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Protection for sale under monopolistic competition

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Abstract

This paper broadens the protection for sale model of Grossman and Helpman (1994) by incorporating the Krugman–Dixit–Stiglitz model of monopolistic competition, given its importance in explaining the prevalence of intraindustry trade. Several new results arise in this paper. First, the endogenous import tariff will never fall below zero, even in unorganized sectors. Second, the endogenous export policy for organized sectors is not necessarily an export subsidy, and can be an export tax as in unorganized sectors. Third, the level of import protection varies inversely with the degree of import penetration, regardless of whether the sector is organized or not.

Keywords: Trade policy; Political economy; Protection for sale; Monopolistic competition; Intraindustry trade

JEL classification: F12; F13

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1. Introduction

Previous contributions to the literature of endogenous trade policy have proposed various theories of political economy to predict the pattern of trade protection. Rodrik (1995) provides a comprehensive survey of this literature. While these prior studies differ in their formulation of the political processes that determine the trade policies,[2] they invariably adopt economic structures with perfect competition and homogeneous goods.[3] The perfect competition assumption is a natural starting point that allows these models to focus on the political processes. However, applying such models to empirical investigations may not be adequate if the industries of the economy under study are far from perfectly competitive. In practice, trade in developed countries is characterized by a large proportion of intraindustry trade, as documented in Helpman (1999). For example, the share of intraindustry trade was 84.6% in the United Kingdom, and 72.2% in Germany, for the year of 1990. Intraindustry trade has generally been considered to be best explained by monopolistic competition in differentiated goods, as captured by the Krugman–Dixit–Stiglitz framework. Recent generalizations of this framework by Melitz (2003) further show that monopolistic competition models prove very helpful in understanding the microstructure of international trade.

This paper attempts to broaden the current theoretical literature on endogenous trade policy by incorporating monopolistic competition, given its importance in explaining the prevalence of intraindustry trade. This is accomplished by combining the Krugman–Dixit–Stiglitz monopolistic competition framework with the protection for sale model of Grossman and Helpman (1994) (henceforth G–H). Explicit formulas are derived for endogenous import and export policies, whose components can be decomposed into the workings of political economy and monopolistic competition. This paper thus provides a generalized framework for empirical investigations of political influence on trade policies, taking into account the presence of intraindustry trade.[4]

The endogenous protection patterns under monopolistic competition differ from those of G–H in a few key aspects. First, the endogenous optimal import policy is always a tariff, regardless of whether a sector is organized or not. This is contrary to the G–H finding where unorganized import-competing sectors will face import subsidies (i.e., negative protection). The difference arises from the fact that the welfare-maximizing import policy (for an economy as a whole) is a positive import tariff for monopolistically competitive

[2] See, for example, the median-voter model of Mayer (1984) and the political-contribution model of Grossman and Helpman (1994).

[3] For example, the Heckscher–Ohlin model is used in Magee et al. (1989) and Mayer (1984), while the Ricardo–Viner model is used in Findlay and Wellisz (1982), Hillman (1982), and Grossman and Helpman (1994).

[4] Grossman and Helpman (1995) present another framework where the endogenous protection pattern can be decomposed into political motives and economic motives for trade intervention, when countries set tariffs unilaterally. The economic incentive for trade intervention in Grossman and Helpman (1995) is rooted in the terms-of-trade gain attained by large countries with perfectly competitive industries. On the other hand, the economic incentive for trade intervention in the current paper arises from monopolistic competition that characterizes the industries of a small country. It is an empirical issue which of these two models will better explain observed protection patterns. Naturally, this depends on the characteristic of the country under study and its production and trade structure.

industries.[5] The lobbies of organized sectors then bid for higher protection than the welfare-maximizing levels for their own sectors. On the other hand, lobbies are interested in the import policy of other sectors only as consumers. Since under monopolistic competition, the consumer does not gain from deviations from zero restrictions on imports, lobby groups actually prefer zero import tariffs for unorganized sectors. Thus, the resulting endogenous import tariff for unorganized sectors, with both general interest and special interest considered, cannot fall below zero.

Second, in the current framework, the endogenous export policy for organized sectors is not necessarily an export subsidy, and can be an export tax as in unorganized sectors. This deviates from the G–H result, where organized export sectors always receive export subsidies and unorganized export sectors always receive export taxes. The intuition is that the export policy does not affect the domestic consumer surplus in the current setup. Starting with zero restrictions on exports, the tax revenue consideration outweighs the profit consideration in the aggregate. Thus, the welfare maximizing export policy is an export tax. The influence of special interests then pushes for higher taxes on exports of unorganized sectors, compared to the welfare-maximizing levels, since the lobbies have no claims to the profit of unorganized sectors. On the other hand, the lobbies collectively will bid for lower taxes on exports of organized sectors, compared to the welfare-maximizing levels. Whether the endogenous export policy for organized sectors will be an export tax or export subsidy depends on the strength of the revenue consideration relative to the profit consideration by the lobbies and the government. An export subsidy is likely to emerge in organized sectors, if the lobbies are a small fraction of the total population, so that the revenue consideration is less important, and the government is strongly biased toward special interests.[6]

One implication of the G–H model that is of interest to empirical researchers is the relationship between import protection and import penetration of a sector. The G–H model predicts that organized sectors with lower import penetration will receive higher protection, while unorganized sectors with higher import penetration will receive higher protection (or more precisely, less negative protection). In the current study, however, a sector with lower import penetration will receive higher protection, regardless of whether the sector is organized or not. This difference in findings may be reconciled by the fact that both organized and unorganized sectors are protected by import tariffs in the current study. In this case, the effect of the size of the domestic industry is similar to that in G–H for organized industries, which receive positive tariffs. In sectors with a larger presence of domestic firms, the gain in profits from import tariffs is relatively larger, while the loss in consumer surplus net of tariff revenue is relatively smaller. This leads to higher levels of tariff protection for sectors with lower import penetration. Readers familiar with the empirical literature on the structure of protection might immediately recognize the

[5] This is consistent with the findings of Gros (1987) and Flam and Helpman (1987).

[6] It is interesting to note that an analogous finding, although for different reasons, is contained in Grossman and Helpman (1995), where an organized export sector may receive either an export tax or an export subsidy. In their paper, the special interest in an export subsidy for an organized sector clashes with the general interest in an export tax, which improves the country's terms of trade. An export subsidy emerges if the terms-of-trade loss due to the subsidy is outweighed by the gain to special interests.

disagreement between this theoretical prediction and previous empirical findings. However, given that previous empirical findings are often either derived from ad hoc regression models without theoretical underpinnings or are based on the G–H model assuming perfect competition, they do not constitute direct evidence against the current study. The results of the current paper suggest that the predictions of the G–H-type model in this regard will depend on the nature of the industry (competitive versus monopolistically competitive), and a correctly specified empirical model relating to the G–H model should allow for heterogeneous responses of protection to import penetration across different market structures. This has not been considered in previous cross-sectional G–H-type empirical work.[7]

In spite of the differences discussed above, some general features of the G–H model remain valid in the current setup with monopolistic competition. Once we adjust for the differences in the welfare-maximizing levels of trade interventions between the current paper and the G–H model, the equilibrium structure of protection under monopolistic competition compares closely with that of G–H. The political parameters such as an industry's state of political organization, a country's overall fraction of population represented by lobbies, and a government's relative weight on aggregate welfare versus lobby contributions, all have similar effects in promoting or depressing the protection level in an industry. Under both economic structures, the protection levels are higher for organized sectors, and lower for unorganized sectors, than the benchmark welfare-maximizing levels. As the government places more weight on aggregate welfare relative to campaign contributions, the endogenous protection levels in both organized and unorganized sectors converge toward the benchmark welfare-maximizing levels. Furthermore, as the fraction of population that belongs to a lobby group increases, the protection levels in all sectors decrease.

The rest of the paper is organized as follows. Section 2 sets up the economic structure of the model within the G–H political framework. Section 3 derives the formulas for the equilibrium structure of protection and discusses their implications. Concluding remarks are collected in Section 4.

2. The economic framework

Suppose that a country is populated by individuals with identical preferences but different factor endowments. Each individual maximizes the quasi-linear utility function given by:

$$U = X_0 + \sum_{i=1}^{n} U_i(X_i) \tag{1}$$

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,..., n. It is assumed that X_i takes the usual

[7] See, for example, Eicher and Osang (2002), Gawande and Bandyopadhyay (2000), and Goldberg and Maggi (1999) for their empirical investigations of the G–H model.

Dixit–Stiglitz form of a constant elasticity of substitution function (Dixit and Stiglitz, 1977):

$$X_i = \left(\sum_{k=1}^{m_i} x_{hi,k}^{\rho_i} + \sum_{k=1}^{m_i^*} x_{fi,k}^{\rho_i} \right)^{\frac{1}{\rho_i}} \qquad 0<\rho_i<1 \tag{2}$$

where $x_{hi,k}$ ($x_{fi,k}$) 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). We focus on the scenarizo where $m_i, m_i^* \neq 0$. The homogeneous good is taken as numeraire, with a world and domestic price equal to one. The price index for differentiated good X_i is:

$$P_i = \left(\sum_{k=1}^{m_i} p_{hi,k}^{1-\sigma_i} + \sum_{k=1}^{m_i^*} p_{fi,k}^{1-\sigma_i} \right)^{\frac{1}{1-\sigma_i}} \tag{3}$$

where $p_{hi,k}$ ($p_{fi,k}$) 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. Therefore, an individual with an income of E maximizes Eq. (1) given the budget constraint $X_0 + \sum_{i=1}^{n} P_i X_i = E$. For simplicity, U_i is assumed to take the form of $E_i \ln X_i$, which amounts to assuming that an individual allocates a fixed amount of expenditure E_i for good i.[8] The rest of the world is assumed to share the same preference structure, but with a possibly different allocation of expenditure on various goods (E_i^*).

The homogeneous good is assumed to be produced both at home and abroad, and is manufactured from labor alone with constant returns to scale and a unit labor requirement equal to one. Since it is traded freely and costlessly, the wage is equal to one universally. 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 of c_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:

$$p_{hi,k} = p_{hi} = \frac{c_i \sigma_i}{\sigma_i - 1}. \tag{4}$$

The sector-specific factors in this country are assumed to be available in inelastic supply ($\bar{K}_i$, i=1, 2,. . ., 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. The number of varieties produced at home in industry i would be $m_i = \bar{K}_i / k_i$. With this

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

restriction on the number of firms in a sector, the rewards to the sector-specific input adjust to absorb the operating surplus of firms, that is, the difference between their revenues and their variable wage costs. This profit earned by the owners of the sector-specific input increases with the output of the industry. Thus, the owners of the sector-specific input in each sector have incentives to form a lobby group to promote their interests if they can overcome the free-rider problem. The presence of sector-specific profits is necessary for the G–H political framework, as the sector-specific lobby groups need to spend financial resources and make political contributions to the government policy maker. In a more usual monopolistic competition setting with broad-based production factors and with free entry of firms so that firms retain zero profits, it is difficult to justify the formation of sector-specific lobby interests.

The technology abroad to produce the differentiated products is assumed to be the same as that at home. Therefore, it follows that $p^*_{fi,k}=p^*_{fi}=p_{hi}$, where $p^*_{fi,k}$ is the consumer (and producer) price at the foreign market for foreign variety k of good i. In this setup, the presence of the homogeneous good ties down the relative producer prices of the home and foreign varieties in a given differentiated-good industry, and hence eliminates possible terms of trade effects from trade policies.[9] Suppose the foreign country is endowed with a stock of the sector-specific factor in the amount of $\bar{K}^*_i$, for i=1, 2,. . ., n. Then, the number of varieties produced abroad in industry i is $m^*_i=\bar{K}^*_i/k_i$. Following Flam and Helpman (1987), we can regard the home country in our model as a small country, because it cannot influence the foreign spending on differentiated goods (E^*_i), the number of foreign varieties of differentiated goods (m^*_i), and the foreign producer price of differentiated goods (p^*_{fi}).

Let the domestic import policy τ_i denote one plus the ad valorem import tariff rate and the domestic export policy s_i represent one plus the ad valorem export subsidy rate for industry i. By this definition, a policy $\tau_i>1$ ($\tau_i<1$) corresponds to an import tariff (subsidy), while a policy $s_i>1$ ($s_i<1$) corresponds to an export subsidy (tax). Similarly, let τ^*_i and s^*_i represent the corresponding foreign import and export policy for industry i, defined in a similar way. Since the producer prices of the home and foreign varieties are the same in a given industry, any difference in the consumer prices of the home and foreign varieties at the domestic market reflects the government interventions in trade. That is,

$$p_{fi,k} = p_{fi} = \frac{\tau_i}{s^*_i} p_{hi} \qquad \tau_i, s^*_i>0. \tag{5}$$

Using Eqs. (4) and (5), we can simplify the price index for the differentiated good i in Eq. (3) as:

$$P_i = p_{hi}\left(m_i + m^*_i\left(\frac{\tau_i}{s^*_i}\right)^{1-\sigma_i}\right)^{\frac{1}{1-\sigma_i}}. \tag{6}$$

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

[9] This point has been suggested by Helpman and Krugman (1989, p. 140) in a similar structure.

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. It follows that the indirect utility function can be expressed as:

$$V(\mathbf{P}, E) = E + S(\mathbf{P}) \tag{7}$$

where $\mathbf{P}$=(P_1, P_2,..., P_n), and $S(\mathbf{P})\equiv\sum_i U_i[D_i(P_i)]$-$\sum_i P_i D_i(P_i)$ is the consumer surplus derived from consumption of the index of the differentiated goods. In the second stage, with a given expenditure E_i on differentiated good i, the individual will consume a representative variety of good i produced at home and abroad at the amount of:

$$x_{hi} = X_i \left[\frac{p_{hi}}{P_i}\right]^{-\sigma_i} = \frac{E_i}{p_{hi}} \frac{1}{m_i + m_i^* (\frac{\tau_i}{s_i^*})^{1-\sigma_i}} \tag{8}$$

$$x_{fi} = X_i \left[\frac{p_{fi}}{P_i}\right]^{-\sigma_i} = \frac{E_i}{p_{fi}} \frac{(\frac{\tau_i}{s_i^*})^{1-\sigma_i}}{m_i + m_i^* (\frac{\tau_i}{s_i^*})^{1-\sigma_i}}.$$

The problem can be solved similarly for differentiated good i in the foreign market, given the home government's export policy s_i and the foreign government's import policy τ_i^*. With a given expenditure of E_i^* on differentiated good i, a foreign individual will consume a representative home variety x_{hi}^* and a representative foreign variety x_{fi}^* of good i according to:

$$x_{hi}^* = \frac{E_i^*}{p_{hi}^*} \frac{(\frac{\tau_i^*}{s_i})^{1-\sigma_i}}{m_i (\frac{\tau_i^*}{s_i})^{1-\sigma_i} + m_i^*} \tag{9}$$

$$x_{fi}^* = \frac{E_i^*}{p_{fi}^*} \frac{1}{m_i (\frac{\tau_i^*}{s_i})^{1-\sigma_i} + m_i^*}$$

where p_{hi}^* is the consumer price abroad for a representative home variety of good i. Similar to Eq. (5), the difference in the consumer prices of the home and foreign varieties at the foreign market will simply reflect the government interventions in trade: $p_{hi}^* = \frac{\tau_i^*}{s_i} p_{fi}^*$. With the domestic and foreign market demand for its product combined, a representative home producer of differentiated good i will produce at the scale of ($N x_{hi}$+$N^* x_{hi}^*$), where N (N^*) is the total population at home (abroad). Therefore, the aggregate reward to the specific factor used in producing good i is:

$$\Pi_i(\tau_i, s_i) = m_i (p_{hi} - c_i)(N x_{hi} + N^* x_{hi}^*). \tag{10}$$

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

$$R(\tau, s) = \sum_{i=1}^{n} m_i^* (\tau_i - 1) \frac{p_{hi}}{s_i^*} x_{fi} - N^*/N \sum_{i=1}^{n} m_i \left(1 - \frac{1}{s_i}\right) p_{hi}\, x_{hi}^* \tag{11}$$

where $\tau=(\tau_1, \tau_2, \ldots, \tau_n)$, and $s=(s_1, s_2, \ldots, s_n)$. It is assumed that the government redistributes the revenue uniformly to each individual. Therefore, $R(\tau, s)$ measures the net government transfer to each individual.

As indicated in Eq. (7), an individual's welfare depends on his income and the consumer surplus he derives from the consumption of differentiated goods. A typical individual's income includes wages and net government transfers, plus possibly the reward from the ownership of some sector-specific input. In accordance with the G–H political framework, claims to the specific inputs are assumed to be indivisible and nontradable, and individuals each own at most one type of specific factor. 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, $C_i(\tau, s)$, contingent on the trade-policy vector set by the government, (τ, s), to maximize the joint welfare of their members. 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

$$W_i(\tau,s) = l_i + \Pi_i(\tau_i,s_i) + \alpha_i N[R(\tau,s) + S(\tau)] \tag{12}$$

where l_i is the total labor supply (and also the labor income) of the 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. Note that the domestic consumer surplus is a function of the domestic price indices of differentiated goods, and is therefore a function of domestic import policies (τ). The domestic export policies (s), on the other hand, do not affect the domestic consumer surplus in the current framework. Given the contribution schedules offered by the lobby groups, the government in turn selects a trade-policy vector (τ, s) to maximize its politically motivated objective function, which includes political contributions as well as general aggregate welfare. Specifically,

$$G(\tau,s) = \sum_{i\in L} C_i(\tau,s) + aW(\tau,s) \qquad a\geq 0 \tag{13}$$

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, net trade tax revenue, and total consumer surplus. That is,

$$W(\tau,s) = l + \sum_{i=1}^{n} \Pi_i(\tau_i,s_i) + N[R(\tau,s) + S(\tau)]. \tag{14}$$

3. The structure of protection

With the basic economic and political framework specified, we are ready to derive the equilibrium structure of protection. I assume that $\frac{1+a}{\alpha_L+a}<\sigma_j$ for all j. This will ensure that finite solutions for the endogenous import and export policy exist. The explanations will be given shortly. As shown in G–H, if the contribution schedules of lobbies are truthful, the government's objective function in Eq. (13) is equivalent to:

$$\tilde{G}(\tau, s) = \sum_{i \in L} W_i(\tau, s) + aW(\tau, s). \tag{15}$$

Let us examine in detail the impact of trade policy on the welfare of individual lobbies and on the country as a whole. First, note that the welfare impact on lobby i of a small change in τ_j or s_j is:

$$\begin{aligned} \frac{\partial W_i}{\partial \tau_j} &= \frac{\partial \Pi_i}{\partial \tau_j} + \alpha_i N \left[\frac{\partial R}{\partial \tau_j} + \frac{\partial S}{\partial \tau_j} \right] \\ &= \delta_{ij} N m_j (p_{hj} - c_j) \frac{\partial x_{hj}}{\partial \tau_j} + \alpha_i N m_j^* (\tau_j - 1) \frac{p_{hj}}{s_j^*} \frac{\partial x_{fj}}{\partial \tau_j}, \end{aligned} \tag{16}$$

$$\begin{aligned} \frac{\partial W_i}{\partial s_j} &= \frac{\partial \Pi_i}{\partial s_j} + \alpha_i N \frac{\partial R}{\partial s_j} \\ &= \delta_{ij} N^* m_j (p_{hj} - c_j) \frac{\partial x_{hj}^*}{\partial s_j} - \alpha_i N^* m_j \left(1 - \frac{1}{s_j} \right) p_{hj} \frac{\partial x_{hj}^*}{\partial s_j} - \alpha_i N^* m_j \frac{p_{hj}}{s_j^2} x_{hj}^*, \end{aligned} \tag{17}$$

where δ_{ij} is an indicator variable which equals 1 if i=j and 0 otherwise. The first term in Eq. (16) or (17) measures the effect of a change in τ_j or s_j on lobby i's welfare as specific-factor owners, while the rest of the terms measure the effect of the policy change on lobby i's welfare as consumers. Eq. (16) indicates that the sum of tariff revenue and consumer surplus is maximized at the zero import tariff level (τ_j=1).[10] Therefore, lobby i, who has no claims to the profit in other sectors, would prefer a zero import tariff for other sectors. This lobbying pattern under monopolistic competition is different from that in G–H where every lobby desires an import subsidy for other sectors. The intuition is that in G–H, an import subsidy lowers the price of the domestic output as well as imports. The specific-factor owners in the sector where the import subsidy is introduced incur the extra burden of profit loss, while the remaining citizens end up gaining more in consumer surplus than the subsidy cost they pay. Thus, unless the import-competing producers are organized, they will get "taxed" in this way by the lobbying activities of their organized neighbors. In the current framework, the price of the domestic output is not affected by an import subsidy. The gain in consumer surplus for an individual from a small subsidy is in proportion to his/her share of subsidy cost. No one gains from deviations from free trade as pure consumers. On the other hand, lobbies as specific-factor owners would prefer an import tariff for their own sectors. An increase in the import tariff in sector i raises the consumer price of imported foreign varieties in the home market, and induces the composition of demand to switch toward the home varieties. This increases the output of the home varieties and the profit of sector i. Since the revenue and consumer surplus considerations cancel out at zero import

[10] To see this, note that $\frac{\partial R}{\partial \tau_j} + \frac{\partial S}{\partial \tau_j} = m_j^*(\tau_j - 1)\frac{p_{hj}}{s_j^*}\frac{\partial x_{fj}}{\partial \tau_j} \gtreqless 0$ if $\tau_j \lesseqgtr 1$, given that $\frac{\partial x_{fj}}{\partial \tau_j} < 0$.

tariffs, the profit consideration alone implies that lobby i would prefer a positive import tariff for its own sector.

Contrary to the import policy, the export policy does not have any bearing on the domestic consumer surplus. Although the domestic profit is affected by the export policy, the producer price is not affected by the change in the scale of production brought about by the change in the export policy. As a result, the domestic consumer price and consumer surplus are independent of the export policy. Thus, the revenue effect is the only concern for pure consumers with regard to export policy. As can be seen in Eq. (17), starting from free trade (s_j=1), a small increase in the export tax increases the revenue.[11] Therefore, lobby i would prefer a positive export tax for other sectors. For its own sector, however, lobby i benefits in profits from an increase in the export subsidy. An increase in the export subsidy reduces the consumer price of the home varieties in the foreign market and increases their overseas market share. This in turn increases the profit of sector i. Overall, depending on the strength of the profit consideration relative to the revenue consideration, lobby i may desire an export subsidy or an export tax for its own sector. The smaller the population of lobby i (α_i), the smaller its revenue consideration, and the more likely that it will demand an export subsidy for its own sector.

For the country as a whole, the effect on aggregate welfare of a small change in τ_j or s_j is:

$$\frac{\partial W}{\partial \tau_j} = Nm_j(p_{hj} - c_j)\frac{\partial x_{hj}}{\partial \tau_j} + Nm_j^*(\tau_j - 1)\frac{p_{hj}}{s_j^*}\frac{\partial x_{fj}}{\partial \tau_j}. \tag{18}$$

$$\frac{\partial W}{\partial s_j} = N^*m_j(p_{hj} - c_j)\frac{\partial x_{hj}^*}{\partial s_j} - N^*m_j\left(1 - \frac{1}{s_j}\right)p_{hj}\frac{\partial x_{hj}^*}{\partial s_j} - N^*m_j\frac{p_{hj}}{s_j^2}x_{hj}^*. \tag{19}$$

Eq. (18) indicates that the welfare-maximizing import tariff rate is strictly positive. Starting from zero restrictions on imports (τ_j=1), the effects of a small tariff increase on revenue and consumer surplus cancel out. The remaining positive effect on profits makes a tariff desirable. This result is consistent with those of Gros (1987) and Flam and Helpman (1987), who show that the optimal tariff is strictly positive for a monopolistically competitive industry in a small country. For the export policy, Eq. (19) indicates that starting with zero restrictions on exports (s_j=1), a small increase in s_j has both a positive effect and a negative effect on national welfare. It increases the profit of industry j, but at the same time, increases the country's subsidy payment. As will be shown later, however, the welfare-maximizing export policy is in fact an export tax. In contrast with the G–H model where the benchmark welfare-maximizing policy is free trade for all sectors under perfect competition, we have positive import tariffs and export taxes as the benchmark welfare-maximizing policies under monopolistic competition.

[11] To see this, note that $\frac{\partial R}{\partial s_j} = -\alpha_i N^* m_j p_{hj} x_{hj}^* < 0$ at $s_j = 1$.

Combining lobby interests and national interests, we obtain the effect of a small change in τ_j on the government's political welfare as:

$$\begin{aligned}\frac{\partial \tilde{G}}{\partial \tau_j} &= (I_j + a)Nm_j(p_{hj} - c_j)\frac{\partial x_{hj}}{\partial \tau_j} + (\alpha_L + a)Nm_j^*(\tau_j - 1)\frac{p_{hj}}{s_j^*}\frac{\partial x_{fj}}{\partial \tau_j} \\ &= (I_j + a)\frac{1}{\sigma_j}Nm_jp_{hj}\frac{\partial x_{hj}}{\partial \tau_j} - (\alpha_L + a)\frac{z_j\sigma_j + 1}{z_j(\sigma_j - 1)}\frac{\tau_j - 1}{\tau_j}Nm_jp_{hj}\frac{\partial x_{hj}}{\partial \tau_j},\end{aligned} \tag{20}$$

where $I_j = \Sigma_{i \in L}\delta_{ij}$ is an indicator variable that equals 1 if industry j is organized and 0 otherwise, $\alpha_L = \Sigma_{i \in L}\alpha_i$ is the fraction of the population that is represented by a lobby, and $z_j \equiv \frac{m_j}{m_j^*}\left(\frac{\tau_j}{s_j^*}\right)^{\sigma_j - 1} = \frac{m_j p_{hj} x_{hj}}{m_j^* p_{fj} x_{fj}}$ is the market share of domestic products relative to the market share of foreign products at the tax-included price in the home market.[12] On the other hand, the impact of a small change in s_j on the government's political welfare is:

$$\begin{aligned}\frac{\partial \tilde{G}}{\partial s_j} &= (I_j + a)N^*m_j(p_{hj} - c_j)\frac{\partial x_{hj}^*}{\partial s_j} - (\alpha_L + a)N^*m_j\left(1 - \frac{1}{s_j}\right)p_{hj}\frac{\partial x_{hj}^*}{\partial s_j} \\ &\quad - (\alpha_L + a)N^*m_j\frac{p_{hj}}{s_j^2}x_{hj}^* \\ &= (I_j + a)\frac{1}{\sigma_j}N^*m_jp_{hj}\frac{\partial x_{hj}^*}{\partial s_j} \\ &\quad - (\alpha_L + a)\left\{\frac{1 - \sigma_j}{s_j\left(\sigma_j + \frac{1}{z_j^*}\right)} + 1\right\}N^*m_jp_{hj}\frac{\partial x_{hj}^*}{\partial s_j}.\end{aligned} \tag{21}$$

where $z_j^* \equiv \frac{m_j^*}{m_j}\left(\frac{\tau_j^*}{s_j}\right)^{\sigma_j - 1} = \frac{m_j^* p_{fj}^* x_{fj}^*}{m_j p_{hj}^* x_{hj}^*}$ is the market share of foreign products relative to the market share of domestic products at the tax-included price in the foreign market.[13] Notice in Eq. (20) that $\lim_{\tau_j \to 0}\frac{z_j\sigma_j + 1}{z_j(\sigma_j - 1)}\frac{\tau_j - 1}{\tau_j} = -\infty$ and that $\lim_{\tau_j \to \infty}\frac{z_j\sigma_j + 1}{z_j(\sigma_j - 1)}\frac{\tau_j - 1}{\tau_j} = \frac{\sigma_j}{\sigma_j - 1}$. Thus, finite solutions for the endogenous import policy exist if $(I_j + a)\frac{1}{\sigma_j} < (\alpha_L + a)\frac{\sigma_j}{\sigma_j - 1}$. On the other hand, observe in Eq. (21) that $\lim_{s_j \to 0}\left\{\frac{1 - \sigma_j}{s_j(\sigma_j + 1/z_j^*)} + 1\right\} = -\infty$ and that $\lim_{s_j \to \infty}\left\{\frac{1 - \sigma_j}{s_j(\sigma_j + 1/z_j^*)} + 1\right\} = 1$. Thus, finite solutions for the endogenous export policy exist if $(I_j + a)\frac{1}{\sigma_j} < (\alpha_L + a)$. The assumption made earlier that $\frac{1 + a}{a_L + a} < \sigma_j$ for all j guarantees that both of these conditions are satisfied, and therefore that finite solutions for the endogenous import and export policies exist.

Suppose (τ^o, s^o) is the equilibrium trade policy. Then (τ^o, s^o) must satisfy the first-order and second-order conditions: $\frac{\partial \tilde{G}}{\partial \tau_j}(\tau^o, s^o) = 0$, $\frac{\partial^2 \tilde{G}}{\partial \tau_j^2}(\tau^o, s^o) < 0$, $\frac{\partial \tilde{G}}{\partial s_j}(\tau^o, s^o) = 0$,

[12] To derive Eq. (20), note that given the definition of z_j, we can rewrite Eq. (8) as $x_{hj} = \frac{E_j}{p_{hj}}\frac{z_j}{(z_j + 1)m_j}$ and $x_{fj} = x_{hj}\left(\frac{\tau_j}{s_j^*}\right)^{-\sigma_j}$. Given this, we can further show that $\frac{\partial x_{hj}}{\partial \tau_j} = \frac{(\sigma_j - 1)}{\tau_j(z_j + 1)}x_{hj}$ and $\frac{\partial x_{fj}}{\partial \tau_j} = -\frac{z_j\sigma_j + 1}{\sigma_j - 1}\left(\frac{\tau_j}{s_j^*}\right)^{-\sigma_j}\frac{\partial x_{hj}}{\partial \tau_j}$.

[13] To derive Eq. (21), note that given the definition of z_j^*, we can rewrite x_{hj}^* in Eq. (9) as $x_{hj}^* = \frac{E_j^*}{p_{fj}^*}\frac{z_j^*}{m_j^*(z_j^* + 1)}\left(\frac{\tau_j^*}{s_j}\right)^{-\sigma_j}$ and show that $\frac{\partial x_{hj}^*}{\partial s_j} = \frac{\sigma_j z_j^* + 1}{s_j(z_j^* + 1)}x_{hj}^*$.

and $\frac{\partial^2 \tilde{G}}{\partial s_j^2}(\tau^o, s^o)<0$ for j=1, 2,..., n. The following proposition summarizes the findings.

Proposition 1 (*Endogenous protection structure*). *If the contribution schedules of the lobbies are truthful, then the import policy that will emerge in the political equilibrium must satisfy the first-order condition*[14]

$$\frac{\tau_j^{\mathrm{o}}-1}{\tau_j^{\mathrm{o}}}=\frac{I_j+a}{\alpha_L+a}\frac{\frac{\sigma_j-1}{\sigma_j}}{\sigma_j+\frac{1}{z_j^{\mathrm{o}}}} \qquad \text{for } j=1,2,\ldots,n, \tag{22}$$

and the second-order condition

$$\frac{\tau_j^{\mathrm{o}}}{z_j^{\mathrm{o}}+1}<\frac{\sigma_j}{\sigma_j-1} \qquad \text{for } j=1,2,\ldots,n. \tag{23}$$

On the other hand, the equilibrium export policy must satisfy the first-order condition[15]

$$s_j^{\mathrm{o}}=\frac{\sigma_j-1}{\sigma_j-\frac{I_j+a}{\alpha_L+a}}\frac{\sigma_j}{\sigma_j+\frac{1}{z_j^{*\mathrm{o}}}} \qquad \text{for } j=1,2,\ldots,n. \tag{24}$$

The second-order condition automatically holds at s_j=s_j^{o}. In the above equations, $z_j^{\mathrm{o}}=\frac{m_j p_{hj} x_{hj}^{\mathrm{o}}}{m_j^* p_{fj}^{\mathrm{o}} x_{fj}^{\mathrm{o}}}$ is the equilibrium market share of domestic products relative to the market share of foreign products at the tax-included price in the home market, and $z_j^{*\mathrm{o}}=\frac{m_j^* p_{fj}^* x_{fj}^{*\mathrm{o}}}{m_j p_{hj}^{*\mathrm{o}} x_{hj}^{*\mathrm{o}}}$ is the equilibrium market share of foreign products relative to the market share of domestic products at the tax-included price in the foreign market.

Proof of Proposition 1. The proof is given in Appendix A. □

Recall that the producer price (and hence the terms of trade) is fixed in the current framework. This implies that the import and export policies are strategically independent. Thus, they can be derived separately from Eqs. (20) and (21). To verify this, note that $z_j^{\mathrm{o}}=\frac{m_j}{m_j^*}\left(\frac{\tau_j^{\mathrm{o}}}{s_j^*}\right)^{\sigma_j-1}$ and $z_j^{*\mathrm{o}}=\frac{m_j^*}{m_j}\left(\frac{\tau_j^*}{s_j^{\mathrm{o}}}\right)^{\sigma_j-1}$. Therefore, the import policy τ_j^{o} in Eq. (22) and the export policy s_j^{o} in Eq. (24) are indeed mutually independent.

Next, notice that the second-order condition automatically holds at the equilibrium export policy that satisfies the first-order condition, in contrast with the import policy. This asymmetry arises from the fact that unlike the import policy, the export policy does not affect the domestic consumer surplus. The import and export policies have similar influences on the producer interest through the scale effect. But their influences on the consumer interest are not symmetric. While an import policy produces conflicting effects on revenue and

[14] Note that given the definition of import policy τ_j in the current paper, $\frac{\tau_j^{\mathrm{o}}-1}{\tau_j^{\mathrm{o}}}$ in Proposition 1 corresponds to the expression $\frac{t_j^{\mathrm{o}}}{1+t_j^{\mathrm{o}}}$ in Proposition 2 of Grossman and Helpman (1994) when applied to import-competing industries.

[15] The solution for the equilibrium export policy, if expressed in the same way as the import policy, is $\frac{s_j^{\mathrm{o}}-1}{s_j^{\mathrm{o}}}=\frac{\frac{I_j-\alpha_L}{\alpha_L+a}}{\sigma_j-1}-\frac{\sigma_j-\frac{I_j+a}{\alpha_L+a}}{\sigma_j-1}\frac{1}{\sigma_j z_j^{*\mathrm{o}}}$. Since this expression is significantly more complicated, while the implications are the same, I choose to present the export policy in the simpler format s_j^{o}.

consumer surplus, an export policy's revenue effect is not countered by any consumer surplus concern. Observe that in Eq. (21), the term $(\alpha_L+a)\left\{\frac{1-\sigma_j}{s_j(\sigma_j+1/z_j^*)}+1\right\}$is monotonically increasing in s_j, while the term $\frac{(I_j+a)}{\sigma_j}$ is constant. Thus, the first-order condition for the export policy $\frac{\partial\tilde{G}}{\partial s_j}=0$ has a unique solution, which is also the maximizer. On the other hand, in Eq. (20), the term $\frac{z_j\sigma_j+1}{z_j(\sigma_j-1)}\frac{\tau_j-1}{\tau_j}$ is not necessarily monotonically increasing in τ_j. The first-order condition for the import policy $\frac{\partial\tilde{G}}{\partial\tau_j}=0$ has potentially multiple solutions. The second-order condition in Eq. (23) helps identify the local maxima at which the term $\frac{z_j\sigma_j+1}{z_j(\sigma_j-1)}\frac{\tau_j-1}{\tau_j}$ is increasing locally. Note that in Eq. (23), $\frac{1}{z_j^{\mathrm{o}}+1}$ is the equilibrium market share of foreign products in the home market, and $\frac{\sigma_j}{\sigma_j-1}$ is the degree of monopoly power of a representative firm in sector j. Thus, the second-order condition for the import policy in Eq. (23) says that at the equilibrium, the import policy τ_j^{o} multiplied by the market share of foreign products in sector j should be smaller than the degree of monopoly power of a representative firm in sector j.

I proceed now to discuss the endogenous protection pattern under monopolistic competition. First, Proposition 1 implies that the welfare-maximizing trade policy under monopolistic competition is an import tariff and an export tax for each sector. Note that the welfare-maximizing trade policy can be regarded as a special case of the endogenous trade policy when the government is not politically motivated. This is equivalent to setting α_L=0 and I_j=0 for all j in the endogenous trade policy equations (22) and (24). The import policy equation becomes $\frac{\tau_j^{\mathrm{o}}-1}{\tau_j^{\mathrm{o}}}=\frac{(\sigma_j-1)/\sigma_j}{\sigma_j+1/z_j^{\mathrm{o}}}$, which is strictly positive, given that σ_j>1 and that $m_j,m_j^*\neq 0$. Thus, the welfare-maximizing import tariff is positive. This confirms our earlier observations in Eq. (18) regarding the aggregate welfare impact of an import policy change. On the other hand, when the government is not politically motivated, the export policy equation reduces to $s_j^{\mathrm{o}}=\frac{\sigma_j}{\sigma_j+1/z_j^{*\mathrm{o}}}$, which is strictly less than 1. By the definition of s_j, this implies an export tax. As indicated in Eq. (19), starting with zero restrictions on exports, an export tax has both a positive and negative impact on national welfare. The result here suggests that the positive effect of a small increase in the export tax on revenue outweighs the negative effect on profits. Thus, a small export tax is welfare improving.

Second, Proposition 1 indicates that lobby influences induce the government to increase the protection level in organized sectors, and decrease the protection level in unorganized sectors, compared to the welfare-maximizing (import tariff and export tax) level.[16] Compare Eq. (16) with Eq. (18), or Eq. (17) with Eq. (19). We observe that lobby j would want a higher protection level than the benchmark welfare-maximizing level for sector j, because the profit consideration is relatively stronger. On the other hand, the lobbies of other sectors would want lower protection for sector j, because they do not receive any profit from sector j. Overall, the lobbies together work to promote higher protection for organized sectors and lower protection for unorganized sectors. Weighing the lobby interest against the general interest, the government then sets the endogenous trade policies such that they lie in between the welfare-maximizing level and the higher protection level desired by the lobbies for organized

[16] To see this, note that in Eq. (22), $\frac{I_j+a}{\alpha_L+a}$>1 if $I_j=1$, and $\frac{I_j+a}{\alpha_L+a}$<1 if $I_j=0$; similarly in Eq. (24), $\frac{\sigma_j-1}{\sigma_j-\left(I_j+a\right)/(\alpha_L+a)}$>1 if $I_j=1$, and $\frac{\sigma_j-1}{\sigma_j-\left(I_j+a\right)/(\alpha_L+a)}$<1 if $I_j=0$.

sectors, and in-between the welfare-maximizing level and the lower protection level desired by the lobbies for unorganized sectors.

Notice that the lower bounds on import tariffs, which are what lobbies desire for unorganized sectors, are zero. Thus, the endogenous import tariff for unorganized sectors will never fall below zero. On the other hand, the upper bounds on export policy, which are what lobbies desire for organized sectors, can be an export tax. Thus, it is possible that the endogenous export policy for organized sectors is an export tax. Whether the endogenous export policy for organized sectors will be an export tax or export subsidy depends on the relative strength of the revenue consideration versus the profit consideration by the lobbies and the government. An export subsidy is likely to emerge in organized sectors, if the lobbies are a small fraction of the total population and the government is strongly biased toward lobby interests. These findings are different from the G–H result where the unorganized import-competing sector always faces an import subsidy, whereas the organized export sector always receives an export subsidy.

Third, Proposition 1 indicates a positive (negative) association between the market share of the domestic products and the import (export) protection level, in either organized or unorganized sectors. Given the intraindustry trade structure, let us re-define the "import penetration" of an industry as the market share of foreign products relative to the market share of domestic products at the tax-included price in the home market. This corresponds to $\frac{1}{z_j^{\mathrm{o}}}$ in Eq. (22) and is negatively correlated with the endogenous import policy τ_j^{o} in both organized and unorganized sectors. Thus, a sector with higher import penetration receives lower import protection, regardless of whether the sector is politically represented or not. This is contrary to the G–H model, where the relationship between the import penetration and the import protection level differs between organized and unorganized sectors. In G–H, organized sectors with higher import penetration will receive lower protection, but unorganized sectors with higher import penetration will receive higher protection (or more precisely, less negative protection). This difference in findings may be reconciled by the fact that both organized and unorganized sectors are protected by import tariffs in the current study. In this case, the effect of the size of the domestic industry is similar to that in G–H for organized industries, which receive positive import tariffs. In sectors with a larger presence of domestic firms, the gain in profits from an import tariff is relatively larger, while the loss in consumer surplus net of tariff revenue is relatively smaller. This leads to higher levels of tariff protection for sectors with lower import penetration.

Contrary to the positive effect of market share on the import protection that a sector will receive, a sector with a larger market share in the foreign market will receive less protection on its exports. To see this, note that a sector with higher "export penetration," as represented by $\frac{1}{z_j^{*\mathrm{o}}}$ in Eq. (24), receives lower export subsidies (or incurs higher export taxes), regardless of the state of the industry's political organization. The intuition is that the size of exports has a first-order effect on tax revenue while it has only a secondary effect on profits. When an export tax is introduced in sectors with a larger export market, the gain from tax revenue over the loss in profits is relatively larger than in sectors with a smaller export market. In the case of an export subsidy, the cost of subsidy payment over the gain from profits is relatively larger in sectors with a larger export market than in sectors with a smaller one. Thus, the export tax would be higher, or the export subsidy would be lower, in sectors with higher export market shares.

Proposition 2 (*Comparative statics*). *The political and economic parameters of the economy have the following effects on the endogenous protection levels (τ^o,s^o):*

$$(i)\quad \frac{\partial \tau_j^o}{\partial a}>0 \text{ if } I_j=0 \text{ and } \frac{\partial \tau_j^o}{\partial a}<0 \text{ if } I_j=1,\ \frac{\partial \tau_j^o}{\partial \alpha_L}<0,\ \frac{\partial \tau_j^o}{\partial m_j}>0,\ \frac{\partial \tau_j^o}{\partial m_j^*}<0,$$
$$\text{for } j=1,2,\ldots,n;$$

$$(ii)\quad \frac{\partial s_j^o}{\partial a}>0 \text{ if } I_j=0 \text{ and } \frac{\partial s_j^o}{\partial a}<0 \text{ if } I_j=1,\ \frac{\partial s_j^o}{\partial \alpha_L}<0,\ \frac{\partial s_j^o}{\partial m_j}<0,\ \frac{\partial s_j^o}{\partial m_j^*}>0,$$
$$\text{for } j=1,2,\ldots,n;$$

Proof of Proposition 2. The derivations are given in Appendix A. □

Proposition 2 indicates that as the government places more weight on aggregate welfare relative to campaign contributions, the endogenous protection levels increase in unorganized sectors and decrease in organized sectors. As the parameter a becomes large, the endogenous protection levels in both organized and unorganized sectors approach the benchmark welfare-maximizing protection levels.[17] In other words, the more the government is concerned about aggregate welfare relative to campaign contributions, the smaller are the deviations of the endogenous trade policies from the welfare-maximizing levels. This property also holds in G–H, with the welfare-maximizing levels being free trade instead of import tariffs and export taxes.

Proposition 2 also says that the endogenous protection levels in all sectors decrease with the fraction of population that is politically represented. Parallel results can be found in G–H. As the lobby members become negligible in number (α_L=0), they care little about the trade policy in other sectors. In the unorganized sectors (I_j=0), the government's concern for general welfare is not countered by special interests, so the welfare-maximizing protection levels prevail in these sectors. On the other hand, when every voter belongs to some interest group (α_L=1) and all industries are organized, the demand of an organized lobby (I_j=1) for a higher protection level above the welfare-maximizing level for its sector is exactly offset in equilibrium by the bids of all other lobbies to lower the protection level below the welfare-maximizing level for the sector. As a result, the protection for all sectors will reduce to the benchmark levels.[18]

In the situation of monopolistic competition, new parameters regarding the numbers of domestic and foreign firms in the industries are introduced. Proposition 2 indicates that the number of domestic firms in an industry has a positive effect on the import protection level, but has a negative effect on the export protection level. The number of foreign firms

[17] To see this, note that in Eq. (22), $\frac{I_j+a}{\alpha_L+a}\rightarrow 1$, as $a\rightarrow\infty$; similarly, in Eq. (24), $\frac{\sigma_j-1}{\sigma_j-\frac{I_j+a}{\alpha_L+a}}\rightarrow 1$, as $a\rightarrow\infty$.

[18] To see this, note that in Eqs. (22) and (24), when $I_j=\alpha_L=0$ or 1, $\frac{I_j+a}{\alpha_L+a}=1$ and $\frac{\sigma_j-1}{\sigma_j-\frac{I_j+a}{\alpha_L+a}}=1$.

has exactly the opposite effect. This result is consistent with the earlier observations regarding import/export penetration. An industry with more domestic firms or fewer foreign firms has lower import penetration. The profit gain from tariffs is relatively larger as the number of domestic firms increases, while the loss in consumer surplus net of tariff revenue is relatively smaller as the number of foreign firms decreases. Therefore, endogenous import tariffs are higher in industries with lower import penetration. This is true regardless of the industry being politically represented or not. On the other hand, an industry with more domestic firms or fewer foreign firms has higher export penetration and will receive less protection on its exports. This applies to both organized and unorganized industries.

A final parameter of interest is the elasticity of substitution among the home and foreign varieties σ_j, which is also the approximate elasticity of import demand and of export supply. Unlike G–H, where a negative association exists between the elasticity (in absolute value) and the deviation from the welfare-maximizing policy, no such definite relationship is found in the current framework with monopolistic competition.

4. Conclusion

This paper incorporates the Krugman–Dixit–Stiglitz monopolistic competition framework into the protection for sale model of Grossman and Helpman (1994). This is to account for the prevalence of intraindustry trade and to examine the endogenous structure of protection that will emerge under the alternative trade structure. Explicit formulas for the endogenous import and export policy are derived, which provide clear predictions of cross-sectoral protection patterns.

Several new results arise in this paper. First, the endogenous import tariff in unorganized sectors will never fall below zero. This is contrary to the G–H prediction that unorganized import-competing sectors will face import subsidies. Second, the endogenous export policy for organized sectors can be an export tax or an export subsidy, depending on the degree of lobby representation and the government's concern for general welfare. In G–H, organized export sectors always receive export subsidies. Third, the current paper predicts an inverse relation between import penetration and levels of import protection, regardless of whether a sector is politically organized or not. This deviates from the G–H result where the relation between import penetration and import protection is negative if the import-competing sector is organized, and is positive if the sector is unorganized. The difference in findings between the current paper and the G–H paper suggests that the endogenous protection structure varies with the nature of the industry (competitive or monopolistically competitive). Thus, a properly designed empirical framework based on the G–H-type model should allow for heterogeneous responses of protection to the underlying political/economic factors across different market structures.

There are some fruitful directions in which the current paper may be extended. Notice that the results of the current study rely on two simplifying assumptions, which may be relaxed to yield new insights. First, the producer price (and hence the terms of trade) is fixed given the production and consumption structure of the model. It follows that the export policy does not affect the domestic consumer price and consumer surplus. This implies that import and export policies are strategically independent. Second, the demand and supply of an industry depend only on the price in its own industry, and not on prices in other industries. Hence, industry lobbyists are interested in the trade policy of other sectors only as consumers, and not as producers (this second assumption follows the original G–H model). If the above assumptions are relaxed to allow for import and export policy substitution and sectoral interactions, it is possible that the conclusions about the export policy will change, especially the result that exports of unorganized sectors will be charged export taxes, which are not common in practice. These generalizations form part of the agenda for future research.

Appendix A. Proofs for the propositions

Proof of Proposition 1. Given Eq. (20), the desired result in Eq. (22) follows immediately by the first-order condition that $\frac{\partial \tilde{G}}{\partial \tau_j} = 0$ at $\tau_j = \tau_j^o$. The equilibrium import policy must also satisfy the second-order condition that $\frac{\partial^2 \tilde{G}}{\partial \tau_j^2} < 0$ at $\tau_j = \tau_j^o$, such that τ_j^o identifies a relative maximum instead of minimum. Given Eq. (20), it is straightforward to show that

$$\begin{aligned}\frac{\partial^2 \tilde{G}}{\partial \tau_j^2} &= \left[(I_j + a)\frac{1}{\sigma_j} - (\alpha_L + a)\frac{z_j\sigma_j + 1}{z_j(\sigma_j - 1)}\frac{\tau_j - 1}{\tau_j} \right] N m_j p_{hj} \frac{\partial^2 x_{hj}}{\partial \tau_j^2} \\ &\quad - \frac{\alpha_L + a}{\tau_j^2}\left[\frac{\sigma_j + \frac{1}{z_j}}{\sigma_j - 1} - \frac{\tau_j - 1}{z_j} \right] N m_j p_{hj} \frac{\partial x_{hj}}{\partial \tau_j}. \end{aligned} \tag{25}$$

Note that the terms in the first bracket equal to zero, when evaluated at $\tau_j = \tau_j^o$, by the first-order condition. It follows that the second-order condition holds if and only if $\frac{\sigma_j + 1/z_j^o}{\sigma_j - 1} - \frac{\tau_j^o - 1}{z_j^o} > 0$, or equivalently, $\frac{\tau_j^o}{z_j^o + 1} < \frac{\sigma_j}{\sigma_j - 1}$.

Given Eq. (21), the desired result in Eq. (24) follows by the first-order condition that $\frac{\partial \tilde{G}}{\partial s_j} = 0$ at $s_j = s_j^o$. Again, the equilibrium export policy must also satisfy the second-order condition that $\frac{\partial^2 \tilde{G}}{\partial s_j^2} < 0$ at $s_j = s_j^o$. Using Eq. (21), we can show that

$$\begin{aligned}\frac{\partial^2 \tilde{G}}{\partial s_j^2} &= \left[(I_j + a)\frac{1}{\sigma_j} - (\alpha_L + a)\left(\frac{1 - \sigma_j}{s_j\left(\sigma_j + \frac{1}{z_j^*}\right)} + 1 \right) \right] N^* m_j p_{hj} \frac{\partial^2 x_{hj}^*}{\partial s_j^2} \\ &\quad - (\alpha_L + a)\frac{(\sigma_j - 1)\left(\sigma_j + \frac{1}{z_j^*}\right)z_j^* + 1}{s_j^2 z_j^* \left(\sigma_j + \frac{1}{z_j^*}\right)^2} N^* m_j p_{hj} \frac{\partial x_{hj}^*}{\partial s_j}. \end{aligned} \tag{26}$$

When evaluated at $s_j = s_j^o$, the terms in the bracket equal to zero by the first-order condition, while the terms after the minus sign are positive. It follows that the second-order condition automatically holds at $s_j = s_j^o$. □

Proof of Proposition 2. Take the total differentiation of the import tariff equation (22) with respect to τ_j^o and a, and use the fact that $\frac{\partial z_j}{\partial \tau_j} = \frac{\sigma_j - 1}{\tau_j} z_j$. It is straightforward to show that

$\frac{\partial \tau_j^o}{\partial a} = \frac{\alpha_L - I_j}{(\alpha_L + a)^2}(\tau_j^{o2} z_j^o)/(\frac{\sigma_j}{\sigma_j - 1} - \frac{\tau_j^o}{z_j^o + 1})$. Similarly, take the total differentiation of the import tariff equation (22) with respect to τ_j^o and α_L, we can show that $\frac{\partial \tau_j^o}{\partial \alpha_L} = -\frac{I_j + a}{(\alpha_L + a)^2}(\tau_j^{o2} z_j^o)/(\frac{\sigma_j}{\sigma_j - 1} - \frac{\tau_j^o}{z_j^o + 1})$. Note also that $\frac{\partial z_j}{\partial m_j} = \frac{z_j}{m_j}$ and $\frac{\partial z_j}{\partial m_j^*} = -\frac{z_j}{m_j^*}$. Apply this and take the total differentiation of Eq. (22) with respect to τ_j^o and m_j (or m_j^*), we have that $\frac{\partial \tau_j^o}{\partial m_j} = \frac{I_j + a}{\alpha_L + a}\frac{1}{m_j(\sigma_j z_j^o + 1)}(\tau_j^{o2} z_j^o)/\left(\frac{\sigma_j}{\sigma_j - 1} - \frac{\tau_j^o}{z_j^o + 1}\right)$ and that $\frac{\partial \tau_j^o}{\partial m_j^*} = -\frac{I_j + a}{\alpha_L + a}\frac{1}{m_j^*(\sigma_j z_j^o + 1)}(\tau_j^{o2} z_j^o)/(\frac{\sigma_j}{\sigma_j - 1} - \frac{\tau_j^o}{z_j^o + 1})$. The desired result (i) in Proposition 2 follows immediately by the second-order condition (23).

The comparative statics analysis for the export policy can be carried out analogously. First, note that $\frac{\partial z_j^*}{\partial s_j} = -\frac{\sigma_j - 1}{s_j} z_j^*, \frac{\partial z_j^*}{\partial m_j} = -\frac{z_j^*}{m_j}$, and $\frac{\partial z_j^*}{\partial m_j^*} = \frac{z_j^*}{m_j^*}$. Use these results and take the total differentiation of the export policy equation (24) with respect to s_j^o and the parameter under study. It is straightforward to show that $\frac{\partial s_j^o}{\partial a} = \frac{\alpha_L - I_j}{(\alpha_L + a)^2}\frac{z_j^{*o}}{z_j^{*o} + 1}(\sigma_j - 1)/(\sigma_j - \frac{I_j + a}{\alpha_L + a})^2$. We can further derive that $\frac{\partial s_j^o}{\partial \alpha_L} = -\frac{I_j + a}{(\alpha_L + a)^2}\frac{z_j^{*o}}{z_j^{*o} + 1}(\sigma_j - 1)/(\sigma_j - \frac{I_j + a}{\alpha_L + a})^2$, $\frac{\partial s_j^o}{\partial m_j} = -\frac{1}{m_j}\frac{1}{(\sigma_j + 1/z_j^{*o})(z_j^{*o} + 1)}(\sigma_j - 1)/(\sigma_j - \frac{I_j + a}{\alpha_L + a})$, and $\frac{\partial s_j^o}{\partial m_j^*} = \frac{1}{m_j^*}\frac{1}{(\sigma_j + 1/z_j^{*o})(z_j^{*o} + 1)}(\sigma_j - 1)/(\sigma_j - \frac{I_j + a}{\alpha_L + a})$. The desired result (ii) in Proposition 2 follows by the assumption that $\frac{1 + a}{\alpha_L + a} < \sigma_j$. □

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