" in the case of a legislator; "she" in the case of a lobby; and "it" in the case of the agenda setter.

<sup>13</sup>We investigate H3 because we believe that in reality contribution schedules under H2 might not be possible. For one, it might be too complicated to design such a contribution schedule. Even if designing such a schedule were possible, legislators might not understand what was being offered, especially given that contributions are non-monetary. Furthermore, a legislator might prefer contributions that are dependent only on his actions, and might not want to consider contributions conditional on multiple events not under his influence.

transnational lobby can prevent implementation of any policy that is not beneficial to her and can do so at no cost by utilizing the *pivot strategy* described below. Furthermore, any policy beneficial to the transnational lobby will be majority approved. In equilibrium, the transnational lobby creates a prisoner's dilemma by offering a contribution schedule that ensures that no legislator will be pivotal; hence no legislator acting alone can affect the outcome. Dal Bo (2000, 2006) reaches a similar result in a setting with a single lobby and three voters with preferences over outcomes.

Under H3, for any proposal we order the national lobbies according to the change in their payoff (relative to the status quo) that would occur if this proposal were implemented. We find that no proposal that negatively impacts the payoff to the transnational lobby can pass, unless the benefit of this proposal to the median national lobby is greater than the loss to the transnational lobby. On the other hand, the agenda setter can successfully propose any policy that benefits the transnational lobby, so long as any loss to the median national lobby is not greater than the benefit to the transnational lobby.

Section 3.5 presents a simple version of the model in a trade setting. We pose the following question: If all sectors differ only with respect to goods produced and location(s) of production, does a transnational lobby have an advantage? Under both H2 and H3 we find that the unique final outcome of a multiple round game is free trade in all national sectors and a status quo tariff in the transnational sector.

### 3.1 The model

We first derive results for a single round game and then show how these results extend to games of multiple rounds. The outcome of our single round game is a policy vector specifying which of four projects are on and which are off. Countries are labeled '1,' '2', and '3;' we label the transnational sector '4.' A policy is a quadruple  $z = (z_1, z_2, z_3, z_4)$ , where  $z_i \in \{0, 1\}$ , with  $z_i = 1$  indicating that project  $i$  is on and  $z_i = 0$  indicating that project  $i$  is off. We denote the status quo by the quadruple  $z^q = (z_1^q, z_2^q, z_3^q, z_4^q)$ . We denote a policy proposal as  $z' = (z'_1, z'_2, z'_3, z'_4)$  and a generic element of this vector as  $z'_i$ . The proposed policy and the status quo are in the policy space  $Z = \{0, 1\}^4$ .

The actors are three legislators,  $(l_1, l_2, l_3)$ ; four lobbies,  $i = 1, 2, 3$ , and 4; and one external agenda setter. In this section, we adopt more general payoff functions for lobbies than in Section 2.1. Given the status quo  $z^q$  and a policy proposal  $z'$ , define  $g_i(z', z^q)$  as the change in lobby  $i$ 's payoff that would result if policy were changed from  $z^q$  to  $z'$  (for example,  $g_i(z^q, z^q) = 0$ ).<sup>14</sup> Thus, if  $g_i(z', z^q) > 0$ , lobby  $i$  prefers the proposal to the status quo; if  $g_i(z', z^q) < 0$ , lobby  $i$  prefers the status quo to the proposal. For each status quo and proposal we rank all national lobbies according to their  $g_i$  and refer to the median lobby as ' $m$ .' Legislators care only about maximizing received contributions (an extension to the case where legislators have preferences over policies is provided in Section 5). Each project  $i$  that is on imposes a cost of  $d_i$  on the agenda setter.

After the agenda setter proposes a policy alternative  $z' \in Z$  to the status quo, lobbies offer contributions to legislators. We assume that contributions must be non-negative. Lobbies 1, 2, and 3 can offer contributions only to their respective legislator, while lobby 4 can offer

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<sup>14</sup>The payoffs in Section 2.1 are a special case.

contributions to every legislator. Legislator  $i$  is offered contributions of  $x_i$  by his national lobby and contributions of  $x_{4i}$  by lobby 4. Each legislator  $l_i$  casts vote  $v_i \in \{0, 1\}$  on the proposed policy, where  $v_i = 1$  signifies a "yes" vote and  $v_i = 0$  indicates a "no" vote. A voting profile is a vector  $v = (v_1, v_2, v_3)$ . Note that there are eight possible voting profiles:  $v \in V = \{(0, 0, 0), (0, 0, 1), (0, 1, 0), (1, 0, 0), (1, 1, 0), (1, 0, 1), (0, 1, 1), (1, 1, 1)\}$ .

Under H2, each lobby can condition her contributions on the entire voting profile  $v$ . We denote the contribution schedule of national lobby  $i$  (for  $i = 1, 2, 3$ ) to legislator  $i$  as  $x_i : l_i * V \rightarrow \mathbb{R}$ ; a specific contribution to  $l_i$  conditional on voting profile  $v$  is denoted  $x_i^v$ . Lobby 4 offers to each legislator  $i$  a contribution schedule  $x_{4i}$ , conditional on the voting profile. Lobby 4's contributions, conditional on a particular voting profile  $v$ , are denoted by the vector  $x_4^v = (x_{41}^v, x_{42}^v, x_{43}^v)$ . Note that  $x_4 : \{l_1, l_2, l_3\} * V \rightarrow \mathbb{R}$ . Each legislator observes the contributions offered to him only. For each possible voting profile, the legislator will receive an offer from his national lobby and an offer from the transnational lobby. Hence the strategy space for legislators is  $v_i : \mathbb{R}^{16} \rightarrow \{0, 1\}$ .

Under H3, each lobby can condition her contributions to legislator  $i$  only on that legislator's vote,  $v_i$ . We denote the contribution schedule of national lobby  $i$  (for  $i = 1, 2, 3$ ) to legislator  $i$  as  $x_i : l_i * \{0, 1\} \rightarrow \mathbb{R}$ ; a specific contribution conditional on vote  $v_i$  is denoted as  $x_i^{v_i}$ . Lobby 4 offers to each legislator  $i$  a contribution schedule  $x_{4i} = (x_{4i}^1, x_{4i}^0)$ , conditional only on legislator  $i$ 's vote,  $v_i$ . Her strategy is  $x_4 = (x_{41}^1, x_{42}^1, x_{43}^1, x_{41}^0, x_{42}^0, x_{43}^0)$ , where  $x_4 : \{l_1, l_2, l_3\} * \{0, 1\} \rightarrow \mathbb{R}$ . Each legislator observes the contributions offered to him only and then votes. Each legislator's strategy space is  $v_i : \mathbb{R}^4 \rightarrow \{0, 1\}$ .

The objectives of each actor are as follows: The agenda setter minimizes costs; that is,

$$\max_z W_A(z) = - \sum_i I_i(z) d_i$$

with  $I_i(z) = \begin{cases} 1 & \text{if } z_i = 1 \\ 0 & \text{if } z_i = 0 \end{cases}$ . Lobbies maximize payoffs net of contributions. That is,

$$\max_{x_i^v} g_i(z, z^q) - x_i^v \text{ (under H2) or } \max_{x_i^{v_i}} g_i(z, z^q) - x_i^{v_i} \text{ (under H3) for } i = 1, 2, 3 ; \text{ and}$$

$$\max_{x_{4i}^v} g_4(z, z^q) - \sum_{j=1}^3 x_{4j}^v \text{ (under H2) or } \max_{x_{4i}^{v_i}} g_4(z, z^q) - \sum_{j=1}^3 x_{4j}^{v_i} \text{ (under H3) for lobby 4.}$$

Legislators maximize contributions received; that is,

$$\max_{v_i} x_i^v + x_{4i}^v \text{ (under H2) or } \max_{v_i} x_i^{v_i} + x_{4i}^{v_i} \text{ (under H3).}$$

Under both assumptions, the one-round game proceeds via the following substages:

Substage 1): Given a status quo  $z^q \in Z$ , the agenda setter makes a proposal  $z' \in Z$ .

Substage 2): Lobbies observe the proposal  $z'$  then simultaneously and non-cooperatively offer contribution schedules to the legislators. Lobbies  $i = 1, 2, 3$  offer contribution schedules  $x_i$  to their corresponding legislator  $l_i$ . Lobby 4 offers contribution schedules  $x_{4i}$  to each legislator  $l_i$ , for  $i = 1, 2, 3$ .

Substage 3): Each legislator observes the contributions offered to him only. The legislators simultaneously vote either for  $z^q$  or  $z'$ . Legislators cannot abstain. Decisions are by majority rule: proposal  $z'$  wins if and only if  $\sum_{i=1}^3 v_i \geq 2$ .

## 3.2 Equilibrium when lobbies can condition payments on all votes

### Equilibrium

The equilibrium concept is pure strategy subgame perfect Nash.

**Definition 1** *A contribution schedule is said to be **consequential** iff non pivotal legislators are offered zero contributions, both on and off the equilibrium path.*<sup>15</sup>

### Results

We solve the game backwards. Once the agenda setter has made a proposal, lobbies and legislators face a binary outcome. In substage 1, the agenda setter will propose the policy that maximizes its welfare, subject to approval of a majority of legislators, who in turn base their decisions on the offers of lobbies.

The fact that a ‘*pivot strategy*’ (described below) is available to the transnational lobby ensures that the following result holds:

**Lemma 1 *Pivot strategy*** *Under H2, for any  $z^q$ , there exists an equilibrium in which the agenda setter proposes its most preferred policy from among those preferred to the status quo by the transnational lobby ( $\hat{z}' = \arg \max_z W_A(z)$  s.t.  $g_4(z, z^q) \geq 0$ ), all lobbies offer zero contributions for any voting profile ( $\hat{x}_i^v = \hat{x}_{4i}^v = 0 \forall i$  and  $\forall v$ ) and all legislators vote for the proposal ( $\hat{v} = (1, 1, 1)$ ). Furthermore, any equilibrium in which only consequential strategies are used has the properties that the outcome is  $\hat{z} = \hat{z}'$  and no positive contributions are ever paid on the equilibrium path ( $\hat{x}_i^{\hat{v}} = \hat{x}_{4i}^{\hat{v}} = 0 \forall i$ ).*

A proof is presented in Appendix A. The intuition is as follows: In the final two substages, lobbies and legislators face a binary alternative between the status quo and a proposal. For any proposal, consider the case in which all lobbies offer zero contributions for any voting profile and all legislators vote for the alternative preferred by the transnational lobby. No one has an incentive to deviate: In Substage 3, legislators receive zero contributions regardless of their vote, and hence have nothing to gain from deviating. In Substage 2, the transnational lobby obtains her preferred outcome for free and national lobbies cannot affect the outcome since their corresponding legislator is not pivotal.

There exist other equilibria. However, if only consequential strategies are played in equilibrium, then, given a proposal, there is no equilibrium in which the transnational lobby’s preferred alternative is rejected or the transnational lobby pays positive contributions. Suppose there was such a candidate equilibrium. Then the transnational lobby could deviate by playing the following *pivot strategy*: In Substage 2, for any voting profile, the transnational lobby offers to each legislator voting against the transnational lobby’s preferred alternative slightly more than the legislator’s national lobby is offering in the candidate equilibrium. In Substage 3, every legislator’s dominant strategy will then be to vote for the transnational lobby’s preferred alternative. No legislator will be pivotal if the transnational lobby deviates using this strategy. Hence, in the deviation, contributions will only have to be made

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<sup>15</sup>Requiring contributions to be consequential is equivalent to using an equilibrium refinement. We are not restricting the set of strategies, but rather the set of equilibria. In other words, if a player could profitably deviate from a candidate equilibrium by playing a non-consequential strategy, then this would not in fact be an equilibrium.



to non-pivotal legislators. But because the transnational lobby is deviating from an equilibrium in which lobbies play only consequential strategies, she will only have to contribute an arbitrarily small amount. Since the contributions required to sustain this deviation are arbitrarily small and therefore less than the benefit to the transnational lobby from sustaining the deviation, this deviation is profitable for the transnational lobby. Thus, the candidate equilibrium does not exist. The pivot strategy (although it will never be played in equilibrium) enables the transnational lobby to exploit majority rule by creating a prisoner's dilemma.<sup>16</sup> In section 4 we show how this result holds even if legislators have personal preferences.

### 3.3 Equilibrium when lobbies can condition payments only on the legislator's own vote

#### Equilibrium

The equilibrium concept is pure strategy subgame perfect Nash.

**Definition 2** *Contribution schedules are said to be **preference consistent** iff no lobby offers a positive amount for a vote against her preferred outcome (on or off the equilibrium path).*

**Definition 3** *If there exist multiple equilibria, we say that an equilibrium is **collusion proof** iff two or more legislators could not profitably deviate to a different equilibrium.*

#### Results

We solve the game backwards and establish the following:

**Lemma 2 Median Lobby Result.** *Under H3, there exists an equilibrium in which the agenda setter proposes its most preferred policy from among those such that the sum of net benefits to the transnational lobby and the median lobby is positive ( $\hat{z}' = \arg \min_z - \sum_i I_i(z)d_i$  s.t.  $g_4(z, z^q) + g_m(z, z^q) \geq 0$ ). Furthermore, all collusion proof equilibria have outcome  $\hat{z} = \hat{z}'$  and have equilibrium paths that share the following properties: If the proposal creates a loss for the transnational lobby ( $g_4(\hat{z}', z^q) < 0$ ), then two national lobbies each pay contributions equal to the amount of this loss ( $\hat{x}_i^{\hat{v}_i} = \hat{x}_j^{\hat{v}_j} = -g_4(\hat{z}', z^q)$  and  $\hat{x}_k^{\hat{v}_k} = 0$  for some  $i \neq j \neq k$ ) and lobby 4 pays no contributions ( $\hat{x}_{4i}^{\hat{v}_i} = 0 \forall i$ ). If  $g_4(\hat{z}', z^q) \geq 0$  and contributions are preference consistent, then no contributions are paid on the equilibrium path ( $\hat{x}_i^{\hat{v}_i} = \hat{x}_i^{\hat{v}_i} = 0 \forall i$ ).*

A proof is provided in Appendix A; here we present the intuition. In the final two substages, lobbies and legislators again face a binary alternative between the status quo and the proposal. Assume, without loss of generality, that the transnational lobby favors the proposal. There exists an equilibrium of this continuation game in which all legislators vote for the proposal and no contributions are offered for any vote. No legislator has an incentive to deviate, since contributions are the same regardless of his vote. Since no legislator is

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<sup>16</sup>Note that even if we do not eliminate weakly dominated strategies, in equilibrium no weakly dominated strategies are played.

pivotal, no national lobby has an incentive to deviate. The transnational lobby obtains her preferred policy at no cost.

However, there might also exist an equilibrium in which a majority of legislators vote for the status quo. For this to be the case, it must be that only two legislators vote for the status quo and the other votes against: If instead the status quo passed unanimously, then no legislator would receive positive contributions (since any lobby offering positive contributions could profitably deviate by reducing her contribution). But then the transnational lobby could profitably deviate by offering two legislators an arbitrarily small amount for a "yes" vote and zero for a "no" vote. Hence, the status quo can be approved only by two pivotal legislators. Given this, the transnational lobby only needs to recruit one additional vote to change the outcome. The maximum that each pivotal legislator  $i$  can receive in this equilibrium is  $\max[-g_i, 0]$ . With  $g_m < 0$  the transnational lobby would have to pay at most  $-g_m + \varepsilon$  to recruit one pivotal legislator. Hence, if  $g_4 \geq 0$  and  $g_4 > -g_m$ , the status quo cannot be the equilibrium outcome. On the other hand, if  $g_4 \geq 0$  and  $g_4 \leq -g_m$ , then there exists an equilibrium in which the status quo receives the votes of two legislators and positive contributions are paid.

Whenever there is such an equilibrium, we argue that the equilibrium in which all three legislators vote for the proposal is unrealistic: two legislators could jointly deviate to the equilibrium with the status quo as the outcome and both would be better off.

Given these continuation equilibria, the agenda setter will solve the constrained maximization problem described in Lemma 2. Note that restricting the set of strategies to those that are preference consistent merely guarantees that lobbies with  $g_i \geq 0$  will not arbitrarily increase the contributions that lobby 4 must pay to ensure that the proposal passes. This restriction affects only equilibrium contributions and not the equilibrium outcome.

### 3.4 Results for $T > 1$

In this subsection we briefly explain how the results of Lemma 1 and Lemma 2 can be used to derive equilibria for games of multiple rounds.

Consider a game with a finite number of rounds  $T > 1$ . Denote the contributions paid by each lobby  $i$  on the continuation equilibrium path from round  $t$  given that policy  $z$  is majority approved as  $x_i(z, t)$ .<sup>17</sup> As in section 2.1, given a status quo  $z^{qt}$  and a proposal  $z^t$ , the dynamic sophisticated equivalents are  $\delta(z^{qt}, t)$  and  $\delta(z^t, t)$ . Since on the continuation path positive contributions might be paid, we further define the *dynamic sophisticated equivalent payoff*,  $\delta g_i(z^t, z^{qt}, t)$ , to lobby  $i$ :

$$\delta g_i(z^t, z^{qt}, t) = g_i(\delta(z^t, t)) - x_i(z^t, t) - [g_i(\delta(z^{qt}, t)) - x_i(z^{qt}, t)]$$

We can now state the following:

**Corollary 1** *Any  $T > 1$  round game can be solved backwards using Lemma 1 and Lemma 2 (under H2 and H3 respectively) through the use of dynamic sophisticated equivalent outcomes and payoffs.*

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<sup>17</sup>Note that this term does not include contributions paid in round  $t$ .

We give an example. Consider a game with  $T = 3$ . At  $t = 3$ , given any status quo  $z^{q3}$ , Lemma 1 and Lemma 2 give the equilibrium outcome and the contributions paid by each lobby at  $t = 3$ . These contributions are in turn the contributions paid on the continuation equilibrium path from  $t = 2$ ,  $x_i(z^{q3}, 2)$ .<sup>18</sup> Going back to round 2, for any status quo  $z^{q2}$  and any proposal  $z^2$ , the equilibrium of round 3 determines the continuation outcomes  $\delta(z^{q2}, 2)$  and  $\delta(z^2, 2)$ . Therefore, in round  $t = 2$ , we can look at the remaining game as a one round game. The dynamic sophisticated equivalent payoffs would be  $\delta g_i(z^2, z^{q2}, 2) = g_i(\delta(z^2, 2)) - g_i(\delta(z^{q2}, 2)) - x_i(z^2, 2) + x_i(z^{q2}, 2)$ . Lemma 1 and Lemma 2 now give us the final outcome for any  $z^{q2}$  and the contributions paid on the continuation equilibrium path from  $t = 1$ . The equilibrium of round 2 determines  $\delta(z^{q1}, 1)$  and  $\delta(z^1, 1)$  for any  $z^{q1}$  and  $z^1$ . Going back to round 1, we can again apply the Lemmas by substituting  $\delta g_i(z^1, z^{q1}) = g_i(\delta(z^1, 1)) - g_i(\delta(z^{q1}, 1)) - x_i(z^1, 2) + x_i(z^{q1}, 1)$  as payoffs, which will give the outcome of the whole game. In essence, a multiple round game can be reduced to a single round game through the use of dynamic sophisticated equivalents and the preceding lemmas.

By applying the corollary to any  $T \geq 1$  round game under H2, we find that no proposal that leaves the transnational lobby worse off than the initial status quo can ever pass. In particular, whenever the projects of other lobbies create a cost to lobby  $i$  and whenever no lobby can be compensated for the loss of its project via side payments, for any status quo  $z^{q1} = (z_1^{q1}, z_2^{q1}, z_3^{q1}, z_4^{q1})$ , the final outcome will be  $z^{T+1} = (0, 0, 0, z_4^{q1})$ . This follows from the fact that, regardless of the number of rounds,  $\delta g_4(z^t, z^{qt}, t) < 0$  for any policy that turns off project 4 in the last round. In addition, all other projects can be eliminated in the first round for any  $T \geq 1$  since  $\delta g_4(z^t, z^{qt}, t) > 0$  for such proposals. Note that in section 2.1, three rounds were needed to guarantee that all national projects would be turned off. One round is sufficient under H2 and transnational lobbying.

Under H3, the outcome of a multiple round game will depend on the relative dynamic sophisticated equivalent payoffs of the transnational and the median lobbies. However, with  $T \geq 3$ , as long as the projects associated with each lobby create a cost to other lobbies, the results of section 2.1 guarantee that all national projects can be eliminated (for a formal proof of this generalization see Bernheim and Console Battilana 2006). Thus, if  $z_4^{q1} = 1$ , the final equilibrium outcome will be either  $(0, 0, 0, 0)$  or  $(0, 0, 0, z_4^{q1})$ , depending on  $\delta g_4 \gtrless \delta g_m$ .

The next section applies the above results to a specific trade example.

### 3.5 The transnational advantage: An application to trade policy

In this subsection we present an application to trade policy. Starting from a protectionist status quo, we pose the question: If the transnational lobby is identical to all other lobbies except with respect to being organized transnationally, does this transnational lobby have a strategic advantage in determining trade policy?

We look at a small open economy ("the union"), comprised of three nations  $i = 1, 2, 3$ . The exogenous vector of world prices is  $p^*$ . We normalize the total population of the union to 1. Each nation  $i$  has a portion of total population,  $\alpha_i$ , who own the factors used to produce good  $i$  (which is produced only in nation  $i$ ) and who reside in nation  $i$ . A fourth good, 4, is produced in all nations. The owners of factors used to produce good 4 constitute

<sup>18</sup>Notice that  $z^{q3}$  is by definition the policy that is majority approved at round 2 and thus will equal either  $z^{q2}$  or  $z^2$ .

a portion  $\alpha_4$  of the union's total population and are spread across all three nations. We call sectors 1, 2, and 3 "national" and sector 4 "transnational." Because we want to study the advantage of the transnational sector holding all other economic variables equal, we assume  $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha \leq \frac{1}{4}$ .

Factors used to produce one good are used to produce that good only. Individuals owning a factor used to produce a particular good cannot own factors used to produce other goods. Each individual is homogenous in their compensated demand for all goods. The producers of each sector are organized in lobby  $i$ . We assume quasi-linear, separable compensated demand functions and quasi-linear supply functions within the union. Therefore, quantity demanded and supplied for good  $i$  depends on the price of good  $i$  only, and there are no income effects. Figure 1 illustrates demand and supply for one good.

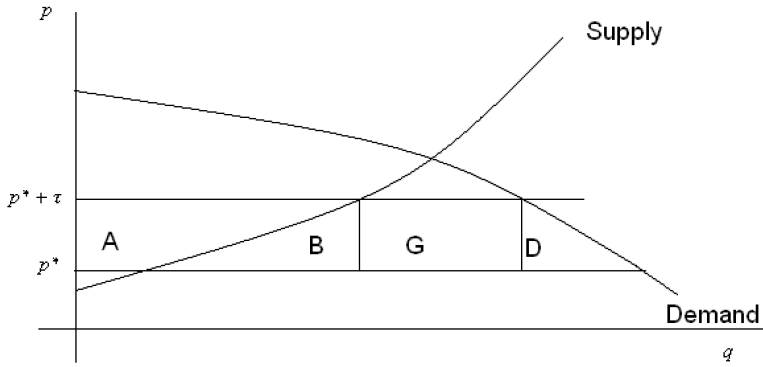


Figure 1

The economy faces a status quo vector of tariffs,  $z^{q1}$ , with an identical positive tariff  $\tau$  in all sectors ( $z^{q1} = (\tau, \tau, \tau, \tau)$ ). Relative to free trade, a positive tariff has the following effects: it reduces total consumer surplus (area  $A + B + G + D$ ); it increases producer surplus (area  $A$ ); it generates government revenue (area  $G$ ); and it reduces the total welfare of the economy by creating a distortion (area  $B + D$ ). We assume that the net revenue from tariffs (area  $G$ ) is equally distributed among all individuals, hence total consumer loss is net of tariff revenue (area  $A + B + D$ ; we denote this sum as  $C$ ).

We assume that the agenda setter seeks to maximize the sum of the utility of all individuals. A tariff creates a net benefit  $A - \alpha C$  to its lobby while generating a cost of  $\alpha C$  for all other lobbies and a cost of  $B + D$  for the agenda setter. To guarantee uniqueness of equilibria, we assume that the agenda setter resolves any indifference among national tariffs by first attempting to lower tariff 1, then tariff 2, and then tariff 3.

The game proceeds as follows through a finite number of rounds,  $T \geq 3$ :

1. At any round  $t$ , given a status quo  $z^{qt}$ , the agenda setter proposes a tariff vector  $z^t = (z_1^t, z_2^t, z_3^t, z_4^t)$ , with  $z_i^t, z_i^{qt} \in \{0, \tau\}$ . (As before, the choice is binary: protection or free trade).

2. Lobbies simultaneously and non-cooperatively offer contributions (under H2 or H3; we derive results separately for each case below). Lobbies 1, 2, and 3 can offer contributions only to their nation's legislator; lobby 4 can contribute to all legislators.

3. Legislators observe only the contributions offered to them, then vote simultaneously and non-cooperatively. The winning policy becomes the status quo for the new round,  $z^{qt+1}$ .

4. The game is repeated from  $t = 1$  to  $t = T \geq 3$ . The policy receiving a majority of votes in round  $T$  is implemented.

### Equilibrium and results

The equilibrium concept is pure strategy subgame perfect Nash. Contributions are either contingent on the entire voting profile (H2) or only on the vote of the legislator receiving the contribution (H3). Under H2, we look for equilibria in which only consequential strategies are played. Under H3, we look only for collusion proof equilibria in which lobbies' strategies are preference consistent.

We solve backwards, and find the following:

**Proposition 3** *For any  $T \geq 3$ , under both H2 and H3, if  $\alpha > \frac{A}{4C}$ , the final outcome is free trade in all sectors,  $(0, 0, 0, 0)$ ; if  $\alpha < \frac{A}{4C}$ , the final outcome is free trade in all national sectors and the status quo tariff in the transnational sector,  $(0, 0, 0, \tau)$ ; if  $\alpha = \frac{A}{4C}$  the equilibrium outcome could be either  $(0, 0, 0, 0)$  or  $(0, 0, 0, \tau)$ .*

The proof is in Appendix B. The intuition is as follows: The agenda setter seeks to eliminate as many tariffs as possible. The cost to each lobby from shifting to free trade in her sector is  $-A$ ; the gain from shifting to free trade in any sector is  $\alpha C$ . Thus, the maximum gain for each lobby is  $4\alpha C$  and the maximum loss is  $-A$ . If  $\alpha > \frac{A}{4C}$ , all lobbies prefer  $(0, 0, 0, 0)$  to the status quo  $(\tau, \tau, \tau, \tau)$ . If  $\alpha < \frac{A}{4C}$ , then eliminating a lobby's tariff will always harm that lobby no matter how many other sectors' tariffs are eliminated.

Under H2, no policy disliked by the transnational lobby can ever be implemented (as discussed above). Hence, if  $\alpha < \frac{A}{4C}$ , no policy proposing the elimination of sector 4's tariff will ever pass. Therefore, the Commission's second best objective is to eliminate the tariffs of all other sectors. We have seen in section 3.4 that this can be achieved with any  $T \geq 1$ .

Under H3, national tariffs can still be eliminated if there are at least three rounds. However, at any round  $t$ , a proposal that would lead to the elimination of the transnational tariff at time  $T$  will pass only if the sum of the dynamic sophisticated equivalent payoffs to the transnational lobby and the median national lobby is greater than zero (i.e., the ultimate loss to the transnational lobby is smaller than the ultimate gain to the median national lobby). This never happens if  $\alpha < \frac{A}{4C}$ ; in this case the transnational sector's tariff can never be eliminated.

#### 3.5.1 Political Economic Implications

This section has demonstrated that, within an institutional setting similar to that of the EU, a transnational lobby will be able to retain her sector's tariff by exploiting the majority rule setting. If we allowed the Commission more than a binary choice between protection and free trade, then the Commission would be able to lower the tariff of the transnational sector to the point at which the cost to the transnational lobby is equal to the benefit that the

transnational lobby derives from the elimination of other tariffs. However, the transnational tariff still could not be eliminated.

These theoretical results may explain why high tariff peaks tend to exist in sectors organized transnationally and also why lobby consultancy firms recommend building pan-European coalitions. Coen (1997) notes that EU institutions advantage those interest groups capable of establishing an "European identity" through alliances with rival firms. We show this transnational advantage is not simply a matter of greater resources or economies of organizational scale, but rather derives from the ability of a transnational lobby to exploit the EU institutional setting.

## 4 Extension

### 4.1 $N > 3$ nations and legislators with outcome dependent preferences

In this section we extend the model to a setting with an odd number  $N \geq 3$  of nations and we allow legislators to have preferences that depend on policy outcomes in addition to contributions. We again study a single round game. Our results will apply to games of multiple rounds through the use of dynamic sophisticated equivalents.

Even with additional nations and legislators with outcome dependent preferences, versions of the pivot strategy and median lobby lemmas presented above still hold. In particular, we find that

**Proposition 4** *If there are an odd number  $N \geq 3$  of legislators with personal preferences dependent on the outcome,  $N$  corresponding national lobbies, and one transnational lobby, then, given an alternative between any  $z$  and any  $z^q$*

1. *Under H2, in all equilibria in which consequential strategies are played, the transnational lobby obtains her preferred policy at no cost, even if all legislators and all national lobbies dislike the outcome.*
2. *Under H3, in equilibrium the transnational lobby obtains her preferred outcome if the benefit of this policy to the transnational lobby is greater than the sum of: 1) the maximum loss that can be incurred by the minimum number of legislators necessary to constitute a majority and 2) the loss incurred by the median national lobby.*

We present both the formal set up and the proof in Appendix C. Here we provide a brief intuition for each part of the proposition.

Part 1. When contributions can be conditioned on the entire voting profile, the transnational lobby will obtain her preferred outcome at no cost. This result holds because the transnational lobby can design contributions so that no legislator will be pivotal in equilibrium, and hence no legislator can affect the outcome. Therefore a legislator's personal outcome dependent preferences do not affect his voting decision.

By playing such a pivot strategy, the transnational lobby can eliminate any candidate equilibrium which does not have her preferred policy as its outcome. The pivot strategy is simply to offer a supermajority (at least a majority plus one) of legislators an arbitrarily small amount more than what they would receive in the candidate equilibrium. All legislators offered this schedule will vote for the policy preferred by the transnational lobby and no legislator will be pivotal. In equilibria in which consequential strategies are played, no national lobby offers positive contributions to a non-pivotal legislator. Therefore, if there was a candidate equilibrium in which the transnational lobby had to pay positive contributions or did not obtain her preferred outcome, the transnational lobby could deviate by playing this pivot strategy and would have to pay only an arbitrarily small amount to each legislator within the supermajority. The transnational lobby could do so regardless of how small her gain or how high the loss to other national lobbies. Thus, every equilibrium has the property that the transnational lobby obtains her preferred outcome at no cost.

Part 2. When contributions can be conditioned only on the vote of the recipient legislator, we show there exists an equilibrium in which a supermajority of legislators votes for the policy preferred by the transnational lobby and no contributions are offered. Yet, because actors cannot coordinate, multiple equilibria exist. The condition presented in the proposition is a sufficient condition: it ensures that there does not exist an equilibrium in which the policy preferred by the transnational lobby is not the outcome. Suppose not, i.e., suppose the aforementioned condition holds and that there is a candidate equilibrium with an outcome not preferred by the transnational lobby. If in such an equilibrium no legislator was pivotal, the transnational lobby could offer to compensate a majority of legislators for their loss of personal utility and to contribute an additional arbitrarily small amount. Since in the candidate equilibrium no legislator is receiving positive contributions (no one is pivotal), a majority of legislators would deviate and the transnational lobby would be better off. Suppose instead that an exact majority of legislators was voting against the transnational lobby in the candidate equilibrium. In this case every legislator within this majority would be pivotal. The transnational lobby could recruit the remaining legislators at the price of their personal outcome dependent payoff plus an arbitrarily small amount and in addition recruit the least expensive legislator from within the majority. This remaining legislator would have to be compensated both for his outcome dependent payoff and for the contributions he might be receiving from his national lobby. Regardless of the original candidate equilibrium, the latter amount can be at most  $|g_m|$ , the absolute value of the payoff to the median lobby of the outcome not preferred by the transnational lobby. By assumption, the transnational lobby would be willing to offer sufficient contributions to recruit a majority. Hence, no equilibrium with an outcome not preferred by the transnational lobby can exist.<sup>19</sup>

## 5 Conclusion

Procedure affects outcomes. A major achievement of game theoretic work on political economics has been to highlight the ways in which rules play an independent role in shaping

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<sup>19</sup>Note that the proposition states a sufficient condition, not a necessary condition: the outcome not preferred by the transnational lobby could also be defeated through a joint effort of the transnational lobby and national lobbies with aligned preferences. However, multiple equilibria can arise as a result of coordination problems across lobbies.

policy. The present paper contributes to this literature. Our results underscore the power of an external agenda setter in a multiple round majority rule setting similar to that of many institutions, including the EU trade policy apparatus. Previous theoretical work has found that, when actors are sophisticated, such an agenda setter can reach any outcome in the uncovered set. Our finding is much stronger. We show that, if the agenda setter is not limited to proposing non-contingent (or "symmetric amendment") agenda but can instead modify its proposals in response to other actors, the agenda setter can in fact reach any outcome immediately.

Applied to EU trade policy for the period following the creation of an internal market, our model suggests institutional reasons for the observed general decline in external trade barriers, despite earlier predictions of increasing protectionism. Reality, however, suggests that the power of a free-trade biased EU Commission is far from absolute—very high tariffs persist in certain sectors. This paper also adds to existing theory on this count, by providing game theoretic proof that unanimity rule or transnational lobbying may each limit the agenda setter's ability to reach its most preferred outcome.

With respect to transnational lobbying, our result is again stronger than those of most literature. When contributions are conditioned on the entire voting profile, we show that no policy disliked by the transnational lobby can ever pass and that the transnational lobby achieves this outcome at no cost. If contributions are conditioned on the vote of each recipient legislator, we find that the transnational lobby can prevent passage of any proposal by outbidding the median national lobby. The transnational lobby's advantage does not derive simply from its ability to recruit the cheapest minimum winning coalition. Instead, this advantage stems from the transnational lobby's unique ability to play a *pivot strategy* and thereby induce an equilibrium in which no legislator is pivotal. Groseclose and Snyder (1996) show that recruiting a supermajority may be cheaper than recruiting a smaller majority. We show that recruiting a supermajority is costless when a pivot strategy can be employed.

In other work, we extend the theory developed here. Console Battilana and Shepsle (2006) apply the theoretical framework of the present paper to supreme court nominations. Bernheim and Console Battilana (2006) incorporate a generic policy space and show that unlimited agenda power persists under pre-commitment (to a contingent agenda) or if there exist adjournment possibilities. Console Battilana (2006) explores the case in which lobbies appeal directly to the agenda setter via informational lobbying. In all of these papers, versions of the results outlined above continue to hold.

Hanson (1998) p. 56 argues that "European integration has played a considerable role in the liberalization of European external trade policy by changing the institutional context in which trade policy is made, creating a systematic bias toward liberalization over increased protection." Taken as a whole, our model explains game theoretically why this has been the case and also why liberalization has not spread to all EU sectors.



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# Appendix A

## *Proof of Proposition 1, Agenda Power*

**Proof.** We solve the game backwards from round  $T$ . For each of the eight possible configurations of the status quo  $z^{qT}$ , the pure strategy subgame perfect Nash equilibrium outcomes are given by the table below:

Table 1		
Status quo $z^{qT}$	Possibilities <sup>20</sup>	Outcome
(0, 0, 0)	(0, 0, 0), (0, 1, 1), (1, 0, 1), (1, 1, 0), (1, 1, 1)	(0, 0, 0)
(0, 0, 1)	(0, 0, 0), (0, 0, 1), (1, 1, 0), (1, 1, 1)	(0, 0, 0)
(0, 1, 0)	(0, 0, 0), (0, 0, 1), (0, 1, 0), (1, 0, 1), (1, 1, 1)	(0, 0, 0)
(1, 0, 0)	(0, 0, 0), (0, 0, 1), (0, 1, 0), (1, 0, 0), (0, 1, 1), (1, 1, 1)	(0, 0, 0)
(0, 1, 1)	(0, 0, 1), (0, 1, 0), (0, 1, 1)	(0, 0, 1)
(1, 0, 1)	(0, 0, 1), (1, 0, 0), (0, 1, 1), (1, 0, 1)	(0, 0, 1)
(1, 1, 0)	(0, 1, 0), (1, 0, 0), (0, 1, 1), (1, 0, 1), (1, 1, 0)	(0, 1, 0)
(1, 1, 1)	(0, 1, 1), (1, 0, 1), (1, 1, 0), (1, 1, 1)	(0, 1, 1)

In each case, "possibilities" are all proposals that would pass (including trivially the status quo) and "outcome" is the agenda-setter's preferred choice among these. Knowing these are the possible outcomes in the last round (i.e. the possible dynamic sophisticated equivalents for any round  $t < T$ ), we take one step back to round  $T - 1$ . For each possible status quo  $z^{qT-1}$  and proposal  $z^{T-1}$ , we know that the vote is between the outcome that arises in round  $T$  if policy  $z^{qT-1}$  wins,  $\delta(z^{qT-1}, T - 1)$ , versus the outcome that arises in round  $T$  if proposal  $z^{T-1}$  wins,  $\delta(z^{qT-1}, T - 1)$ . For example, suppose the status quo of round  $T - 1$  is (0, 1, 0). From the last round game, we know that, if this wins in the second to last round and becomes the status quo for the last round, the outcome will be  $\delta((0, 1, 0), T - 1) = (0, 0, 0)$ . Therefore, when voting in  $T - 1$  lobbies will vote for (0, 1, 0) iff they prefer (0, 0, 0) to the dynamic sophisticated equivalent that would emerge if they voted for the agenda setter's proposal,  $z^{T-1}$ . Notice that this is not the same as asking whether they prefer (0, 0, 0) to  $z^{T-1}$ .

From round  $T$ , we know that there are only four possible outcomes: (0, 0, 0), (0, 0, 1), (0, 1, 0), and (0, 1, 1). In round  $T - 1$ , each  $z^{qT-1}$  and each  $z^{T-1}$  is associated with one of these outcomes,  $\delta(z, T - 1) \in \{(0, 0, 0), (0, 0, 1), (0, 1, 0), (0, 1, 1)\}$  for  $z \in \{z^{T-1}, z^{qT-1}\}$ . Consequently, the two round game is just like a one round game where the possible choices are the dynamic sophisticated equivalents. For this "reduced" one round game, we have Table 2.

Table 2		
$\delta(z, T - 1)$	Possibilities at time $T$	Outcome
(0, 0, 0)	(0, 0, 0), (0, 1, 1)	(0, 0, 0)
(0, 0, 1)	(0, 0, 0), (0, 0, 1)	(0, 0, 0)
(0, 1, 0)	(0, 0, 0), (0, 0, 1), (0, 1, 0)	(0, 0, 0)
(0, 1, 1)	(0, 0, 1), (0, 1, 0), (0, 1, 1)	(0, 0, 1)

<sup>20</sup>Without loss of generality, we are showing the case in which  $c_1 > c_2 > c_3$ . This assumption only affects the possibilities column and not the outcome column.

Combining table 2 with table 1, we can make up the required table for the two round game.

Table 3		
Status quo $z^{qT-1}$	Proposal(s) $z^{T-1}$	Outcome
(0, 0, 0)	(0, 0, 0), (0, 0, 1), (0, 1, 0), (1, 0, 0)	(0, 0, 0)
(0, 0, 1)	(0, 0, 0), (0, 0, 1), (0, 1, 0), (1, 0, 0)	(0, 0, 0)
(0, 1, 0)	(0, 0, 0), (0, 0, 1), (0, 1, 0), (1, 0, 0)	(0, 0, 0)
(1, 0, 0)	(0, 0, 0), (0, 0, 1), (0, 1, 0), (1, 0, 0)	(0, 0, 0)
(0, 1, 1)	(0, 0, 0), (0, 0, 1), (0, 1, 0), (1, 0, 0)	(0, 0, 0)
(1, 0, 1)	(0, 0, 0), (0, 0, 1), (0, 1, 0), (1, 0, 0)	(0, 0, 0)
(1, 1, 0)	(0, 0, 0), (0, 0, 1), (0, 1, 0), (1, 0, 0)	(0, 0, 0)
(1, 1, 1)	(0, 1, 1), (1, 0, 1)	(0, 0, 1)

For example, consider the status quo  $z^{qT-1} = (1, 0, 1)$ . We know from table 1 that, if this becomes the status quo for round  $T$ , the outcome will be  $\delta((1, 0, 1), T - 1) = (0, 0, 1)$ . However, from Table 2 we see that for this dynamic sophisticated equivalent the outcome is (0, 0, 0), which therefore appears in the "outcome" column of table 3. From table 1, we see that this outcome is obtained if (0, 0, 0), (0, 0, 1), (0, 1, 0), or (1, 0, 0) becomes the status quo for round  $T$ . Consequently, the agenda setter can propose any of these alternatives in round  $T - 1$ .

Having solved backwards for the pure strategy subgame perfect Nash equilibrium in round  $T$  and  $T - 1$ , we go back one round, and look at the game from round  $T - 2$ . Given a status quo  $z^{qT-2}$  and a policy proposal  $z^{T-2}$ , the lobbies compare the dynamic sophisticated equivalents: the final outcome that arises in round  $T$  if the status quo or the policy proposal win round  $T - 2$ . From round  $T - 1$ , we know that there are only two possible outcomes: (0, 0, 0) and (0, 0, 1). In round  $T - 2$ , each  $z^{qT-2}$  and  $z^{T-2}$  is associated with one of these outcomes:  $\delta(z, T - 1) \in \{(0, 0, 0), (0, 0, 1)\}$  for  $z \in \{z^{T-2}, z^{qT-2}\}$ . Consequently, the three round game is just like a one round game where the possible choices are (0, 0, 0) and (0, 0, 1). For this "reduced" one round game, we can make up a table like table 1.

Table 4		
$\delta(z, T - 2)$	Possibilities	Outcome
(0, 0, 0)	(0, 0, 0)	(0, 0, 0)
(0, 0, 1)	(0, 0, 0), (0, 0, 1)	(0, 0, 0)

Combining table 4 with table 3, we can make up the required table for the three round game.

Table 5		
Status quo $z^{qT-2}$	Outcome	Proposal(s) $z^{T-2}$
(0, 0, 0)	(0, 0, 0)	Anything but (1, 1, 1)
(0, 0, 1)	(0, 0, 0)	Anything but (1, 1, 1)
(0, 1, 0)	(0, 0, 0)	Anything but (1, 1, 1)
(1, 0, 0)	(0, 0, 0)	Anything but (1, 1, 1)
(0, 1, 1)	(0, 0, 0)	Anything but (1, 1, 1)
(1, 0, 1)	(0, 0, 0)	Anything but (1, 1, 1)
(1, 1, 0)	(0, 0, 0)	Anything but (1, 1, 1)
(1, 1, 1)	(0, 0, 0)	Anything but (1, 1, 1)

For example, consider the status quo  $z^{qT-2} = (1, 0, 1)$ . We know from table 3 that, if this becomes the status quo for round  $T-1$ , the outcome will be  $\delta((1, 0, 1), T-2) = (0, 0, 0)$ . From table 4, we see that, in the reduced form one round game,  $(0, 0, 0)$  leads to the outcome  $(0, 0, 0)$ , which therefore appears in the "outcome" column of table 5. From table 3, we see that this outcome is obtained if anything other than  $(1, 1, 1)$  becomes the status quo for round  $T-1$ . Consequently, the agenda setter can propose any of these alternatives in round  $T-2$ . If  $T = 3$ ,  $z^{q1} = (1, 1, 1)$  and the agenda setter proposes  $(0, 0, 0)$  in the first round, two lobbies are strictly better voting for it, even though they prefer  $(1, 1, 1)$  to  $(0, 0, 0)$ . Moreover, with  $T > 3$ , we know the outcome will be  $(0, 0, 0)$  regardless of the status quo inherited by the third to last round. Therefore, all play before the third-to-last round is irrelevant. If  $(0, 0, 0)$  is proposed in the first round, there always exists an equilibrium in which it is accepted in the first round by indifference. ■

### Proof of Pivot Strategy Lemma 1

**Proof.** We solve backwards. In substage two and three, lobbies and legislators are facing a binary alternative between a given  $z$  and a given  $z^q$ . We first solve these substages for a generic  $z$ , and then apply constrained maximization for substage one. Without loss of generality, we prove the results of substage two and three for  $g_4 \geq 0$  (the case with  $g_4 \leq 0$  is symmetric).

**Existence.** Equilibrium voting profile  $(1, 1, 1)$  is sustained by a contribution schedule in which each lobby offers zero contributions for every voting profile ( $\hat{x}_i^v = \hat{x}_{4i}^v = 0 \forall i$  and  $\forall v$ ). No legislator has an incentive to deviate, since he always receives zero contributions for  $v_i \in \{0, 1\}$ . No lobby has an incentive to deviate: lobby 4 is receiving its preferred outcome at no cost. Lobby  $i = 1, 2, 3$  can only influence the vote of one legislator, since each legislator only observes changes in contributions offered to him. But no legislator is pivotal, hence no lobby has an incentive to deviate.

If contributions are consequential, there is no equilibrium in which a status quo different than the proposal is approved. Suppose there was one. This candidate equilibrium would also be characterized by a contribution schedule  $\tilde{x}_i$  for all  $i$ . Lobby 4 could deviate by offering  $x_{41}^{1,v_2,v_3} = \tilde{x}_1^{0,v_2,v_3} + \varepsilon \forall v_2, v_3$ ,  $x_{42}^{v_1,1,v_3} = \tilde{x}_2^{v_1,0,v_3} + \varepsilon \forall v_1, v_3$ ,  $x_{43}^{v_1,v_2,1} = \tilde{x}_3^{v_1,v_2,0} + \varepsilon \forall v_1, v_2$  and  $x_{4i}^v = 0 \forall v$  s.t.  $v_i = 0$ . We will refer to this strategy as the *pivot strategy*. Voting 1 is a dominant strategy for each legislator, hence there is a deviation to  $(1, 1, 1)$ . If the initial configuration with the status quo as an outcome ( $\sum_{i=1}^3 \tilde{v}_i < 2$ ) had been an equilibrium with consequential strategies, then  $\tilde{x}_1^{0,1,1} = \tilde{x}_2^{1,0,1} = \tilde{x}_3^{1,1,0} = 0$  (take for example  $\tilde{x}_1^{0,1,1}$ . In voting profile  $v = (0, 1, 1)$  legislator  $l_i$  is not pivotal, therefore he is offered no contributions for that voting profile in a consequential strategy profile). Therefore, the new equilibrium payoff of lobby 4 would be  $g_4 - 3\varepsilon > 0$  for  $\varepsilon$  arbitrarily small. Since in any equilibrium with outcome  $z^q$  lobby 4's net payoff is less or equal to zero, lobby 4 would be strictly better off and the original profile with the status quo as an outcome could not have been an equilibrium.

Now suppose there was a candidate equilibrium with outcome  $\tilde{z}$  and lobby 4 paid total positive contributions,  $\sum_i \tilde{x}_{4i}^{\tilde{v}} = y > 0$ . If contributions are consequential, this can not happen in  $\tilde{v} = (1, 1, 1)$ , since no legislator is pivotal. Therefore, it has to be that the candidate

equilibrium had two pivotal legislators,  $\sum_{i=1}^3 \tilde{v}_i = 2$ . But then, lobby 4 could play the pivot strategy with  $\varepsilon = \frac{y}{4}$ , and all legislators would vote 1. Lobby 4 would be contributing  $3\varepsilon < y$ , since  $\tilde{x}_1^{0,1,1} = \tilde{x}_2^{1,0,1} = \tilde{x}_3^{1,1,0} = 0$  in any equilibrium with consequential contributions.

In substage one, knowing the continuation game, the agenda setter proposes its preferred policy under the constraint that it is approved. ■

### Proof of Median Lobby Lemma 2

We prove the Lemma by establishing successive claims that refer to substage two (contributions) and substage three (votes) of the game. In equilibrium the agenda setter will propose the policy that maximizes its payoff and is majority approved. Hence, we first solve the subgame given a proposal  $z$  and a status quo  $z^q$ , and determine which policies could be majority approved. Without loss of generality, assume  $g_4 \geq 0$ . Relabel the lobbies (and the legislators) so that  $g_1 \leq g_2 \leq g_3$ . We denote this lobby 2 as the "*median lobby*". Let  $\varepsilon$  denote an arbitrary small positive real number.

**Claim 2** *On the equilibrium path of play*

1. *No lobby makes a positive payment if her preferred outcome is not implemented.*
2. *Whenever  $g_i \geq 0$  ( $g_i < 0$ ), lobby  $i$  does not contribute more than  $g_i$  ( $-g_i$ ) for a vote in favor of  $z$  ( $z^q$ ) and zero for outcome  $z^q(z)$ . Lobby 4 never pays more than  $g_4$  in total for outcome  $z$  and zero for outcome  $z^q$ .*

**Proof.** Suppose there were a lobby that makes a positive payment when her less preferred outcome is chosen. But then, the lobby could deviate to contribute zero in all cases, and her loss would be reduced regardless of which policy is chosen. Suppose a lobby were paying more than her net benefit from the preferred policy relative to the other outcome and the preferred policy were implemented. But then the lobby could deviate to contribute zero in all cases. If the outcome does not change, the lobby is better off. If the outcome changes, the lobby loses the net benefit, but saves more than the net benefit in contributions, therefore the lobby is better off. ■

**Claim 3** *On the equilibrium path of play a non-pivotal legislator receives a compensation of 0.*

**Proof.** Suppose not. Any lobby  $i$  contributing to the non-pivotal legislator could reduce the contribution. Regardless of whether the legislator changes his vote, the outcome does not change: he is not pivotal and other legislators observe only the contributions offered to them, hence their vote is not affected. Lobby  $i$  is better off. ■

**Claim 4** *There does not exist an equilibrium voting profile where all legislators vote for 0.*

**Proof.** Suppose  $v = (0, 0, 0)$  was an equilibrium voting profile given some profile of contribution offers. By Claim 3, for all legislators,  $x_i^0 = x_{4i}^0 = 0$ . But then, lobby 4 could offer  $x_4 = (\varepsilon, \varepsilon, 0, 0, 0, 0)$ . Both  $l_1$  and  $l_2$  would deviate, the outcome would be  $z$  and lobby 4 would be better off. Hence  $v = (0, 0, 0)$  cannot be an equilibrium. ■

**Claim 5** *There exists an equilibrium where the proposal is majority approved. Furthermore, in any such equilibrium,*

(a) *if  $g_2 < 0$ , all three legislators vote for the proposal and no payment is made on the equilibrium path and*

(b) *if  $g_2 \geq 0$ , if preference consistent strategies are used, no payment is made on the equilibrium path and either 2 or 3 legislators vote for the proposal*

**Proof.** We first prove  $(1, 1, 1)$  is an equilibrium outcome for any configuration of  $g_i$ . Let  $x_i^0 = x_i^1 = x_{4i}^0 = x_{4i}^1 = 0$  be the equilibrium contribution schedule for all  $i$ . No legislator  $i$  has an incentive to deviate from  $v = (1, 1, 1)$ , since his payoffs are always zero. No lobby has an incentive to deviate: lobby 4 is getting her preferred policy at no cost. No lobby  $i$  has an incentive to deviate because  $l_i$  is non pivotal, and hence lobby  $i$  cannot affect the outcome. We now prove that there is no other contribution schedule sustaining this equilibrium. By Claim 3,  $x_i^1 = x_{4i}^1 = 0$  for all  $i$ . If there was any positive contribution for a zero vote, at least one legislator would deviate and the voting profile would not have been an equilibrium. Therefore,  $x_i^0 = x_{4i}^0 = 0$  for all  $i$ .

(a) We prove that neither  $(1, 1, 0)$ , or  $(0, 1, 1)$  or  $(1, 0, 1)$  can be an equilibrium if  $g_2 < 0$ .

Assume by contradiction there was a 'candidate' equilibrium in which two legislators, denoted as  $l_p$  and  $l_n$ , were pivotal and voted 1,  $\tilde{v}_{p=n} = 1$  and denote the non pivotal legislator as  $l_k$  (so  $\tilde{v}_k = 0$ ). By claim 2, the non pivotal legislator would be receiving no payments to vote for 0,  $\tilde{x}_k^0 = \tilde{x}_{4k}^0$ . In the 'candidate' equilibrium, either  $\tilde{x}_{4p}^1 > 0$  or  $\tilde{x}_{4n}^1 > 0$ . If not, either lobby  $p$  or lobby  $n$  (or both) would prefer outcome 0 and offer positive contributions to its legislator (either  $x_p^0 > 0$ , or  $x_n^0 > 0$ ) who would deviate to vote 0. But then lobby 4 could have saved these contributions by offering the following schedule: no contributions to the legislator receiving a positive amount,  $x_{4k}^1 = \varepsilon$ ,  $x_{4k}^0 = 0$  to the non-pivotal legislator and unchanged contributions to the remaining legislator. The winning policy would still be the proposal, and lobby 4 would have saved on contributions.

(b) We have shown that  $(1, 1, 1)$  is an equilibrium. We show  $(0, 1, 1)$  is an equilibrium sustained by  $x_i^0 = x_i^1 = x_{4i}^0 = x_{4i}^1 = 0 \forall i$ . No legislator has an incentive to deviate, since contributions are always zero. No lobby has an incentive to deviate: lobby 2, 3, 4 are receiving their preferred policy at no cost and lobby 1 can influence only  $l_1$ , who cannot affect the outcome. Furthermore, in all equilibria with two pivotal legislators voting for 1, no contributions are paid for any choice if lobbies are playing preference consistent strategies. Denote the non pivotal legislator as  $l_k$  and pivotal legislators as  $l_p$  and  $l_n$ . By Claim 3, no contributions are offered to  $l_k$  to vote 0, so  $x_{ik}^0 = x_{4k}^0 = 0$ . He also receives no contributions to vote 1, otherwise he would deviate, so  $x_{ik}^1 = x_{4k}^1 = 0$ . Total payments from lobby 4 to  $l_p$  and  $l_n$  are zero,  $x_{4p}^0 + x_{4n}^0 = 0$ . Suppose not. Then lobby 4 could deviate to offer  $x_4 = (0, \varepsilon, \varepsilon, 0, 0, 0)$ ,  $\varepsilon$  arbitrarily small. Since lobbies are playing preference consistent strategies and  $g_2 \geq 0$ ,  $l_2$  and  $l_3$  are offered no contributions to vote 0,  $x_2^0 = x_3^0 = 0$ , hence they would vote for 1 and lobby 4 would be better off. Therefore,  $x_{4p}^1 = x_{4n}^1 = 0$ . Consequently,  $x_{4p}^0 = x_{4n}^0 = 0$ , otherwise the legislators would deviate. We also show that lobby  $p$  and  $n$  never offer positive contributions to their legislators:  $x_p^1 = x_p^0 = x_n^1 = x_n^0 = 0$ . If they offered positive payments for vote 1,  $\hat{x}_p^1 > 0$  or  $\hat{x}_n^1 > 0$  they could deviate to  $x_p^1 = \frac{\hat{x}_p^1}{2}$ ,  $x_p^0 = 0$  and  $x_n^1 = \frac{\hat{x}_n^1}{2}$ ,  $x_n^0 = 0$  respectively and the legislator would not change his vote (since

$x_{4p}^0 = x_{4n}^0 = 0$ ). If they offered positive contributions for a 0 vote,  $\hat{x}_p^0 > 0$  or  $\hat{x}_n^0 > 0$ , given  $x_{4p}^1 = x_{4n}^1 = 0$  and  $x_p^1 = x_n^1 = 0$ , the legislator would deviate. Hence, no contributions are ever offered in equilibrium. ■

**Claim 6** *If  $g_2 \geq 0$ , there is no equilibrium where the status quo is chosen*

**Proof.** Suppose the status quo was chosen. By claim 4, the equilibrium voting profile cannot be  $(0, 0, 0)$ . Suppose it was  $v = (1, 0, 0)$ . Then, by claim 2,  $x_2^0 = x_3^0 = 0$ . But then lobby 4 would have profitable deviation:  $x_4 = (0, \varepsilon, \varepsilon, 0, 0, 0)$ , two legislators deviate and the proposal wins. Suppose then the voting profile was either  $v = (0, 1, 0)$  or  $(0, 0, 1)$ . Denote the legislator voting no as  $l_n \in \{l_2, l_3\}$  and the other legislator  $l_y \in \{l_2, l_3\}$ . By claim 2,  $x_n^0 = 0$  and  $x_{4n}^0 = 0$ . By claim 3  $x_y^1 = 0$  and  $x_{4y}^1 = 0$ . In addition,  $x_y^0 = 0$ , otherwise the legislator would deviate. But then, lobby 4 could deviate by offering  $x_4 = (0, \varepsilon, \varepsilon, 0, 0, 0)$ ,  $l_2$  and  $l_3$  would both vote for the proposal and lobby 4 would be better off. ■

**Claim 7** *If  $g_2 < 0$ , there exists an equilibrium in which the status quo is chosen iff  $-g_2 \geq g_4$*

**Proof.** We first show existence. We claim that, if  $g_2 < 0$  and  $-g_2 \geq g_4$ , voting profile  $(0, 0, 1)$  and contribution schedules  $x^4 = (g_4, g_4, 0, 0, 0, 0)$ ,  $x_1 = (0, g_4)$ ,  $x_2 = (0, g_4)$ ,  $x_3 = (0, 0)$  are an equilibrium. No legislator has an incentive to deviate:  $l_3$  never receives positive contributions,  $l_1$  and  $l_2$  always receive  $g_4$ . No lobby has an incentive to deviate. Lobby 3 cannot affect the outcome. If lobby 2 or lobby 1 lowers her contributions for a no vote,  $l_2$  or  $l_1$  deviates. Lobby 2 or lobby 1 have nothing to gain by raising contributions to more than  $g_4$  for a no vote: if they did, the outcome would not be affected and they would be worse off. Hence, lobby 1 and 2 have no profitable deviation. Lobby 4 has no profitable deviation: to affect the outcome she would have to offer either  $x_{41}^1 > g_4$  or  $x_{42}^1 > g_4$ . But, if lobby 4 succeeded switching the vote of either of them, lobby 4 would have a negative payoff and be worse off. Hence this is not a profitable deviation.

Now suppose  $g_2 < 0$  and  $-g_2 < g_4$ . Suppose there was an equilibrium in which the status quo was chosen. By Claim 3, there exists a non pivotal legislator  $l_k$  such that  $v_k = 1$ . By Claim 3,  $x_k^1 = 0$ . But then,  $x_k^0 = 0$ , otherwise legislator  $l_k$  would deviate. Now consider the pivotal legislators. If  $l_3$  is one of them, and  $g_3 \geq 0$ , then  $x_3^0 = 0$  by claim 2. But then, lobby 4 can deviate as follows:  $x_{4k} = x_{43} = (\varepsilon, 0)$  and zero to the third legislators. Both  $l_k$  and  $l_3$  vote for the proposal and lobby 4 would be better off. Therefore, it could not have been an equilibrium. Consider instead the case in which either a)  $l_3$  is pivotal and  $g_3 < 0$  or b)  $l_2$  is pivotal. By claim 2, a)  $x_3^0 \leq -g_3$  b)  $x_2^0 \leq -g_2$ . But then lobby 4 would have a deviation: offer a)  $x_{43} = (-g_3 + \varepsilon, 0)$ ,  $x_{4k} = (\varepsilon, 0)$  b)  $x_{42} = (-g_2 + \varepsilon, 0)$ ,  $x_{4k} = (\varepsilon, 0)$  and offer  $(0, 0)$  to the remaining legislator. Both legislator  $l_k$  and a)  $l_3$  b)  $l_2$  would vote for the proposal and lobby 4 would be better off since  $-g_3 < -g_2 < g_4$ .

Whenever  $g_2 < 0$  and  $-g_2 \geq g_4$  we have shown two equilibria:  $v = (1, 1, 1)$ ,  $x_i^0 = x_i^1 = x_{4i}^0 = x_{4i}^1 = 0 \forall i$  and  $v = (0, 0, 1)$ ,  $x^4 = (g_4, g_4, 0, 0, 0, 0)$ ,  $x_1 = (0, g_4)$ ,  $x_2 = (0, g_4)$ ,  $x_3 = (0, 0)$ . The first equilibrium is not collusion proof, since legislators  $l_1$  and  $l_2$  receive a positive payment of  $g_4$  in the second equilibrium. ■



# Appendix B

## Proof of Proposition 3

We prove the proposition by establishing several claims: first we show that the Proposition is true for  $\alpha > \frac{A}{4C}$ . Then we show that, whenever  $\alpha < \frac{A}{4C}$ , the following holds: under H2,  $\tau_4$  can not be eliminated (claim 9) and  $(0, 0, 0, \tau)$  is the unique outcome of round  $T$  (claim 10); under H3,  $\tau_4$  can not be eliminated (claim 11) and  $(0, 0, 0, \tau)$  is the unique outcome of round  $T$  (claim 12). The case for  $\alpha = \frac{A}{4C}$  follows.

In order to facilitate the proofs, we sometimes use Nash game threes. When we use the terminology 'node' we are referring to this three: in the first round there is one node, in the second round there are two different nodes and so on. Under H2 we always assume that consequential strategies are played and under H3 we always assume that lobbies are preference consistent and that the legislators play a collusion proof equilibrium vote strategy. In order to apply Lemma 1 and Lemma 2, we use dynamic sophisticated equivalent payoffs.

**Claim 8** *If  $\alpha > \frac{A}{4C}$  (and  $\alpha \leq \frac{1}{4}$ ), then the unique outcome is  $(0, 0, 0, 0)$  under both H2 and H3.*

**Proof.** All lobbies prefer  $(0, 0, 0, 0)$  to  $(\tau, \tau, \tau, \tau)$  because each lobby has a benefit of  $4\alpha C - A > 0$  (given  $\alpha > \frac{A}{4C}$ ), therefore, by Lemma 1 and Lemma 2, there exists an equilibrium in which the agenda setter proposes  $(0, 0, 0, 0)$  in every round and it is approved in round  $t = 1$  (since  $\delta g_i(z^t, z^{qt}, t) \geq 0 \forall t$  and  $\forall i = 1, 2, 3, 4$ ). Furthermore, there can be no other outcome because  $(0, 0, 0, 0)$  is the agenda setter first best and it would deviate to proposing  $z^T = (0, 0, 0, 0)$  in round  $T$  if  $z^{T+1} \neq (0, 0, 0, 0)$ . ■

**Claim 9** *If  $\alpha < \frac{A}{4C}$ , the tariff of the transnational sector can never be eliminated under H2.*

**Proof.** Suppose it could be eliminated in the last round,  $T$ . This would imply that  $\delta g_4(z^T, z^{qT}, T) < 0$  and the proposal was accepted, a contradiction of Lemma 1: only proposals with  $\delta g_4(z^T, z^{qT}, T) \geq 0$  can be approved. Therefore, the tariff of the transnational sector cannot be eliminated in the last round. Now assume it cannot be eliminated in round  $t$ , and show it cannot be eliminated in round  $t - 1$ . In round  $t - 1$ , any proposal to eliminate the tariff in sector 4 would bring to a dynamic sophisticated equivalent with free trade in sector 4. If the proposal was rejected, then the status quo for round  $t$  would include the tariff of the transnational sector, and it could not be eliminated by assumption. Therefore, in  $t - 1$ ,  $\delta g_4(z^{t-1}, z^{qt-1}, t - 1) < 0$  for any proposal to eliminate the tariff of the transnational sector, and hence the proposal is rejected by Lemma 1. Therefore, the tariff of the transnational sector can never be eliminated. ■

**Claim 10** *If  $\alpha < \frac{A}{4C}$ ,  $(0, 0, 0, \tau)$  is the unique last round outcome under H2.*

**Proof.** We prove the claim by induction. Given lobby 4's tariff is in place (because of claim 9),  $(0, 0, 0, \tau)$  is proposed in the last round  $T$ , and it is majority approved with zero contributions (see Lemma 1), regardless of the status quo. There are no deviations for lobbies and legislators: if the status quo of round  $T - 1$  has  $n > 0$  positive tariffs in some

national sector, the transnational lobby has a gain of  $nC > 0$  from their elimination, and the proposal is accepted by Lemma 1. If the status quo of round  $T - 1$  is  $(0, 0, 0, \tau)$ , the proposal is accepted by indifference. By claim 9, the status quo cannot be  $(0, 0, 0, 0)$ . The agenda setter has no deviations: it can never eliminate the tariff in the transnational sector. If it chooses to propose a policy with positive tariff in the transnational sector and  $n > 0$  national sectors and the proposal is accepted, it reduces its benefit by  $n(B + D)$ . Hence, the agenda setter has no deviation.

We prove that there can be no other outcome. Suppose  $(0, 0, 0, 0)$  was an equilibrium outcome in the last round. This contradicts claim 9. Suppose there was a last round equilibrium with  $n > 0$  positive tariffs in national sectors. But then the agenda setter would have a positive deviation of  $n(B + D)$  in proposing  $(0, 0, 0, \tau)$  in the last round.

Note that, even if there is a single round, the agenda setter can also propose  $(0, 0, 0, \tau)$  and it is approved. Even if there are  $T > 1$  rounds, the agenda setter can propose  $(0, 0, 0, \tau)$  in the first round, it wins and it is not changed in subsequent rounds. ■

All claims that follow use the results derived in Lemma 2 and Claim 7. To apply them, at each node of the Nash game three we re-order the national lobbies so that  $\delta g_1(z^t, z^{qt}, t) \leq \delta g_{2=med}(z^t, z^{qt}, t) \leq \delta g_3(z^t, z^{qt}, t)$  and define  $\delta g_{med}(z^t, z^{qt}, t)$  to be the net payoff of the median lobby.

**Claim 11** *If  $\alpha < \frac{A}{4C}$ , the tariff of sector 4 cannot be eliminated under H3.*

**Proof.** Suppose it could be eliminated in the last round  $T$ . This would imply that there was a proposed tariff vector with free trade in sector four that would be majority approved to an alternative tariff vector with tariff in sector four, henceforth '*the alternative*'. If the two tariff vectors differed only by the tariff in sector 4, in the proposed tariff vector lobby 4 would be worse off by  $\delta g_4(z^T, z^{qT}, T) = -A + \alpha C$  and the median lobby would be better off by  $\delta g_{med}(z^T, z^{qT}, T) = \alpha C$ . But, since  $\alpha < \frac{A}{4C}$ ,  $-\delta g_4(z^T, z^{qT}, T) > \delta g_{med}(z^T, z^{qT}, T)$ , therefore the proposal could not be approved by Lemma 2. Now suppose instead the proposal eliminates the tariff in sector 4 and one other tariff in respect with *the alternative* with positive tariff in sector four. But then,  $\delta g_4(z^T, z^{qT}, T) = -A + 2\alpha C$  and  $\delta g_{med}(z^T, z^{qT}, T) = 2\alpha C$ . But then, since  $\alpha < \frac{A}{4C}$ ,  $-\delta g_4(z^T, z^{qT}, T) > \delta g_{med}(z^T, z^{qT}, T)$ , therefore the proposal could not be approved by Lemma 2. Now suppose that instead the proposal eliminates tariff four and two or more national tariffs in respect to *the alternative*. But then, both the transnational lobby and the median lobby would incur in a loss,  $\delta g_4(z^T, z^{qT}, T) + \delta g_{med}(z^T, z^{qT}, T) < 0$ , and the proposal could not have been approved by Lemma 2. Therefore, in round  $T$ , no proposal that eliminates the tariff in sector four can be approved. Suppose that no proposal that eliminates  $\tau_4$  can be approved in round  $t$ . Then, no proposal that eliminates  $\tau_4$  in round  $t - 1$  can be approved: if  $z^{qt-1}$  wins, by assumption, the dynamic sophisticated equivalent at time  $T$  keeps the tariff of sector 4. Instead, if the proposal passes, the dynamic sophisticated equivalent has free trade in sector 4. Hence,  $\delta g_4(z^{t-1}, z^{qt-1}, t - 1) + \delta g_{med}(z^{t-1}, z^{qt-1}, t - 1) < 0$ . Therefore the proposal is rejected in round  $t - 1$  by Lemma 2. By induction, the tariff of sector 4 can never be eliminated. ■

**Claim 12** *If  $\alpha < \frac{A}{4C}$ , policy vector  $(0, 0, 0, \tau)$  is the unique outcome under H3,.*

**Proof.** By the previous claim, tariff four cannot be eliminated. We claim the strategy shown in Figure 2 leads to outcome  $(0, 0, 0, \tau)$  in equilibrium:

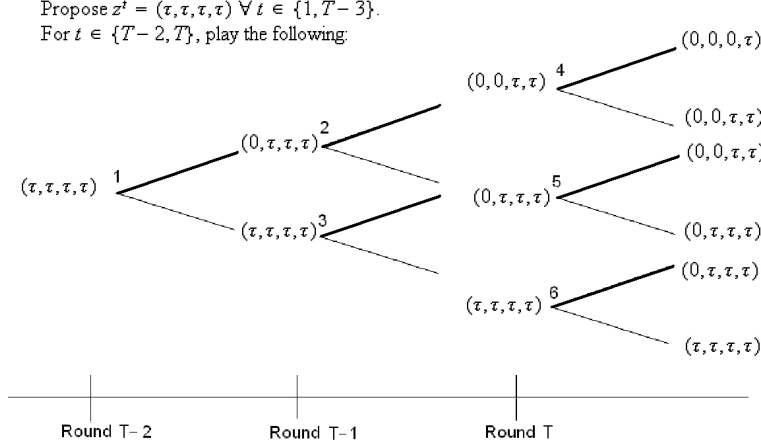


Figure 2

**Proof.** We solve the game backwards referring to Figure 2. In round  $T$ , the (node specific) median lobby and the transnational lobby both always prefer the proposal, since it gives a benefit of  $2\alpha C$  to both (see node 4,5,6 in Figure 3). Therefore, it is majority approved by Lemma 2 and no contributions are paid. In node 2 of Figure 3, round  $T-1$ , given the continuation game, the alternative is between approving and reaching  $\delta((0, 0, \tau, \tau), T-1) = (0, 0, 0, \tau)$  or rejecting the proposal and reaching  $\delta((0, \tau, \tau, \tau), T-1) = (0, 0, \tau, \tau)$ . Both the transnational lobby and the (node specific) median lobby have a positive benefit of  $2\alpha C$  from the proposal, therefore proposal  $(0, 0, \tau, \tau)$  is accepted by Lemma 2. In node 3 of Figure 3, round  $T-1$ , the proposed policy leads to outcome  $\delta((0, \tau, \tau, \tau), T-1) = (0, 0, \tau, \tau)$ , while rejecting the proposal leads to outcome  $\delta((\tau, \tau, \tau, \tau), T-1) = (0, \tau, \tau, \tau)$ . Both the transnational lobby and the median lobby (recall that the median lobby is node specific, hence the median lobby is one whose project is not eliminated) have a positive benefit of  $2\alpha C$ , therefore the proposal is majority approved. In round  $T-2$ , given the continuation game, approving the proposal leads to outcome  $\delta((0, \tau, \tau, \tau), T-2) = (0, 0, 0, \tau)$ , while rejecting it leads to outcome  $\delta((\tau, \tau, \tau, \tau), T-2) = (0, 0, \tau, \tau)$ . Both the transnational and the (node specific) median lobby have a positive benefit of  $2\alpha C$ , therefore the proposal is majority approved in round  $T-2$ . From round 1 to round  $T-3$ , the agenda setter proposes the status quo  $(\tau, \tau, \tau, \tau)$  and this policy will be the status quo for round  $T-2$ . (It is irrelevant if it is accepted or rejected along the path). ■

No other outcome can be an equilibrium. Given claim 11, eliminating all national tariffs is the second best for the agenda setter, so that the agenda setter's loss in equilibrium is  $-B - D$ . Suppose there was an equilibrium with  $n \in \{1, 2, 3\}$  national tariffs on in the final round. But then, the agenda setter's payoff would be  $-(1+n)B - (1+n)D < -B - D$ , therefore the agenda setter would deviate to the above strategy. ■

# Appendix C

## The set up

We look at an economy that has to decide between two alternative policies, the status quo,  $z^q$ , and a given proposal,  $z$ . The actors are an odd number  $N > 4$  of legislators, labelled  $(l_1, l_2, \dots, l_N)$ ,  $N$  national lobbies, each denoted as  $i = 1, 2, \dots, N$ , and a transnational lobby, denoted as lobby  $N + 1$ . We assume that each lobby has a personal utility dependent on the final outcome, denoted as  $g_i(\cdot)$ . We normalize the benefits from the status quo to zero, and denote as  $g_i(z)$  the benefits from the proposal. Likewise, lobby  $N + 1$  derives a utility  $g_{N+1}(z)$  from the proposal, and zero utility from the status quo,  $g_{N+1}(z^q) = 0$ .

Legislator's  $i$  utility is given by the sum of contributions he receives, plus  $L_i(\cdot)$ , his personal benefit from the policy outcome. We normalize benefits from the status quo to zero, and denote  $L_i(z)$  to be the benefit from the proposal. Note that  $g_i(z) > 0$  or  $L_i(z) > 0$  implies that the lobby and the legislator respectively prefer the proposal to the status quo, while  $g_i(z) < 0$  or  $L_i(z) < 0$  denotes a preference for the status quo.

The strategies of each player are as follows: Each lobby offers contributions: lobbies  $i \in \{1, N\}$  offer contributions to the corresponding legislator  $l_i$  only, the transnational lobby  $N + 1$  is free to offer contributions to any legislator. Each legislator  $l_i$  casts a vote  $v_i = \{0, 1\}$ ,  $v_i = 0$  if he votes against the proposal (for the status quo), and  $v_i = 1$  if he votes in favor of the proposal. We define  $v = (v_1, v_2, \dots, v_N)$  to be a voting profile. There are  $2^N$  possible profiles, and we call the set of possible voting profiles  $V$ . The decision rule is majority rule: let  $M = \frac{N+1}{2}$ . If more or equal to  $M$  legislators cast vote for the same outcome, that outcome is implemented.

Under H2, contributions are conditional on the entire voting profile. Hence, the strategy space for contributions of lobby  $i$  to legislator  $l_i$  will be  $x_i : l_i * V \rightarrow \mathbb{R}$ , while lobby  $N + 1$  can contribute to each legislators, hence  $x_{N+1} : V * \{l_1, l_2, \dots, l_N\} \rightarrow \mathbb{R}$ . Each legislator observes his personal utility and the contributions offered to him only. The strategy space for each legislator is  $\nu_i : \mathbb{R} * 2\mathbb{R}^{2^N} \rightarrow \{0, 1\}$ .

Under H3, contributions are conditional only on the vote of each legislator. The strategy space of lobby  $i \in \{1, N\}$  is  $x_i : l_i * \{0, 1\} \rightarrow \mathbb{R}$ , and lobby  $N + 1$  can contribute to any legislator,  $x_{N+1} : \{l_1, l_2, \dots, l_N\} * \{0, 1\} \rightarrow \mathbb{R}$ . Each legislator observes the contributions offered to him only and his personal utility and casts a vote,  $\nu_i : \mathbb{R} * \mathbb{R}^4 \rightarrow \{0, 1\}$ . We write the contributions as  $x_i = \{\text{contributions offered to } l_i \text{ for } v_i = 1, \text{ contributions offered for } v_i = 0\}$ .

The game proceeds as follows: given a status quo  $z^q$  and an alternative  $z$ , observed by all players

1) Lobbies simultaneously and non cooperatively offer contribution schedules to the legislators. Lobbies  $i \in \{1, N\}$  can offer contribution schedules  $\{x_i\}$  only to the corresponding legislator  $l_i$ , i.e. lobby 2 can contribute only to legislator  $l_2$ . Lobby  $N + 1$  is free to offer contribution schedules  $\{x_{N+1}\}$  to any legislator  $l_i$

2) Each legislator observes the contributions offered to him only. The legislators simultaneously vote. A majority carries the day: if  $\sum_{i=1}^N v_i \geq M$ , then  $z$  wins, otherwise  $z^q$  is the outcome.

# Equilibrium when contributions are conditional on the entire voting profile

## Equilibrium concept

We look at pure subgame Nash equilibria in which lobbies play consequential strategies.

**Proposition 5** *Under H2, all equilibria in which consequential strategies are played possess the property that the policy preferred by the transnational lobby is the unique outcome ( $\hat{z} = \begin{cases} z & \text{if } g_{N+1}(z, z^q) \geq 0 \\ z^q & \text{if } g_{N+1}(z, z^q) < 0 \end{cases}$ ) and the transnational lobby pays zero contributions on the equilibrium path ( $x_{N+1,i}^v = 0 \forall i$ )*

**Proof.** Without loss of generality, assume  $g_{N+1} \geq 0$ . Existence. The following strategies constitute an equilibrium: each legislator casts  $v_i = 1$  for any possible voting profile and contribution schedule, each national lobby offers  $x_i^v = 0 \forall v$  and lobby  $N + 1$  offers the following contribution schedule to every legislator:

$$x_{N+1,i} = \begin{cases} \max[0, -L_i(z)] & \forall v \text{ in which } v_i = 1 \text{ and exactly } M - 1 \text{ other legislators vote 1} \\ 0 & \text{all other } v \in V \end{cases}$$

No lobby has an incentive to deviate. The transnational lobby obtains her preferred outcome for free, since in equilibrium more than  $M$  legislators vote 1. The national lobbies can only influence their own legislator, and their own legislator is not pivotal. If lobby  $i \in \{1, N\}$  offers positive contributions to their legislator for a voting profile in which all other legislators vote 1, the outcome is unaffected and lobby  $i$  is worse off. If lobby  $i$  offers positive contributions for a different voting profile, this does not affect the equilibrium, hence is not a profitable deviation. Each legislator  $l_i$  is either indifferent between  $v_i = 1$  and  $v_i = 0$ , or weakly prefers  $v_i = 1$ . If legislator  $l_i$  is pivotal (when exactly  $M - 1$  other legislators vote 1) and votes  $v_i = 1$ , the outcome is  $z$  and his total utility including contributions is  $L_i(z) - L_i(z) = 0$  if  $L_i(z) \leq 0$ , and is  $L_i(z) > 0$  otherwise. If he is pivotal and votes  $v_i = 0$ , the outcome is  $z^q$  and his utility is 0. Whenever he is pivotal, he is either indifferent (when  $L_i(z) \leq 0$ ) or prefers voting  $v_i = 1$ . If legislator  $l_i$  is not pivotal, there are two possibilities: either weakly more than  $M$  legislators vote 1, and his total utility is  $L_i(z)$  regardless from what he votes, or weakly more than  $M$  legislators vote 0, and his utility is 0 regardless from what he votes. Therefore, no legislator has an incentive to deviate and no legislator is choosing a weakly dominated strategy.

There is no equilibrium with outcome  $z^q \neq z$  (hence  $g_{N+1}(z, z^q) > 0$ ) and no equilibrium in which lobby  $N + 1$  pays positive contributions. Suppose there was one, denote it as the "candidate" equilibrium. We show lobby  $N + 1$  can deviate to a "pivot" strategy that guarantees outcome  $z$  at a cost  $(M + 1)\varepsilon$ , with  $\varepsilon > 0$  arbitrarily small. There is always  $\varepsilon$  small enough such that this deviation is profitable: if the outcome of the candidate equilibrium was  $z^q$ ,  $\varepsilon < \frac{g_{N+1}}{M+1}$ ; if lobby  $N + 1$  was paying total positive contributions  $y > 0$  in the candidate equilibrium,  $\varepsilon < \frac{y}{M+1}$ .

In order to define the "pivot" strategy, we introduce new notation. We are interested in the offers to legislator  $l_i$ , taking as given the action of all other legislators. Therefore we define the partial voting profile  $v_{-i}$ , composed by the actions of all legislators other than  $l_i$ , and denote as  $0, v_{-i}$  and  $1, v_{-i}$  the voting profiles in legislators other than  $l_i$  behave

according to  $v_{-1}$  and legislator  $l_i$  voted  $v_i = 0$  and  $v_i = 1$  respectively. We are assuming the "candidate" equilibrium exists, and denote the equilibrium contributions of local lobbies as  $\tilde{x}_i$ . In particular,  $\tilde{x}_i^{0,v-i}$  denotes the contributions schedule offered from lobby  $i$  to legislator  $l_i$  whenever he votes  $v_i = 0$  and the remaining lobbies vote according to  $v_{-i}$ . (note that there are  $2^{99}$  possible  $0, v_{-i} \in V$ ). Lobby  $N + 1$  can deviate to offer the following contribution schedule to  $M + 1$  legislators:

$$x_{N+1,i} = \begin{cases} \max[0, -L_i(z)] + \tilde{x}_i^{0,v-i} + \varepsilon & \forall v_{-i} \text{ in which } \sum_{j \neq i} v_j = M - 1 \text{ and } v_i = 1 \\ \tilde{x}_i^{0,v-i} + \varepsilon & \forall v_{-i} \text{ in which } \sum_{j \neq i} v_j \neq M - 1 \text{ and } v_i = 1 \\ 0 & \text{For } v_i = 0 \text{ and } \forall v_{-i} \end{cases}$$

Note that  $\sum_{j \neq i} v_j = M - 1$  means exactly  $M - 1$  legislators other than  $l_i$  vote  $v_j = 1$ .

Every legislator offered the above contribution schedule has one dominant strategy: vote  $v_i = 1$ . If exactly  $M - 1$  other legislators vote 1, he is pivotal and has a utility of at least (he might be receiving positive  $\tilde{x}_i^{1,v-i}$ )  $L_i(z) + \max[0, -L_i(z)] + \tilde{x}_i^{0,v-i} + \varepsilon$  if he votes  $v_i = 1$  and a utility of  $L_i(z^q) + \tilde{x}_i^{0,v-i} = \tilde{x}_i^{0,v-i}$  if he votes  $v_i = 0$ . He has a net benefit of at least  $L_i(z) + \max[0, -L_i(z)] + \varepsilon > 0$  from voting  $v_i = 1$ . If not exactly  $M - 1$  other legislators vote 1, he is not pivotal. If at least  $M$  other legislators vote 1, the outcome is  $z$  regardless from his vote, and his utility gain in voting 1 is at least  $L_i(z) + \tilde{x}_i^{0,v-i} + \varepsilon - L_i(z) - \tilde{x}_i^{0,v-i} = \varepsilon > 0$ . If at least  $M$  other legislators vote 0, the outcome is  $z^q$  regardless from his vote and his utility gain from voting 1 is at least  $0 + \tilde{x}_i^{0,v-i} + \varepsilon - 0 - \tilde{x}_i^{0,v-i} = \varepsilon > 0$ . Therefore, for each of the  $M + 1$  legislators facing this contributions schedule, it is a best response to play 1.

Hence, at least  $M + 1$  legislators play 1 in the deviation from the candidate equilibrium. The transnational lobby therefore will have to pay  $M + 1$  legislators for the deviation, and pay them what she had offered in the case in which strictly more than  $M - 1$  other legislators vote 1, since  $M + 1$  will vote 1. This corresponds to  $\tilde{x}^{0,v-1} + \varepsilon$ . However, when  $v_{-1}$  has  $M$  legislators other than  $l_i$  voting 1, no legislator is pivotal. By the definition of consequential strategies,  $\hat{x}^{0,v-1} = 0$ . Therefore, the transnational lobby can obtain outcome 1 at the cost  $(M + 1) * \varepsilon$ , where  $\varepsilon$  is arbitrarily small.

Therefore, all equilibria respect the properties described in Proposition 5. <sup>21</sup> ■

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<sup>21</sup>In order to facilitate the intuition of the reader, we provide a simple example.

**Example 1** Suppose  $N = 5, g_6 = 6, g_{1=2=3=4=5} = -8, L_{1=2=3=4=5} = -7$ . The following is an equilibrium:

$$\hat{x}_{1=2=3=4=5} = 0 \text{ for all } v, \hat{x}_{6,i} = \begin{cases} 7 \forall v \text{ in which } v_i = 1 \text{ and exactly 2 other legislators vote 1} \\ 0 \text{ all other } v \in V \end{cases}, \hat{v} = (1, 1, 1, 1, 1).$$

No legislators is playing a weakly dominated strategy. If a legislator is pivotal and votes 1, he obtains a benefit of 7 in contributions and of  $-7$  in personal utility. If he is pivotal and votes 0, he receives 0 in contributions and 0 in personal benefit. In both cases, his total utility is 0. If he is not pivotal, regardless of his vote, he will receive 0 contributions and his personal outcome dependent utility can not be affected from his vote. Hence he is indifferent.

# Equilibrium when contributions are conditional on the vote of the single legislator

## Equilibrium concept

We look for subgame perfect pure strategy Nash equilibria.<sup>22</sup>

## Results

We order all lobbies so that  $g_1 \leq g_2 \leq \dots \leq g_{m-1} \leq g_m \leq \dots \leq g_n$ , and denote the median lobby  $m$  to be the one associated with the median payoff  $g_m$ .

**Proposition 6** *For any proposal  $z$  and any status quo  $z^q$ , there always exists an equilibrium in which the transnational lobby obtains her preferred policy at no cost. Furthermore, there is no equilibrium in which the transnational lobby does not obtain her preferred policy as long as the transnational's lobby benefits from the policy are higher than the sum of disutility from this policy, if any, of every possible combination of  $M$  legislators plus the disutility, if any, of the median national lobby.*

We establish the result by proving successive claims. Without loss of generality, assume  $g_{N+1} \geq 0$ . Define  $\varepsilon$  to be an arbitrarily small positive number. Claim 2 and Claim 3 still hold, and their proof is unchanged.

**Claim 13** *There exists an equilibrium supported by a voting profile in which at least  $M + 1$  legislators vote for 1, so the outcome preferred by the transnational lobby is chosen.*

**Proof.** Take a voting profile in which  $M + 1$  legislators vote  $v_i = 1$ , the remaining legislators vote  $v_i = 0$ , contributions are  $x_i = \{0, 0\} \forall i$  and  $x_{N+1,i} = \{0, 0\} \forall i$ . No legislator  $l_i$  has an incentive to deviate: since no legislator is pivotal, switching vote would not affect the outcome and contributions would still be zero. Note that some legislators might be playing weakly dominated strategies (i.e., if they were pivotal, they might be better off voting differently), but this might be the only equilibrium. No lobby has an incentive to deviate. The transnational lobby is obtaining her preferred outcome for free, and hence will not deviate. No national lobby can affect the outcome, since she can only influence the vote of her corresponding legislator who is not pivotal. ■

**Claim 14** *Given a status quo  $z^q$  and a proposal  $z$ , in an equilibrium of the game there is no voting profile in which at least  $M + 1$  (non pivotal) legislators vote for 0 ( $\sum_{i=1}^N v_i < M - 1$ ) if there exists a set of legislators  $M$  s.t.  $g_{N+1} > \sum_M \max[0, -L_i]$*

**Proof.** Suppose there was an equilibrium with such a voting profile. By Claim 3, every legislator  $l_i$  is receiving zero contributions on the equilibrium path. Furthermore, every  $l_i$  is also receiving zero contributions off the equilibrium path, otherwise  $l_i$  would deviate. Therefore, in this candidate equilibrium,  $\tilde{x}_i = \tilde{x}_{N+1,i} = \{0, 0\} \forall i$ . But then lobby  $N + 1$  could offer

<sup>22</sup>Since we are giving a sufficient condition, we do not need to use the equilibrium refinement

$$x_{N+1,i} = \begin{cases} \max[0, -L_i] + \varepsilon & \text{for } v_i = 1 \\ 0 & \text{for } v_i = 0 \end{cases} \text{ to } M \text{ legislators such that } g_{N+1} > \sum_M \max[0, -L_i].$$

Each of these legislators has a payoff of  $0 + \max[0, -L_i] + \varepsilon$  if he votes 1 and is pivotal and a payoff of 0 if he is pivotal and votes 0. If he is pivotal, his best response is to vote 1. If he is not pivotal, he receives always  $\max[0, -L_i] + \varepsilon$  if he votes 1, and zero if he votes 0, hence voting 1 is a best response for each legislator offered this contribution schedule. There always exist  $\varepsilon$  small enough such that  $g_{N+1} - \sum_M \max[0, -L_i] - M\varepsilon > 0$  and lobby  $N + 1$  is better off. Therefore, there could not have been an equilibrium in which a supermajority votes against the preferred policy of lobby  $N + 1$ . Note that we are providing a sufficient condition. If we assume that all legislators believe they will not be pivotal even once they observe a deviation, the transnational lobby can obtain a deviation for just  $\varepsilon$  arbitrarily small. ■

**Claim 15** *There does not exist an equilibrium voting profile in which exactly  $M$  (pivotal) legislators vote for 0 if  $g_{N+1} > \max_M \sum_{M \in N} \max[0, -L_i] + \max[0, -g_m]$ .*

**Proof.** Suppose there was such an equilibrium, called the candidate equilibrium. Define the set of  $M$  legislators voting against the proposal as  $Q$ . Then  $\tilde{v}_i = 0 \forall l_i \in Q, \tilde{v}_i = 1 \forall l_i \in \{N/Q\}$ . The  $N - Q$  legislators voting 1 are not pivotal. By claim 3 they receive no contributions to vote 1 on the equilibrium path. Contributions offered to vote 0 must also be zero for these  $N - Q$  legislators: Suppose there was a legislators who was offered by his national lobby a positive contribution to vote 0. Since he is not pivotal, regardless of his personal outcome dependent utility, he would have a positive deviation and hence he could not have voted 1 in equilibrium. Therefore, for it to be an equilibrium, it has to be that  $\tilde{x}_i = \tilde{x}_{N+1,i} = \{0, 0\}$  for all  $l_i \in \{N/Q\}$ .

By claim 2,  $\tilde{x}_i^0 \leq \max[0, -g_i] \forall l_i \in Q$ : no legislator voting 0 in the candidate equilibrium can be offered more than  $\max[0, -g_i]$  from lobby  $i$  to vote 0. But then lobby  $N + 1$  could offer  $x_{N+1,i} = \{\max[0, -L_i] + \varepsilon, 0\} \forall l_i \in \{N/Q\}$  (legislators that were voting 1 in the candidate equilibrium) and  $x_{N+1,i^*} = \{\max[0, -g_{i^*}] + \max[0, -L_{i^*}] + \varepsilon, 0\}$  to the legislator  $l_{i^*}$  among those voting 0 that is cheapest,  $l_{i^*} = \arg \min_{l_i \in Q} \max[0, -g_i] + \max[0, -L_i]$ , and offer  $x_{N+1,i} = \{0, 0\} \forall l_i \in \{Q/i^*\}$  (to all remaining legislators). Legislators  $l_i \in \{N/Q\}$  (that were voting 1 in candidate equilibrium) have a unique best response: vote 1. If they are pivotal in the deviation profile, their net gain will be  $L_i + \max[0, -L_i] + \varepsilon - 0 - 0 > 0$ , if they are not pivotal in the deviation profile, their net gain will be  $\max[0, -L_i] + \varepsilon > 0$ . Legislator  $l_{i^*} \in \{N/Q\}$ , has a unique best response: vote 1. If he is pivotal, his minimum net gain from voting 1 is  $L_{i^*} + \max[0, -g_{i^*}] + \max[0, -L_{i^*}] + \varepsilon - \max[0, -g_{i^*}] > 0$ , if he is not pivotal his minimum net gain is  $\max[0, -g_{i^*}] + \max[0, -L_{i^*}] + \varepsilon - \max[0, -g_{i^*}] > 0$ . Note that this is a minimum net gain for two reasons:  $\tilde{x}_{i^*}^0 \leq \max[0, -g_{i^*}]$  and  $\tilde{x}_{i^*}^1 \geq 0$ .

Hence, if the transnational lobby deviates in this manner, a majority of legislators votes 1 (all  $l_i \in \{N/Q\}$  and  $l_{i^*}$ ) and the new outcome will be  $z$ . The transnational lobby will have a net gain of  $g_{N+1} - \max[0, -g_{i^*}] + \max[0, -L_{i^*}] - \sum_{N-Q} \max[0, -L_i] - N\varepsilon$ . We show this is positive. Order all lobbies so that  $g_n \leq g_{n+1}$ . Define the *median lobby* to be the lobby associated to the median payoff in this ranking,  $g_m$ . Define  $L_m$  to be the legislator associated with the  $m'$  th payoff when ranking payoffs according to  $L_n \leq L_{n+1}$ . Given that



$l_{i^*} = \arg \min_{l_i \in Q} \max[0, -g_i] + \max[0, -L_i]$ ,  $\max[0, -g_{i^*}] + \max[0, -L_{i^*}] \leq \max[0, -g_m] + \max[0, -L_m]$ . Therefore,  $g_{N+1} - \max[0, -g_{i^*}] + \max[0, -L_{i^*}] - \sum_{N-Q} \max[0, -L_i] - N\varepsilon > g_{N+1} - \max_M \sum_{M \in N} \max[0, -L_i] + \max[0, -g_m] - N\varepsilon$  which is positive by assumption for any  $\varepsilon < \frac{g_{N+1} - \max_M \sum_{M \in N} \max[0, -L_i] + \max[0, -g_m]}{N}$ . We have proven that  $g_{N+1} > \max_M \sum_{M \in N} \max[0, -L_i] + \max[0, -g_m]$  is a sufficient condition to guarantee  $z$  is the outcome. However, it is not necessary: there might be cheaper deviations when exactly  $M$  legislators are voting 0. For example, rather than compensating  $N - M$  legislators only for their personal preference and one legislator for both his preference and the contributions from his lobby, it might be cheaper to compensate more than one legislator for both contributions from lobbies and personal utility. If we assume that legislators in the set  $N/Q$  will keep voting 1 because they observe no deviation, the transnational lobby can deviate for an amount lower or equal to  $\max[0, -g_m] + \max[0, -L_m]$ . Furthermore, there might be equilibria in which national lobbies are also contributing in favor of outcome  $z$ .<sup>23</sup> However, the claim establishes sufficiency, therefore a characterization of all possible equilibria is beyond the scope of the proposition.

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<sup>23</sup>The example below illustrates the multiplicity of equilibria:

**Example 2** Suppose  $N = 5$ .  $L_{1=2=3=4=5} = -7$ ,  $g_{1=2=3=4=5} = +2$ ,  $g_6 = 18$ . *Equilibrium 1*:  $x_{1=2=3=4=5} = \{0, 0\}$ ,  $x_{61=62=63=64=65} = \{0, 0\}$ ,  $v = \{1, 1, 1, 1, 1\}$ . *Equilibrium 2*:  $x_{1=2=3=4=5} = \{0, 0\}$ ,  $x_{61=62=63=64=65} = \{0, 0\}$ ,  $v = \{0, 0, 0, 1, 1\}$ . *Equilibrium 3*:  $x_{1=2} = \{0, 0\}$ ,  $x_{3=4=5} = \{2, 0\}$ ,  $x_{61=62} = \{0, 0\}$ ,  $x_{63=64=65} = \{5, 0\}$ ,  $v = \{0, 0, 1, 1, 1\}$ . *Equilibrium 4*:  $x_{1=2} = \{0, 0\}$ ,  $x_{3=4=5} = \{1, 0\}$ ,  $x_{61=62} = \{0, 0\}$ ,  $x_{63=64=65} = \{6, 0\}$ ,  $v = \{0, 0, 1, 1, 1\}$

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