Protection for Sale when Exporters Lobby

Pao-Li Chang*
School of Economics and Social Sciences
Singapore Management University

Gerald Willmann
Department of Economics
University of Kiel, Germany

March 19, 2006

Abstract

This paper studies how the interests of domestic versus exporting firms determine multilateral tariff levels. In a Melitz model, less productive domestic firms lobby for lower tariffs whereas exporters favor liberalization to gain market access abroad. The government weighs social welfare and contributions when setting trade policy. If neither or both groups within an industry lobby, the socially optimal tariff results. When only one group lobbies, domestic (exporting) firms obtain a higher (lower) tariff. Our model implies an upward bias in the estimate for the weight on social welfare, were one to apply the standard model, explaining the high estimates found in empirical studies.

Keywords: Protection for Sale; Heterogeneous Firms; Multilateral Tariff Setting.

JEL classification: F12; F13

*Tel: +65-6828-0830; fax: +65-6828-0833. *E-mail address:* plchang@smu.edu.sg (P.-L. Chang).

1. INTRODUCTION

It is well established that lobbying influences policy and trade policy is no exception, as the success of the "protection for sale" approach confirms. The empirical investigations that have followed the theoretical contribution by Grossman and Helpman (1994) seem to support this claim. When taking a closer look at the empirical results, however, one cannot fail to notice a peculiar aspect: The weight that the government places on social welfare is consistently estimated to be almost a hundred percent, implying a correspondingly minimal weight on contributions. This surprising fact seems to call into question the whole approach. After all, why bother to model lobbying if it plays hardly any role in practice. The answer provided in this paper focuses on the role of exporting firms and the fact that their interests with regards to trade policy differ from the objectives of purely domestic firms. As tariffs are usually set by multilateral agreement in the context of the WTO, exporting firms understand that their own government's willingness to lower tariffs will be matched by other countries, and therefore lead to improved access to export markets.

In order to take into account the special interests of exporters, we present a model that features both, domestic as well as exporting firms. While the economic side of the original "protection for sale" model is firmly rooted in what has come to be called old trade, we skip a step and apply "protection for sale" to new new trade.[1] As a starting point we choose the model of Melitz (2003) who generalizes the Dixit and Stiglitz (1977) framework by allowing for heterogenous firms. These heterogenous firms self-select into purely domestic and exporting firms, or exit the market, depending on their respective productivity levels. In line with several recent papers, we assume that firms draw their productivity levels from a Pareto distribution.[2] This distributional assumption enables us to derive closed form solutions for the critical productivity levels, below which low-productivity firms exit and above which high-productivity firms enter the export market respectively.

As for trade policy, we treat tariff setting as a multilateral — as opposed to unilateral — policy choice. Setting a tariff in our framework not only applies to the domestic rate, but also implies that the same rate will be set by other countries, which are the tariffs that domestic exporters face abroad. The motivation for this modelling decision is the fact that most tariffs are set by

[1] The intermediate step of applying "protection for sale" to new trade is taken by Chang (2005), whose model features a Dixit-Stiglitz setup with homogenous firms.

[2] A prominent example is Helpman, Melitz, and Yeaple (2004). Empirical evidence for this assumption is provided by Axtell (2001).

multilateral agreement. In addition, we are able to avoid the inconsistency inherent in most of the empirical protection for sale literature, that tests a model formulated in tariffs using NTB coverage ratios, because tariffs are not set unilaterally.[3] Under our assumption, the model predicts that domestic firms benefit from a higher tariff whereas exporters lose because their export profits decline by more than the increase in profits from the domestic market.

Based on this framework, we model the determination of trade policy as the outcome of a menu auction between the lobbies — potentially two in each industry representing domestic and exporting firms respectively — and the government. As is standard in the literature, we take the set of lobbies as given.[4] The lobbies submit contribution schedules to the government which specify the monetary contributions that the groups are willing to pay to the government as a function of the tariff vector chosen. The government then chooses the tariff vector — or rather negotiates the tariff vector with its counterparts at the WTO — seeking to maximize a weighted sum of social welfare and the contributions offered to it by the lobbies.

The resulting tariff depends, apart from economic considerations, on the organizational structure of an industry. Whereas in the standard model the organizational state of a particular industry is modelled as binary (either the sector lobbies or it does not), our model features a richer set of possibilities: neither domestic nor exporting firms are organized, both groups are organized, only domestic firms lobby, or only exporters do. In the first case the outcome is the socially optimal tariff, because the government maximizes social welfare for lack of contributions from this sector. The outcome under the second scenario is the same, as the lobbying efforts of domestic firms and exporters exactly offset each other. If only one group lobbies, however, that group is able to obtain a tariff that closer to its interests: a higher tariff in the case of purely domestic firms, and a lower level of protection in the case of exporters.

The second organizational scenario is especially noteworthy. Both groups lobby and yet the socially optimal tariff obtains. Regarding ours as the true model, suppose one were to apply the standard "protection for sale" approach in this situation. The standard model would predict that the government only weighs social welfare, as it sets the socially optimal tariff even though the sector lobbies. Our model therefore implies that there is an upward bias in the estimate of the

[3]See Facchini, Van Biesebroeck, and Willmann (2006) for a modified version of the "protection for sale" model that allows for NTBs and that they consistently estimate using coverage ratios.

[4]See Mitra (1999) for endogenous lobby formation.

weight that the government places on social welfare if one applies the standard model. This insight is of utmost importance, as it suggests that lobbying plays a much more prominent role than the very limited one implied by the low estimates that the literature has found for the weight that the government places on contributions.

As for its relation to the previous literature, our contribution combines the work on "protection for sale" with the recent new new trade literature. The theoretical model of Melitz (2003) has gained tremendous popularity in recent years, not least because it provides a solid foundation for the empirical evidence on exporting firm characteristics.[5] Quite apart from its popularity, it seems ideally suited for integrating the diverging interests of exporters into the "protection for sale" framework. Taking into account those interests allows us to provide an answer to the long-standing puzzle of the empirical "protection for sale" literature, namely why estimates for "a" (the weight the government places on social welfare) are consistently very high. This issue has been taken up by both Mitra, Thomakos, and Ulubasoglu (2006) and Gawande and Li (2004). The former contribution explores varying α_L (the share of the population involved in lobbying) as a possible explanation, the latter introduces a success probability of lobbying. This paper provides an important additional explanation.

Whereas taking into account the interests of exporters seems a novel aspect in the area of "protection for sale", allowing firms to be heterogenous is not. Bombardini (2005) generalizes the specific factor setup by introducing firms that differ in their endowment with the specific factor. She makes use of this heterogeneity to investigate which firms in an industry will lobby and which will not. While she concentrates on firms' decision to lobby, we allow firms to make the economically important exporting decision, and then focus on the consequences of the diverging interests that arise, abstracting for the most part from the lobbies' participation decision.

The rest of the paper is organized as follows. In Section 2, we introduce the economic model that underlies our analysis. Section 3 sets up the lobbying game and analyzes the resulting tariffs. In Section 4, we show that the standard model leads to a biased estimate of a if ours is the true model. Section 5, finally, offers concluding remarks.

[5] Direct supporting evidence is provided by Chaney (2006).

2. THE MODEL

2.1 Demand

Suppose there are $(n+1)$ symmetrical countries in the world with the same economic structure. The representative country is populated by individuals with identical preferences, given by:

$$U = Q_0 + \sum_{i=1}^{m} U_i(Q_i) \tag{1}$$

where Q_0 denotes consumption of good 0, Q_i denotes consumption of good i, $i = 1, 2, \ldots, m$, and U_i is an increasing concave function. Good 0 serves as numeraire, with a world and domestic price equal to 1. Let P_i denote the domestic price of good i. The demand for good i implied by the preferences in (1) is denoted $D_i(P_i)$, where $D_i(\cdot)$ is the inverse of $U_i^{'}(\cdot)$. The indirect utility of an individual with income E is given by $V = E + \sum_{i=1}^{m} S_i(P_i)$, where $S_i(P_i) = U_i(D_i(P_i)) - P_i D_i(P_i)$ is the consumer surplus derived from good i. To simplify the analysis, we assume that the utility function U_i in (1) takes the functional form: $U_i = E_i \, lnQ_i$. This amounts to assuming that an individual allocates a fixed amount of expenditure E_i on good i.

The non-numeraire sector is characterized by monopolistic competition, with Q_i representing the aggregate consumption of differentiated goods in sector i. The aggregation follows the Dixit-Stiglitz functional form, over a continuum of differentiated goods indexed by ω Dixit and Stiglitz (1977):

$$Q_i = \left[\int_{\omega \in \Omega} q_i(\omega)^{\rho_i} d\omega \right]^{\frac{1}{\rho_i}} \qquad 0 < \rho_i < 1 \tag{2}$$

where the measure of the set Ω represents the mass of available varieties and $\sigma_i \equiv 1/(1-\rho_i) > 1$ represents the elasticity of substitution between any two varieties of good i. The corresponding aggregate price P_i for sector i is:

$$P_i = \left[\int_{\omega \in \Omega} p_i(\omega)^{1-\sigma_i} d\omega \right]^{\frac{1}{1-\sigma_i}} \tag{3}$$

where $p_i(\omega)$ is the consumer price for variety ω of good i. The preferences in (1) and (2) imply that the demand and expenditure for individual varieties of good i are:

$$q_i(\omega) = NQ_i \left[p_i(\omega)/P_i\right]^{-\sigma_i} \tag{4}$$

$$r_i(\omega) = NE_i \left[p_i(\omega)/P_i\right]^{1-\sigma_i}, \tag{5}$$

where N is the size of the country's population.

2.2 Production

Good 0 is taken to be a homogeneous good, produced one-to-one from labor. It is traded freely and costlessly, so the wage is equal to one at home and abroad. The differentiated goods in sector i, for $i = 1, 2, \ldots, m$, are produced by a continuum of firms, each producing a different variety ω. The production requires a fixed overhead cost and constant marginal cost, with the marginal cost determined by the firm's productivity. Specifically, the labor requirement for producing a variety of good i at an output q_i equals $l_i = f_i + \frac{q_i}{\varphi}$, where f_i is the fixed overhead labor requirement and $\varphi > 0$ is the productivity level of the firm. The labor is available in inelastic supply L. As will be shown later, given that the aggregate expenditure on good i is constant, sector i will employ a fixed labor size of $L_i = NE_i$. It is assumed that the country's labor force is large enough that the production of the numeraire good is positive at $Q_0 = L - \sum_{i=1}^{m} L_i$.

Given the preferences specified in (2), each firm faces a residual demand curve with constant elasticity σ_i. Thus, with profit maximization, each firm charges a price that is a constant markup $(\frac{\sigma_i}{\sigma_i - 1} = \frac{1}{\rho_i})$ over its marginal cost. Suppose the firm caters only to the domestic market. Then it charges a domestic price of $p_{d,i}(\varphi) = \frac{1}{\rho_i \varphi}$, receives a revenue of $r_{d,i}(\varphi) = NE_i[P_i \rho_i \varphi]^{\sigma_i - 1}$, and makes a profit of $\pi_{d,i}(\varphi) = \frac{r_{d,i}(\varphi)}{\sigma_i} - f_i$ from the domestic market. Suppose the firm also exports to foreign markets. It incurs an extra fixed cost $f_{x,i}$ per period by entering a foreign market and faces a foreign import barrier τ_i (which is defined as one plus the equivalent ad valorem tariff rate). In this case, the firm charges a foreign price of $p_{x,i}(\varphi) = \frac{\tau_i}{\rho_i \varphi}$, receives a revenue of $r_{x,i}(\varphi) = r_{d,i}(\varphi)\tau^{1-\sigma_i}$, and makes an extra profit of $\pi_{x,i}(\varphi) = \frac{r_{x,i}(\varphi)}{\sigma_i} - f_{x,i}$ from each foreign market.

2.3 Firm Entry, Exit, and Export Status

In order to enter the market, firms have to incur an initial investment cost f_e. Prior to entry, firms face uncertainty over its productivity level, which we assume to be a random draw from the Pareto distribution

$$g_i(\varphi) = \frac{\theta_i \varphi_{0,i}^{\theta_i}}{\varphi^{\theta_i+1}}, \qquad \text{for } \varphi \geq \varphi_{0,i} \text{ and } \theta_i > \sigma_i - 1. \tag{6}$$

Upon entry, firms learn of their realized productivity level and exit the market immediately if the production profit is negative. Let φ_i^* denote the lower cutoff level of firm productivity for successful entry. For firms with successful entry, they choose to export if the extra profit from entering the foreign market is nonnegative. Let $\varphi_{x,i}^*$ denote the lower cutoff level of firm productivity for exporting. Following Melitz (2003), we focus on the scenario where successful entrants are partitioned into those with lower productivity levels who only caters to the domestic market and those with higher productivity levels who also export. This scenario of partitioning of firms by export status ($\varphi_i^* < \varphi_{x,i}^*$) occurs if and only if $\tau_i^{\sigma_i-1} f_{x,i} > f_i$. By definition, the cutoff levels must then satisfy $\pi_{d,i}(\varphi_i^*) = 0$ and $\pi_{x,i}(\varphi_{x,i}^*) = 0$. For firms who have successfully entered the market, they also face a probability δ in every period of a bad shock that forces them to exit.

We make the following assumptions to limit the scope of analysis that follows.

Assumption 1 For sector $i = 1, 2, \ldots, m$,

(i) $\tau_i \geq 1$ (import subsidy is not allowed);

(ii) $f_{x,i} > f_i$;

(iii) $\frac{\sigma_i - 1}{\theta_i - (\sigma_i - 1)} \frac{f_i}{\delta f_{e,i}} \geq 1$;

(iv) $\theta_i f_i > f_i + n f_{x,i}$.

Assumptions (i) and (ii) implies that $\tau_i^{\sigma_i-1} f_{x,i} > f_i$ and thus ensures the partitioning of firms by export status discussed in the previous paragraph. The implications of the remaining assumptions will become clear as we proceed.

Let $G_i(\varphi)$ denote the corresponding cumulative distribution function of $g_i(\varphi)$. It is straightforward to show that $G_i(\varphi) = 1 - (\frac{\varphi_{0,i}}{\varphi})^{\theta_i}$. Thus, the average productivity level $\tilde{\varphi}_i$ of firms with

$\varphi > \varphi_i^*$ is:

$$\tilde{\varphi}_i(\varphi_i^*) \equiv \left[\frac{1}{1 - G(\varphi_i^*)} \int_{\varphi_i^*}^{\infty} \varphi^{\sigma_i - 1} g_i(\varphi) d\varphi \right]^{\frac{1}{\sigma_i - 1}} = \left[\frac{\theta_i}{\theta_i - (\sigma_i - 1)} \right]^{\frac{1}{\sigma_i - 1}} \varphi_i^*. \tag{7}$$

where the existence of $\tilde{\varphi}_i$ is ensured by the assumption that $\theta_i > \sigma_i - 1$. Given (7) and the definition of the entry cutoff level φ_i^*, it follows that

$$r_{d,i}(\tilde{\varphi}_i) = \left[\frac{\tilde{\varphi}_i}{\varphi_i^*} \right]^{\sigma_i - 1} r_{d,i}(\varphi_i^*) = \frac{\theta_i \sigma_i}{\theta_i - (\sigma_i - 1)} f_i, \tag{8}$$

and that

$$\pi_{d,i}(\tilde{\varphi}_i) = \left[\frac{\tilde{\varphi}_i}{\varphi_i^*} \right]^{\sigma_i - 1} \frac{r_{d,i}(\varphi_i^*)}{\sigma_i} - f_i = \frac{\sigma_i - 1}{\theta_i - (\sigma_i - 1)} f_i \tag{9}$$

Similarly, the average productivity level $\tilde{\varphi}_{x,i}$ of firms with $\varphi > \varphi_{x,i}^*$ is:

$$\tilde{\varphi}_{x,i} \equiv \tilde{\varphi}_i(\varphi_{x,i}^*) = \left[\frac{\theta_i}{\theta_i - (\sigma_i - 1)} \right]^{\frac{1}{\sigma_i - 1}} \varphi_{x,i}^*. \tag{10}$$

Using (10) and the definition of the export cutoff level $\varphi_{x,i}^*$, it follows that

$$r_{x,i}(\tilde{\varphi}_{x,i}) = \left[\frac{\tilde{\varphi}_{x,i}}{\varphi_{x,i}^*} \right]^{\sigma_i - 1} r_{x,i}(\varphi_{x,i}^*) = \frac{\theta_i \sigma_i}{\theta_i - (\sigma_i - 1)} f_{x,i}, \tag{11}$$

and that

$$\pi_{x,i}(\tilde{\varphi}_{x,i}) = \left[\frac{\tilde{\varphi}_{x,i}}{\varphi_{x,i}^*} \right]^{\sigma_i - 1} \frac{r_{x,i}(\varphi_{x,i}^*)}{\sigma_i} - f_{x,i} = \frac{\sigma_i - 1}{\theta_i - (\sigma_i - 1)} f_{x,i}. \tag{12}$$

Observe that $r_{x,i}(\varphi_{x,i}^*)/r_{d,i}(\varphi_i^*) = \tau_i^{1-\sigma_i}(\varphi_{x,i}^*/\varphi_i^*)^{\sigma_i - 1} = f_{x,i}/f_i$. Thus, the export cutoff level $\varphi_{x,i}^*$ can be expressed as a function of the entry cutoff level φ_i^*:

$$\varphi_{x,i}^* = \varphi_i^* \tau_i \left(f_{x,i}/f_i \right)^{1/(\sigma_i - 1)}. \tag{13}$$

Let $\mathtt{p}_{x,i} \equiv [1 - G_i(\varphi_{x,i}^*)]/[1 - G_i(\varphi_i^*)]$ denote the conditional probability of exporting given that a firm has successfully entered the market. It is straightforward to show that

$$\mathtt{p}_{x,i} = (\varphi_i^*/\varphi_{x,i}^*)^{\theta_i} = \tau_i^{-\theta_i}(f_{x,i}/f_i)^{-\theta_i/(\sigma_i - 1)}, \tag{14}$$

which ranges between 0 and 1 by Assumptions (i) and (ii). Thus, the average revenue of incumbent firms is:

$$\begin{aligned}
\bar{r}_i &\equiv \int_{\varphi_i^*}^{\infty} r_{d,i}(\varphi)\frac{g_i(\varphi)}{1-G_i(\varphi_i^*)}d\varphi + n\int_{\varphi_{x,i}^*}^{\infty} r_{x,i}(\varphi)\frac{g_i(\varphi)}{1-G_i(\varphi_i^*)}d\varphi \\
&= \int_{\varphi_i^*}^{\infty}\left[\frac{\varphi}{\varphi_i^*}\right]^{\sigma_i-1} r_{d,i}(\varphi_i^*)\frac{g_i(\varphi)}{1-G_i(\varphi_i^*)}d\varphi + n\frac{1-G_i(\varphi_{x,i}^*)}{1-G_i(\varphi_i^*)}\int_{\varphi_{x,i}^*}^{\infty}\left[\frac{\varphi}{\varphi_{x,i}^*}\right]^{\sigma_i-1} r_{x,i}(\varphi_{x,i}^*)\frac{g_i(\varphi)}{1-G_i(\varphi_{x,i}^*)}d\varphi \\
&= r_{d,i}(\tilde{\varphi}_i) + n\mathtt{p}_{x,i}r_{x,i}(\tilde{\varphi}_{x,i}) \\
&= \frac{\theta_i\sigma_i}{\theta_i-(\sigma_i-1)}(f_i + n\mathtt{p}_{x,i}f_{x,i}). \qquad (15)
\end{aligned}$$

Similarly, the average profit of incumbent firms is:

$$\begin{aligned}
\bar{\pi}_i &\equiv \int_{\varphi_i^*}^{\infty} \pi_{d,i}(\varphi)\frac{g_i(\varphi)}{1-G_i(\varphi_i^*)}d\varphi + n\int_{\varphi_{x,i}^*}^{\infty} \pi_{x,i}(\varphi)\frac{g_i(\varphi)}{1-G_i(\varphi_i^*)}d\varphi \\
&= \pi_{d,i}(\tilde{\varphi}_i) + n\mathtt{p}_{x,i}\pi_{x,i}(\tilde{\varphi}_{x,i}) \\
&= \frac{\sigma_i-1}{\theta_i-(\sigma_i-1)}(f_i + n\mathtt{p}_{x,i}f_{x,i}) \qquad \text{(ZCP)}, \qquad (16)
\end{aligned}$$

which corresponds to the zero cutoff profit condition in Melitz (2003).

Free entry ensures that in equilibrium, the expected profit of entry net of the entry cost should be zero. Thus, it follows that $\mathtt{p}_{e,i}\bar{v}_i - f_{e,i} = 0$, where $\mathtt{p}_{e,i} \equiv [1 - G_i(\varphi_i^*)]$ is the probability of successful entry, and $\bar{v}_i \equiv \sum_{t=0}^{\infty}(1-\delta)^t\bar{\pi}_i = \bar{\pi}_i/\delta$ is the sum of future profits with successful entry, discounted by the probability of exit as a result of bad shocks. This yields:

$$\begin{aligned}
\bar{\pi}_i &= \delta f_{e,i}/\mathtt{p}_{e,i} \\
&= \delta f_{e,i}[\varphi_i^*/\varphi_{0,i}]^{\theta_i} \qquad \text{(FE)}, \qquad (17)
\end{aligned}$$

which corresponds to the free entry equilibrium condition in Melitz (2003). Equations (16) and (17) together determine the equilibrium entry cutoff level φ_i^*:

$$\varphi_i^* = \left\{\frac{\sigma_i-1}{\theta_i-(\sigma_i-1)}\frac{f_i+n\mathtt{p}_{x,i}f_{x,i}}{\delta f_{e,i}}\right\}^{1/\theta_i}\varphi_{0,i}. \qquad (18)$$

Assumption (iii) ensures that $\varphi_i^* \geq \varphi_{0,i}$ so that an interior solution for φ_i^* exists. The equilibrium export cutoff level $\varphi^*_{x,i}$ is in turn determined by (13).

It is straightforward to show that $d\mathrm{p}_{x,i}/d\tau_i = -\theta_i/\tau_i \mathrm{p}_{x,i} < 0$. Given this, we can further show that:

$$\frac{d\varphi^*_i}{d\tau_i} = -\frac{n\mathrm{p}_{x,i}f_{x,i}}{f_i + n\mathrm{p}_{x,i}f_{x,i}}\frac{\varphi^*_i}{\tau_i} < 0. \tag{19}$$

Thus, a tariff reduction will raise the equilibrium entry cutoff level: the least productive firms will be driven out of the market with a tariff reduction. On the other hand, we can show that:

$$\frac{d\varphi^*_{x,i}}{d\tau_i} = \frac{f_i}{f_i + n\mathrm{p}_{x,i}f_{x,i}}\frac{\varphi^*_{x,i}}{\tau_i} > 0. \tag{20}$$

Thus, the equilibrium export cutoff level falls with the tariff: proportionally more incumbent firms will enter the export market when the tariff is lower. In summary, the conditional probability of incumbent firms exporting will increase with a tariff reduction. Each country by lowering the tariff will experience a higher degree of import penetration, in return for a freer access to foreign markets and a higher volume of exports.

2.4 Aggregate Equilibrium and Welfare

Suppose the mass of incumbent firms is M_i in sector i and the mass of new entrants in every period is $M_{e,i}$. Then, in a stationary equilibrium, the mass of successful entrants should equal the mass of incumbents who exit: $\mathrm{p}_{e,i}M_{e,i} = \delta M_i$, so that the aggregate variables remain constant over time. Let $R_i = NE_i = M_i\bar{r}_i$ denote the aggregate firm revenue of sector i, $\Pi_i = M_i\bar{\pi}_i$ the aggregate firm profit of sector i. Also let $L_{p,i}$ and $L_{e,i}$ denote the aggregate labor used for firm production and entry investment, respectively. By definition, aggregate firm profits are what remains of aggregate revenue after paying for workers used in production: $\Pi_i \equiv R_i - L_{p,i}$. Use the stationary condition $\mathrm{p}_{e,i}M_{e,i} = \delta M_i$ and the free entry condition (17). It follows that $\Pi_i = M_i\bar{\pi}_i = M_{e,i}f_{e,i} = L_{e,i}$. Thus, the aggregate revenue of sector i equals the aggregate labor payment (employment) in sector i: $R_i = \Pi_i + L_{p,i} = L_{e,i} + L_{p,i} = L_i$. Given this, the equilibrium mass of incumbent firms is determined by:

$$M_i = \frac{R_i}{\bar{r}_i} = \frac{\theta_i - (\sigma_i - 1)}{\theta_i\sigma_i}\frac{L_i}{f_i + n\mathrm{p}_{x,i}f_{x,i}}, \tag{21}$$

where $L_i = NE_i$. Using (21), the zero cutoff profit condition (16), and the fact that $\frac{\sigma_i - 1}{\sigma_i} = \rho_i$, we obtain the equilibrium aggregate profit as:

$$\Pi_i = M_i \bar{\pi}_i = \frac{R_i}{\bar{r}_i}\bar{\pi}_i = \frac{\rho_i}{\theta_i} L_i, \tag{22}$$

which turns out to be independent of the trade policy τ_i.

Next, the equilibrium tariff revenue from sector i is:

$$\begin{aligned} TR_i &= (\tau_i - 1) n \mathtt{p}_{x,i} M_i \int_{\varphi_{x,i}^*}^{\infty} r_{x,i}(\varphi) \frac{g_i(\varphi)}{1 - G_i(\varphi_{x,i}^*)} d\varphi \\ &= (\tau_i - 1) n \mathtt{p}_{x,i} M_i r_{x,i}(\tilde{\varphi}_{x,i}) \\ &= (\tau_i - 1) \frac{n \mathtt{p}_{x,i} f_{x,i} L_i}{f_i + n \mathtt{p}_{x,i} f_{x,i}}, \end{aligned} \tag{23}$$

where we have used (11) and (21) in the last equality. Recall that the conditional probability of firm exporting, $\mathtt{p}_{x,i}$, decreases as the tariff increases. Thus, a tariff increase raises the unit tariff revenue (the first term in (23)), but at the same time lowers the aggregate import value (the second term in (23)). The net effect on the total tariff revenue depends on the parameters and the tariff level.

Since the expenditure E_i by an individual on good i is constant by assumption, the consumer surplus $S_i \equiv U_i(Q_i) - P_i Q_i = U_i(Q_i) - E_i$ varies only with $U_i(Q_i)$. Note also that $q_{d,i}(\varphi) = \frac{r_{d,i}(\varphi)}{p_{d,i}(\varphi)} = (\frac{\varphi}{\varphi_i^*})^{\sigma_i - 1} \sigma_i f_i (\rho_i \varphi) = (\frac{\varphi}{\varphi_i^*})^{\sigma_i - 1} (\sigma_i - 1) f_i \varphi$ and that $q_{x,i}(\varphi) = \frac{r_{x,i}(\varphi)}{p_{x,i}(\varphi)} = (\frac{\varphi}{\varphi_{x,i}^*})^{\sigma_i - 1} \sigma_i f_{x,i} (\rho_i \varphi \tau_i^{-1}) = (\frac{\varphi}{\varphi_{x,i}^*})^{\sigma_i - 1} (\sigma_i - 1) \frac{f_{x,i}}{\tau_i} \varphi$. Thus, at equilibrium, the utility derived from consuming good i by an individual is:

$$\begin{aligned} U_i(Q_i) &= \left\{ M_i \int_{\varphi_i^*}^{\infty} q_{d,i}(\varphi)^{\rho_i} \frac{g_i(\varphi)}{1 - G_i(\varphi_i^*)} d\varphi + n \mathtt{p}_{x,i} M_i \int_{\varphi_{x,i}^*}^{\infty} q_{x,i}(\varphi)^{\rho_i} \frac{g_i(\varphi)}{1 - G_i(\varphi_{x,i}^*)} d\varphi \right\}^{\frac{1}{\rho_i}} \\ &= \left\{ M_i \int_{\varphi_i^*}^{\infty} \left[(\frac{\varphi}{\varphi_i^*})^{\sigma_i - 1} (\sigma_i - 1) f_i \varphi \right]^{\rho_i} \frac{g_i(\varphi)}{1 - G_i(\varphi_i^*)} d\varphi + n \mathtt{p}_{x,i} M_i \int_{\varphi_{x,i}^*}^{\infty} \left[(\frac{\varphi}{\varphi_{x,i}^*})^{\sigma_i - 1} (\sigma_i - 1) \frac{f_{x,i}}{\tau_i} \varphi \right]^{\rho_i} \frac{g_i(\varphi)}{1 - G_i(\varphi_{x,i}^*)} d\varphi \right\}^{\frac{1}{\rho_i}} \\ &= (\sigma_i - 1) \left\{ \frac{M_i f_i^{\rho_i}}{\varphi_i^{*(\sigma_i - 1)\rho_i}} \int_{\varphi_i^*}^{\infty} \varphi^{\sigma_i - 1} \frac{g_i(\varphi)}{1 - G_i(\varphi_i^*)} d\varphi + n \mathtt{p}_{x,i} \frac{M_i f_{x,i}^{\rho_i}}{\tau_i^{\rho_i} \varphi_{x,i}^{*\,(\sigma_i - 1)\rho_i}} \int_{\varphi_{x,i}^*}^{\infty} \varphi^{\sigma_i - 1} \frac{g_i(\varphi)}{1 - G_i(\varphi_{x,i}^*)} d\varphi \right\}^{\frac{1}{\rho_i}} \\ &= (\sigma_i - 1) \left\{ \frac{M_i f_i^{\rho_i} \tilde{\varphi}_i^{\sigma_i - 1}}{\varphi_i^{*(\sigma_i - 1)\rho_i}} + n \mathtt{p}_{x,i} \frac{M_i f_{x,i}^{\rho_i} \tilde{\varphi}_{x,i}^{\sigma_i - 1}}{\tau_i^{\rho_i} \varphi_{x,i}^{*\,(\sigma_i - 1)\rho_i}} \right\}^{\frac{1}{\rho_i}} \\ &= (\sigma_i - 1) f_i \left(\frac{L_i}{\sigma_i f_i} \right)^{1/\rho_i} \varphi_i^*, \end{aligned} \tag{24}$$

where the last equality follows from (7), (10), and (13). As the entry cutoff level φ_i^* rises with a lower tariff, a tariff reduction improves the consumer surplus.

Summing indirect utilities over all individuals, and noting that aggregate income is the sum of labor income, profits, and tariff revenue, one obtains the aggregate welfare:

$$\begin{aligned} W &= NE + N\sum_{i=1}^{m} S_i \\ &= (L - \sum_{i=1}^{m} L_i) + \sum_{i=1}^{m}(L_{p,i} + \Pi_i) + \sum_{i=1}^{m} TR_i + N\sum_{i=1}^{m} S_i \\ &= L + \sum_{i=1}^{m} TR_i + N\sum_{i=1}^{m} S_i. \end{aligned} \tag{25}$$

Given (23), it is straightforward to show that

$$\frac{dTR_i}{d\tau_i} = \frac{n\mathtt{p}_{x,i} f_{x,i} L_i}{(f_i + n\mathtt{p}_{x,i} f_{x,i})^2}\left[f_i + n\mathtt{p}_{x,i} f_{x,i} + (\frac{1}{\tau_i} - 1)\theta_i f_i\right], \tag{26}$$

where the expression in the bracket is a decreasing function of τ_i for $\tau_i \geq 1$. Thus, given Assumption (iv), there exists a tariff-maximizing tariff $\hat{\tau}_i > 1$ such that $\frac{dTR_i}{d\tau_i} = 0$ for $\tau_i = \hat{\tau}_i$ and $\frac{dTR_i}{d\tau_i} \gtreqless 0$ for $\tau_i \lesseqgtr \hat{\tau}_i$.

Given (24), it is also straightforward to show that

$$\frac{dU_i}{d\tau_i} = -\frac{n\mathtt{p}_{x,i} f_{x,i}}{f_i + n\mathtt{p}_{x,i} f_{x,i}}(\sigma_i - 1) f_i \left(\frac{L_i}{\sigma_i f_i}\right)^{1/\rho_i} \frac{\varphi_i^*}{\tau_i} < 0, \tag{27}$$

and that $\frac{d^2 U_i}{d\tau_i^2} > 0$. Thus, U_i is a decreasing convex function of τ_i.

Given (26) and (27), we have

$$\begin{aligned} \frac{dW}{d\tau_i}|_{\tau_i=1} &= \frac{dTR_i}{d\tau_i}|_{\tau_i=1} + N\frac{dU_i}{d\tau_i}|_{\tau_i=1} \\ &= \frac{n\mathtt{p}_{x,i} f_{x,i} L_i}{f_i + n\mathtt{p}_{x,i} f_{x,i}} - N\frac{n\mathtt{p}_{x,i} f_{x,i}}{f_i + n\mathtt{p}_{x,i} f_{x,i}}(\sigma_i - 1) f_i \left(\frac{L_i}{\sigma_i f_i}\right)^{1/\rho_i} \varphi_i^* \\ &= \frac{n\mathtt{p}_{x,i} f_{x,i} N}{f_i + n\mathtt{p}_{x,i} f_{x,i}}\left[E_i - (\sigma_i - 1) f_i \left(\frac{L_i}{\sigma_i f_i}\right)^{1/\rho_i} \varphi_i^*\right]. \end{aligned} \tag{28}$$

Given the definition of φ_i^* in (18) and the definition of $\mathtt{p}_{x,i}$ in (14), it follows that $\frac{dW}{d\tau_i}|_{\tau_i=1} = 0$ if and only if

$$\varphi_{0,i} = \left\{ \frac{\theta_i - (\sigma_i - 1)}{\sigma_i - 1} \frac{\delta f_{e,i}}{f_i + n\left(f_{x,i}/f_i\right)^{-\theta_i/(\sigma_i-1)} f_{x,i}} \right\}^{1/\theta_i} \frac{E_i}{(\sigma_i - 1) f_i \left(\frac{L_i}{\sigma_i f_i}\right)^{1/\rho_i}}. \tag{29}$$

We will assume that the underlying economic parameters satisfy this necessary condition for free trade to be the welfare-maximizing policy. To ensure that free trade is the welfare-maximizing policy, it is sufficient that $\frac{dW}{d\tau_i} < 0$ for all $\tau_i > 1$. This condition is apparently satisfied for $\tau_i \geq \hat{\tau}_i$, where $\frac{dTR_i}{d\tau_i} \leq 0$ and $\frac{dU_i}{d\tau_i} < 0$. For $1 < \tau_i < \hat{\tau}_i$, there is incentive to increase tariff arising from tariff-revenue consideration; on the other hand, there is also disincentive to increase tariff because of loss in consumer surplus. In general, we have that

$$\begin{aligned}
\frac{dW}{d\tau_i} &= \frac{dTR_i}{d\tau_i} + N\frac{dU_i}{d\tau_i} \qquad (30)\\
&= \frac{n\mathrm{p}_{x,i} f_{x,i} N}{f_i + n\mathrm{p}_{x,i} f_{x,i}} \left[E_i + E_i(\frac{1}{\tau_i} - 1)\frac{\theta_i f_i}{f_i + n\mathrm{p}_{x,i} f_{x,i}} - (\sigma_i - 1) f_i \left(\frac{L_i}{\sigma_i f_i}\right)^{1/\rho_i} \frac{\varphi_i^*}{\tau_i} \right]\\
&= \frac{n\mathrm{p}_{x,i} f_{x,i} N}{f_i + n\mathrm{p}_{x,i} f_{x,i}} \left[E_i + E_i(\frac{1}{\tau_i} - 1)\frac{\theta_i f_i}{f_i + n\mathrm{p}_{x,i} f_{x,i}} - E_i(\frac{1}{\tau_i})\frac{f_i + n\mathrm{p}_{x,i} f_{x,i}}{f_i + n(f_{x,i}/f_i)^{-\theta_i/(\sigma_i-1)} f_{x,i}} \right]\\
&= \frac{n\mathrm{p}_{x,i} f_{x,i} N E_i}{f_i + n\mathrm{p}_{x,i} f_{x,i}} \left[1 - (1 - \frac{1}{\tau_i})\frac{\theta_i f_i}{f_i + n\mathrm{p}_{x,i} f_{x,i}} - (\frac{1}{\tau_i})\frac{f_i + n\mathrm{p}_{x,i} f_{x,i}}{f_i + n(f_{x,i}/f_i)^{-\theta_i/(\sigma_i-1)} f_{x,i}} \right],
\end{aligned}$$

where in the third equality, we have used the condition (29) for $\varphi_{0,i}$ in the definition of φ_i^*. We can show that for sufficiently large θ_i, the expression in the bracket is negative for $\tau_i > 1$ (to be double-checked again!!). Thus, we will take it to be the case that the underlying parameter θ_i for $i = 1, 2, \ldots, m$ is sufficiently large, so that $\frac{dW}{d\tau_i} < 0$ for $\tau_i > 1$ and for $i = 1, 2, \ldots, m$. This ensures that the aggregate welfare function is a monotonically decreasing function of τ_i for $\tau_i > 1$.

3. THE LOBBYING GAME

3.1 Group Interests

We consider a lobbying game as in the original protection for sale model. However, we now have different interests within each industry. Profits from selling to the domestic market amount to $\pi_d(\varphi) = (\varphi/\varphi^*)^{\sigma-1} f - f$ and profits from selling to a foreign market are $\pi_x(\varphi) = \tau^{1-\sigma}(\varphi/\varphi^*)^{\sigma-1} f -$

f_x. It is straightforward to show that:

$$\frac{d\pi_d(\varphi)}{d\tau} = \frac{(\sigma-1)f}{\tau}\frac{n\mathtt{p}_x f_x}{f+n\mathtt{p}_x f_x}\left(\frac{\varphi}{\varphi^*}\right)^{\sigma-1} > 0, \tag{31}$$

and that:

$$\frac{d\pi_x(\varphi)}{d\tau} = -\frac{(\sigma-1)f}{\tau^\sigma}\frac{f}{f+n\mathtt{p}_x f_x}\left(\frac{\varphi}{\varphi^*}\right)^{\sigma-1} < 0. \tag{32}$$

Thus firms with $\varphi < \varphi_x^*$ that serve only the domestic market benefit from an increase in the tariff (lose from a tariff reduction). Firms with $\varphi > \varphi_x^*$, on the other hand, which export in addition to supplying the domestic market make a higher profit in the domestic market yet lose profits abroad. Further derivations show that:

$$\frac{d\pi_d(\varphi)}{d\tau} + n\frac{d\pi_x(\varphi)}{d\tau} = \frac{(\sigma-1)f}{\tau}\frac{n\mathtt{p}_x f_x}{f+n\mathtt{p}_x f_x}\left(\frac{\varphi}{\varphi^*}\right)^{\sigma-1}\left[1-\left(\tau^{\sigma-1}\frac{f_x}{f}\right)^{\frac{\theta-(\sigma-1)}{\sigma-1}}\right] < 0, \tag{33}$$

where the last inequality follows from our earlier assumption that $\tau_i^{\sigma_i-1} f_{x,i} > f_i$. Thus, exporting firms with $\varphi > \varphi_x^*$ are worse off (better off) overall when the world-wide tariff rate increases (decreases) because this restricts (facilitates) market access in other countries.

The export cut-off productivity level φ^* therefore separates firms within each sector into two camps of conflicting interests: Let group ℓ denote the group of lower productivity firms with $\varphi < \varphi^*$ and group h the group of higher productivity firms with $\varphi > \varphi^*$. The combined profit of the former group amounts to:

$$\begin{aligned}\Pi_\ell &= M\int_{\varphi^*}^{\varphi_x^*}\pi_d(\varphi)\frac{g(\varphi)}{1-G(\varphi^*)}d\varphi = \frac{M}{\mathtt{p}_e}\int_{\varphi^*}^{\varphi_x^*}\pi_d(\varphi)g(\varphi)d\varphi \\ &= \tilde{M}\left\{\frac{\theta}{\theta-(\sigma-1)}f\left[\left(\frac{\varphi_0}{\varphi^*}\right)^\theta - \left(\frac{\varphi_0}{\varphi_x^*}\right)^\theta\left(\frac{\varphi_x^*}{\varphi^*}\right)^{\sigma-1}\right] - f\left[\left(\frac{\varphi_0}{\varphi^*}\right)^\theta - \left(\frac{\varphi_0}{\varphi_x^*}\right)^\theta\right]\right\},\end{aligned} \tag{34}$$

and the aggregate profit of the higher productivity firms is:

$$\begin{aligned}\Pi_h &= M\int_{\varphi_x^*}^{\infty}\pi_d(\varphi)\frac{g(\varphi)}{1-G(\varphi^*)}d\varphi + nM\int_{\varphi_x^*}^{\infty}\pi_x(\varphi)\frac{g(\varphi)}{1-G(\varphi^*)}d\varphi \\ &= \frac{M}{\mathrm{p}_e}\left\{\int_{\varphi_x^*}^{\infty}\pi_d(\varphi)g(\varphi)d\varphi + n\int_{\varphi_x^*}^{\infty}\pi_x(\varphi)g(\varphi)d\varphi\right\} \\ &= \tilde{M}\left(\frac{\varphi_0}{\varphi_x^*}\right)^{\theta}\left\{\frac{1+n\tau^{1-\theta}}{\theta-(\sigma-1)}\theta f\frac{\varphi_x^*}{\varphi^*} - f - nf_x\right\},\end{aligned} \tag{35}$$

where $\tilde{M} \equiv \frac{M}{\mathrm{p}_e} = \frac{\Pi}{\bar{\pi}\mathrm{p}_e} = \frac{\Pi}{\delta f_e}$ does not depend on τ, and from (31) and (33) it follows that $d\Pi_\ell/d\tau > 0$ and $d\Pi_h/d\tau < 0$. Furthermore, it follows from $d\bar{\Pi}/d\tau = 0$ that $d\Pi_\ell/d\tau = -d\Pi_h/d\tau$.

Having analyzed the profits of the two groups within each industry, we can write their respective gross pay-off functions as follows:

$$W_{i,g}(\tau) = \Pi_{i,g} + \alpha_{i,g}(CS + TR) \qquad g \in \{\ell, h\} \tag{36}$$

To influence the government, each group — if organized — offers a contribution schedule $C_{i,\ell}(\tau)$ and $C_{i,h}(\tau)$ to the government, which specifies how much the interest group will pay the government conditional on the tariff vector chosen.

Faced with the contribution schedules, the government sets a tariff vector that maximizes the following weighted sum of social welfare and contributions:

$$G(\tau) = aW + \sum_{i=1}^{n} I_{i,\ell}C_{i,\ell}(\tau) + \sum_{i=1}^{n} I_{i,h}C_{i,h}(\tau), \tag{37}$$

where the parameter a represents the relative weight the government places on social welfare and the Is are indicator functions that take a value of one if that particular group is organized and zero otherwise. Note that there are four possible organizational scenarios in each industry: neither group is organized, both groups are, only domestic firms lobby, or only exporters do.

3.2 Solving the Lobbying Game

In solving the lobbying game outlined above, we look for a subgame perfect Nash equilibrium defined as follows:

Definition 1 *The collection* $(\{C^0_{i,\ell}(\tau) : i \in L_\ell\}, \{C^0_{i,h}(\tau) : i \in L_h\}, \tau^0)$ *is a subgame perfect Nash equilibrium of the lobbying game if* $C^0_{i,g}$ *is feasible for all* $(i,g) \in L_\ell \cup L_h$*,* τ^0 *maximizes* $G(\tau)$*, and, given* $\{C^0_j(\tau)\}_{j \in L \setminus i}$*, no lobby* i *has an alternative feasible strategy* $C_i(\tau)$ *that would yield a higher (net) payoff.*

To find such an equilibrium, we make use of of Lemma 2 in Bernheim and Whinston (1986). The following proposition restates their lemma using our notation:

Proposition 1 $(\{C^0_{i,\ell}(\tau) : i \in L_\ell\}, \{C^0_{i,h}(\tau) : i \in L_h\}, \tau^0)$ *is a subgame perfect Nash equilibrium for the lobbying game if and only if:*

i) $C^0_{i,g}(\tau)$ *is feasible* $\forall (i,g) \in L_\ell \cup L_h$,

ii) $\tau^0 \in \arg\max \; G(\tau)$,

iii) $\tau^0 \in \arg\max \; G(\tau) + W_{i,g}(\tau) - C_{i,g}(\tau) \;\; \forall i \in L_\ell \cup L_h$,

iv) $\forall (i,g) \in L_\ell \cup L_h, \;\; \exists \tau^{i,g} \in \mathbb{R}^n$ *that maximizes* $G(\tau)$ *such that* $C^0_{i,g}(\tau^{i,g}) = 0$.

Assuming the usual differentiability of the contributions schedules, and combining conditon *ii*) and *iii*) above, we obtain the following implicit equation for the equilibrium tariff rates:

$$a\frac{\partial W}{\partial \tau_j} + \sum_{i=1}^{n} I_{i,\ell}\frac{\partial W_{i,\ell}}{\partial \tau_j} + \sum_{i=1}^{n} I_{i,h}\frac{\partial W_{i,h}}{\partial \tau_j} = 0 \qquad \forall j \in N. \tag{38}$$

Recall the compositon of W and $W_{i,g}$ and note that aggregate profits do not depend on τ and industry profits do only depend on their own tariff. This allows us to rewrite the previous equation as follows:

$$(a+\alpha_L)\left(\frac{\partial CS}{\partial \tau_j} + \frac{\partial TR}{\partial \tau_j}\right) + I_{j,\ell}\frac{\partial \Pi_{j,\ell}(\tau_j)}{\partial \tau_j} + I_{j,h}\frac{\partial \Pi_{j,h}(\tau_j)}{\partial \tau_j} = 0 \qquad \forall j \in N. \tag{39}$$

The very first term represents the welfare cost of a tariff: the loss in consumer surplus net of tariff revenue weighted by a, that is, by how much weight the government places on social welfare. The second term represents the consumer and revenue interests of all groups that lobby. The third term is the positive effect of a tariff on the profits off the domestic subgroups, provided they lobby, and the last term stands for the detrimental effect on exporters' profits. In order to discuss the tariffs implied by this equation, recall the four organizational possibilities for each industry mentioned above: (1) neither subgroup of an industry is organized, (2) both subgroups are organized, (3) only domestic firms lobby, and (4) only exporters do. We analyze these four cases in turn.

The scenario where neither low-productivity domestic firms nor high-productivity exporters are organized is easily understood. Since both $I_{j,\ell}$ as well as $I_{j,h}$ are zero, equation (39) reduces to:

$$(a+\alpha_L)\left(\frac{\partial CS}{\partial \tau_j}+\frac{\partial TR}{\partial \tau_j}\right)=0. \tag{40}$$

It is straightforward to see that this corresponds to choosing the socially optimal tariff, as maximizing $W=\Pi+CS+TR$ also implies that $\partial CS/\partial\tau+\partial TR/\partial\tau=0$. This result is quite intuitive: if the industry does not lobby the government chooses the socially optimal policy vis-à-vis the sector.

Consider now the case where both groups within industry j are organized, i.e. $I_{j,\ell}=I_{j,h}I_{j,h}=1$. Equation (39) then becomes:

$$(a+\alpha_L)\left(\frac{\partial CS}{\partial \tau_j}+\frac{\partial TR}{\partial \tau_j}\right)+\frac{\partial \Pi_{j,\ell}(\tau_j)}{\partial \tau_j}+\frac{\partial \Pi_{j,h}(\tau_j)}{\partial \tau_j}=0. \tag{41}$$

Recalling that $\partial\Pi_{j,\ell}/\partial\tau_j=-\partial\Pi_{j,h}/\partial\tau_j$, we see that in this case the effects of both groups' lobbying efforts cancel and the government again chooses the socially optimal tariff.

Under the third scenario, only low-profitability domestic firms lobby. Equation (39) thus takes the form:

$$(a+\alpha_L)\left(\frac{\partial CS}{\partial \tau_j}+\frac{\partial TR}{\partial \tau_j}\right)+\frac{\partial \Pi_{j,\ell}(\tau_j)}{\partial \tau_j}=0. \tag{42}$$

From the government's perspective, the cost in terms of welfare and lobbies' consumer (and revenue) interests — the first two terms — now stands against the benefit to the domestic producers which is conveyed to the government via lobbying. The government thus chooses to set the tariff higher than its socially optimal level to satisfy the special interest of the domestic producers. Note that the extent of this distortion depends on the weight the government places on social welfare and the aggregate degree of organization.

The fourth and final case has only high-productivity exporting firms lobbying. Equation (39) becomes:

$$(a+\alpha_L)\left(\frac{\partial CS}{\partial \tau_j}+\frac{\partial TR}{\partial \tau_j}\right)+\frac{\partial \Pi_{j,h}(\tau_j)}{\partial \tau_j}=0. \tag{43}$$

Under this scenario, it is the exporters who convey their interests in a lower tariff via lobbying. The government takes this interest into account — again depending on the weight it places on welfare and aggregate lobbies' consumer and revenue interests — and lowers the tariff compared to its socially optimal level.

4. BIAS OF THE STANDARD MODEL

tbw

5. CONCLUSION

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