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Political Asymmetry and Common External Tariffs in a Customs Union*

By

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Abstract

This paper examines the effect of political and economic asymmetries in the formation of common external tariffs (CETs) in a customs union (CU). We do so by introducing possible cross-border lobbying and by endogenizing tariff formation in a political economic model for the determination of CETs. The latter allows us to consider asymmetries among the member nations in their susceptibilities to lobbying. We also consider asymmetries in the influence of the member nations in CU-wide decision-making. A central finding of this paper is that, in the absence of economic asymmetry, the CET rises monotonically with the degree of asymmetry in country influences if the two countries are equally susceptible to lobbying. If influences are the same, the CET also rises monotonically with the degree of asymmetry in susceptibilities. These results hold irrespective of whether the lobby groups in the two member countries cooperate or work non-cooperatively.

Keywords: Asymmetry, Customs union, Common external tariff, Politics.
JEL Classification: F13

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1 Introduction

The importance of lobbying in economic policymaking in general cannot be overstated. There are many alternative approaches in modeling such lobbying activities (see Rodrik, 1995, for a survey), including the directly unproductive rent-seeking activities (DUPs) approach (Bhagwati, 1982), the tariff-formation function approach (Findlay and Wellisz, 1982), the political support function approach (Hillman, 1982), the campaign contribution approach (Magee et al., 1989), and the political contributions approach (Grossman and Helpman, 1994).

In particular, the role of lobbying in formulating and forming a preferential trading area and a customs union (CU) has been analyzed extensively.[1,2] Different researchers have used various approaches to model political economy. For example, Cadot et al. (1999) present a political economy model following the Grossman and Helpman (1994) approach. On the other hand, Panagariya and Findlay (1996), Richardson (1994), and Bandyopadhyay and Wall (1999), among others, follow the DUP approach, which also incorporates the tariff-formation approach of Findlay and Wellisz (1982) that assumes an exogenously specified tariff-generating function. The first goal of our paper is to generalize the DUP approach by endogenizing tariff formation.

Analyzing lobbying introduces additional interesting issues when economic polices are made by a group of governments. One such example is the determination of common external tariffs (CETs) in a CU, which is decided by all members of the CU together and

[1] There has been a proliferation of preferential trading agreements worldwide. Prominent among them are the North American Free Trade Area (NAFTA) and the European Union (EU). In the former arrangement, member nations trade freely among themselves but set tariffs on non-members independently. This is an example of a Free Trade Agreement (FTA). On the other hand, the EU is organized along the lines of a CU, where, in addition to intra-bloc free trade, the members set a common tariff on non-members (i.e., the common external tariff (CET)). The CET is determined jointly by the member nations, with members having different levels of influence on the decision-making.

[2] The literature on the economics of CU and FTA is not new (see, for example, Viner, 1950). There has been renewed interest in the subject (see, for example, Riezman, 1979; Gatsios and Karp, 1991 and 1995; Krishna, 1998; Bond et al.; 2004, Raimondos-Møller and Woodland, 2006; Abrego et al., 2006; Melatos and Woodland, 2007a and 2007b.)

applies to all individual member nations. Some economists are concerned that the process of determination of CETs may lead to more inefficiencies by encouraging cooperation among country-specific lobby groups that may also become international in scope and engage in cross-border lobbying (see, for example, Schiff and Winters, 2003).[3] In fact, cross-border lobbying has become widespread, particularly in the EU. Organizations such as EuroCommerce, EuropaBio (European Association for Bioindustries), and Friends of Europe are extremely active in EU-wide lobbying. Bandyopadhyay and Wall (1999) present a model of cross-border lobbying of the DUP type to compare FTA and CU tariffs. In their model, tariff formation is exogenous, as mentioned above. The second goal of our paper is to introduce cross-border lobbying for the determination of CETs in a CU, alongside endogenous tariff formation.

The third and final goal of our paper is to consider the effect of political asymmetries on CETs. We find different treatment of asymmetries in the literature: Saggi (2006) examines the effect of cost asymmetries among FTA and CU member nations; Bandyopadhyay and Wall (1999) examine how asymmetries in the influence of member countries in CU decision-making affect the differences between FTA and CU tariffs. In this paper, we consider not only asymmetries in the influence of the member countries on CU decision-making on CET, but also the effect of asymmetries in the susceptibility of each member nation's government to cross-border and within-border lobbying on CET. The latter type of asymmetry can be considered here because of the endogenization of tariff formation. We consider three scenarios. First, we assume that the lobby groups in the two member countries cooperate and lobby jointly. Second, we assume that the lobby groups do not cooperate and lobby individually. Finally, we consider a situation where cross-border lobbying is not allowed.

[3] Cross-border lobbying is not uncommon even outside CUs. A recent contribution by Gawande et al. (2006) finds that foreign lobbies play an empirically significant role in the determination of U.S. tariffs. Allowing for cross-border lobbying, Grossman and Helpman (1995, Appendix) find that FTAs may be more difficult to implement, because now a lobby can block the agreement not only by lobbying its own government but also by approaching the other member governments.

The next section sets up the basic framework under cooperation between the lobby groups. Section 3 then examines the effect of political and economic asymmetries on the CET. In section 4, we reexamine the issues under two scenarios: (i) when cross-broder lobbying is not allowed (section 4.1), and (ii) when the lobby groups do not cooperate (section 4.2). Some concluding remarks are made in section 5.

2 The Theoretical Framework

For simplicity, we consider a CU with two members, A and B. The rest of the world is C. There is one good, which we call "CU importable," that is imported from C by A and B and subject to a CET t, which is decided by the CU jointly. This decision is influenced by lobbying from the producers of this good in countries A and B. Given the prevalence of cross-border lobbying, as mentioned in the introduction, we first assume that the producers in the two countries cooperate with each other and lobby governments in both A and B jointly. In section 4.2, we relax this assumption and consider non-cooperative lobbying.

We assume lobbying is of the DUP type. Domestic producers of the CU importable in country i spend a total amount of h_i (in units of some scarce resources) on lobbying both governments. Because this lobbying is socially unproductive, it entails a social welfare loss of the amount h_i in country i ($i = A, B$). Consumers' surplus, domestic profits plus tariff revenue, in country i is affected by the level of CET t; we denote it by $S_i(t)$ with $S_i'' < 0$. We assume that country i's government cares about not only social welfare, given by $S_i(t) - h_i$, but also the net total income of the lobby group.

Net profits of producers from countries A and B are given by

$$\pi_i(t) - h_i, \quad i = A, B, \tag{1}$$

where $\pi_i(t)$ satisfied $\pi_i' > 0$ and $\pi_i'' \geq 0$.

Let h^j be the total amount of lobbying which country j's government is subjected to. Because each government accepts lobbying from producers in both countries and the two producers act cooperatively and lobby jointly, the net income of the lobby group is

$$\pi_A(t) + \pi_B(t) - (h_A + h_B) = \pi_A(t) + \pi_B(t) - (h^A + h^B),$$

since $h_A + h_B = h^A + h^B$.

As for the effect of lobbying, we follow the political support function approach suggested by Hillman (1982). The key assumption underlying this function is that the weight attached to the income of the lobby group is larger than the weight attached to the income or welfare of people who do not lobby. Thus, the objective function of the government in country i is given by

$$G^i = S_i(t) - h_i + \rho^i[\pi_A(t) + \pi_B(t) - (h^A + h^B)], \quad i = A, B, \tag{2}$$

where $\rho^i > 0$ is the extra weight attached to the net income of the lobby group by the government of country i. The first two terms represent social welfare, and the last term is the additional importance attached to the lobby group's income in the government's objective function. Because the two firms lobby together and each government cares to some extent about the income of the lobbyists, it is assumed that the government cannot discriminate between the two individual lobbyists. As a result, foreign profit is assigned the same weight as domestic profit in each government's objective function. In section 4.2, we consider a situation where lobbyists do not cooperate and each government can discriminate between the two lobby groups.

We endogenize the tariff-formation function by making the reasonable assumption that the weight ρ^i is an increasing function of the amount of lobbying country i's government receives. In particular, we assume

$$\rho^A = (1 + \varepsilon)\rho(h^A), \text{ and } \rho^B = (1 - \varepsilon)\rho(h^B), \tag{3}$$

where the parameter $1+\varepsilon$ $(1-\varepsilon)$ represents country A (B) government's susceptibility to lobbying. That is, a higher value of ε implies a higher degree of asymmetry in the countries' susceptibilities. Starting from $\varepsilon = 0$ (the case of symmetry), an increase in the value of ε implies that country A becomes more (and country B becomes less) susceptible to lobbying. We assume that $\rho' > 0$ and $\rho'' < 0$.[4] The assumptions made so far are formally stated as

Assumption 1 $S_j'' < 0,\ \pi_j'(t) > 0,\ \pi_j''(t) \geq 0,\ \rho'(h^j) > 0,\ \rho''(h^j) < 0 \quad (j = A, B).$

Having introduced most of the important variables and functions, we proceed to the solution of the optimal level of CETs. We consider a two-stage game. In stage 1, domestic producers decide on their lobbying levels by maximizing their joint profits. In stage 2, the CU authority decides on the level of CET by maximizing a weighted sum of the two governments' objective functions. We use backward induction to obtain a sub-game perfect equilibrium. We describe the two stages, starting with the second stage, in the following two subsections.

2.1 Tariff Determination by the Customs Union

We assume that the CU authority maximizes a weighted sum of the individual member governments' objective functions to find the optimal value of the CET t. That is, the problem facing the CU authority is

$$\max_t \quad G^{CU} \equiv \alpha\ G^A(t, h_A, h_B, h^A, h^B) + (1-\alpha)\ G^B(t, h_A, h_B, h^A, h^B),$$

where G^A and G^B are defined in (2) and α and $(1-\alpha)$ are the weights given to the objective function of country A and B respectively. We take α to represent country A's relative influence in the CU decision-making process. A country's relative influence on decision-making typically depends on a number of factors. In the EU such factors include a country's

[4] At the end of section 3, we shall discuss how the results would change if $\rho(\cdot)$ was a convex function.

contributions to the EU budget which in turn is closely related to tariff revenue generated in that country.[5] The length of membership in the EU is another factor.

Using (2), the first-order condition for the above optimization problem can be written as

$$G_t^{CU} \equiv \alpha S_A'(t) + (1-\alpha)S_B'(t) + \left[\alpha(1+\varepsilon)\rho(h^A) + (1-\alpha)(1-\varepsilon)\rho(h^B)\right]\pi' = 0, \qquad (4)$$

where $\pi \equiv \pi_A + \pi_B$.

Differentiating (4) yields:

$$\frac{\partial t}{\partial h^A} = -\frac{\alpha(1+\varepsilon)\pi'\rho'(h^A)}{\Delta}, \quad \frac{\partial t}{\partial h^B} = -\frac{(1-\alpha)(1-\varepsilon)\pi'\rho'(h^B)}{\Delta}, \qquad (5)$$

$$\frac{\partial t}{\partial \alpha} = -\frac{S_A' - S_B' + \pi'\mu}{\Delta}, \quad \frac{\partial t}{\partial \varepsilon} = -\frac{[\alpha\rho(h^A) - (1-\alpha)\rho(h^B)]\pi'}{\Delta}, \qquad (6)$$

where

$$\begin{aligned} \mu &= (1+\epsilon)\rho(h^A) - (1-\epsilon)\rho(h^B), \\ \Delta &= \alpha S_A'' + (1-\alpha)S_B'' + \left[\alpha(1+\varepsilon)\rho(h^A) + (1-\alpha)(1-\varepsilon)\rho(h^B)\right]\pi''. \end{aligned}$$

For the second-order condition to be satisfied, Δ must be negative. Formally,

Assumption 2 $\quad \Delta < 0$.

Since we assumed that $S_i'' < 0$ and $\pi_i'' \geq 0$ for $i = A, B$ (assumption 1), the above assumption puts an upper bound on the degree of convexity of the π functions. From assumptions 1 and 2, it follows that $\partial t/\partial h^A > 0$ and $\partial t/\partial h^B > 0$. In other words, in (4) we have endogenously determined the tariff-formation function, which is typically imposed exogenously in the literature.

Having described the second stage of the game, we now explain the first stage, which determines the levels of lobbying activities.

[5] A country is allowed to keep a small proportion (approximately 10%) of tariff revenue to cover the costs of collection of tariffs on imports.

2.2 Determination of Lobbying Levels

As mentioned earlier, we assume that the producers of the CU importables in the two countries maximize their joint net profits in determining the levels of lobbying activities. Formally, the optimizing problem facing them is

$$\max_{h^A, h^B} \quad \pi^{CU} \equiv \pi_A(t) + \pi_B(t) - (h^A + h^B),$$

subject to the reaction function given by (4).

The first-order conditions for the above problem are given by

$$\pi^{CU}_{h^i} \equiv (\pi'_A(t) + \pi'_B(t)) \cdot \partial t / \partial h^i - 1 = 0, \quad i = A, B. \tag{7}$$

The two equations in (7) and (4) together determine the endogenous variables h^A, h^B, and t. This completes the description of the theoretical framework; we next derive some properties of the equilibrium.

3 Political Asymmetry and CET

In this section, we examine the effect of political asymmetries — that is, changes in the parameters α and ε on the equilibrium level of the CET t. From (3), (5), and (7), we determine that

$$\alpha(1+\epsilon)\rho'(h^A) = (1-\alpha)(1-\epsilon)\rho'(h^B). \tag{8}$$

From (8), we obtain the following result:

Lemma 1 $\qquad h^A \gtreqless h^B \qquad$ *according as* $\qquad \frac{\alpha}{1-\alpha} \gtreqless \frac{1-\varepsilon}{1+\varepsilon}$.

The proof follows directly from (8) and the assumption that $\rho'' < 0$ (assumption 1). As a corollary of lemma 1, we get:

(i) When $\varepsilon = 0$, we have $h^A \gtreqless h^B$ according as $\alpha \gtreqless 1/2$, and

(ii) when $\alpha = 1/2$, $h^A \gtreqless h^B$ according as $\varepsilon \gtreqless 0$.

From lemma 1 it also follows that (a) when $\varepsilon < 0$, h^A can be lower than h^B when $\alpha > 1/2$, and (b) when $\alpha < 1/2$, h^A can be lower than h^B when $\varepsilon > 0$.

Turning to the total effect on the CET t, note that

$$\frac{dt}{dj} = \frac{\partial t}{\partial j} + \frac{\partial t}{\partial h^A} \cdot \frac{dh^A}{dj} + \frac{\partial t}{\partial h^B}\frac{dh^B}{dj}, \quad j = \alpha,\ \varepsilon. \tag{9}$$

Substituting (5) into (7), we get for country A

$$-(\pi')^2 \alpha (1+\epsilon)\rho'(h^A) = \Delta. \tag{10}$$

Equations (4), (8) and (10) together determine the endogenous variables h^A, h^B and t. Totally differentiating these equations, we obtain:

$$\begin{aligned} E\,\frac{dt}{d\alpha} \quad = \quad & S'_A - S'_B - \frac{\rho'(h^A)F(S''_A - S''_B)}{(1+FD)\pi'\rho''(h^A)} + \mu\pi'\left[1 - \frac{\rho'(h^A)\pi'' F}{(1+FD)(\pi')^2\rho''(h^A)}\right] \\ & - \frac{\pi'(1+\epsilon)(\rho'(h^A))^2}{(1+FD)\rho''(h^A)} \cdot \left[1 - \frac{\alpha}{1-\alpha} \cdot \frac{\rho''(h^A)}{\rho'(h^A)} \cdot \frac{\rho'(h^B)}{\rho''(h^B)}\right], \end{aligned} \tag{11}$$

where the parameters D, E and F, and the derivation of (11) are provided in appendix I. In order for the second-order conditions to be satisfied, we must have $1 + DF > 0$ and $E > 0$.

Let us first of all consider the case where asymmetries between the two countries are only in the political arena and there are no economic asymmetries, i.e., $\alpha \neq 1/2$ and $\varepsilon \neq 0$ and $S_A(t) \equiv S_B(t)$. In this case, the first two terms on the right hand side of (11) drop out. The third term is positive if and only if $\mu > 0$, i.e., $(1+\varepsilon)\rho(h^A) > (1-\varepsilon)\rho(h^B)$. When $\varepsilon = 0$, this condition is satisfied if and only if $\alpha > 1/2$. In addition, if $\rho(h) = h^\eta$ with $\eta \in (0, 1)$, the fourth term is also positive if and only if $\alpha > 1/2$. These results are summarized formally in the following proposition.

Proposition 1 *When $\rho(h) = h^\eta$ with $\eta \in (0,1)$ and $\varepsilon = 0$ and when economic asymmetries are absent, an increase in asymmetry in political influences of the two member countries (i.e., either an increase in α from $\alpha > 1/2$ or a decrease in α from $\alpha < 1/2$) will unambiguously increase the equilibrium value of the CET.*

Similar conclusions can be drawn when the asymmetry is only with respect to the susceptibility parameter ε, i.e., when $\alpha = 1/2$ and $\varepsilon \neq 0$.

When $\varepsilon = 0$, if α exceeds 1/2, we know from Lemma 1 that h^A exceeds h^B. Thus, $\rho(h^A)$ exceeds $\rho(h^B)$, and a rise in α must raise the weight attached to marginal industry profit π' in equation (4). Under economic symmetry [i.e., $S_A(t) = S_B(t) \equiv S(t)$], this has the effect of raising the marginal benefit of the CET in equation (4) without affecting the marginal cost $S'(t)$. Thus, the CET must rise. The mechanism is the following. The composite weight attached to marginal industry profit in (4) is a weighted average of the lobbying functions $\rho(\cdot)$ of the two nations. If at the initial equilibrium $\rho(h^A)$ exceeds $\rho(h^B)$, as is the case when $\alpha > 1/2$, then a rise in α gets a higher weight [i.e., $\rho(h^A)$] than the concomitant fall in $(1-\alpha)$ [weighted by $\rho(h^B)$]. As a result, the composite weight must rise, raising the marginal benefit of granting CET.

There is also a second round effect via a change in the lobbying levels themselves. From (5) and (7) it is clear that the rise in α will also raise the marginal benefit of lobbying the government in country A. On the other hand, the marginal benefit of lobbying country B's government falls. For the functional form $\rho(h) = \eta^h$, $[\eta \in (0,1)]$, we can establish that the rise in h^A dominates the fall in h^B . The mechanism is the following: $\rho'(h)$ changes more slowly for higher values of h [since $\rho''' > 0$]. Thus, the change in $\rho'(h^A)$ is slower than that $\rho'(h^B)$. Therefore, as α rises, h^A has to rise to a greater degree (than the fall in h^B) to revert the marginal benefit from lobbying (which is scaled by ρ') to the marginal cost of lobbying. The rise in total lobbying adds to the rise in the CET.

Finally, a third effect is present when the profit function is strictly convex. In this case, the first-round rise in t raises π', which changes the magnitudes of the effects mentioned above. However, as we show analytically, this effect does not overturn our findings.

Note that in proposition 1 we only consider one type of political asymmetry. If both types co-exist, then in view of the remarks made after lemma 1, it is possible that increasing α beyond 1/2 (i.e., increasing asymmetry in political influences in the CET decision making) may actually lower CET if $\varepsilon < 0$, i.e., if country A has a government that puts less weight on firms' profits than country B.

Proposition 1 implies that, in the absence of economic asymmetries, the minimum value of CET t is attained at $\alpha = 1/2$ when $\varepsilon = 0$. Let us now examine at what value of α CET is minimized in the presence of economic asymmetry. In particular, suppose $S_A(t) \equiv nS_B(t)$ where $n > 1$ ($n < 1$) implies that country A is bigger (smaller) economically than country B. The first two terms in (I.6) can be rewritten as

$$(n-1)\left[S_B' - \frac{\rho'(h^A)FS_B''}{(1+FD)\pi'\rho''(h^A)}\right].$$

If $S_B' < 0$, then the above expression is negative if and only if $n > 1$. In fact, from (4), we have $[n\alpha + 1 - \alpha]S_B' = -[\alpha(1+\varepsilon)\rho(h^A) + (1-\alpha)(1-\varepsilon)\rho(h^B)]\pi' < 0$. Thus, S_B' is indeed negative. Therefore, the above expression is negative if and only if $n > 1$. It then follows that if we allow economic asymmetry in proposition 1, the value of CET will attain its minimum at a value of α which is more (less) than 1/2 if $n > 1$ ($n < 1$). That is, if the larger of the two country's initial influence in the CU decision-making was somewhat more than that of the smaller country, then moving toward symmetry in their relative influences would increase the equilibrium level of the CET. Equivalently, if the smaller country has a relatively smaller influence initially, then moving toward symmetry would increase the equilibrium level of the CET. Formally,

Proposition 2 *Suppose $\rho(h) = h^{\eta}$ with $\eta \in (0,1)$, $\varepsilon = 0$, and the two member countries are economically asymmetric. Starting from a situation where the bigger (smaller) country has a relatively somewhat higher (lower) influence in the CET decision-making, a move toward political symmetry would increase the equilibrium level of the CET.*

For any given α, when n exceeds unity, country A's efficiency loss $S'_A(t)$ is amplified in equation (4). This enhanced efficiency loss tends to moderate the equilibrium level of the CET. The larger country A is relative to country B (i.e., the higher n is), the stronger is this effect and the lower the CET. Analogously, starting from an n which exceeds unity, raising α from $1/2$ confers a greater weight to the nation which suffers the greater efficiency loss. This tends to moderate the CET. Put differently, when country A is economically larger than country B, a reduction in α starting from a value greater than $1/2$ (i.e., a move toward greater political symmetry) can raise the CET. In this latter scenario, reducing the weight given to country A is equivalent to ignoring (albeit partially) the disproportionate efficiency losses that the larger nation incurs. Consequently, the CET rises.

We conclude this section by noting how the results would change if the function $\rho(\cdot)$, representing the extra weight each CU member government attaches to the net income of the lobby group, was convex rather than concave as has been assumed in this paper. First of all, note that when $\rho(\cdot)$ is convex, the lobby groups objective function is also convex in the lobby levels. Therefore, the first order condition (7) gives the minima in the optimization problem. For the maxima, one has to look at the two corner solutions. The first corner is given by the solution when lobbying does not take place at all. The other corner corresponds to an accumulation of lobbying in only one country, and this would be the country which has a higher influence on the CU decision-making. If the first corner yields a higher value of the objective function, then an increase in political asymmetry would have no effect on the equilibrium level of the CET. If, on the other hand, the solution is at the other corner, then an increase in the level of political asymmetry (a higher level for α) would imply a higher level of the equilibrium level of the CET.

4 Some Modifications of the Basic Model

In this section we shall consider two modifications of the preceding analysis. In the first, we rule out cross-border lobbying. Next consider the case where the lobby groups act non-cooperatively. These two cases will be considered separately in the following two sub-sections.

4.1 No Cross-border Lobbying

We shall continue to use the notations h^A and h^B for lobbying by firms in country A and B respectively. However, in this subsection, firms in a country only lobby the government in that country. Therefore, each government's objective function will be somewhat different, and it will in particular not depend on the income of the lobby group in a different country. That is, the objective function of the government in country i is given by

$$G^i = S_i(t) - h_i + \rho^i[\pi_i(t) - h^i], \quad i = A, B, \tag{12}$$

but the objective function of the CU authority remains the same as before, and that is

$$\max_t \quad G^{CU} \equiv \alpha\ G^A(t, h_A, h_B, h^A, h^B) + (1-\alpha)\ G^B(t, h_A, h_B, h^A, h^B),$$

yielding the first-order condition

$$G_t^{CU} \equiv \alpha S_A'(t) + (1-\alpha)S_B'(t) + \alpha(1+\varepsilon)\pi_A'(t)\rho(h^A) + (1-\alpha)(1-\varepsilon)\pi_B'(t)\rho(h^B) = 0. \tag{13}$$

As in the previous section, we examine the effect of political asymmetries — that is, changes in the parameters α and ε on the equilibrium level of the CET t. However, in order to focus on political asymmetry we make assumptions that eliminate asymmetries elsewhere;

in particular, we assume that $\pi_A(t) = \pi_B(t) = \pi(t)$ and $S_A(t) = S_B(t) = S(t)$. Because of these assumptions, from (3), (5), and (7), we determine that

$$\alpha(1+\varepsilon)\rho'(h^A) = (1-\alpha)(1-\varepsilon)\rho'(h^B). \tag{14}$$

Since (14) is the same as (8), lemma 1 will continue to hold in this subsection.

Differentiating (13) and using (14) yields:

$$\begin{aligned} \frac{\tilde{\Delta}}{\pi'(t)} \cdot dt &= -(1-\alpha)(1-\varepsilon)\rho'(h^B)[dh^A + dh^B] + [(1-\varepsilon)\rho(h^B) - (1+\varepsilon)\rho(h^A)]\ d\alpha \\ &\quad + [(1-\alpha)\rho(h^B) - \alpha\rho(h^A)]\ d\varepsilon, \end{aligned} \tag{15}$$

where $\tilde{\Delta} = \alpha S''_A + (1-\alpha)S''_B + \alpha(1+\varepsilon)\pi''_A\rho(h^A) + (1-\alpha)(1-\varepsilon)\pi''_B\rho(h^B) < 0$.

If the initial equilibrium is symmetric (i.e., $\alpha = 1/2$ and $\varepsilon = 0$ so that $h^A = h^B$), an increase in α or ε will increase t if and only if it also increases the total amount of lobbying. If the initial equilibrium is not symmetric, and in particular if $h^A > h^B$ (or, because of lemma 1, equivalently, $\alpha > 1/2$), an increase in α or ε has a direct effect given by the second and the third terms in (15), which is to increase t. The indirect effect as a result of changes in the total amount of lobbying is positively related to the size of changes in the total amount of lobbying.

Finally, differentiating (7) and using (7), (14), and (15), we obtain changes in h^A, h^B, and $h^A + h^B$. Derivations of these expressions are given in Appendix I.

From equations (II.1)-(II.6) and assumption 3 in Appendix II, we find that:

$$\begin{aligned} \left.\frac{dh^A}{d\alpha}\right|_{\substack{\alpha=1/2\\ \varepsilon=0}} &> 0, \quad \left.\frac{dh^B}{d\alpha}\right|_{\substack{\alpha=1/2\\ \varepsilon=0}} < 0, \\ \left.\frac{dh^A}{d\varepsilon}\right|_{\substack{\alpha=1/2\\ \varepsilon=0}} &> 0, \quad \left.\frac{dh^B}{d\varepsilon}\right|_{\substack{\alpha=1/2\\ \varepsilon=0}} < 0. \end{aligned}$$

That is, starting with complete symmetry, an increase in either α or ε unambiguously increases h^A and decreases h^B. An increase in a country's influence in CU-wide decision-making or in that country's susceptibility to lobbying increases lobbying received by that country and reduces lobbying received by the other country. This is expected. However, in the presence of initial asymmetry, this result may not hold because of the diminishing returns from lobbying activities. If one country has much more influence in the CU than the other, that country will naturally receive more lobbying. However, if it becomes even more influential, then the return to lobbying efforts in this country will be minimal and the efforts of lobby groups will be better directed at the other country. Thus, it is possible that an increase in α can reduce h^A under asymmetry. Similar arguments apply for changes in ε. However, this possibility will disappear if, for example, $\pi'' \simeq 0$.[6] When $\pi'' \simeq 0$, it can be verified that

$$\begin{aligned}
\Phi \cdot \frac{dh^A}{d\alpha} &= 4(1+\varepsilon)(1-\varepsilon)(1-\alpha)(\pi')^4 \rho'(h^A)\rho''(h^B) > 0, \\
\Phi \cdot \frac{dh^B}{d\alpha} &= 4(1+\varepsilon)(1-\varepsilon)\alpha(\pi')^4 \rho'(h^B)\rho''(h^A) < 0,
\end{aligned}$$

for all values of $\alpha \in (0,1)$.

As for the effects on the total amount of lobbying (i.e., $h^A + h^B$) of an increase in α (the analysis for ε is similar), equation (II.5) simplifies to

$$\begin{aligned}
\left(-\frac{\Phi}{\tilde{\Delta}}\right) \cdot \frac{d(h^A + h^B)}{d\alpha} &= -3\pi''\{(1+\varepsilon)\rho(h^A) - (1-\varepsilon)\rho(h^B)\}\left[\frac{\rho''(h^A)}{\rho'(h^B)} + \frac{\rho''(h^A)}{\rho'(h^B)}\right] \\
&\quad - \left[\frac{\rho''(h^A)}{(1-\alpha)\rho'(h^A)} - \frac{\rho''(h^B)}{\alpha\rho'(h^B)}\right],
\end{aligned}$$

from which it follows that

$$\left.\frac{d(h^A + h^B)}{d\alpha}\right|_{\substack{\alpha=1/2 \\ \varepsilon=0}} = 0,$$

and then from (15) that

$$\left.\frac{dt}{d\alpha}\right|_{\substack{\alpha=1/2 \\ \varepsilon=0}} = 0.$$

[6] In an earlier version of the paper in which we assumed the production technologies to be of the Leontief type with sector-specific capital stocks, π'' was equal to zero (see Bandyopadhyay et al., 2007).

That is, starting with a symmetric equilibrium, an increase in α has no effect on the total amount of lobbying and thus on the CET. However, if the initial equilibrium is not symmetric — in particular, if $\alpha > 1/2$ — it follows from assumption 1 and lemma 1 that the first effect on the right-hand side of the above equation is positive: the increase in h^A dominates the decrease in h^B when the initial level of h^A is higher. The second effect, which takes into account the diminishing returns to lobbying, can be either positive or negative depending on the degree of concavity of the lobbying function and on the initial level of α.

Turning now to the effect on CET, substituting (II.5) and (II.6) into (15) and using (7) and (14) yields:

$$\begin{aligned}
\frac{-\tilde{\Delta}\Phi}{\pi'} \cdot dt \; = \; & 4(\pi')^4\alpha(1-\alpha)(1-\varepsilon)(1+\varepsilon)\rho''(h^A)\rho''(h^B)\{(1+\varepsilon)\rho(h^A) - (1-\varepsilon)\rho(h^B)\}\; d\alpha \\
& + \frac{\alpha(1+\varepsilon)\rho''(h^B)\tilde{\Delta}^2}{1-\alpha} \cdot \left[\frac{\rho''(h^A)}{\rho''(h^B)} - \left(\frac{1-\alpha}{\alpha}\right)^2 \cdot \frac{1-\varepsilon}{1+\varepsilon}\right] d\alpha \\
& + 4(\pi')^4\alpha(1-\alpha)(1-\varepsilon)(1+\varepsilon)\rho''(h^A)\rho''(h^B)\{\alpha\rho(h^A) - (1-\alpha)\rho(h^B)\}\; d\varepsilon \\
& + \frac{\alpha(1+\varepsilon)\rho''(h^B)\tilde{\Delta}^2}{1-\varepsilon} \cdot \left[\frac{\rho''(h^A)}{\rho''(h^B)} - \left(\frac{1-\varepsilon}{1+\varepsilon}\right)^2 \cdot \frac{1-\alpha}{\alpha}\right] d\varepsilon.
\end{aligned}$$

Focusing on the effect of α, and assuming *pro tempore* $\varepsilon = 0$, it follows from lemma 1 that the first effect of an increase in α is positive (negative) if and only if $\alpha > 1/2$ ($\alpha < 1/2$). For the second term, if, for example, $\rho(h) = h^\eta$ where $0 < \eta < 1$, we can derive from (14) that

$$\frac{h^B}{h^A} = \left(\frac{1-\alpha}{\alpha}\right)^{\frac{1}{1-\eta}}. \tag{16}$$

With this functional form of ρ, it can be verified that the second effect is positive (negative) if $\alpha > 1/2$ ($\alpha < 1/2$). That is, when $\rho(h) = h^\eta$ with $\eta \in (0,1)$, the equilibrium value of CET is a U-shaped function of α and it takes the minimum value for $\alpha = 1/2$. Formally:

Proposition 3 *When $\rho(h) = h^\eta$ with $\eta \in (0,1)$ and $\varepsilon = 0$, an increase in asymmetry in* *political influences of the two member countries (i.e., either an increase in α from $\alpha > 1/2$ or a decrease in α from $\alpha < 1/2$) will unambiguously increase the equilibrium value of the CET.*

Similar conclusions can be drawn in much the same way for asymmetry with respect to the susceptibility parameter ε when $\alpha = 1/2$.

Why political asymmetry increases CET is best explained by looking at the condition that determines it, viz., equation (13). This equation can be rewritten as

$$\begin{aligned} G_t^{CU} &= \alpha G_t^A + (1-\alpha)G_t^B = G_t^B + \alpha(G_t^A - G_t^B) \\ &= G_t^B + \alpha\pi'\{\alpha(1+\varepsilon)\rho(h^A) - (1-\alpha)(1-\varepsilon)\rho(h^B)\}. \end{aligned} \tag{17}$$

Clearly, an increase in α will increase the equilibrium value of t if it also increases G_t^{CU}. One of the components of the effect of an increase in α on G_t^{CU} is $\pi'\{\alpha(1+\varepsilon)\rho(h^A) - (1-\alpha)(1-\varepsilon)\rho(h^B)\}\, d\alpha$. From lemma 1 it follows that this component is always positive for all $\alpha \neq 1/2$, and this in part explains why asymmetry increases the equilibrium value of t.

We conclude this section by noting a property of the equilibrium CET. We have already shown that $G_t^A - G_t^B = \pi'\{\alpha(1+\varepsilon)\rho(h^A) - (1-\alpha)(1-\varepsilon)\rho(h^B)\}$. Therefore, if $\alpha > 1/2$, using lemma 1 we can say that $G_t^A - G_t^B > 0$. Furthermore, at the equilibrium $G_t^{CU} = 0$, and thus from (17) we have $G_t^B + \alpha(G_t^A - G_t^B) = 0$. Thus, if $\alpha > 1/2$, we must have $G_t^B < 0$. Then, since $\alpha G_t^A + (1-\alpha)G_t^B$ is also equal to zero at the equilibrium (see (17)), G_t^A must be positive. Combining these observations and assuming both G^A and G^B to be concave in t, we can conclude that when $\alpha > 1/2$, the equilibrium value of t is lower (higher) than what country A (B) would desire. This result is stated formally below.

Proposition 4 *Suppose that the two countries do not have the same influence in the CU decision-making. The more (less) influential member country would have preferred a higher (lower) value of the CET than the equilibrium one.*

The equilibrium value of the CET is a compromise and the above proposition states the direction of the compromise for the different members.

4.2 Non-cooperative Lobbying

In the previous section, we assumed that the lobby groups in the two member countries cooperate and lobby jointly. In contrast, in this section we consider a situation where the two lobby groups do not cooperate and lobby individually. The economic intuitions between the various results are similar to the ones in the previous section; therefore, in this section we simply present the formal results without explaining them intuitively. For brevity, we also consider only one type of asymmetry and assume $\varepsilon = 0$.

Let h_{ij} $(i = j = A, B)$ be the amount of lobbying by the firm in country i on the government of country j. Net profits of the firm in country i are given by

$$\tilde{\pi}_i = \pi_i(t) - h_{iA} - h_{iB}, \quad i = A, B. \tag{18}$$

Since lobbying now is done by the two firms individually and without cooperation, the objective functions of the two governments and the CU authority are:

$$\begin{aligned} G^A &= S_A(t) - h_{AA} - h_{AB} + \rho(h_{AA})\tilde{\pi}_A + \rho(h_{BA})\tilde{\pi}_B, & (19)\\ G^B &= S_B(t) - h_{BA} - h_{BB} + \rho(h_{AB})\tilde{\pi}_A + \rho(h_{BB})\tilde{\pi}_B, & (20)\\ G^{CU} &= \alpha G^A + (1-\alpha)G^B. & (21) \end{aligned}$$

In stage 2 of the game, the CU authority maximizes G^{CU} with respect to t, giving rise to the first-order condition:

$$\begin{aligned} \frac{\partial G^{CU}}{\partial t} &= \alpha S'_A + (1-\alpha)S'_B + \alpha\rho(h_{AA})\pi'_A + \alpha\rho(h_{BA})\pi'_B + (1-\alpha)\rho(h_{AB})\pi'_A \\ &\quad + (1-\alpha)\rho(h_{BB})\pi'_B = 0. \end{aligned} \tag{22}$$

From (22), we find:

$$\begin{aligned}\frac{\partial t}{\partial h_{AA}} &= -\frac{\alpha\pi'_A\rho'(h_{AA})}{\hat{\Delta}}, \quad \frac{\partial t}{\partial h_{BA}} = -\frac{\alpha\pi'_B\rho'(h_{BA})}{\hat{\Delta}}, \\ \frac{\partial t}{\partial h_{AB}} &= -\frac{(1-\alpha)\pi'_A\rho'(h_{AB})}{\hat{\Delta}}, \quad \frac{\partial t}{\partial h_{BB}} = -\frac{(1-\alpha)\pi'_B\rho'(h_{BB})}{\hat{\Delta}},\end{aligned}$$

where

$$\hat{\Delta} = \alpha S''_A + (1-\alpha)S''_B + \alpha\rho(h_{AA})\pi''_A + \alpha\rho(h_{BA})\pi''_B + (1-\alpha)\rho(h_{AB})\pi''_A + (1-\alpha)\rho(h_{BB})\pi''_B < 0.$$

The levels of lobbying are determined in the first stage by the two non-cooperating lobby groups in a Nash equilibrium as:

$$\begin{aligned}\frac{\partial\tilde{\pi}_A}{\partial h_{AA}} &= \pi'_A \cdot \frac{\partial t}{\partial h_{AA}} - 1 = 0, \quad \frac{\partial\tilde{\pi}_A}{\partial h_{AB}} = \pi'_A \cdot \frac{\partial t}{\partial h_{AB}} - 1 = 0, \\ \frac{\partial\tilde{\pi}_B}{\partial h_{BA}} &= \pi'_B \cdot \frac{\partial t}{\partial h_{BA}} - 1 = 0, \quad \frac{\partial\tilde{\pi}_B}{\partial h_{BB}} = \pi'_B \cdot \frac{\partial t}{\partial h_{BB}} - 1 = 0,\end{aligned}$$

which can be written as:

$$\alpha\left(\pi'_A\right)^2\rho(h_{AA}) = -\hat{\Delta}, \quad (1-\alpha)\left(\pi'_A\right)^2\rho(h_{AB}) = -\hat{\Delta}, \tag{23}$$

$$\alpha\left(\pi'_B\right)^2\rho(h_{BA}) = -\hat{\Delta}, \quad (1-\alpha)\left(\pi'_B\right)^2\rho(h_{BB}) = -\hat{\Delta}. \tag{24}$$

As before, we focus on political asymmetry — $\alpha \neq 1/2$ — and assume symmetry elsewhere; in particular, we assume that $\pi_A(t) = \pi_B(t) = \pi(t)$ and $S_A(t) = S_B(t) = S(t)$.

Given these assumptions, from (23) and (24) it immediately follows that for all values of $\alpha \in (0,1)$ the equilibrium must satisfy

$$h_{AA} = h_{BA}, \quad h_{AB} = h_{BB}.$$

Using the above property, equations (22), (23), and (24) can be reduced to the following three equations:

$$\begin{aligned} S'(t) + 2\alpha\rho(h_{AA})\pi'(t) + 2(1-\alpha)\rho(h_{BB})\pi'(t) &= 0, && (25) \\ \alpha(\pi'(t))^2\rho'(h_{AA}) &= -\hat{\Delta}, && (26) \\ (1-\alpha)(\pi'(t))^2\rho'(h_{BB}) &= -\hat{\Delta}, && (27) \end{aligned}$$

in three unknowns t, h_{AA}, and h_{BB}, where $\tilde{\Delta}$ also simplifies to

$$\hat{\Delta} = S''(t) + 2\alpha\rho(h_{AA})\pi''(t) + 2(1-\alpha)\rho(h_{BB})\pi''(t).$$

Note that from (26) and (27), we derive

$$\alpha\rho'(h_{AA}) = (1-\alpha)\rho'(h_{BB}). \quad (28)$$

Differentiating (25) and using (28), we find

$$\frac{\tilde{\Delta}}{2\pi'} \cdot dt = -[\rho(h_{AA}) - \rho(h_{BB})]\ d\alpha - \alpha\rho'(h_{AA})\ d(h_{AA} + h_{BB}). \quad (29)$$

Now, differentiating (26) and (27) and using (28) and (29), we obtain changes in h_{AA}, h_{BB} and $h_{AA} + h_{BB}$. These are given in Appendix III.

From equations (III.1)-(III.3), assumption 4 in Appendix II, and equation (29), it follows that

$$\left.\frac{dh_{AA}}{d\alpha}\right|_{\alpha=1/2} > 0, \quad \left.\frac{dh_{BB}}{d\alpha}\right|_{\alpha=1/2} < 0, \quad \left.\frac{d(h_{AA}+h_{BB})}{d\alpha}\right|_{\alpha=1/2} = 0, \text{ and } \left.\frac{dt}{d\alpha}\right|_{\alpha=1/2} = 0, \quad (30)$$

and then all results derived in the previous section also hold here.

The main reason for obtaining the same qualitative result for cooperative and non-cooperative lobbying is the property of the equilibrium in the non-cooperative case that each government receives the same amount of lobbying from the two firms in two different member countries (i.e., $h_{AA} = h_{BA},\ \ h_{AB} = h_{BB}$). This result follows from our assumption that a government responds equally to lobbying from the two firms; that is, the functional form of the $\rho(\cdot)$ function is not firm specific.

5 Conclusion

The effect of lobbying — domestic and cross-border — depends on two factors: (i) the more easily a government may be convinced through lobbying (say, susceptibility of a government), the greater is the effect; and (ii) the greater the power/influence of a government (and its representative) on the central tariff-making body, the higher is the effect of lobbying that government. The differences between the member governments in these two factors are at the heart of this paper. We examine the effect of asymmetries between the member governments in the effects of lobbying on the equilibrium level of the CET.

We find a positive monotonic relationship between the degrees of asymmetry and the level of the CET. For equal susceptibilities, a greater relative power of a member nation's government monotonically raises the CET. On the other hand, for equal power, a rise in the spread of the susceptibilities must also monotonically raise the tariff. The qualitative message of the central results offered in sections 2 and 3 continue to be supported when we relax the structure of the basic model. In the last part of section 3 we relax the assumption of economic symmetry and derive some interesting results which we present in proposition 2. These extend and complement proposition 1. Furthermore, section 4 considers two different variants of the model. In the first, we rule out cross border lobbying, while in the second, we allow for the lobby groups in the two nations to engage in non-cooperative behavior. Our results continue to be supported.

Our findings have the interesting policy implication that more heterogeneous CUs are likely to be more protectionist with respect to non-members. They also imply that when considering expansion of a CU, free trade–oriented members should be less sympathetic to bringing in dissimilar new entrants.

Appendix I

From (8)

$$(1-\alpha)(1-\epsilon)\rho''(h^B)dh^B = \alpha(1+\epsilon)\rho''(h^A)dh^A + [(1+\epsilon)\rho'(h^A) + (1-\epsilon)\rho'(h^B)]d\alpha, \quad \text{(I.1)}$$

and therefore:

$$\begin{aligned} dh^A + dh^B &= F\ dh^A + \frac{(1+\epsilon)\rho'(h^A) + (1-\epsilon)\rho'(h^B)}{(1-\alpha)(1-\epsilon)\rho''(h^B)} d\alpha \\ &= F\ dh^A + \frac{(1+\epsilon)\rho'(h^A)}{(1-\alpha)^2(1-\epsilon)\rho''(h^B)} d\alpha \ \text{ using (8)}, \end{aligned} \quad \text{(I.2)}$$

where

$$F = 1 + \frac{\alpha(1+\epsilon)\rho''(h^A)}{(1-\alpha)(1-\epsilon)\rho''(h^B)} > 0.$$

Differentiating (10) and then using (8), we get:

$$-dh^A = H\ dt + C\ d\alpha + D\ d(h^A + h^B), \quad \text{(I.3)}$$

where

$$H = \frac{2\pi'\pi''\alpha(1+\epsilon)\rho(h^A) + \alpha s_A''' + (1-\alpha)S_B''' + \{\alpha(1+\epsilon)\rho(h^A) + (1-\alpha)(1-\epsilon)\rho(h^B)\}\pi'''}{(\pi')^2\alpha(1+\epsilon)\rho''(h^A)},$$

$$C = \frac{S_A'' - S_B'' + \mu\pi'' + (\pi')^2(1+\epsilon)\rho'(h^A)}{(\pi')^2\alpha(1+\epsilon)\rho''(h^A)},$$

$$D = \frac{\pi''\rho'(h^A)}{(\pi')^2\rho''(h^A)}.$$

Substituting dh^A from (I.3) into the right hand side of (I.2), we get

$$[1 + FD]\ d(h^A + h^B) = -FH\ dt - \left[FC - \frac{(1+\epsilon)\rho'(h^A)}{(1-\alpha)^2(1-\epsilon)\rho''(h^B)}\right]\ d\alpha. \quad \text{(I.4)}$$

Using (5) and (7), equation (9) becomes

$$-\Delta \cdot \frac{dt}{d\alpha} = S_A' - S_B' + \pi'\mu + \pi'\alpha(1+\epsilon)\rho'(h^A)\frac{d(h^A + h^B)}{d\alpha}. \quad \text{(I.5)}$$

Substituting (I.4) in (I.5) gives:

$$\begin{aligned} E\ \frac{dt}{d\alpha} &= S'_A - S'_B + \pi'\mu - \frac{\pi'\alpha(1+\epsilon)\rho'(h^A)}{1+FD}\left[FC - \frac{(1+\epsilon)\rho'(h^A)}{(1-\alpha)^2(1-\epsilon)\rho''(h^B)}\right] \\ &= S'_A - S'_B - \frac{\rho'(h^A)F(S''_A - S''_B)}{(1+FD)\pi'\rho''(h^A)} + \mu\pi'\left[1 - \frac{\rho'(h^A)\pi''F}{(1+FD)(\pi')^2\rho''(h^A)}\right] \\ &\quad - \frac{\pi'(1+\epsilon)(\rho'(h^A))^2}{(1+FD)\rho''(h^A)} \cdot \left[1 - \frac{\alpha}{1-\alpha}\cdot\frac{\rho''(h^A)}{\rho'(h^A)}\cdot\frac{\rho'(h^B)}{\rho''(h^B)}\right]. \end{aligned} \tag{I.6}$$

where

$$E = -\Delta + \frac{\pi'\alpha(1+\epsilon)\rho'(h^A)FH}{1+FD}.$$

Appendix II

Differentiating (7) and using (7), (14), and (15) and ignoring third-order derivatives of f and S, we get:

$$\begin{aligned} \pi^{CU}_{h^Ah^A}\ dh^A + \pi^{CU}_{h^Ah^B}\ dh^B &= -\pi^{CU}_{h^A\alpha}\ d\alpha - \pi^{CU}_{h^A\varepsilon}\ d\varepsilon, \\ \pi^{CU}_{h^Bh^A}\ dh^A + \pi^{CU}_{h^Bh^B}\ dh^B &= -\pi^{CU}_{h^B\alpha}\ d\alpha - \pi^{CU}_{h^B\varepsilon}\ d\varepsilon, \end{aligned}$$

where

$$\begin{aligned} \pi^{CU}_{h^Ah^A} &= 2(\pi')^2\alpha(1+\varepsilon)\rho''(h^A) + 3\alpha(1+\varepsilon)\rho'(h^A)\pi'', \\ \pi^{CU}_{h^Ah^B} &= \pi^{CU}_{h^Bh^A} = 3\alpha(1+\varepsilon)\rho'(h^A)\pi'', \\ \pi^{CU}_{h^Bh^B} &= 2(\pi')^2(1-\alpha)(1-\varepsilon)\rho''(h^B) + 3\alpha(1+\varepsilon)\rho'(h^A)\pi'', \\ \pi^{CU}_{h^A\alpha} &= 3\pi''\{(1+\varepsilon)\rho(h^A) - (1-\varepsilon)\rho(h^B)\} + 2(1+\varepsilon)(\pi')^2\rho'(h^A), \\ \pi^{CU}_{h^B\alpha} &= 3\pi''\{(1+\varepsilon)\rho(h^A) - (1-\varepsilon)\rho(h^B)\} - 2(1-\varepsilon)(\pi')^2\rho'(h^B), \\ \pi^{CU}_{h^A\varepsilon} &= 3\pi''\{\alpha\rho(h^A) - (1-\alpha)\rho(h^B)\} + 2\alpha(\pi')^2\rho'(h^A), \\ \pi^{CU}_{h^B\varepsilon} &= 3\pi''\{\alpha\rho(h^A) - (1-\alpha)\rho(h^B)\} - 2(1-\alpha)(\pi')^2\rho'(h^B). \end{aligned}$$

Solving the above two equations, we find:

$$
\begin{aligned}
\Phi \cdot \frac{dh^A}{d\alpha} &= -\pi^{CU}_{h^A\alpha}\pi^{CU}_{h^Bh^B} + \pi^{CU}_{h^B\alpha}\pi^{CU}_{h^Ah^B} \\
&= -6\pi''(\pi')^2(1-\alpha)(1-\varepsilon)\rho''(h^B)\{(1+\varepsilon)\rho(h^A) - (1-\varepsilon)\rho(h^B)\} \qquad \text{(II.1)} \\
&- 2(\pi')^2(1+\varepsilon)(1-\varepsilon)\rho'(h^A)\left[2(\pi')^2(1-\alpha)\rho''(h^B) + \frac{3\rho'(h^A)\pi''\alpha(1+\varepsilon)}{(1-\alpha)(1+\varepsilon)}\right] \\
\Phi \cdot \frac{dh^B}{d\alpha} &= -\pi^{CU}_{h^B\alpha}\pi^{CU}_{h^Ah^A} + \pi^{CU}_{h^A\alpha}\pi^{CU}_{h^Ah^B} \\
&= -6(\pi')^2\pi''\alpha(1+\varepsilon)\rho''(h^A)\{(1+\varepsilon)\rho(h^A) - (1-\varepsilon)\rho(h^B)\} \qquad \text{(II.2)} \\
&+ 2(\pi')^2(1-\varepsilon)\rho'(h^B)[2(\pi')^2\alpha(1+\varepsilon)\rho''(h^A) + 3(1+\varepsilon)\rho'(h^A)\pi''],
\end{aligned}
$$

$$
\begin{aligned}
\Phi \cdot \frac{dh^A}{d\varepsilon} &= -\pi^{CU}_{h^B\varepsilon}\pi^{CU}_{h^Ah^A} + \pi^{CU}_{h^A\varepsilon}\pi^{CU}_{h^Ah^B} \\
&= -6\pi''(\pi')^2(1-\varepsilon)(1-\alpha)\rho''(h^B)\{\alpha\rho(h^A) - (1-\alpha)\rho(h^B)\} \qquad \text{(II.3)} \\
&\quad -2(\pi')^2\alpha(1-\alpha)\rho'(h^A)\left[2(\pi')^2(1-\varepsilon)\rho''(h^B) + \frac{3\rho'(h^A)\pi''(1+\varepsilon)\alpha}{(1-\varepsilon)\alpha}\right], \\
\Phi \cdot \frac{dh^B}{d\varepsilon} &= -\pi^{CU}_{h^B\varepsilon}\pi^{CU}_{h^Ah^A} + \pi^{CU}_{h^A\varepsilon}\pi^{CU}_{h^Ah^B} \\
&= -6(\pi')^2\pi''\alpha(1+\varepsilon)\rho''(h^A)\{\alpha\rho(h^A) - (1-\alpha)\rho(h^B)\} \qquad \text{(II.4)} \\
&+ 2(\pi')^2(1-\alpha)\rho'(h^B)[2(\pi')^2\alpha(1+\varepsilon)\rho''(h^A) + 3\alpha\rho'(h^A)\pi''],
\end{aligned}
$$

and thus

$$
\begin{aligned}
\Phi \cdot \frac{d\left(h^A + h^B\right)}{d\alpha} &= \pi^{CU}_{h^A\alpha}\left(\pi^{CU}_{h^Ah^B} - \pi^{CU}_{h^Bh^B}\right) + \pi^{CU}_{h^B\alpha}\left(\pi^{CU}_{h^Ah^B} - \pi^{CU}_{h^Ah^A}\right) \\
&= \tilde{\Delta}\left[\frac{\rho''(h^B)\pi^{CU}_{h^A\alpha}}{\rho'(h^B)} + \frac{\rho''(h^A)\pi^{CU}_{h^B\alpha}}{\rho'(h^A)}\right], \qquad \text{(II.5)} \\
\Phi \cdot \frac{d\left(h^A + h^B\right)}{d\varepsilon} &= \pi^{CU}_{h^A\varepsilon}\left(\pi^{CU}_{h^Ah^B} - \pi^{CU}_{h^Bh^B}\right) + \pi^{CU}_{h^B\varepsilon}\left(\pi^{CU}_{h^Ah^B} - \pi^{CU}_{h^Ah^A}\right) \\
&= \tilde{\Delta}\left[\frac{\rho''(h^B)\pi^{CU}_{h^A\varepsilon}}{\rho'(h^B)} + \frac{\rho''(h^A)\pi^{CU}_{h^B\varepsilon}}{\rho'(h^A)}\right], \qquad \text{(II.6)}
\end{aligned}
$$

where

$$\begin{aligned}\Phi &= \pi^{CU}_{h^A h^A}\pi^{CU}_{h^B h^B} - \left[\pi^{CU}_{h^A h^B}\right]^2 \\ &= 4(\pi')^4\alpha(1-\alpha)(1-\varepsilon)(1+\varepsilon)\rho''(h^A)\rho''(h^B) \\ &\quad -3\pi''\tilde{\Delta}\left[\alpha(1+\varepsilon)\rho''(h^A)+(1-\alpha)(1-\varepsilon)\rho''(h^B)\right].\end{aligned}$$

We assume the second-order condition for the lobby group's optimization problem to be satisfied. That is,

Assumption 3 $\pi^{CU}_{h^A h^A} < 0$, $\pi^{CU}_{h^B h^B} < 0$ *and* $\Phi > 0$.

Appendix III

Differentiating (26) and (27) and using (28) and (29), we find:

$$[6\alpha\pi''\rho'(h_{AA}) + \alpha(\pi')^2\rho''(h_{AA})]dh_{AA} + 6\alpha\pi''\rho'(h_{AA})dh_{BB} = A_1 d\alpha$$
$$6\alpha\pi''\rho'(h_{AA})dh_{AA} + [6\alpha\pi''\rho'(h_{AA}) + (1-\alpha)(\pi')^2\rho''(h_{BB})]dh_{BB} = A_2 d\alpha.$$

where $A_1 = -6\pi''\{\rho(h_{AA}) - \rho(h_{BB})\} + \hat{\Delta}/\alpha$ and $A_2 = -6\pi''\{\rho(h_{AA}) - \rho(h_{BB})\} - \hat{\Delta}/(1-\alpha)$.

Solving the above two equations yields:

$$\frac{\tilde{\Phi}}{(-\hat{\Delta})}\cdot\frac{dh_{AA}}{d\alpha} = -\frac{6\pi''\rho'(h_{AA})}{1-\alpha} - \frac{(1-\alpha)(\pi')^2\rho''(h_{BB})}{\alpha} + \frac{6(1-\alpha)(\pi')^2\pi''\rho''(h_{BB})\{\rho(h_{AA})-\rho(h_{BB})\}}{\hat{\Delta}}, \tag{III.1}$$

$$\frac{\tilde{\Phi}}{(-\hat{\Delta})}\cdot\frac{dh_{BB}}{d\alpha} = \frac{6\pi''\rho'(h_{AA})}{1-\alpha} + \frac{(\alpha(\pi')^2\rho''(h_{BB})}{1-\alpha} + \frac{6\alpha(\pi')^2\pi''\rho''(h_{AA})\{\rho(h_{AA})-\rho(h_{BB})\}}{\hat{\Delta}}, \tag{III.2}$$

$$\frac{\tilde{\Phi}}{(-\hat{\Delta})} \cdot \frac{(dh_{AA} + h_{BB})}{d\alpha} = 6\pi''\hat{\Delta}\{\rho(h_{AA}) - \rho(h_{BB})\}\left[\frac{\rho''(h_{AA})}{\rho'(h_{AA})} + \frac{\rho''(h_{BB})}{\rho'(h_{BB})}\right] + (\hat{\Delta})^2\left[\frac{\rho''(h_{AA})}{(1-\alpha)\rho'(h_{AA})} - \frac{\rho''(h_{BB})}{\alpha\rho'(h_{BB})}\right], \tag{III.3}$$

where $$\tilde{\Phi} = 6\alpha(1-\alpha)\rho'(h_{AA})(\pi')^2\pi''\rho''(h_{BB}) + 6\alpha^2\rho'(h_{AA})(\pi')^2\pi''\rho''(h_{AA}) + \alpha(1-\alpha)(\pi')^4\rho''(h_{BB})\rho''(h_{AA}).$$

The second-order conditions and the stability of the first-stage Nash equilibrium are assumed to be satisfied. That is,

Assumption 4 $6\alpha\pi''\rho'(h_{AA}) + \alpha(\pi')^2\rho''(h_{AA}) < 0$, $6\alpha\pi''\rho'(h_{AA}) + (1-\alpha)(\pi')^2\rho''(h_{BB}) < 0$, *and* $\tilde{\Phi} > 0$.

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