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Endogenous Tariff Formation with Intra-Industry Trade

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Abstract

Previous theoretical contributions on endogenous tariff formation have focused on trade models with homogeneous goods and constant returns to scale. This paper investigates the political equilibrium of trade policy when economic structure is instead characterized by differentiated products and increasing returns to scale and there exists intra-industry trade. The result shows that endogenous tariffs are positive for all industries with non-negligible shares of world production. However, the level of protection is less than the optimal tariff that would otherwise be imposed by a benevolent government in an unorganized industry, and higher in an organized industry. The protection provided to all unorganized (organized) industries increases (falls) with the relative weight the government attaches to aggregate welfare vis-à-vis campaign contributions and falls with the fraction of the population that belongs to a lobby group. The model also indicates that the endogenous tariff level in an organized industry might be explosive. The higher is the fraction of the population represented by a lobby and the higher is the weight on aggregate welfare in the government's objective function, the smaller is the possibility for such an explosive tariff.

Keywords: endogenous tariff; intra-industry trade

JEL classification: F12; F13

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1 Introduction

In order to reconcile the discrepancy between the well-embraced doctrine of "free" trade in theory and the prevalence of trade restrictions among nations in practice, the literature of endogenous trade policy has proposed "politics" as the missing element. When "politics" is introduced into conventional trade models, the best policy for a country in general is not necessarily pursued; instead, a policy that solicits the most political support or survives in the political competition process might be adopted. This endogenous trade policy determination process has been modelled theoretically and documented empirically by a large and distinguished literature developed over the years. For a comprehensive survey of this literature, the readers are referred to Rodrik (1995), among others.

Previous theoretical contributions on endogenous determination of trade policy have focused on models with homogeneous goods and constant returns to scale. The two major trade models which are used most frequently are the Heckscher-Ohlin model (Magee et al. (1989), Mayer (1984)) and the Ricardo-Viner model (Findlay and Wellisz (1982), Hillman (1989), Grossman and Helpman (1994)). Thus the trade structure that underlies the alternative specifications of political process introduced by these papers is restricted to one-way trade. It is therefore interesting to see what the pattern of endogenous trade policy would look like when the economic structure is instead characterized by differentiated products and increasing returns to scale and there exists intra-industry trade.

The optimal trade policy for a country under monopolistic competition has been studied by Gros (1987) and Flam and Helpman (1987), among others. Gros (1987) used Krugman's (1980) model and showed that even a small country has an optimal positive tariff, which equals the proportional markup used by monopolistically competitive producers. When the model is broadened to include both a homogeneous and a differentiated sector, Flam and Helpman (1987) showed that a small tariff is welfare improving, but that other industrial policies' welfare consequences depend on details of the production structure and the sectoral interlinkages through factor markets and preferences.

To investigate the political equilibrium of trade policy when countries are characterized by monopolistic competition and intra-industry trade, this paper embeds the Krugman (1980) model into the Ricardo-Viner specific-factors model and uses the campaign contribution approach of Grossman and Helpman (1994) to derive the endogenous tariff equilibrium.

The result shows that when the number of varieties produced at home relative to the rest of the world in an industry is negligible, the industry can not secure any import protection, regardless of whether the government has the national interest in mind or is politically motivated. In general, as the number of varieties produced at home relative to the rest of the world in an industry decreases, the endogenous tariff decreases. In other words, a larger industry will receive higher protection, regardless of whether the industry is represented by a lobby group or not. In Grossman and Helpman (1994), however, this is only true for organized sectors. When an organized sector has a larger domestic output relative to imports, it is protected by higher import tariffs. The size effect works in the opposite direction if the sector is unorganized. The larger is an unorganized industry relative to its imports, the bigger is the magnitude of negative protection (import subsidies) it will receive.

Furthermore, it is shown that the endogenous protection pattern that emerges from this study actually parallels that of Grossman and Helpman (1994) very much, if we adjust for the difference in the benchmark (optimal) tariff levels, which are free trade in Grossman and Helpman (1994) for a small competitive economy and positive tariffs in the current study with monopolistic competition. Under both economic structures, the protection levels for organized sectors are higher than the benchmark level while they are lower than the benchmark level for all unorganized sectors. As the government places less weight on aggregate welfare relative to campaign contributions, the more will the endogenous tariff levels in both organized and unorganized sectors diverge from the benchmark tariff level. Otherwise, they will converge toward the benchmark. Moreover, it is also true under both economic structures that protection levels in all sectors decrease with the fraction of the population that belongs to a lobby group. Overall, therefore, we can conclude that the endogenous protection pattern under monopolistic competition with intra-industry trade compares similarly to that of perfect competition with inter-industry trade once we adjust for the difference in their benchmark optimal tariff levels.

This study also indicates that with monopolistic competition and intra-industry trade, the endogenous tariff level in an *organized* industry might be unbounded in some parameter setup. This happens when a condition in the model holds, which depends on such demand and political parameters as the elasticity of substitution among varieties in the industry, the fraction of the population that is represented by a lobby, and the weight that the government places on aggregate welfare relative to campaign financing. The higher is the fraction of the population that is represented by a lobby and the higher is the weight on aggregate welfare in the government's objective function, the smaller is the possibility for such an explosive tariff.

The rest of the paper is organized as follows. Section 2 lays out the preference and production structure of the model and derives the corresponding equations in the political framework of Grossman and Helpman (1994). Section 3 then investigates the protection pattern for intra-industry trade in both the "small" industry case and the general case. Concluding remarks are collected in Section 4.

2 The Model

Suppose that a country is populated by individuals with identical preferences but different factor endowments. On the preference side, each individual maximizes utility given by

$$U = X_0 + \sum_{i}^{n} U_i(X_i)$$

where X_0 is the consumption of homogeneous good 0 and X_i is an index of consumption of differentiated goods in industry i, $i = 1, 2, \ldots, n$. The homogeneous good is taken as numeraire, with a world and domestic price equal to 1. The index of consumption of differentiated goods in industry i takes the usual Dixit-Stiglitz form:

$$X_i = (\sum_{k=1}^{m_i} x_{ik}^{\rho_i} + \sum_{k=1}^{m_i^*} {x_{ik}^*}^{\rho_i})^{1/\rho_i} \qquad 0 < \rho_i < 1$$

where x_{ik} (x_{ik}^*) is the consumption of domestic (foreign) variety k of good i and m_i (m_i^*) is the number of varieties of good i produced at home (abroad). The price index for a differentiated good i is

$$P_i = (\sum_{k=1}^{m_i} p_{ik}^{1-\sigma_i} + \sum_{k=1}^{m_i^*} {p_{ik}^*}^{1-\sigma_i})^{1/1-\sigma_i} \tag{1}$$

where p_{ik} (p_{ik}^*) is the consumer price at home for domestic (foreign) variety k of good i and $\sigma_i = \frac{1}{1-\rho_i} > 1$ is the elasticity of substitution among different varieties of good i. For simplicity, U_i is assumed to take the form of $E_i \; lnX_i$, which amounts to assuming that an individual allocates a fixed amount of expenditure E_i for good i.[1] The rest of the world is assumed to share the same preference structure.

On the production side, the homogeneous good is assumed to be manufactured from labor alone with constant returns to scale and a unit labor requirement equal to 1. It is produced both at home and abroad, and is traded freely and costlessly. Therefore, the wage is equal to 1 universally.[2] Production of the differentiated goods requires labor and a sector-specific input. Each variety of the differentiated good i is assumed to require a fixed amount of the sector-specific factor k_i in order to produce at all; after that, there is a constant unit labor requirement, a_i. Assume that there are a large number of varieties (home and foreign combined) available to the consumer. Then given the preferences specified above, each variety's producer faces an approximately constant elasticity of demand, equal to σ_i. With profit maximization, each domestic variety's producer charges the same price:

$$p_{ik} = p_i = \frac{a_i\ \sigma_i}{\sigma_i - 1}. \tag{2}$$

The sector-specific factors in this country are assumed to be available in inelastic supply ($\bar{K}_i, i = 1, 2, \ldots, n$). Therefore, the size of a differentiated-good industry in a country is predetermined by the amount of the sector-specific factor that the country is endowed with. That is, the number of varieties produced at home in industry i would be $m_i = \bar{K}_i / k_i$. It is assumed that the technology abroad to produce the differentiated products is the same as that at home, so any difference in the consumer price of a variety from home and from abroad would reflect only government intervention and nothing else. That is,

$$p^*_{ik} = p^*_i = \tau_i\ p_i \qquad \tau_i \geq 0 \tag{3}$$

where τ_i is the government intervention in sector i. For example, in the case of an import tariff, τ_i is one plus its ad valorem value.

In the presence of intra-industry trade, an export subsidy (tax) would help (hurt) the domestic firms in the same way that an import tariff (subsidy) would. The former expands (shrinks) the domestic firms' market shares in the export market, while the latter expands (shrinks) them in

[1]To see this, note that by the first order condition, it holds that $\frac{\partial U}{\partial X_0} = \lambda P_0$ or $\lambda = 1$. Similarly, $\frac{\partial U}{\partial X_i} = \lambda P_i$, or $\frac{E_i}{X_i} = P_i$. It follows that $E_i = P_i X_i$.

[2]In this setup, the presence of the homogeneous good ties down the relative producer prices of the differentiated goods from home and abroad, and hence eliminates possible terms of trade effects from import tariffs or subsidies that are applied to these goods. This point has been suggested by Helpman and Krugman (1989, p. 140) in a similar structure.

the domestic market. This study focuses on one of these two dimensions, and assumes that the government only intervenes in trade using an import tariff or subsidy.

Given the structure of preferences, we can solve the utility optimization problem in two stages. In the first stage, an individual with an income of E will consume $X_i = D_i(P_i)$ of the index of differentiated good i (where $D_i(P_i) = E_i/P_i$) and $X_0 = E - \sum_i P_i D_i(P_i)$ of the homogeneous good. The indirect utility function therefore can be expressed as

$$V(\mathbf{P}, E) = E + s(\mathbf{P}), \qquad \mathbf{P} = (P_1, P_2, \ldots, P_n) \tag{4}$$

where $s(\mathbf{P}) \equiv \sum_i U_i[D_i(P_i)] - \sum_i P_i D_i(P_i)$ is the consumer surplus derived from consumption of the index of the differentiated goods. Using equations (2) and (3), we can simplify the price index for the differentiated good i in equation (1) as

$$P_i = p_i \ (m_i + m_i^* \tau_i^{1-\sigma_i})^{1/1-\sigma_i}.$$

It can be shown that $\partial s(\mathbf{P})/\partial P_i = -D_i < 0$ and $\partial P_i/\partial \tau_i > 0$. Therefore,

$$\frac{\partial s(\mathbf{P})}{\partial \tau_i} = -D_i \frac{\partial P_i}{\partial \tau_i} < 0$$

which says that raising the import tariff (subsidy) would reduce (enhance) an individual's consumer surplus.

In the second stage, with the given expenditure E_i on differentiated good i, the individual will consume

$$x_i = d_i(\tau_i) = \frac{E_i}{p_i} \frac{1}{m_i + m_i^* \tau_i^{1-\sigma_i}}$$

of a representative variety of good i produced at home and

$$x_i^* = d_i^*(\tau_i) = \frac{E_i}{p_i^*} \frac{\tau_i^{1-\sigma_i}}{m_i + m_i^* \tau_i^{1-\sigma_i}} \tag{5}$$

of a representative variety of good i produced abroad. It is straightforward to show that

$$\frac{\partial d_i}{\partial \tau_i} = \frac{E_i}{p_i} \frac{(\sigma_i - 1) m_i^* \tau_i^{-\sigma_i}}{(m_i + m_i^* \tau_i^{1-\sigma_i})^2} > 0, \tag{6}$$

and

$$\frac{\partial d_i^*}{\partial \tau_i} = -\frac{E_i}{p_i^*}\frac{\tau_i^{1-\sigma_i}[\sigma_i m_i \tau_i^{-1} + m_i^* \tau_i^{-\sigma_i}]}{(m_i + m_i^* \tau_i^{1-\sigma_i})^2} < 0. \tag{7}$$

Therefore, a higher tariff (subsidy) in industry i raises (lowers) the market shares of the home produced varieties and lowers (raises) those of foreign varieties.

Take any tariff level or subsidy rate imposed abroad, τ_i^*, as given. A representative home producer of differentiated good i will produce at the scale of

$$y_i = N d_i(\tau_i) + N^* d_{if}(\tau_i^*)$$

where $N(N^*)$ is total population at home (abroad) and d_{if} is the foreign demand for a representative home variety of good i, which is a mirror image of equation (5). Therefore, the aggregate reward to the specific factor used in producing good i is

$$\Pi_i(\tau_i, \tau_i^*) = m_i(p_i - a_i)y_i.$$

Since

$$\frac{\partial \Pi_i}{\partial \tau_i} = m_i(p_i - a_i)N\frac{\partial d_i}{\partial \tau_i} > 0, \tag{8}$$

a higher tariff (subsidy) in sector i benefits (hurts) the owners of the specific factor used in this sector.

The net revenue from all taxes and subsidies, expressed on a per capita basis, is given by

$$r(\tau) = \sum_i^n m_i^*(\tau_i - 1)p_i d_i^*, \qquad \tau = (\tau_1, \tau_2, \ldots, \tau_n).$$

It is assumed that the government redistributes the revenue uniformly to each individual. Therefore, $r(\tau)$ is the net government transfer to each individual. Because

$$\frac{\partial r}{\partial \tau_i} = m_i^* p_i d_i^* + m_i^*(\tau_i - 1)p_i \frac{\partial d_i^*}{\partial \tau_i} > 0 \qquad \text{if } \tau_i \leq 1,$$

starting with free trade, a small increase in the tariff rate in any sector raises the transfer amount.

However, with some manipulation, it can be shown that

$$\frac{\partial r}{\partial \tau_i} + \frac{\partial s}{\partial \tau_i} = m_i^*(\tau_i - 1)p_i \frac{\partial d_i^*}{\partial \tau_i} \lesseqgtr 0 \qquad \text{when } \tau_i \gtreqless 1. \tag{9}$$

That is, the consumer welfare (government transfer and consumer surplus combined) is highest at the free trade level. Therefore, a general consumer without claims to any specific factor would be hurt by any deviations from free trade.

In what follows, the political contribution framework of Grossman and Helpman (1994) will be briefly reviewed and applied to the present model, which allows us to investigate the endogenous tariff equilibrium in the next section.

As stated in equation (4), an individual's welfare depends on his income level and the consumer surplus he enjoys from the consumption of differentiated goods. A typical individual's income includes wages and government transfers, and possibly the reward from the ownership of some sector-specific input. It is assumed that claims to the specific inputs are indivisible and nontradable and individuals each own at most one type of specific factor. Given the fact that the owners of a certain specific factor have a common interest in protection for their sector, they may choose to unite their forces for political activity. It is assumed that in some exogenous set of sectors, denoted L, the owners of the specific factors have been able to organize themselves into lobby groups. These lobbies compete noncooperatively for the government's favor and propose contribution schedules, $C_i(\tau)$, contingent on the trade-policy vector set by the government, τ, to maximize the joint welfare of their members.[3] The joint welfare of a lobby i, V_i, is its gross welfare W_i net of the contribution C_i made to the government. We observe that

$$W_i(\tau) = l_i + \Pi_i(\tau_i) + \alpha_i N[r(\tau) + s(\tau)] \tag{10}$$

where l_i is the total labor supply (and also the labor income) of owners of the specific input used in industry i and α_i is the fraction of the population that owns some of this specific factor.[4]

Faced with the contribution schedules offered by the lobby groups, the government selects a

[3] As will be seen immediately, a lobby's joint welfare is tied to other sectors' tariff rates as well as its own sector's. Therefore, a lobby will tailor its contribution schedule conditional on the whole vector of trade policies.

[4] Note that the total labor supply (population) of an industry and the lobby that represents it (the specific-factor owners) are potentially different. Equation (10) is only concerned with the welfare of the lobby members.

trade-policy vector τ to maximize the objective function,

$$G = \sum_{i \in L} C_i(\tau) + aW(\tau) \qquad a \geq 0 \tag{11}$$

where W is the aggregate, gross-of-contributions welfare and a is the weight that the government places on aggregate welfare relative to campaign contributions. Aggregate gross welfare is the sum of aggregate income, total tariff revenue, and consumer surplus; that is,

$$W(\tau) = l + \sum_{i}^{n} \Pi_i(\tau_i) + N[r(\tau) + s(\tau)]. \tag{12}$$

To facilitate the exposition of tariff equilibrium later, I will take the stricter version of Grossman and Helpman (1994) in assuming that the contribution schedules are globally truthful. A contribution schedule is globally truthful if it everywhere reflects the true preference of a lobby. As shown in Grossman and Helpman (1994), if the contribution schedules are globally truthful, the government's objective function is equivalent to

$$\tilde{G} = \sum_{i \in L} W_i(\tau) + aW(\tau). \tag{13}$$

Let us first calculate the impact of marginal trade policy changes on the welfare of various lobbies. Using equations (8), (9), and (10), we find that for lobby i, a small increase in τ_j will cause its welfare to change by

$$\begin{aligned} \frac{\partial W_i}{\partial \tau_j} &= \frac{\partial \Pi_i}{\partial \tau_j} + \alpha_i N[\frac{\partial r}{\partial \tau_j} + \frac{\partial s}{\partial \tau_j}] \\ &= \delta_{ij} N m_j (p_j - a_j) \frac{\partial d_j}{\partial \tau_j} + \alpha_i N m_j^* (\tau_j - 1) p_j \frac{\partial d_j^*}{\partial \tau_j} \end{aligned} \tag{14}$$

where δ_{ij} is an indicator variable which equals 1 if $i = j$ and 0 otherwise. Equation (14) says that lobby i benefits from an increase in the protection of its own sector, but is hurt by any deviations from free trade in other sectors. Starting with free trade, a small increase in the protection of sector i would induce domestic consumers to switch demand away from imported varieties in sector i toward domestically produced varieties. This would increase domestic varieties' production and accordingly the profit income (aggregate reward) to the specific-factor owners in sector i. On the other hand, for all other sectors, lobby i has only general interest as consumers in trade policies that would affect import prices in these sectors. We have seen in equation (9) that it is in the best interest of consumers that free trade be implemented, when both government transfers and consumer surplus are taken into account. Therefore, lobby i would prefer free trade in all sectors but its own.

Next, we sum the expression in (14) for all $i \in L$ to obtain the joint impact on all lobbies of a marginal tariff change in sector j,

$$\sum_{i \in L} \frac{\partial W_i}{\partial \tau_j} = I_j N m_j (p_j - a_j) \frac{\partial d_j}{\partial \tau_j} + \alpha_L N m_j^* (\tau_j - 1) p_j \frac{\partial d_j^*}{\partial \tau_j} \tag{15}$$

where $I_j = \sum_{i \in L} \delta_{ij}$ is an indicator variable that equals 1 if industry j is organized and 0 otherwise, while $\alpha_L = \sum_{i \in L} \alpha_i$ is the fraction of the total population that is represented by a lobby. Equation (15) states that starting with free trade, lobby members as a group benefit from an increase in the tariff on any good that is produced by an organized sector, but are hurt by any deviations from free trade in all unorganized sectors. This together with equation (14) indicates that as lobbies each bid for a positive tariff in their own sectors but free trade in all other sectors, they jointly bid for import tariffs in all organized sectors but free trade in all unorganized sectors. This lobbying pattern for trade policies is different from that in Grossman and Helpman (1994), in which lobbying activity as a whole bids for import tariffs (or export subsidies) in all organized sectors but import subsidies (or export taxes) in all unorganized sectors.

Finally, let us calculate the effect of a marginal tariff change on aggregate welfare. Using equations (8), (9), and (12), we find that

$$\begin{aligned} \frac{\partial W}{\partial \tau_j} &= \sum_{i}^{n} \frac{\partial \Pi_i}{\partial \tau_j} + N[\frac{\partial r}{\partial \tau_j} + \frac{\partial s}{\partial \tau_j}] \\ &= N m_j (p_j - a_j) \frac{\partial d_j}{\partial \tau_j} + N m_j^* (\tau_j - 1) p_j \frac{\partial d_j^*}{\partial \tau_j}. \end{aligned} \tag{16}$$

Equation (16) says that starting with free trade in sector j, a small increase in τ_j improves the national welfare because of the increase in profit. Therefore, if the incumbent government is not influenced by lobby activities and maximizes aggregate welfare when setting trade policies, the optimal tariffs would be positive for every sector. This differs from the benchmark trade policy in

Grossman and Helpman (1994) when the government is not politically motivated, as free trade in every sector is efficient for a small, competitive economy that is studied in their model.

3 The Endogenous Tariff Equilibrium

We are now ready to investigate the equilibrium trade policies that would emerge in the campaign-contribution framework with intra-industry trade. By using equations (15) and (16), we have

$$\begin{aligned}\frac{\partial \tilde{G}}{\partial \tau_j} &= \sum_{i\in L}\frac{\partial W_i}{\partial \tau_j} + a\frac{\partial W}{\partial \tau_j} \\ &= (I_j + a)Nm_j(p_j - a_j)\frac{\partial d_j}{\partial \tau_j} + (\alpha_L + a)Nm_j^*(\tau_j - 1)p_j\frac{\partial d_j^*}{\partial \tau_j}.\end{aligned} \tag{17}$$

The first order condition (FOC) for an equilibrium trade-policy vector τ requires that $\frac{\partial \tilde{G}}{\partial \tau_j} = 0$ for $j = 1, 2, \ldots, n$. When the equilibrium in a sector does exist, the tariff satisfies the following implicit function:

$$\tau_j - 1 = \frac{(I_j + a)m_j}{(\alpha_L + a)m_j^*\sigma_j}\frac{\frac{\partial d_j}{\partial \tau_j}}{-\frac{\partial d_j^*}{\partial \tau_j}}. \tag{18}$$

However, as will be discussed later, an equilibrium tariff for an industry does not necessarily exist in certain circumstances, so to investigate the existence and the properties of the tariff that maximizes (13), let us rewrite $\frac{\partial \tilde{G}}{\partial \tau_j}$ as

$$\begin{aligned}\frac{\partial \tilde{G}}{\partial \tau_j} &\equiv [R(\tau_j) - S(\tau_j)]Z(\tau_j), \text{ where} \\ R(\tau_j) &= -\frac{\partial d_j}{\partial \tau_j}/\frac{\partial d_j^*}{\partial \tau_j}, \\ S(\tau_j) &= \frac{(\alpha_L + a)m_j^*\sigma_j}{(I_j + a)m_j}(\tau_j - 1), \\ Z(\tau_j) &= (I_j + a)Nm_j(p_j - a_j)(-\frac{\partial d_j^*}{\partial \tau_j}).\end{aligned}$$

$R(\tau_j)$ is the ratio of the changes in the market sizes of a home variety relative to a foreign variety in industry j when τ_j varies, while $S(\tau_j)$ can be viewed as the ratio of the weights attached to the consumer welfare loss relative to the producer welfare gain. Since $Z(\tau_j) > 0$, the FOC is equivalent to $R(\tau_j) = S(\tau_j)$. When $R(\tau_j) < S(\tau_j)$, lowering τ_j would increase the objective function $\tilde{G}$; when

$R(\tau_j) > S(\tau_j)$, the opposite holds true. Given equations (6) and (7), we note that

$$R(\tau_j) = \frac{(\sigma_j - 1)m_j^*}{\sigma_j m_j \tau_j^{-1} + m_j^* \tau_j^{-\sigma_j}} > 0 \qquad \forall \tau_j > 0,$$

$$\frac{\partial R}{\partial \tau_j} = \frac{\sigma_j(\sigma_j - 1)m_j^*(m_j \tau_j^{-2} + m_j^* \tau_j^{-\sigma_j - 1})}{(\sigma_j m_j \tau_j^{-1} + m_j^* \tau_j^{-\sigma_j})^2} > 0 \qquad \forall \tau_j > 0,$$

$$\frac{\partial^2 R}{\partial \tau_j^2} = \frac{\sigma_j(\sigma_j - 1)^2 m_j^{*2} \tau_j^{-\sigma_j - 2}(m_j^* \tau_j^{-\sigma_j} - (\sigma_j - 2)m_j \tau_j^{-1})}{(\sigma_j m_j \tau_j^{-1} + m_j^* \tau_j^{-\sigma_j})^3} \gtreqless 0.$$

We can also show that

$$R(0) = 0, \ \lim_{\tau_j \to \infty} R(\tau_j) \to \infty;$$

$$\frac{\partial R}{\partial \tau_j}(0) = 0, \ \lim_{\tau_j \to \infty} \frac{\partial R}{\partial \tau_j}(\tau_j) = \frac{(\sigma_j - 1)m_j^*}{\sigma_j m_j}.$$

Therefore, $R(\tau_j)$ is a monotonic increasing function in τ_j starting from zero and increasing toward infinity with the slope approaching $\frac{(\sigma_j - 1)m_j^*}{\sigma_j m_j}$ as τ_j becomes large. Nevertheless, we are not sure about the curvature of $R(\tau_j)$. Intuitively speaking, when τ_j increases, the demand for a domestic variety, d_j, increases, while the demand for a foreign variety, d_j^*, decreases. However, the rate of increase in d_j is bigger than the rate of decrease in d_j^*. Therefore, as τ_j increases, R increases. However, the rate of the increase in R could be increasing, constant, or decreasing, depending on τ_j and the parameters. This schedule is only influenced by the demand and production parameters and not by political factors, so it will stay the same as we alter the political scenarios.

On the other hand, $S(\tau_j)$ is a linear function in τ_j with $S(1) = 0$ and a slope of $\frac{(\alpha_L + a)m_j^* \sigma_j}{(I_j + a)m_j}$, which depends on the parameters that characterize the political environment as well as the demand and production structure. Let $S_o(\tau_j)$ and $S_u(\tau_j)$ denote the schedule when the industry is "organized" ($I_j = 1$) and "unorganized" ($I_j = 0$), respectively. In addition, it will serve as a benchmark to look at the schedule that corresponds to the circumstance where politics is not present and the government maximizes the general welfare. This is equivalent to setting $\alpha_L = I_j = 0$ and thus $S(\tau_j) = \frac{m_j^* \sigma_j}{m_j}(\tau_j - 1)$. Let $S_b(\tau_j)$ denote this schedule. In sum, the corresponding equations of

$S(\tau_j)$ in different political scenarios are:

$$
\begin{aligned}
S_u(\tau_j) &= \frac{(\alpha_L + a)m_j^*\sigma_j}{am_j}(\tau_j - 1), \\
S_b(\tau_j) &= \frac{m_j^*\sigma_j}{m_j}(\tau_j - 1), \\
S_o(\tau_j) &= \frac{(\alpha_L + a)m_j^*\sigma_j}{(1+a)m_j}(\tau_j - 1).
\end{aligned} \tag{19}
$$

3.1 The Small Industry Equilibrium

When an industry is "small" such that the number of varieties produced at home relative to the rest of the world is negligible ($\frac{m_j}{m_j^*} \to 0$), the corresponding $R(\tau_j)$ schedule becomes strictly convex. To see this, note that

$$
\text{as } \frac{m_j}{m_j^*} \to 0, \;\; R(\tau_j) \to (\sigma_j - 1)\tau_j^{\sigma_j},
$$

which is a strictly convex function of τ_j. On the other hand, the schedules, S_u, S_b, S_o, all converge to the vertical line which passes through $\tau_j = 1$. Since $0 < R(1) = \sigma_j - 1 < \infty$, it must be the case that $R(\tau_j)$ and $S(\tau_j)$ intersect once at $\tau_j = 1$ and we have a unique equilibrium $\tau_j = 1$. This is illustrated in Figure 1.

Therefore, when the number of varieties produced at home relative to the rest of the world in an industry is negligible, the industry can not secure any import protection from the government, regardless of whether the government has the national interest in mind or is politically motivated. Intuitively speaking, although a rise in the tariff on a certain industry benefits the producers of home varieties, it hurts the consumers who deem the home varieties as imperfect substitutes for the foreign varieties. When the number of varieties produced at home is negligible relative to the rest of the world, the gain in profit by raising the tariff is overwhelmed by the loss in the consumer welfare. This is true even when the government takes the lobbies' interests into account and weighs the production gain proportionately more against the consumer loss, as indicated in equation (17). Therefore, free trade is optimal for such a "small" industry with a negligible share of world production, whether the government is politically influenced or not.

In general, it can be shown that as the number of varieties produced at home relative to the rest of the world in an industry decreases ($\frac{m_j}{m_j^*} \downarrow$), the endogenous tariff level as in equation (18) decreases. In other words, a larger industry will receive higher protection, regardless of whether the industry is represented by a lobby group or not. In Grossman and Helpman (1994), however, this is only true for organized sectors. When an organized sector has a larger domestic output relative to imports, it is protected by higher import tariffs. The size effect works in the opposite direction if the sector is unorganized. The larger is an unorganized industry relative to its imports, the bigger is the magnitude of negative protection (import subsidies) it will receive.

3.2 The General Tariff Equilibrium

This section studies the general pattern of protection when the number of varieties produced at home relative to the rest of the world in an industry is not negligible.

As a benchmark, let us start by investigating the optimal tariff level when political activities are not present and the government is benevolent. It can be shown that $\frac{\partial R}{\partial \tau_j} < \frac{\partial S_b}{\partial \tau_j}$ for all $\tau_j > 0$. Therefore, $R(\tau_j)$ and $S_b(\tau_j)$ intersect at a single point. Let τ_j^b denote the corresponding tariff . This scenario is illustrated in Figure 2. Depending on the demand and production parameters, there are other even more wiggly shapes that are possible for the schedule $R(\tau_j)$, but the slope of $R(\tau_j)$ should be always less than that of $S_b(\tau_j)$. Since $R(\tau_j) > S_b(\tau_j)$ for all $\tau_j < \tau_j^b$ and $R(\tau_j) < S_b(\tau_j)$ for all $\tau_j > \tau_j^b$, $\tilde{G}(\tau_j^b)$ is the local (and global) maximum and τ_j^b is the optimal tariff. It is easy to see that $R(1) - S_b(1) = \frac{(\sigma_j - 1)m_j^*}{\sigma_j m_j + m_j^*} > 0$. Hence, the optimal tariff rate is strictly positive for an industry with non-negligible intra-industry trade. This verifies the observations made earlier on equation (16).

If instead political activities are present but the industry is *unorganized*, the relevant $S(\tau_j)$ schedule is $S_u(\tau_j)$. Because $S_u(\tau_j)$ has a bigger slope than $S_b(\tau_j)$, it follows that $\frac{\partial R}{\partial \tau_j} < \frac{\partial S_u}{\partial \tau_j}$ for all $\tau_j > 0$. Moreover, it is again true that $R(1) - S_u(1) = \frac{(\sigma_j - 1)m_j^*}{\sigma_j m_j + m_j^*} > 0$. Hence, the equilibrium tariff for an unorganized industry, τ_j^u, is unique and the tariff rate is strictly positive as shown in Figure 3. However, the protection is less than the optimal tariff level the industry would otherwise be granted by a benevolent government.

If the industry is *organized*, it is no longer necessarily true that $\frac{\partial R}{\partial \tau_j} < \frac{\partial S_o}{\partial \tau_j}$ for all $\tau_j > 0$. Therefore, an equilibrium tariff in this sector does not necessarily exist. However, when an equilibrium does exist as in Figure 4, the tariff level, τ_j^o, would be higher than that imposed by a benevolent government. To see this, observe that $R(\tau_j^b) = S_b(\tau_j^b)$ and $S_b(\tau_j) > S_o(\tau_j)$ for all $\tau_j > 1$, so it follows that $R(\tau_j^b) > S_o(\tau_j^b)$. As a result, τ_j^o must be higher than τ_j^b.

The foregoing conclusion about the endogenous tariffs in unorganized and organized sectors relative to those imposed by a benevolent government is actually very intuitive. Recall from equations (15) and (16) that when contributions are the only consideration for the government, the lobbying forces as a whole would prompt the government to impose positive tariffs in organized sectors and free trade in unorganized sectors. On the other hand, when national welfare is the only concern, a benevolent government would prefer positive tariffs in all sectors. When both political and national interests are taken into account as in (17), these two forces would restrain each other and the end result is that the endogenous tariff in the unorganized sector falls below the benchmark tariff level while the endogenous tariff in the organized sector rises above the benchmark tariff level.

As the government puts more weight on the national interest ($a \uparrow$), the endogenous tariffs in either organized or unorganized sectors approach the optimal tariff level imposed by a benevolent government. On the other hand, as the government puts more weight on campaign contributions, the endogenous tariffs approach the desired levels of the lobbies. To see this, look at equation (19) and Figure 5. As $a \to \infty$, $S_u(\tau_j)$ and $S_o(\tau_j)$ converge to $S_b(\tau_j)$ and we have τ_j^u and τ_j^o converge to τ_j^b. In contrast, as $a \to 0$, $S_u(\tau_j)$ and $S_o(\tau_j)$ diverge with the former approaching the vertical line and the latter approaching $\frac{\alpha_L m_j^* \sigma_j}{m_j}(\tau_j - 1)$, which is the flattest possible line for $S_o(\tau_j)$ in a given industry. Therefore, we have τ_j^u converge to the free trade level and τ_j^o converge to its highest possible level, which is the desired result of the lobbies.

In addition to the weight the government places on aggregate welfare, the protection pattern across industries is also affected by the fraction of the population that is represented by a lobby. As the fraction becomes higher ($\alpha_L \to 1$), the emphasis on the loss in consumer welfare as in equation (17) rises in the government's decision. Therefore, the tariffs in each sector would be reduced. The opposite is true when the fraction draws close to 0. This can be illustrated with equation (19) and Figure 6. As $\alpha_L \to 1$, $S_u(\tau_j)$ and $S_o(\tau_j)$ pivot to the left with the former approaching $\frac{(1+a)m_j^* \sigma_j}{a m_j}(\tau_j - 1)$ and the latter approaching $S_b(\tau_j)$. Therefore, both τ_j^u and τ_j^o decrease with τ_j^o converging to τ_j^b. In contrast, as $\alpha_L \to 0$, $S_u(\tau_j)$ and $S_o(\tau_j)$ pivot to the right with the former approaching $S_b(\tau_j)$ and the latter approaching $\frac{a m_j^* \sigma_j}{(1+a)m_j}(\tau_j - 1)$. Hence, both τ_j^u and τ_j^o increase with τ_j^u converging to τ_j^b.

Therefore, the protection provided to all unorganized (organized) industries increase (fall) with the relative weight the government attaches to aggregate welfare vis-à-vis campaign contributions and fall with the fraction of the population that belongs to an organized lobby group.

It is interesting to note that the endogenous protection pattern that emerges from this study actually parallels that of Grossman and Helpman (1994) very much, if we adjust for the difference in the benchmark (optimal) tariff levels, which are free trade in Grossman and Helpman (1994) for a small competitive economy and positive tariffs in the current study with monopolistic competition. Under both economic structures, the protection levels for organized sectors are higher than the benchmark level while they are lower than the benchmark level for all unorganized sectors. As the government places less weight on aggregate welfare relative to campaign contributions, the more will the endogenous tariff levels in both organized and unorganized sectors diverge from the benchmark tariff level. Otherwise, they will converge toward the benchmark. Moreover, it is also true under both economic structures that protection levels in all sectors decrease with the fraction of the population that belongs to a lobby group. Overall, therefore, we can conclude that the endogenous protection pattern under monopolistic competition with intra-industry trade compares similarly to that of perfect competition with inter-industry trade once we adjust for the difference in their benchmark optimal tariff levels.

Our last task is to explore the condition that guarantees the existence of a political equilibrium tariff in an organized sector under the economic structure of monopolistic competition and intra-industry trade.

PROPOSITION 1 *The endogenous tariff for an organized industry j exists if $\frac{\partial R}{\partial \tau_j} < \frac{\partial S_o}{\partial \tau_j}$ as $\tau_j \to \infty$, or equivalently $\frac{\sigma_j - 1}{\sigma_j^2} < \frac{\alpha_L + a}{1+a}$; on the other hand, if $\frac{\sigma_j - 1}{\sigma_j^2} > \frac{\alpha_L + a}{1+a}$, the endogenous tariff is explosive.*

[PROOF]: Since $R(\tau_j)$ is a strictly increasing function with $R(0) = 0$ and $S_o(\tau_j)$ is a linear function with $S_o(1) = 0$, if $\frac{\partial R}{\partial \tau_j} < \frac{\partial S_o}{\partial \tau_j}$ as $\tau_j \to \infty$, the schedule $R(\tau_j)$ must have intersected the schedule $S_o(\tau_j)$ at an odd number of points and fall *below* it after the final intersection. Therefore, the highest tariff level that satisfies the FOC is bounded and corresponds to a local (and potentially a global) maximum of $\tilde{G}(\tau_j)$. The global maximum of $\tilde{G}(\tau_j)$, chosen among the local maxima, therefore exists and we have a finite endogenous tariff in the organized industry. The situation is illustrated in Figure 7. Since it is true that $\lim_{\tau_j \to \infty} \frac{\partial R}{\partial \tau_j} = \frac{(\sigma_j - 1) m_j^*}{\sigma_j m_j}$ and $\frac{\partial S_o}{\partial \tau_j} = \frac{(\alpha_L + a) m_j^* \sigma_j}{(1+a) m_j}$, $\forall \tau_j$, the condition that $\lim_{\tau_j \to \infty} \frac{\partial R}{\partial \tau_j} < \frac{\partial S_o}{\partial \tau_j}$ is equivalent to $\frac{(\sigma_j - 1) m_j^*}{\sigma_j m_j} < \frac{(\alpha_L + a) m_j^* \sigma_j}{(1+a) m_j}$, or $\frac{\sigma_j - 1}{\sigma_j^2} < \frac{\alpha_L + a}{1+a}$.

On the other hand, if $\frac{\partial R}{\partial \tau_j} > \frac{\partial S_o}{\partial \tau_j}$ as $\tau_j \to \infty$, or equivalently $\frac{\sigma_j - 1}{\sigma_j^2} > \frac{\alpha_L + a}{1+a}$, $R(\tau_j)$ would rise *above* $S_o(\tau_j)$ eventually. It follows that $R(\tau_j) - S_o(\tau_j) > 0$ after the final intersection, and it is always beneficial to continue increasing the tariff. Therefore, the endogenous tariff level is unbounded and explosive. The situation is illustrated in Figure 8. Note that in either of the scenarios, the condition is "sufficient" but not "necessary", as when $\frac{\sigma_j - 1}{\sigma_j^2} = \frac{\alpha_L + a}{1+a}$, the endogenous tariff could be either finite or explosive. Q.E.D.

Therefore, the endogenous tariff level for an *organized* industry might rise without limit. This happens when the condition $\frac{\sigma_j - 1}{\sigma_j^2} > \frac{\alpha_L + a}{1+a}$ in the model holds for an organized industry j. This condition depends on such demand and political parameters as the elasticity of substitution among varieties in this industry, the fraction of the population that is represented by a lobby, and the weight that the government places on aggregate welfare relative to campaign financing. The higher is the fraction of the population that is represented by a lobby and the higher is the weight on aggregate welfare in the government's objective function, the smaller is the possibility for such an explosive tariff.[5]

This is also very intuitive and ties closely to the observations made above on the effects of the parameters α_L and a on the protection patterns. Both higher α_L and higher a would raise the slope of $S_o(\tau_j)$ and shift it toward $S_b(\tau_j)$. This makes it more possible to realize the condition, $\frac{\partial R}{\partial \tau_j} < \frac{\partial S_o}{\partial \tau_j}$ as $\tau_j \to \infty$, and to have a finite endogenous tariff in an organized industry.

4 Conclusion

This paper investigates the political equilibrium of trade policy when economic structure is characterized by differentiated products and increasing returns to scale and there exists intra-industry trade. This is accomplished by embedding the Krugman (1980) model into the Ricardo-Viner specific-factors model and employing the political contribution framework of Grossman and Helpman (1994) to derive the endogenous tariff equilibrium.

The result shows that endogenous tariffs are positive for all industries with non-negligible shares of world production. However, the level of protection is less than the optimal tariff that would otherwise be imposed by a benevolent government if the industry is unorganized, and higher if

[5]To see this, note that $0 < \frac{\sigma_j - 1}{\sigma_j^2} < 1$, $0 \le \frac{\alpha_L + a}{1+a} \le 1$, $\frac{\partial \{\frac{\alpha_L + a}{1+a}\}}{\partial \{\alpha_L\}} > 0$, and $\frac{\partial \{\frac{\alpha_L + a}{1+a}\}}{\partial \{a\}} > 0$.

the industry is organized. As the fraction of the population that belongs to an organized lobby group increases, the tariff in the sector decreases; the opposite is true when the fraction draws close to zero. The protection pattern across industries is also affected by the relative weight the government attaches to aggregate welfare vis-à-vis campaign contributions. As the relative weight increases, the endogenous tariffs in either organized or unorganized sectors converge to the optimal tariff levels that would otherwise be imposed by a benevolent government. On the other hand, as the government puts more weight on campaign contributions, the endogenous tariffs would diverge, with those in unorganized sectors approaching the free trade level and those in organized sectors approaching the desired levels of the lobbies.

The model also indicates that the political equilibrium of the tariff level in an organized industry might be explosive. The higher is the fraction of the population represented by a lobby and the higher is the weight the government places on aggregate welfare relative to campaign contributions, the smaller is the possibility for such an explosive tariff.

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Figure 1: Endogenous Tariff in Small-Industry Case ($\frac{m_j}{m_j^*} \to 0$)

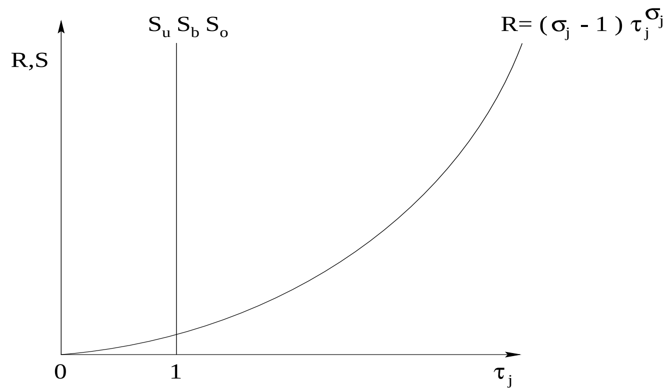

Figure 2: Optimal Tariff in No-Politics Case

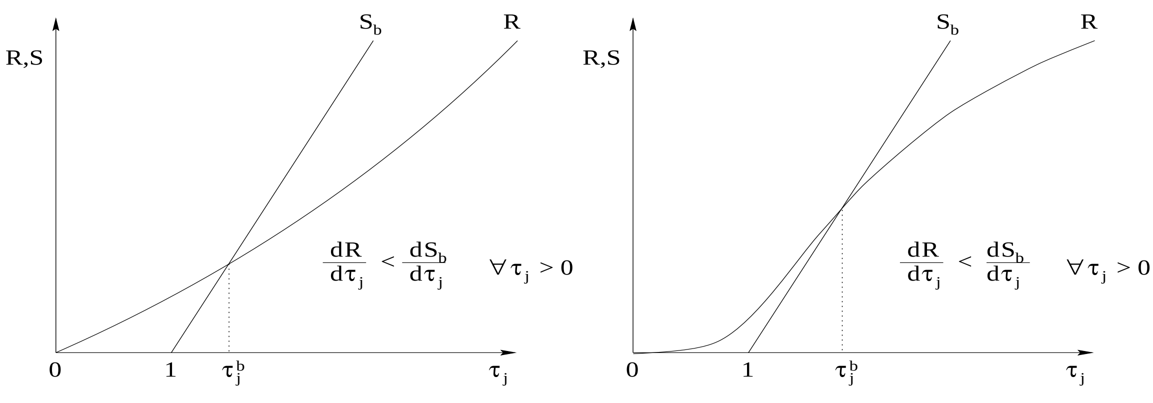

Figure 3: Endogenous Tariff in Unorganized Sector

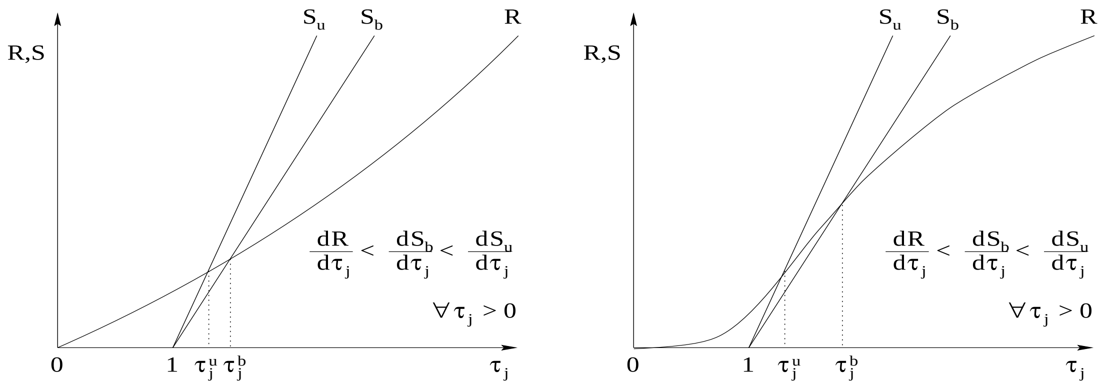

Figure 4: Endogenous Tariff in Organized Sector when a unique equilibrium exists

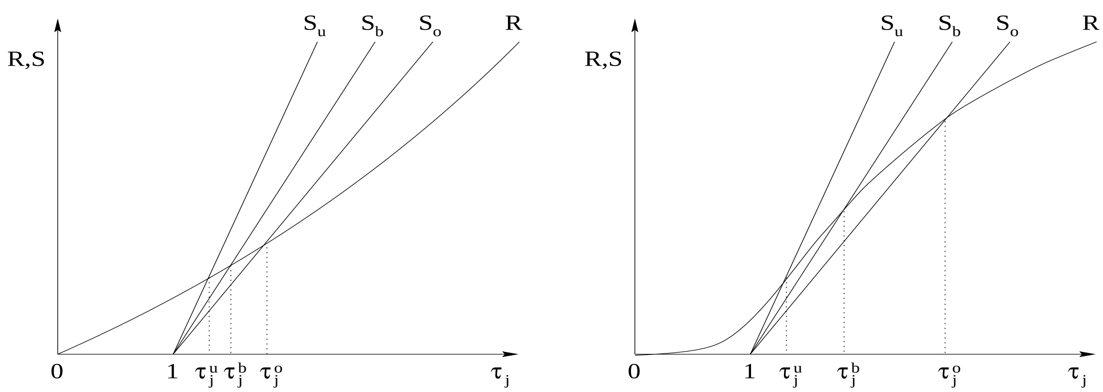

Figure 5: Endogenous Tariffs as a varies

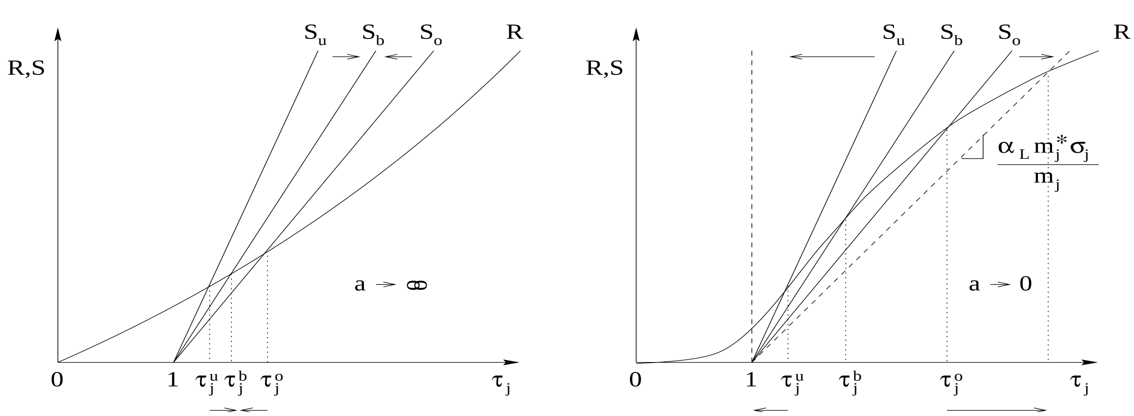

Figure 6: Endogenous Tariffs as α_L varies

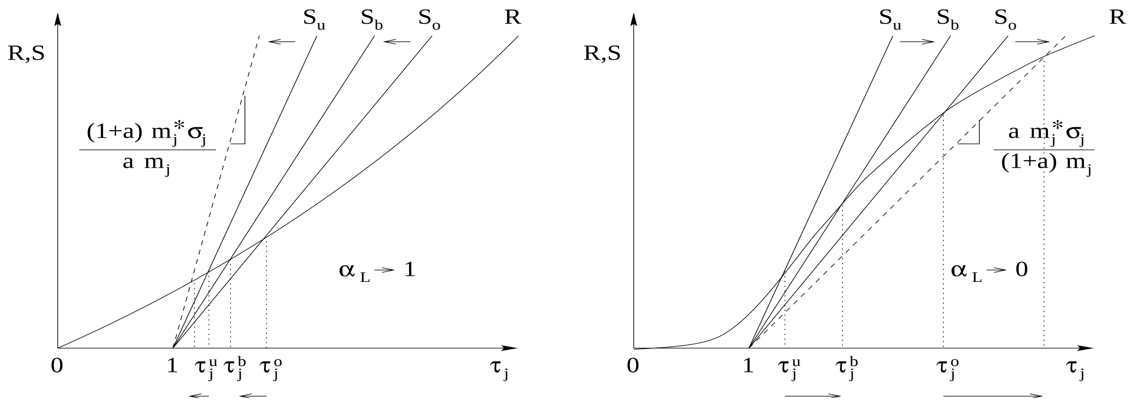

Figure 7: Finite Endogenous Tariff in Organized Sector

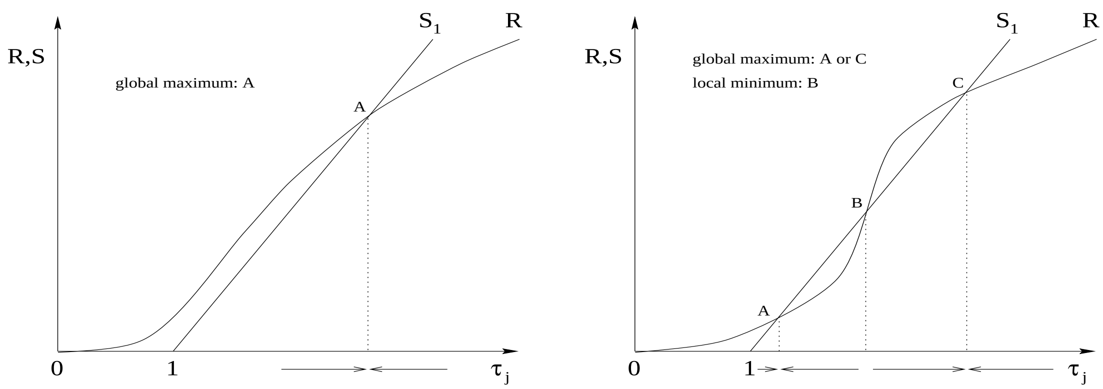

Figure 8: Explosive Endogenous Tariff in Organized Sector