CHAPTER 4

NONCOOPERATIVE VERSUS COOPERATIVE ENDOGENOUS DOMESTIC AND TRADE POLICIES WITH ENVIRONMENTAL EXTERNALITIES

4.1. Introduction

This paper explores the relationship of two distinctive features of recent trade negotiations: the emergence of the trade-environment complex and the impact of special-interest lobbying. For example, the agreements of the GATT Uruguay Round incorporate a work program on the environment and trade, including the foundation of a Committee on Trade and Environment and agreements on Sanitary and Phytosanitary Standards and on Technical Barriers to Trade. Some even predict that the next GATT round of negotiations could be the 'Green Round'.[54] NAFTA is the first trade agreement in history to formally contain environmental objectives, and includes, for example, an Environmental Side Agreement as well as a "US-Mexico Integrated Border Environmental Plan".[55]

While public discussion has often focused on trade policies, standard economic theory suggests that domestic policies are more efficient to address an externality. Trade policies incur a higher deadweight loss with less environmental protection than a more direct intervention such as effluent fees, or input, output, or consumption taxes. The superiority of domestic policies on efficiency grounds is also recognized in the GATT. GATT Article XX allows countries to deviate from basic GATT obligations for certain public policy goals such as the protection of human life or health, but protective trade measures are prohibited when these goals can be fully achieved through non-discriminatory GATT-conforming domestic policies.[56]

In addition, various International Environmental Agreements (IEA) such as the 1987 Montreal Protocol (on Substances That Deplete the Ozone Layer) or the 1972 Stockholm Conference on Human Environment address the use of domestic as well as trade policies for environmental purposes. In general IAE state environmental goals and let member countries chose policies to achieve these goals. While command-and-control type regulation is still the dominant approach, the role of market-based policies such as "Eco-taxes" has been increasing for political and economic reasons, at least in OECD countries (OECD 1995). When budgets are tight, policy-makers find the revenue generated by environmental or health taxes, for example, on energy, motor vehicles and tobacco products, particularly attractive.

[54] For example, Charles R. Carlisle, then Deputy Director-General of the GATT (quoted in Wilkinson, 1994).
[55] See Esty (1994) for a detailed description of environmental considerations in NAFTA.
[56] See Sorsa (1992) for the relationship between GATT rules and various environmental issues.

Finally, some international trade agreements address not only trade policies, but also trade-distorting domestic policies. In particular, the Uruguay Round Agreement of the GATT requires a 20-percent reduction in total expenditures on price supports in agriculture, which might also have implications for environmental quality. For example, wheat and corn production account for over 50 percent of all nitrogen fertilizer applied in the United States, causing attendant water quality problems. Thus, depending on the production technology, a reduction in domestic price supports might lead to a decreasing fertilizer use and improving environmental quality. While the Uruguay Round domestic support reductions are estimated to have little effect given previous domestic policy reform and specific GATT exceptions (Orden 1994), future GATT provisions on domestic programs might become binding.

The above observations lead to the conclusion that trade policies should be analyzed in conjunction with domestic policies, in particular in the trade and environment context. Such analysis is developed in this paper.

The influence of organized interest groups on the structure of trade policies has long been recognized. A well developed literature on endogenous trade policy formation derives the equilibrium policies as the outcomes of a political process that may include self interested governments, organized industry groups, bureaucrats and voters as participants (see Hillman 1989 and Rodrik 1995 for overviews). As Grossman and Helpman (1995, p. 676) point out, this literature almost exclusively considers the small-country case. Thus, governments set trade policies without regard to the objectives and reactions of other countries' governments.[57] To analyze the strategic relationship between interest groups and the government on the national level, and between governments from different countries on the international level, Grossman and Helpman (1995) examine the structure of protection in a large-country model when governments set trade policies either noncooperatively (trade wars) or cooperatively (trade talks). In the Grossman-Helpman framework, which was originally applied to analyze industry protection in a small-country model (Grossman and Helpman 1994), protection-seeking lobbies of owners of sector-specific factors of production offer a menu of policy-contingent contributions (schedules) to an incumbent government (agent) in order to influence its trade policy stance. In modeling the interactions between the government and the lobbies (principals) as a common agency game with perfect information, this model provides a micro-foundation for the standard reduced-form political support function approach. The support-function approach, which is due to Stigler (1971) and Peltzman (1976), features a self-interested policy-maker that sets policies to maximize a weighted sum of designated interest groups' welfare and social welfare. Campaign contributions are not formally modeled and have no direct impact on the government's policies in the political support function approach.

[57] Hillman and Moser (1995), who use a political support function approach, and Grossman and Helpman (1995) themselves, are the exceptions.

Until recently, formal analyses of the political economy of trade and environmental policies were rare. Hillman and Ursprung (1992) apply the political competition approach to show how organized interest groups affect the chances for liberal versus protectionist policy outcomes. Organized industry and environmental groups make contributions to candidates with predetermined policy stances in order to increase the probability of their favorite candidate getting elected. Recent studies by Bommer (1996) and Bommer and Schulze (1996) are based on the political support function approach. Bommer shows that European integration could lead to a high-level harmonization of environmental process standards, instead of a downward competition that would provide domestic industries with a competitive advantage. Bommer and Schulze demonstrate that trade liberalization, which favors 'dirty' exporting industries, allows governments to impose tighter environmental standards to satisfy 'clean' importing industries and environmental groups.

The models above typically include one or two industries, which exclusively maximize profits, and organized environmental groups, which exclusively maximize environmental quality. The consumption side of the economy is generally neglected. If these models did not include environmental groups, the policy maker would not care about the environmental impact of the selected policies. This differs fundamentally from the studies by Fredriksson (1997), Aidt (1997a,b) and Schleich (1997) which are based on the Grossman-Helpman model. In the latter models, the utility of individual members of the industry lobbies also depends on the level of the production externality, the lobbies' contribution schedules will incorporate the impact of the government's production policies (taxes or subsidies on output) on the environment. Thus, the government is concerned about the externality even when there are no organized environmental lobbies per se. Aidt's main objective is to demonstrates how the menu auction in the common agency game leads to the internalization of a production externality. Fredriksson and Aidt (1997a) concentrate on one endogenously derived policy only, that is on production policy, while Aidt (1997b) also allows for input taxes/subsidies. Aidt and Fredriksson allow for organized environmental groups, but they only consider a production externality. Schleich characterizes the political equilibrium policies when the government has multiple policies available and when production or consumption of an industry's output generates a local negative externality. In his model, the government can apply domestic policies--that is subsidies or taxes on production or consumption--and trade policies--that is subsidies or taxes on imports and exports--to satisfy the lobbies and to address the externality.

This paper extends previous work in several dimensions. Using the Grossman-Helpman interest group framework, the political equilibrium structure of environmental and industry protection for two large open economies (home and foreign) is characterized, when governments choose domestic policies *together* with trade policies. Governments decide on their policies either noncooperatively or cooperatively. The equilibrium outcomes when governments have only one type of policy available, either domestic or trade policies, are analyzed as special cases of the general model.

It is shown that, when there are no externalities, the results of Grossman and Helpman (1995) for the noncooperative and cooperative scenario arise as special cases when the governments have only trade policies at hand. Grossman and Helpman (1995) have also shown that, when governments negotiate over trade policies only, industry protection depends on the industry's political power compared to that of its counterpart abroad. Because of the market clearing condition, one industry will be better off and the other industry will be worse off than under free trade. The findings indicate further that, when production policies (or consumption and trade policies) are available, politically strong home and foreign industries can both enjoy substantial protection. When only consumption policies are available, protection for an industry increases with the political power of the industry abroad and protection for both industries is the same.

In extending the model to include externalities, local and global production and consumption externalities are considered separately. Thus, it will be illustrated how either local or global production and consumption externalities can be internalized when governments set their policies cooperatively and lobbies' contribution schedules depend on the outcomes of the negotiations, that is on all countries' domestic and trade policies.

The results show that a political economy version of Bhagwati's (1971) normative targeting principle applies in the noncooperative as well as in the cooperative scenario of the extended large-country Grossman-Helpman political economy model. In the noncooperative scenario, when governments have both policies available and the production of a good causes a negative externality, governments use production subsidies to satisfy the lobbies, which are counterbalanced by environmental production taxes. Trade policy is used to exploit the terms of trade and--when the externality is global--to reduce production abroad by decreasing the world price. In a normative analysis Krutilla (1989) has shown that in a large-country model the chosen output tax for a local production externality is higher than the standard Pigouvian tax if the country is an exporter because a production tax is also used to affect the terms of trade. The findings indicate that for an exporting country the political equilibrium tax might even be lower than the Pigouvian tax since the government tries to please the lobbies with lower output taxes

For a negative consumption externality, trade policies are used to satisfy the lobbies, to exploit international market power and--when the externality is global--to reduce consumption abroad. The consumption policy is applied to offset the distortions that are due to the political power of lobbies as well as to address the externality. For a normative model, Krutilla has shown that in a large-country model the chosen consumption tax for a local consumption externality is higher than the standard Pigouvian tax if the good is imported because a consumption tax also improves the terms of trade. Since in the political equilibrium the government uses a consumption subsidy to address the lobbies, the consumption tax in the political equilibrium might be lower than the Pigouvian tax.

In the cooperative scenario, the political equilibrium policies are the same whether governments have only production policies or production policies together with trade policies available. Since cooperating governments no longer use their policies to manipulate the terms of trade, they apply production policies to satisfy the lobbies and to address a local or global production externality.[58] Therefore, environmental protection will generally be lower than under a Pigouvian tax.

Conversely, in the cooperative scenario for a consumption externality, governments prefer to use both policies. Trade policies are applied to satisfy the lobbies while consumption policies address the distortions arising from the trade policies as well as the externality. In this case, environmental protection is the same as under a Pigouvian tax.

Section 4.2. develops the noncooperative model for the production externality. In Section 4.3. the results for the consumption externality are analyzed. In Section 4.4. the cooperative model for the production externality is explored and in Section 4.5. the cooperative outcomes for a consumption externality are studied. Conclusions are presented in Section 4.6.

4.2. Production Externality under Noncooperation

The model is based on Grossman and Helpman (1995) and contains two large countries, home and foreign, with similar political and economic systems. The exposition focuses on the home country, while variables and parameters associated with the foreign country are denoted with an asterisk. This section develops the general framework for a production externality when governments do not cooperate.

Consumers

In the home country, the population of N residents provides a total labor supply l and has identical, additively separable quasi-linear preferences defined over (n+1) goods and environmental quality. Each individual j maximizes $u_j = c_{0j} + \sum_{i=1}^{n} u_{ij}(c_{ij}) + u_{Ej}(E)$, where c_{0j} is the consumption of the numeraire good, c_{ij} is the consumption of good i by individual j, and $u_{Ej}(E)$ is the utility that individual j derives from the state of the environment as determined by the externality E. All $u_{ij}(.)$ are assumed to be increasing and concave functions, and, for specificity, it is assumed that the externality is negative, that is $\frac{\partial u_{Ej}}{\partial E} = u'_{Ej} < 0$.

The quasi-linear preferences lead to ordinary demand functions that depend only on their own prices $d_i(p_i^d)$, and all individuals have the same marginal utility of income equal to one.

[58] See Dixit, Grossman and Helpman (1997) on the choice of efficient policies in the Grossman-Helpman interest group model.

Individual indirect utility can be expressed as $v(p^d, y, E) = y + s(p^d) + u_E(E)$ where $p^d = (p_1^d, p_2^d, ..., p_n^d)$ is the vector of consumer prices for nonnumeraire goods, y represents her income, and $s(p^d) = \sum_{i=1}^{n} u_i[d_i(p_i^d)] - \sum_{i=1}^{n} p_i^d d_i(p_i^d)$ is her consumer surplus from all nonnumeraire goods. Individual demands are $d_i(p_i^d) = -\frac{\partial s}{\partial p_i^d}$, and total demand for any good i in the home country is $D_i(p_i^d) = Nd_i(p_i^d)$, with $\frac{\partial D_i}{\partial p_i^d} = D_i' < 0$.

Producers

All sectors produce under perfect competition. The numeraire good is made from labor alone, such that one unit of labor produces one unit of output. Since the domestic and world (offshore) prices of the numeraire good are equal to one, the economy wide wage rate is fixed at unity. All other goods are produced from labor and one inelastically supplied specific input, with constant returns to scale in both factors but diminishing returns in individual factors. This production structure leads to (aggregate) quasi-rents of $\Pi_i(p_i^s)$ to the fixed factor in industry i that only depend on the output price received by producers p_i^s, with supply $X_i(p_i^s) = \Pi_i'(p_i^s)$, and $\frac{\partial X_i}{\partial p_i^s} = X_i' > 0$.

Suppose that the production of one or more nonnumeraire goods e in one or both countries generates an externality E such that $\frac{\partial E(X_e, X_e^*)}{\partial X_e} = E_X > 0$ and $\frac{\partial E(X_e, X_e^*)}{\partial X_e^*} = \gamma E_{X^*} \geq 0$, where γ = 1 if the externality is global and γ = 0 otherwise. The externality does not affect the production process of any other good, but instead it negatively affects the well-being of consumers.

Lobbies

Owners of the specific factor used in the production of good i have an incentive to lobby for policies that raise p_i^s because a higher price increases their rents. An exogenously determined subset L of all owners of a specific factor is assumed to overcome the free-rider problem (Olson, 1965) and organize themselves in order to affect government policies.[59] Each of these lobbies represents one of the n sector-specific factors and offers the government a *contribution schedule*

[59] It is assumed that each individual can own at most one specific factor.

that maps every policy vector into a non-negative contribution level. Following Grossman and Helpman (1995), lobbies can only influence the policies in their own country. So, the home (foreign) lobbies' contribution schedules are contingent on the home (foreign) policies only. Lobbies are assumed to credibly commit to their actions or write binding contracts. The governments then choose their policies to maximize their objectives.

Government

Each government is assumed to maximize a weighted sum of monetary contributions from organized industries and total consumer welfare. The government uses the contributions for its reelection campaign or for its own private consumption. It is concerned about total consumer welfare because consumer well-being influences its chances for reelection or for (unspecified) ethical reasons. To achieve its objectives, the government can impose *ad valorem* production policies τ_i and/or trade policies θ_i on any of the nonnumeraire goods. The production policies drive a wedge between the prices that cons umers and producers face, and the trade policies separate domestic producer and world (or offshore) prices p_i^w. Supply and demand price equilibria for good i require $p_i^s = \frac{\theta_i}{\tau_i} p_i^w$ and $p_i^d = \theta_i p_i^w$ respectively.

The net revenue of the government (excluding contributions by lobbies) is generated by its domestic and trade policies. The use of differentiated lump-sum taxes or subsidies as an independent policy instrument is ruled out by assumption, but the government's net revenue is redistributed evenly on a per-capita basis. The net per-capita transfer by the government is

$$(1) \quad r(\tau,\theta) = \tfrac{1}{N}\sum_{i=1}^{n} p_i^s(\tau_i - 1)X_i(p_i^s) + \tfrac{1}{N}\sum_{i=1}^{n} p_i^w(\theta_i - 1)[D_i(p_i^d) - X_i(p_i^s)].$$

Contributions received by the government from organized interest groups are not part of the per-capita transfer (1) and do not enter the subsequent market equilibrium conditions of the model, except to imply a decrease in income of owners of the sector-specific factors utilized in organized industries.

Like Grossman and Helpman, the analysis in this paper is based on Bernheim and Whinston who model the lobbies' and government's behavior as a first-price menu auction in a common agency game.[60]

[60] Alternatively, the equilibrium outcomes could be derived using the Nash bargaining solution as in Chapter 3.

Equilibrium under Noncooperation

In the first stage of the two-stage noncooperative game, lobbies in either country simultaneously and noncooperatively set their contribution schedules contingent on their own country's domestic and trade policies $C_i(\tau,\theta;\tau^*,\theta^*)$.[61] In the second stage, the home and foreign governments set both policies simultaneously and noncooperatively, taking the impact of their actions on the other country's government and lobbies as given.

Starting with the second stage of the game, the home government is assumed to maximize a weighted sum of total contributions and average consumer welfare

$$(2)\quad G=\sum_{i\in L} C_i(\tau,\theta;\tau^*,\theta^*)+aW(\tau,\theta,\tau^*,\theta^*),$$

where the coefficient *a* captures the trade-off between contributions and total consumer welfare as perceived by the home country's government. Total consumer welfare consists of the sum of total labor income, total profits, net government revenue, total consumer surplus, and the total utility derived from environmental quality. Thus

$$(3)\quad W(\tau,\theta,\tau^*,\theta^*)\equiv l+\sum_{i=1}^{n}\Pi_i(p_i^s)+Nr(\tau,\theta,\tau^*,\theta^*)+Ns(p^d)+Nu_E(E)$$

In the first stage of the game, each lobby i chooses its contribution schedule to maximize the (aggregate) net welfare of its members

$$(4)\quad \begin{aligned} &W_i(\tau,\theta,\tau^*,\theta^*)-C_i(\tau,\theta,\tau^*,\theta^*)\equiv\\ &l_i+\Pi_i(p_i^s)+[N_i r(\tau,\theta,\tau^*,\theta^*)+N_i s(p^d)+N_i u_E(E)]-C_i(\tau,\theta,\tau^*,\theta^*),\end{aligned}$$

where N_i is the number of people that own factor i and l_i is their (aggregate) labor income.

Necessary conditions for a subgame-perfect equilibrium, which consists of a sets of contribution schedules $(\{C_i^0\}_{i\in L},\{C_i^{0*}\}_{i\in L^*})$ and policy vectors (τ^0,θ^0) and (τ^{*0},θ^{*0}), are (see Grossman and Helpman 1994, 1995):[62]

i) C_i^0 is feasible for all $i\in L$, that is contribution schedules must not be negative and cannot exceed the aggregate income of each lobby given (τ^0,θ^0) and (τ^{*0},θ^{*0});

[61] The foreign policies appear in the home contribution schedules as parameters because the home lobbies' welfare depends on the foreign policies. However, the home contributions are not set to affect the foreign policies.

[62] Similar conditions have to hold for the foreign lobbies' contribution schedules and the foreign domestic and trade policies.

ii) (τ^0, θ^0) maximizes

(5) $\sum_{i \in L} C_i^0(\tau, \theta; \tau^*, \theta^*) + aW(\tau, \theta, \tau^*, \theta^*)$,

that is the optimal home policy vectors are a best response, given the lobbies contribution schedules and the policy choices of the foreign government; and

iii) (τ^0, θ^0) maximizes for every $i \in L$

(6) $W_i(\tau, \theta, \tau^*, \theta^*) - C_i^0(\tau, \theta; \tau^*, \theta^*) + \sum_{j \in L} C_j^0(\tau, \theta, \tau^*, \theta^*) + aW(\tau, \theta, \tau^*, \theta^*)$

Condition (6) implies that the equilibrium policies have to maximize the sum of any lobby's net welfare and the government's objective function, given the payments of all other lobbies. If this condition was violated for any lobby i, it could modify its contribution schedule such that the government selected a more favorable policy vector, and the surplus from such a switch could be shared by lobby i and the government.

As in Grossman and Helpman (1994, 1995) assume that the equilibrium is interior and that the contribution schedules are differentiable around the equilibrium point. Taking the first order conditions for (5) and (6), and combining terms yields

(7) $\nabla_\beta C_i^0(\tau^0, \theta^0; \tau^*, \theta^*) = \nabla_\beta W_i(\tau^0, \theta^0, \tau^*, \theta^*)$, for $\beta = \tau, \theta$ and for all $i \in L$,

where ∇ denotes the gradient vector of the partial derivatives with respect to the β. Equation (7) requires that the marginal change in payments to the government for a small change in the policy vector has to equal the marginal change in lobby i's gross welfare.[63] In particular, since E enters the individual utility functions of members of any lobby, the effects of a change in the

[63]Since under this condition, the shapes of the contribution schedules reveal the lobbies' true preferences around the equilibrium point; Grossman and Helpman (1994) refer to them as being *locally truthful.* Local truthfulness suffices to characterize the structure of protection. Since this game in principle has multiple Nash-equilibria, one has to be selected to determine lobbies' payments in equilibrium. Grossman and Helpman (1994) choose the truthful equilibrium, in which contribution schedules correctly reflect the lobbies' preferences globally, not just around the equilibrium point. In the truthful equilibrium, each lobby pays to the government for any policy vector (τ,θ) the excess of lobby i's gross welfare at (τ,θ) relative to some base level of welfare (Grossman and Helpman 1994, p. 840). A (globally) truthful equilibrium may be focal among the set of Nash equilibria for two reasons: (1) it is coalition-proof, that is it is stable to nonbinding communication among the lobbies, and (2) it is efficient for the strategic players, that is, given the available policy instruments no feasible Pareto superior outcome exists for the government and the organized interest groups (for discussion, see Bernheim and Whinston, for quasilinear preference, and Dixit, Grossman and Helpman, for more general preferences). In the Grossman-Helpman political economy model, since total welfare appears in the government's objective function, efficient choices are made at the truthful equilibrium not just for the strategic players but for the entire polity (see Corollary 2 to proposition 5 in Dixit, Grossman and Helpman).

policy variables τ and θ on the quality of the environment are taken into account by all lobbies. Summing equation (7) over all i and then substituting into the first-order condition for equation (2) yields

$$(8)\quad \sum_{i\in L}\nabla_\beta W_i(\tau^0,\theta^0;\tau^*,\theta^*)+a\nabla_\beta W(\tau^0,\theta^0,\tau^*,\theta^*)=0,\ \text{for}\ \beta=\tau,\theta\,.$$

Using equations (1), (3) and (4), and then collecting terms, the first-order conditions for the equilibrium interventions in industry i can be expressed as

$$(9a)\quad (\tau_i-1)=-\frac{(I_{iL}-\alpha_L)}{(a+\alpha_L)}\frac{X_i}{p_i^s X_i'}+\frac{M_i}{p_i^s(\theta_i D_i'+\theta_i^* M_i'^*)}+(\theta_i-1)\frac{p_i^w}{p_i^s}$$
$$-\delta\frac{Nu_E' E_X}{p_i^s}-\gamma\frac{Nu_E' E_{X*}\theta_i^* X_i'^*}{\tau_i^* p_i^s(\theta_i D_i'+\theta_i^* M_i'^*)}$$

$$(9b)\quad (\theta_i-1)=-\frac{(I_{iL}-\alpha_L)}{(a+\alpha_L)}\frac{X_i}{\tau_i p_i^w M_i'}-\frac{M_i}{p_i^w M_i'^*}-(\tau_i-1)\frac{p_i^s X_i'}{\tau_i p_i^w M_i'}$$
$$-\delta\frac{Nu_E' E_X X_i'}{\tau_i p_i^w M_i'}+\gamma\frac{Nu_E' E_{X*} X_i'^*}{\tau_i^* p_i^w M_i'^*},$$

where $M_i' = D_i' - {}^{X_i'}\!/_{\tau_i}$ and $M_i'^* = D_i'^* - {}^{X_i'^*}\!/_{\tau_i^*}$ are the derivatives of home and foreign import demand with respect to domestic prices, and $\alpha_L = \sum_{i\in L}\frac{N_i}{N}\le 1$ is the exogenous share of the population that owns specific factors in organized industries. The δ and I_{iL} are indicator variables: δ=1 if consumption creates an externality, that is for i=e, and δ=0 otherwise; I_{iL}=1 if industry i is organized and I_{iL}=0 otherwise. Solving equations (9a,b) simultaneously, leads to implicit expressions for the political equilibrium levels of the home country's production and trade policies

$$(10a)\quad (\tau_i-1)=-\frac{(I_{iL}-\alpha_L)}{(a+\alpha_L)}\frac{X_i}{p_i^s X_i'}-\delta\frac{Nu_E' E_X}{p_i^s}=-\frac{(I_{iL}-\alpha_L)}{(a+\alpha_L)}\frac{1}{\varepsilon_{X_i,p_i^s}}-\delta\frac{Nu_E' E_X}{p_i^s}$$

$$(10b)\quad (\theta_i-1)=-\frac{M_i}{p_i^w\theta_i^* M_i'^*}+\gamma\frac{Nu_E' E_{X*} X_i'^*}{p_i^w\tau_i^* M_i'^*}=\frac{1}{\varepsilon_i^*}+\gamma\frac{Nu_E' E_{X*} X_i'^*}{p_i^w\tau_i^* M_i'^*},$$

where ε_i^* is the elasticity of foreign excess supply, which is positive (negative) when the home country imports (exports) good i.[64] Equations (10a,b) together with their foreign counterparts determine the political equilibrium levels for production and trade policies.

When production and trade policies are available, the government uses both policies in the political equilibrium whether the production of good i causes an externality or not.

The structure of industry and environmental protection will now be characterized in greater detail. In particular, it is analyzed which policy satisfies lobbies and which policy addresses a local or global externality. Further it is explored what determines high versus low industry and environmental protection.

When the production of good i does not cause an externality, the equilibrium production policy in equation (10a) contains only a political support effect. For $\alpha_L < 1$, the equilibrium policy will be an output subsidy if industry i is organized (I_{iL}= 1) and a tax if it is not (I_{iL}= 0). In order to satisfy the lobbies, the government sacrifices production efficiency, subsidizing organized industries, and taxing unorganized industries.

In general, the political support effect on production policy, and hence on protection for an organized industry, is inversely related to *a*, the weight the home government attaches to total welfare, also to α_L, the degree of organization, since members of all other organized industries (as consumers) will bid against protection of any given sector, and finally to ε_{X_e, p_e^s} the elasticity of output supply, reflecting the deadweight loss associated with the interventions.

When the country is large, it uses its trade policy to exploit its international market power. Independent of whether the industry is organized or not, when there is no global externality, the optimal trade policy is an import tariff or an export tax and equation (10b) is just the formula for the optimal tariff.

When the production of the good generates an externality (i=e, δ =1), the second term on the RHS of equation (10a) represents an additional environmental effect. It requires a production tax and captures the negative effects of an additional unit of output from home production on the welfare of the home country's consumers. This environmental effect increases with the home population size (N), since the social cost associated with the externality increases with the number of people affected. The environmental effect further increases with the marginal utility of the externality ($|u_E'|$), that is the more environmentally sensitive home residents are, the higher will be the tax. Finally, the environmental effect increases with the marginal contribution of home output to the externality (E_X), that is the more pollutive the home industry is at the margin, the higher will be the tax.

[64] Note that results for the small country case can be obtained for $|\varepsilon_i^*| \to \infty$ ($M_i'^* \to -\infty$).

When the production of the good causes a global externality (γ =1), the trade policy contains an additional global environmental effect that addresses the negative impact of foreign production on the welfare of the residents in the home country. It is positive and requires an import tariff or an export subsidy. These policies lower the world price which in turn leads to a decrease in the foreign producer price, foreign production and the global externality. This global environmental effect increases with home population size, with the sensitivity of home residents toward the environment, with the pollutiveness of foreign output (E_{X^*}), and the price derivative of foreign supply ($X_i'^*$). On the other hand, the global environmental effect decreases with the price derivative of foreign export supply (- $M_i'^*$). The larger - $M_i'^*$ (id est, the flatter foreign excess supply) the smaller is the change in the foreign producer price from a change in the come country's policies.

To sum up, the results illustrate that Bhagwati's (1971) targeting principle from normative economic analysis also applies to the Grossman-Helpman large-country political economy model. The government uses the production policy to address the lobbies as well as the externality generated by domestic production. The government uses the trade policy to exploit its market power and to reduce a global externality generated by production abroad. Whether the equilibrium production and trade policies are taxes or subsidies is generally ambiguous. When the industry is organized (not organized) and the production of the good generates an externality, the political support effect requires a production subsidy (tax), and the environmental effect requires a tax. When the good is exported (imported), the terms-of-trade effect requires an export tax (import tariff) and the global environmental effect requires an export subsidy (import tariff).

Now consider the case when the governments have only production policies available. Setting the ad valorem trade policies in equation (9a) equal to one, the political equilibrium production policy for the home country is implicitly given by

$$(11)\quad (\tau_i - 1) = -\frac{(I_{iL} - \alpha_L)}{(a + \alpha_L)}\frac{X_i}{p_i^s X_i'} + \frac{M_i}{p_i^s (D_i' + M_i'^*)} - \delta\frac{Nu_E' E_X}{p_i^s} - \gamma\frac{Nu_E' E_{X^*} X_i'^*}{\tau_i^* p_i^s (D_i' + M_i'^*)}$$

The first term is again the political support effect which reflects the impact of the lobby groups on the production policy. The second term is the terms-of-trade effect which captures the price-responsiveness of composite demand and takes on a positive (negative) value if the home country exports (imports) good i. The third term represents the local environmental effect and requires a tax to address the externality generated by home production. Finally, the forth term stands for the global environmental effect which implies an output subsidy leading to a lower world price, and thus a reduction in the global externality from reduced foreign production. Again, it is generally ambiguous whether the production policy is a tax or a subsidy.

In a normative analysis Krutilla (1989) has shown that in a large-country model the chosen output tax for a local production externality is higher than the standard Pigouvian tax if the country is an exporter because a production tax is also used to affect the terms of trade. A more general version of Krutilla's equilibrium tax is embedded in equation (11). The second term and the third term in equation (11) reflect the terms-of-trade and environmental tax components of Krutilla's production policy. Equation (11) further illustrates that when the impact of organized industries is taken into account the equilibrium production tax for an exporting country might even be lower than the Pigouvian tax, because the government uses a production subsidy to satisfy the lobby of industry i.

When the governments are restricted to trade policies the political equilibrium policy for the home country is

$$(12) \quad (\theta_i - 1) = -\frac{(I_{iL} - \alpha_L)}{(a + \alpha_L)} \frac{X_i}{p_i^w M_i'} + \frac{1}{\varepsilon_i^*} - \delta \frac{Nu_E' E_X X_i'}{p_i^w M_i'} + \gamma \frac{Nu_E' E_{X^*} X_i'^*}{p_i^w M_i'^*}.$$

When production in industry i does not cause an externality, the equilibrium trade policy contains political support and terms-of-trade effects. The political support effect is positive and represents an import tariff or an export subsidy when the industry is organized and an import tax or an export subsidy when the industry is not organized. As before, the terms-of-trade effect takes on the formula of the optimal tariff.

Without the externality, equation (12) is the same as in Grossman and Helpman (1995). Thus, the political equilibrium policies in Grossman and Helpman arise as a special case when trade policies are the only available policies.[65] For any given level of industry protection (that is for any given output price), production policy causes less costs than trade policy to the other lobbies and total welfare. Thus, support for the organized industries will be higher using production policy (or in combination with trade policy) than using trade policy only.

When production of the industry causes an externality, the third term in equation (12) is negative requiring an import subsidy or an export tax to address the domestic production externality. These policies lower the price home producers receive leading to reduced output and a lower level of externality. For a global externality equation (12) contains a fourth term, which is positive and requires an import tariff or an export subsidy to lower foreign production through a decrease in the world price.

[65] Dixit (1996) and Schleich and Orden (1996) establish a similar result for the small-country model: the structure of protection as derived by Grossman and Helpman (1994) does not hold, when production policies are also available.

In general, the sign of equation (12) is indeterminate. For example, when the industry is organized and import-competing, the political support, the terms-of-trade and the global environmental effects are all positive, calling for an import tariff, while the domestic environmental effect requires an import subsidy. When the industry is organized and the good is exported, terms-of-trade and home environmental effects request an export tax, while the political support and the global environmental effect imply an export subsidy.

Like in the small-country model, in the large-country model herein, it is also possible that trade policy alone leads to higher environmental quality than production policy alone. In the large country case, the terms-of-trade effect will be an additional determinant of whether trade policy alone or production policy alone lead to higher environmental quality. When the polluting industry is exporting, for the trade policy and the production policy, the terms-of-trade effects reinforce the (local) environmental effects since both effects require an export tax or an output tax, respectively. When the polluting industry is import competing the two effects oppose each other for the trade policy and the production policy. In this case, the terms-of-trade effect for the trade policy requires an import tariff while the environmental effect requires in import subsidy. For the production policy, the terms-of-trade effect requires an output subsidy while the environmental effect requires an output tax. Thus, since the relevant terms-of-trade effects for the trade policy in equation (12) and production policy in equation (11) are evaluated at different points, no general conclusion can be drawn as to whether the terms-of-trade effect increases or decreases the chances that trade policy alone will lead to higher environmental quality than production policy alone. However, when the foreign import demand elasticity is constant, or when the equilibrium imports under the production and the trade policy are identical, the terms-of-trade effect will increase (decrease) the chances that trade policy alone will lead to higher environmental quality than production policy alone when the good is exported (imported).[66]

4.3. Consumption Externality under Noncooperation

Suppose that home and possibly foreign consumption of a nonnumeraire generates a negative externality for residents in the home country. For simplicity assume that for each individual j, the externality is just $E = \sum_{\substack{k=1 \\ k \neq j}}^{N} c_{ek} + \gamma \sum_{k=1}^{N^*} c_{ek}^*$. For γ =0, the externality is local while for γ =1, the externality is global. When an individual decides on her level of consumption of a

[66] This result can be deduced by inspection of the terms-of-trade effects in equations (11) and (12). Unlike for the trade policy, the denominator of the term-of-trade effect for the production policy also includes the derivative of domestic demand, which is also negative. Thus, the absolute value of the terms-of-trade effect for the trade policy is unambiguously larger than the absolute value of the terms-of-trade effect for the production policy when the foreign import demand elasticity is constant, or when the equilibrium imports under the production and the trade policy are identical.

good e, she does not take into account the effects of her decision on any other individual's utility.[67] Consumers' preferences between countries may differ, but assume that preferences are identical within countries. Therefore the subscripts for consumers can be dropped. Thus, $E = (N-1)c_e + \gamma N^* c_e^*$, with $\frac{\partial E}{\partial c_e} = (N-1)$ and $\frac{\partial E}{\partial c_e^*} = \gamma N^*$.

When lobbies set their contribution schedules, they again take into account how the government's interventions affect their members' welfare through impacts on E.

The price equilibrium conditions for the supply and demand of good i are now $p_i^s = \theta_i p_i^w$ and $p_i^d = \tau_i \theta_i p_i^w$. The consumption and trade policies generate the net per-capita government transfer

$$(13) \quad r(\tau,\theta,\tau^*,\theta^*) = \frac{1}{N}\sum_{i=1}^{n} p_i^s(\tau_i - 1)D_i(p_i^d) + \frac{1}{N}\sum_{i=1}^{n} p_i^w(\theta_i - 1)[D_i(p_i^d) - X_i(p_i^s)].$$

Using the same approach as before, the first-order conditions for the equilibrium interventions in industry i lead to

$$(14a) \quad (\tau_i - 1) = -\frac{(I_{iL} - \alpha_L)}{(a+\alpha_L)} \frac{X_i}{p_i^w(\theta_i X_i' - \theta_i^* M_i'^*)} + \frac{M_i}{p_i^w(\theta_i X_i' - \theta_i^* M_i'^*)} + (\theta_i - 1)\frac{\theta_i^* M_i'^*}{\theta_i(\theta_i X_i' - \theta_i^* M_i'^*)} - \delta\frac{u_E'(N-1)}{p_i^s} - \gamma\frac{N u_E' D_i'^* \tau_i^* \theta_i^*}{p_i^s(\theta_i X_i' - \theta_i^* M_i'^*)}$$

$$(14b) \quad (\theta_i - 1) = -\frac{(I_{iL} - \alpha_L)}{(a+\alpha_L)} \frac{X_i}{p_i^w \tau_i M_i'} - \frac{M_i}{p_i^w \theta_i^* M_i'^*} - (\tau_i - 1)\frac{p_i^s X_i'}{\tau_i p_i^w M_i'} - \delta\frac{u_E'(N-1)\tau_i D_i'}{p_i^w M_i'} + \gamma\frac{N u_E' D_i'^* \tau_i^* \theta_i^*}{p_i^w \theta_i^* M_i'^*},$$

where now $M_i' = \tau_i D_i' - X_i' < 0$ and $M_i'^* = \tau_i^* D_i'^* - X_i'^* < 0$. Solving equations (14a,b) simultaneously gives implicit expressions for the home country's consumption and trade policies for industry i

$$(15a) \quad (\tau_i - 1) = -\frac{(I_{iL} - \alpha_L)}{(a+\alpha_L)} \frac{X_i}{p_i^s X_i'} - \delta\frac{u_E'(N-1)}{p_i^s}.$$

$$(15b) \quad (\theta_i - 1) = \frac{(I_{iL} - \alpha_L)}{(a+\alpha_L)} \frac{X_i}{p_i^w X_i'} + \frac{1}{\varepsilon_i^*} + \delta\frac{N u_E' D_i'^* \tau_i^*}{p_i^w M_i'^*}$$

[67] Assuming that N (N*) are sufficiently large justifies this assumption.

Equations (15a,b) together with their counterparts for the foreign interventions in industry i determine the political equilibrium levels for both countries' consumption and trade policies.

When consumption and trade policies are available to the government, the political equilibrium for each good involves the use of both policy interventions whether consumption of the good causes an externality or not.

When consumption of good i does not cause an externality, the equilibrium trade policy consists of two parts. The first term in equation (15b) is the political support effect which requires an import tariff or an export subsidy when the industry is organized and an import subsidy or an export tax when the industry is not organized. The second term is the terms-of-trade effect.

The first term in equation (15a) mirrors the political support effect from the trade policy equation with opposite sign. Thus, the consumption policy is used to offset the consumption distortions arising from that part of the trade policy that serves to satisfy the lobbies. However, due to terms-of-trade considerations, domestic consumer and world prices are not perfectly equalized.[68] Suppose, for a given commodity, the home country imposes an import tariff to protect its organized import-competing industry and the foreign country grants an export subsidy to its exporting industry. Then, home and foreign country will apply consumption subsidies to increase domestic consumption. Since the jointly uncooperatively applied consumption subsidies will increase the world price, producers in both countries are better off when the governments have consumption and trade policies available compared to the case where they only have trade policies at hand.[69]

When consumption of a good generates an externality, the second term in equation (15a) is positive. This environmental effect requires a consumption tax to capture the costs of an additional unit of consumption in the home country. Whether the political equilibrium consumption policy for good e is a subsidy or a tax depends on the signs and magnitudes of the political support and environmental effects.

[68] In a small country model domestic consumer prices will equal world prices when the government has domestic and trade policies available, and there is no externality (see Schleich and Orden, 1996).

[69] Given the choice between a tariff, a production and a consumption policy, any one policy can be substituted by a combination of the other two. Thus, using production and trade policies leads to the exact same outcomes as using consumption and trade policies.

For a global consumption externality, the political equilibrium trade policy contains a third term which is negative. This global environmental effect addresses the effect of foreign consumption on home consumers' welfare. The effect is negative and requires an import subsidy or an export tax to reduce consumption in the foreign country through an increase in the world price of good e. The absolute value of this global environmental effect increases with the home population size, with the sensitivity of home consumers toward the environment, and with the absolute value of the derivative of foreign demand. Protection for the home industry decreases with the absolute value of the derivative of foreign import demand. The latter captures the change in foreign consumer prices due to a change in the home trade policy. Again, the sign of equation (15a) is ambiguous.

When the government has both policies available, it uses the trade policy to address the lobbies, the terms of trade and the externality generated by consumption abroad. On the other hand, the consumption policy is applied to counterbalance the consumption distortions from the trade policy and to reduce the externality caused by domestic consumption.

When the governments have only consumption policies available, the political equilibrium policy for the home country is implicitly given by

$$(16)\quad (\tau_i - 1) = -\frac{(I_{iL} - \alpha_L)}{(a + \alpha_L)} \frac{X_i}{p_i^w (X_i' - M_i'^*)} + \frac{M_i}{p_i^w (X_i' - M_i'^*)} - \delta \frac{u_E'(N-1)}{p_i^s} - \gamma \frac{N u_E' D_i'^* \tau_i^*}{p_i^s (X_i' - M_i'^*)}$$

The political support effect requires a consumption subsidy if the industry is organized and a tax if it is not organized. In a large-country case, a consumption subsidy increases the world price of good i, and thus can be used to increase the price that domestic producers receive, benefiting organized interest groups and hurting consumers. The second term is the terms-of-trade effect. It captures the responsiveness of composite supply and takes on a positive (negative) value if the home country imports (exports) good e. The third term in equation (16) is the environmental effect, which requires a consumption tax to address the domestic consumption externality. The final term is directed at the externality generated by foreign consumption. It requires a consumption subsidy which leads to an increases in the world and foreign consumer prices. Whether the equilibrium consumption policy is a tax or a subsidy is ambiguous.

Krutilla (1989) has shown that in a large-country model the optimal environmental tax for a local consumption externality is higher than the standard Pigouvian tax if the country is an importer because a consumption tax is applied to improve the terms of trade. Equation (16) illustrates that this result need not hold in the political economy model: the political support effect requires a consumption subsidy that counterbalances the terms-of-trade and environmental effects.

The equilibrium interventions when the government is limited to the use of trade policy is implicitly given by

$$(17)\quad (\theta_i - 1) = -\frac{(I_{iL} - \alpha_L)}{(a + \alpha_L)} \frac{X_i}{p_i^w M_i'} - \frac{M_i}{p_i^w \theta_i^* M_i'^*} - \delta \frac{u_E'(N-1)D_i'}{p_i^w M_i'} + \gamma \frac{N u_E' D_i'^* \theta_i^*}{p_i^w \theta_i^* M_i'^*}.$$

The political support effect requires an import tariff or an export subsidy if industry i is organized. The terms-of-trade effect implies an import tariff or an export tax. To reduce the externality from domestic consumption, the third term requires an import tariff or an export subsidy. For a global consumption externality, the last term in equation (17) is negative and requires an import subsidy or an export tax, which increases the world price, and thus lead to a reduction in foreign consumption and a decrease in the global externality. Again, the sign of the equilibrium trade policy is generally ambiguous and depends on the signs and magnitudes of all four effects.

Similar to the small-country model, in the large country-model it is ambiguous whether consumption policy alone or trade policy alone lead to higher environmental quality. In the large-country model, the terms-of-trade effect will affect whether trade policy alone or consumption policy alone lead to higher environmental quality. When the good that causes the consumption externality is imported, for the trade policy and the consumption policy, the terms-of-trade effects reinforce the (local) environmental effects since both effects require an import tariff or a consumption tax, respectively. When the good that causes the consumption externality is exported, competing the two effects oppose each other for the trade policy and the consumption policy. In this case, the terms-of-trade effect for the trade policy requires an export tax while the environmental effect requires an export subsidy. For the consumption policy, the terms-of-trade effect requires a consumption subsidy while the environmental effect requires a consumption tax. Thus, since the relevant terms-of-trade effects for the consumption policy in equation (16) and trade policy in equation (17) are evaluated at different points, no general conclusion can be drawn as to whether the terms-of-trade effect increases or decreases the chances that trade policy alone will lead to higher environmental quality than consumption policy alone. However, like in the case for the production externality, when the foreign import demand elasticity is constant, or when the equilibrium imports under the consumption and the trade policy are identical, the terms-of-trade effect will increase (decrease) the chances that trade policy alone will lead to higher environmental quality than consumption policy alone when the good that causes the externality is imported (exported).

When governments set their domestic and trade policies noncooperatively, the home government can affect the externality generated by production or consumption in the foreign country only indirectly, through the terms of trade. The analysis for the noncooperative scenario shows that in this case, policies directed at the home and foreign part of the externality generally oppose each other.

4.4. Production Externality under Cooperation

In the previous scenario the structure of domestic and trade policies was derived when governments of two countries choose policies noncooperatively. The political equilibrium policies served the governments to satisfy organized domestic lobbies, to exploit international market power, and to address a local or global externality. In setting their policies noncooperatively, governments impose costs on each other. First, improving one country's terms of trade worsens the terms of trade of the other country. Second, in case of a global externality, the production or consumption decisions in one country will affect the utility derived from the environment in the other country. These international terms-of-trade and externality spillovers will be taken into account when governments set their policies cooperatively, unlike in the noncooperative case.

In this section it is assumed that domestic and trade policies arise as the outcomes of multilateral negotiations between the home and the foreign governments. Assuming that the governments' negotiations over domestic and/or trade instruments lead to Pareto-efficient outcomes for the governments' objectives, the structure of the selected policies will be characterized.[70]

The governments are assumed to negotiate simultaneously over domestic and trade policies and the lobbies make their contribution schedules contingent on the outcomes of the negotiations, that is on τ, τ^*, θ and θ^*. Efficiency requires that the home government could not be made better off without making the foreign government worse off. Hence, the policy vectors have to maximize the weighted sum

$$(18) \quad A^*G + AG^* = A^*[\textstyle\sum_{i\in L} C_i(\tau,\theta,\tau^*,\theta^*) + aW(\tau,\theta,\tau^*,\theta^*)] + A[\textstyle\sum_{i\in L^*} C_i^*(\tau,\theta,\tau^*,\theta^*) + a^*W^*(\tau,\theta,\tau^*,\theta^*)]$$

where G is the home government's share of the joint surplus, G* is the foreign country's share, $A = (\alpha_L + a)$ and $A^* = (\alpha_L^* + a^*)$.[71,72]

[70] A particular bargaining solution could be imposed to resolve the distribution of the surplus between the two governments from cooperation compared to noncooperation. Outcomes could be derived that would be equivalent to Grossman and Helpman (1995), who apply a modified version of the Rubinstein bargaining solution to characterize intergovernmental transfers.

[71] Multiplication by A* and A respectively is necessary to ensure that the home and foreign governments objectives are measured in the same units. Appendix A covers the more general case where an intergovernmental transfer is included.

[72] Since this paper is not concerned about how the joint surplus from cooperation is divided among the governments, transfer payments are neglected because they do not affect efficiency of the outcomes (see Appendix A).

In the first stage of the game, home and foreign lobbies set their contribution schedules noncooperatively, and in the second stage, the home and foreign governments negotiate simultaneously over production and trade policies. The necessary conditions for the cooperative outcome are not explicitly given, since they are a straightforward extension of the noncooperative scenario[73]. Assuming that the contribution schedules are differentiable around the (interior) equilibrium point, the policies in the cooperative equilibrium must satisfy

$$(19)\quad \begin{aligned} &A^{*}\left(\sum_{i\in L}\nabla_{\beta}W_{i}(\tau,\theta,\tau^{*},\theta^{*}) + a\nabla_{\beta}W(\tau,\theta,\tau^{*},\theta^{*})\right) + \\ &A\left(\sum_{i\in L^{*}}\nabla_{\beta}W_{i}^{*}(\tau^{*},\theta^{*},\tau,\theta) + a^{*}\nabla_{\beta}W^{*}(\tau^{*},\theta^{*},\tau,\theta)\right) = 0, \end{aligned}$$

where now $\beta = \tau, \tau^{*}, \theta, \theta^{*}$.

First consider the case, where the production of a good might generate an externality and the governments negotiate simultaneously over production and trade policies. From the first order condition (19) the home and foreign production policies for industry i (see Appendix A) are

$$\begin{aligned} (20a)\quad (\tau_i - 1) = &-\frac{(I_{iL} - \alpha_L)}{(a+\alpha_L)}\frac{X_i}{p_i^s X_i'} - \frac{(I_{iL^*}^{*} - \alpha_L^{*})}{(a^{*}+\alpha_L^{*})}\frac{X_i^{*}\,\theta_i^{*}/\tau_i^{*}}{p_i^s(\theta_i D_i' + \theta_i^{*} M_i'^{*})} \\ &-(\tau_i^{*} - 1)\frac{p_i^w X_i'^{*}\,\theta_i^{*2}/\tau_i^{*2}}{p_i^s(\theta_i D_i' + \theta_i^{*} M_i'^{*})} \\ &+[(\theta_i - 1) - (\theta_i^{*} - 1)][\frac{p_i^w \theta_i^{*} M_i'^{*}}{p_i^s(\theta_i D_i' + \theta_i^{*} M_i'^{*})}] \\ &-\delta\frac{Nu_E' E_X}{p_i^s} - \gamma\frac{N^{*}u_E'^{*}E_{X^*}X_i'^{*}\,\theta_i^{*}/\tau_i^{*}}{p_i^s(\theta_i D_i' + \theta_i^{*} M_i'^{*})} \\ &-\gamma\frac{N^{*}u_E'^{*}E_X}{p_i^s} - \gamma\frac{Nu_E' E_{X^*}X_i'^{*}\,\theta_i^{*}/\tau_i^{*}}{p_i^s(\theta_i D_i' + \theta_i^{*} M_i'^{*})}] \end{aligned}$$

[73] See Grossman and Helpman (1995, pp. 696) for details.

$$(20b)\quad (\tau_i^* - 1) = -\frac{(I_{iL*}^* - \alpha_L^*)}{(a^* + \alpha_L^*)}\frac{X_i^*}{p_i^{s*} X_i'^*} - \frac{(I_{iL} - \alpha_L)}{(a + \alpha_L)}\frac{X_i'^{\theta_i}/\tau_i}{p_i^{s*}(\theta_i^* D_i'^* + \theta_i M_i')}$$
$$-(\tau_i - 1)\frac{p_i^w X_i'^{\theta_i^2}/\tau_i^2}{p_i^{s*}(\theta_i^* D_i'^* + \theta_i M_i')}$$
$$+[(\theta_i^* - 1) - (\theta_i - 1)][\frac{p_i^w \theta_i M_i'}{p_i^{s*}(\theta_i^* D_i'^* + \theta_i M_i')}]$$
$$-\delta\frac{N^* u_E'^* E_{X*}}{p_i^{s*}} - \gamma\frac{N u_E' E_X X_i'^{\theta_i}/\tau_i}{p_i^{s*}(\theta_i^* D_i'^* + \theta_i M_i')}$$
$$-\delta\frac{N u_E' E_{X*}}{p_i^{s*}} - \gamma\frac{N^* u_E'^* E_X X_i'^{\theta_i}/\tau_i}{p_i^{s*}(\theta_i^* D_i'^* + \theta_i M_i')}$$

where $M_i' = D_i' - X_i'/\tau_i$ and $M_i'^* = D_i'^* - X_i'^*/\tau_i^*$.

As Grossman and Helpman (1995, p. 698) point out, the first order conditions for the home and foreign trade instrument are linearly dependent. Domestic prices are homogenous of degree zero in θ and θ*, so the allocation of resources in the two countries and the joint welfare of the governments depend on the ratio of the trade policies only, not on their respective levels. The first order condition for the home (or the foreign) trade policy leads to

$$(21)\quad (\theta_i - 1) - (\theta_i^* - 1) = -\frac{(I_{iL} - \alpha_L)}{(a + \alpha_L)}\frac{X_i}{p_i^w \tau_i M_i'} + \frac{(I_{iL}^* - \alpha_L^*)}{(a^* + \alpha_L^*)}\frac{X_i^*}{p_i^w \tau_i^* M_i'^*}$$
$$-(\tau_i - 1)\frac{p_i^s X_i'}{p_i^w \tau_i M_i'} + (\tau_i^* - 1)\frac{p_i^{s*} X_i'^*}{p_i^w \tau_i^* M_i'^*}$$
$$-\delta\frac{N u_E' E_X X_i'}{p_i^w \tau_i M_i'} + \frac{N^* u_E'^* E_{X*} X_i'^*}{p_i^w \tau_i^* M_i'^*}$$
$$-\delta\frac{N^* u_E'^* E_X X_i'}{p_i^w \tau_i M_i'} + \gamma\frac{N u_E' E_{X*} X_i'^*}{p_i^w \tau_i^* M_i'^*}$$

Equations (20a,b) and (21) determine the home and foreign country's productions policies and the difference between their trade policies, $(\theta_i - 1) - (\theta_i^* - 1)$. Substituting this difference into the expressions for the production policies (20a) and (20b) and collecting terms yields implicit expressions for the home and foreign country's production policy (see Appendix A)

$$(22a)\quad (\tau_i - 1) = -\frac{(I_{iL} - \alpha_L)}{(a + \alpha_L)}\frac{X_i}{p_i^s X_i'} - \delta\frac{N u_E' E_X}{p_i^s} - \gamma\frac{N^* u_E'^* E_X}{p_i^s}.$$

$$(22b) \quad (\tau_i^* - 1) = -\frac{(I_{iL*}^* - \alpha_L^*)}{(a^* + \alpha_L^*)} \frac{X_i^*}{p_i^{s*} X_i'^*} - \delta \frac{N^* u_E'^* E_{X*}}{p_i^{s*}} - \gamma \frac{N u_E' E_{X*}}{p_i^{s*}}.$$

The political equilibrium production policies only contain political support effects, when there is no global externality and the governments cooperate on production and trade policies. While in this case, the noncooperative production policies in equations (22a,b) have the same structure as the noncooperative production policies in equations (10a,b), the policy levels generally differ since the expressions are evaluated at different points.

For a global externality, an additional global environmental effect addresses the costs of an extra unit of output on the other country's residents and requires an output tax.

Substituting equations (22a,b) into equation (21), yields an implicit expression for the difference or ratio of the trade policies

$$(23) \quad (\theta_i - 1) - (\theta_i^* - 1) = 0.$$

Equation (23) suggests that in the cooperative political equilibrium the governments apply their trade policies at the same rate. Since the domestic consumer and producer prices are homogenous of degree zero in both trade policies, equation (23) implies that the allocation of resources in the two countries is the same as under free trade.[74]

Unlike in the noncooperative scenario, expressions reflecting terms-of-trade considerations do not appear in the expressions for the cooperative equilibrium policies. When governments negotiate over production and trade policies they use production policy to address organized lobbies, local and global externalities. In the noncooperative scenario, production

[74] The levels of the trade policies, however, will affect the division of the surplus from cooperation. Suppose the home country doubles its import tariffs and the foreign country doubles its export subsidies. Since the world (offshore) price is homogenous of degree -1 in θ_i and θ_i^*, doubling both policies will decrease the world price of good i by 50 percent. Such a policy change leaves domestic resource allocations the same, but the two governments are affected asymmetrically. The home country's tariff revenue doubles while the foreign government now has to double its subsidy payments. Since changes in governments' payments exactly offset each other, an equiproportionate change in their trade policies is equivalent to a direct transfer from one country (here foreign) to the other country (here home). Thus the actual trade policy levels would have to be determined through a specific bargaining procedure like in Grossman and Helpman (1995) and the levels of the trade policies depend on the relative bargaining power of the countries.

policy is only directed at the lobbies and a local externality while the trade policy is used to exploit international market power and to address a global externality.[75]

Since the governments use production policies to satisfy their organized polluting industries, environmental quality will be lower than under a socially optimal cooperative tax, independent of whether the good is exported or imported, provided that the marginal disutility from the externality does not decrease too fast in the output price.[76]

Next, the determinants of levels and differences in industry protection across countries–as measured by domestic output prices will be analyzed.[77] When there is no externality, the industry with the higher political support effect is granted the higher output price. Thus politically powerful industries in both countries are granted high levels of protection. However, since production policies also affect the terms of trade, protection for the home industry is not independent of the political power of its foreign counterpart. An industry suffers from the political strength of the same industry abroad, because higher production subsidies lead to a lower world price.

If there is an externality, the output prices will be lowered by the environmental effects. For a local externality, industry protection will be lowered more in the country with the higher population, the higher sensitivity toward the environment and the--at the margin--more pollutive industry. When the externality is global, the sum of the environmental effects is the same for the home and foreign production policies, and the only difference in output prices arises from different political support effects.

When governments have only production policies available the cooperative outcomes are the same as in equations (22a,b). Thus, the structure of the political equilibrium policies is the same, whether negotiations take place over trade policies and production policies together or only over production policies. The levels however, are generally different, since the chosen trade policies will differ between the noncooperative and cooperative scenarios. In this model, when only production policies are available, or when production and trade policies are available, the cooperative outcomes will be the same.

[75] To draw conclusions whether industries are better off under cooperation compared to noncooperation, more specific assumptions about the demand and supply functions are necessary, since the equilibrium policies can only be given implicitly. For example, it can be shown that for constant supply and demand elasticities and when in the noncooperative equilibrium, the importing country's import demand is less elastic than the exporting country's import demand, cooperation leads to higher output prices for exporting industries than noncooperation (Appendix C provides a proof of this proposition). Thus rather restrictive assumptions have to be made to show even intuitively appealing results.

[76] For a proof see the small-country model in chapter 3.

[77] Equivalently environmental protection could be considered. Because of the way the production externality is modelled, higher industry protection automatically means lower environmental protection and vice versa.

When the governments have only trade policies available, the ratio of home and foreign trade polices is implicitly given by

$$
\begin{aligned}
(\theta_i - 1) - (\theta_i^* - 1) = -[&\frac{(I_{iL} - \alpha_L)}{(a + \alpha_L)} \frac{X_i}{p_i^w M_i'} - \frac{(I_{iL}^* - \alpha_L^*)}{(a^* + \alpha_L^*)} \frac{X_i^*}{p_i^w M_i'^*}] \\
&- \delta[\frac{N u_E' E_X X_i'}{p_i^w M_i'} - \frac{N^* u_E'^* E_{X*} X_i'^*}{p_i^w M_i'^*}] \\
&- \gamma[\frac{N^* u_E'^* E_X X_i'}{p_i^w M_i'} - \frac{N u_E' E_{X*} X_i'^*}{p_i^w M_i'^*}].
\end{aligned} \tag{24}
$$

Without the externality, the cooperative outcome in equation (24) is just the result of Grossman and Helpman's (1995) trade talks scenario, which again arises as a special case where governments only have trade policies available. In this case, industry protection depends on the difference in the political strength of the home versus the foreign industry. The politically more powerful industry enjoys more protection. Thus, when only trade policies are available, only the politically stronger industry is better off relative to free trade. This implication is in stark contrast to the findings when governments negotiate over production and trade policies.

When production in both counties generates an externality, the terms in the second row of equation (24) illustrate that--ceteris paribus--the home industry is better off when the home local environmental effect is small compared to the foreign environmental effect, and vice versa. Thus, relative protection for the home industry increases--ceteris paribus--with the foreign versus the home country's population size, with the sensitivity of the foreign versus the home country's residents towards the externality, with the price derivative of the foreign versus the home output supply, and when the home industry is at the margin less pollutive than the foreign. On the other hand, relative protection for the home industry does not necessarily increase with the absolute value of the price derivative of the home country's versus the foreign country's import demand. Both political support and environmental effect are decreasing in $\left|M_i'\right|$ reflecting the deadweight loss associated with trade policies. Since these effects are of opposite signs, the overall impact of $\left|M_i'\right|$ on industry protection or environmental quality is ambiguous.

When the production of good i generates a global externality, equation (24) becomes

$$
\begin{aligned}
(\theta_i - 1) - (\theta_i^* - 1) = -\ &[\frac{(I_{iL} - \alpha_L)}{(a + \alpha_L)} \frac{X_i}{p_i^w M_i'} - \frac{(I_{iL}^* - \alpha_L^*)}{(a^* + \alpha_L^*)} \frac{X_i^*}{p_i^w M_i'^*}] \\
&- (N u_E' + N^* u_E'^*)[\frac{E_X X_i'}{p_i^w M_i'} - \frac{E_{X*} X_i'^*}{p_i^w M_i'^*}].
\end{aligned} \tag{25}
$$

Equation (25) demonstrates that differences in population size or environmental sensitivity across countries does not affect relative protection for the industries. Apart from differences in the political support effects, the home industry enjoys relatively higher protection with the price derivative of foreign versus home output supply, with the absolute value of the price derivative of the home versus foreign import demand, and when the home industry is less pollutive than the foreign industry.

4.5. Consumption Externality under Cooperation

Suppose the consumption of a good causes an externality and the governments negotiate simultaneously over consumption and trade policies. The first order conditions for the home and foreign countries' consumption and trade policies lead to (see Appendix B)

$$(26a)\quad (\tau_i - 1) = -\frac{(I_{iL} - \alpha_L)}{(a + \alpha_L)} \frac{X_i}{p_i^w(\theta_i X_i' - \theta_i^* M_i'^*)} - \frac{(I_{iL*}^* - \alpha_L^*)}{(a^* + \alpha_L^*)} \frac{\theta_i^* X_i^*}{p_i^w \theta_i (\theta_i X_i' - \theta_i^* M_i'^*)}$$
$$-(\tau_i^* - 1)\frac{\tau_i^* \theta_i^{*2} D_i'^*}{\theta_i(\theta_i X_i' - \theta_i^* M_i'^*)} + [(\theta_i - 1) - (\theta_i^* - 1)][\frac{\theta_i^* M_i'^*}{\theta_i(\theta_i X_i' - \theta_i^* M_i'^*)}]$$
$$-\delta[\frac{u_E'(N-1)}{p_i^w \theta_i} + \frac{u_E'^*(N^*-1)D_i'^* \tau_i^* \theta_i^*}{p_i^w \theta_i(\theta_i X_i' - \theta_i^* M_i'^*)}]$$
$$-\gamma\{\frac{u_E'^* N^*}{p_i^w \theta_i} + \frac{N u_E' D_i'^* \tau_i^* \theta_i^*}{p_i^w \theta_i(\theta_i X_i' - \theta_i^* M_i'^*)}\}$$

$$(26b)\quad (\tau_i^* - 1) = -\frac{(I_{iL*}^* - \alpha_L^*)}{(a^* + \alpha_L^*)} \frac{X_i^*}{p_i^w(\theta_i^* X_i'^* - \theta_i M_i')} - \frac{(I_{iL} - \alpha_L)}{(a + \alpha_L)} \frac{\theta_i X_i}{p_i^w \theta_i^* (\theta_i^* X_i'^* - \theta_i M_i')}$$
$$-(\tau_i - 1)\frac{\tau_i \theta_i^2 D_i'}{\theta_i^*(\theta_i^* X_i'^* - \theta_i M_i')} + [(\theta_i^* - 1) - (\theta_i - 1)][\frac{\theta_i M_i'}{\theta_i^*(\theta_i^* X_i'^* - \theta_i M_i')}]$$
$$-\delta[\frac{u_E'^*(N^*-1)}{p_i^w \theta_i^*} + \frac{u_E'(N-1)D_i' \tau_i \theta_i}{p_i^w \theta_i^*(\theta_i^* X_i'^* - \theta_i M_i')}]$$
$$-\gamma[\frac{u_E' N}{p_i^w \theta_i^*} + \frac{N^* u_E'^* D_i' \tau_i \theta_i}{p_i^w \theta_i^*(\theta_i^* X_i'^* - \theta_i M_i')}],$$

and

$$
\begin{aligned}
(\theta_i - 1) - (\theta_i^* - 1) = & -\frac{(I_{iL} - \alpha_L)}{(a + \alpha_L)} \frac{X_i}{p_i^w M_i'} + \frac{(I_{iL}^* - \alpha_L^*)}{(a^* + \alpha_L^*)} \frac{X_i^*}{p_i^w M_i'^*} \\
& -(\tau_i - 1) \frac{p_i^d D_i'}{p_i^w M_i'} + (\tau_i^* - 1) \frac{p_i^{d*} D_i'^*}{p_i^w M_i'^*} \\
& -\delta \left[\frac{u_E'(N - 1) D_i' \tau_i}{p_i^w M_i'} - \frac{u_E'^*(N^* - 1) D_i'^* \tau_i^*}{p_i^w M_i'^*} \right] \\
& -\gamma \left[\frac{u_E'^* N^* D_i' \tau_i}{p_i^w M_i'} - \frac{u_E' N D_i'^* \tau_i^*}{p_i^w M_i'^*} \right],
\end{aligned} \tag{27}
$$

where now $M_i' = \tau_i D_i' - X_i'$ and $M_i'^* = \tau_i^* D_i'^* - X_i'^*$. From equations (26a,b) and (27) the political equilibrium consumption policies can implicitly be derived from the following equations

$$
(\tau_i - 1) = -\frac{(I_{iL} - \alpha_L)}{(a + \alpha_L)} \frac{X_i}{p_i^s X_i'} - \delta \frac{u_E'(N - 1)}{p_i^s} - \gamma \frac{u_E'^* N^*}{p_i^s}. \tag{28a}
$$

$$
(\tau_i^* - 1) = -\frac{(I_{iL*}^* - \alpha_L^*)}{(a^* + \alpha_L^*)} \frac{X_i^*}{p_i^{s*} X_i'^*} - \delta \frac{u_E'^*(N^* - 1)}{p_i^{s*}} - \gamma \frac{u_E' N}{p_i^{s*}}. \tag{28b}
$$

When the consumption of good i causes no global externality, the consumption policies under cooperation have the same structure as under noncooperation. The levels, however, are generally different. For a global consumption externality, the third term on the RHS in equation (28a) requires a consumption tax to account for the negative externality home consumption imposes on foreign residents.

The difference in the political equilibrium trade policies under cooperation is a function of the difference in the political support effects

$$
(\theta_i - 1) - (\theta_i^* - 1) = \frac{(I_{iL} - \alpha_L)}{(a + \alpha_L)} \frac{X_i}{p_i^w X_i'} - \frac{(I_{iL*}^* - \alpha_L^*)}{(a^* + \alpha_L^*)} \frac{X_i^*}{p_i^{w*} X_i'^*}. \tag{29}
$$

Again, no terms-of-trade effect appears in the expressions for the cooperative policies since the governments do not impose costs on each other from exploiting international market power.[78,79]

[78] For a consumption externality, high industry protection implies high environmental protection.

[79] Similar to the noncooperative scenario, resource allocations in the cooperative scenario are the same, whether governments have production and trade policies, or consumption and trade policies available. World prices however, are generally not the same. When production and trade polices are available, world price distortions depend only on the relative bargaining power of the home and foreign government. When consumption and trade policies are used, the extend to which world prices are distorted also depends on the relative impacts of lobby groups in the same industry across countries.

However, equation (29) implies that the domestic resource allocations differ from free-trade allocations to the extend that there are differences in the political support effects across countries.

Equations (28a,b) and (29) illustrate how the governments use trade policies to satisfy organized interest groups and rely on consumption policies to offset the distortionary impact of trade policy on consumption. Since in the cooperative political equilibrium there is no role for terms-of-trade considerations, the consumption policies exactly offset the impact of the trade policies on domestic consumer prices. When there is a local or global externality, consumer prices in both countries are the same as under socially optimal Pigouvian taxes. Thus, from a normative point of view, when the governments have consumption and trade policies (or equivalently production and trade policies) available, lobbies' activities only lead to distortions on the production side, that is too much is produced in the country whose industry has more political power.

When the countries have only consumption policies available, the cooperative outcomes are implicitly given by

$$(30a)\quad (\tau_i - 1) = -[\frac{(I_{iL} - \alpha_L)X_i}{(a + \alpha_L)} + \frac{(I^*_{iL^*} - \alpha^*_L)X^*_i}{(a^* + \alpha^*_L)}]\frac{1}{p^w_i(X'_i + X'^*_i)} - \delta\frac{u'_E(N-1)}{p^w_i} - \gamma\frac{u'^*_E N^*}{p^w_i}$$

and

$$(30b)\quad (\tau^*_i - 1) = -[\frac{(I_{iL} - \alpha_L)X_i}{(a + \alpha_L)} + \frac{(I^*_{iL^*} - \alpha^*_L)X^*_i}{(a^* + \alpha^*_L)}]\frac{1}{p^w_i(X'_i + X'^*_i)} - \delta\frac{u'^*_E(N^*-1)}{p^w_i} - \gamma\frac{u'_E N}{p^w_i}.$$

Equations (30a,b) illustrate that, when there is no externality or when the externality is global, the home and foreign countries' consumption policies are identical (assuming N and N* are large, that is N-1 ≈ N). The sum of the political support effects, which is negative, requires that both governments subsidize consumption to drive up the world price and thus domestic producer prices. When there are local or global externalities these subsidies are counterbalanced by consumption taxes.

When only consumption policies are available, protection for the home industry increases with the political power of the foreign industry, independent of whether a consumption externality exists or not. Home and foreign industries are no longer rivals, and protection for the same industry across countries is the same.[80] Thus, when only consumption policies are available and the terms-of-trade effect for the noncooperative outcomes is sufficiently small, cooperation will lead to higher protection for both industries than noncooperation, because, each government takes into account the effects of its own consumption policy on the other government's objective function.

Since the governments use consumption policies to please the lobbies in both countries, the equilibrium consumption externality will be higher than the socially optimal cooperative tax provided the marginal disutility from the externality does not decrease too fast in the consumption price, independent of whether the good is exported or imported.

When the countries have only trade policies available, the difference of home and foreign trade policies is implicitly given by

$$
\begin{aligned}
(\theta_i - 1) - (\theta_i^* - 1) = & -\frac{(I_{iL} - \alpha_L)}{(a + \alpha_L)} \frac{X_i}{p_i^w M_i'} + \frac{(I_{iL}^* - \alpha_L^*)}{(a^* + \alpha_L^*)} \frac{X_i^*}{p_i^w M_i'^*} \\
& - \delta\left[\frac{u_E'(N-1)D_i'}{p_i^w M_i'} - \frac{u_E'^*(N^*-1)D_i'^*}{p_i^w M_i'^*}\right] \\
& - \gamma\left[\frac{u_E'^* N^* D_i'}{p_i^w M_i'} - \frac{u_E' N D_i'^*}{p_i^w M_i'^*}\right].
\end{aligned} \tag{31}
$$

When the consumption of good i does not cause an externality, the result is again the Grossman-Helpman (1995) outcome, which has already been described earlier.

When the externality is local, relative protection for the home industry (or protection for the home environment) increases with the size of its political support effect relative to that of its foreign counterpart, with home versus foreign population size, with home versus foreign consumers' environmental sensitivity, and with the price derivative of home versus foreign demand. Relative protection for the home industry decreases with the absolute value of the price derivative of home versus foreign import demand, reflecting differences in deadweight losses across countries due to the trade policies.

[80] This differs from the cooperative outcome when governments have only production policies (or consumption and trade policies) available. In that case, a production subsidy that benefits domestic organized industries hurts the industry abroad through a decrease in the offshore price.

To analyze the determinants of differences in industry protection across countries when the externality is global and the population in both countries is sufficiently large, that is N-1≈N, equation (31) can be written as

$$(\theta_i - 1) - (\theta_i^* - 1) = -\frac{(I_{iL} - \alpha_L)}{(a + \alpha_L)} \frac{X_i}{p_i^w M_i'} + \frac{(I_{iL}^* - \alpha_L^*)}{(a^* + \alpha_L^*)} \frac{X_i^*}{p_i^w M_i'^*} \tag{32}$$
$$-(u_E' N + u_E'^* N^*)\left(\frac{D_i'}{p_i^w M_i'} - \frac{D_i'^*}{p_i^w M_i'^*}\right)$$

Equation (32) illustrates that, similar to a global production externality, differences in population size or environmental sensitivity across countries do not affect relative industry protection when the consumption externality is global. Except for differences in the political support effects, relative protection for the home industry increases with the absolute value of the price derivative of the home demand versus foreign demand, and decreases with the absolute value of the price derivative of home versus foreign import demand.

Comparing the cooperative and noncooperative scenarios, several differences are worth noting. Not surprisingly, cooperating governments no longer use their policies to manipulate the terms of trade for optimal-tariff reasons. In the noncooperative scenario, protection for an industry depends only indirectly on the political power of the industry abroad. That is, the political strength of the foreign industry affects the home industry's profits only through their impact on the world price. Further, the governments can use the available policies directly to satisfy the lobbies. In the cooperative scenario this is not necessarily the case. When only trade policies are available, protection for an industry depends on its own political power vis a vis the political power of its rival industry abroad. When externalities exist, protection for the home industry also depends directly on the signs and magnitudes of home versus foreign environmental effects. On the other hand, when only consumption policies are available, home and foreign industries are no longer rivals. As equations (30a,b) illustrate, protection for the home industry increases with the political power of the foreign industry, independent of whether a consumption externality exists or not. Thus, when only consumption policies are available and the terms-of-trade effect is sufficiently small, cooperation will lead to higher protection for both industries than noncooperation, because, each government takes into account the effects of its own consumption policy on the other government's objective function.

When production policy or consumption policy together with trade policy are available, protection of the home industry is not directly affected by the foreign industry's political power. Even in the cooperative scenario, each government can satisfy its own lobby without conceding to the political power of the industry abroad.

While in the noncooperative scenario, socially optimal taxes are generally not the equilibrium outcomes for either a production or a consumption externality, in the cooperative scenario socially taxes will be the outcome for a local or a global consumption externality when domestic and trade policies are available to the governments.

Further, when cooperating countries have domestic policies or domestic and trade policies available and the externality is global, the environmental effects no longer oppose but rather reinforce each. Only when trade policies are the sole policies available, will the environmental effects for the two countries require conflicting policies. First consider the case of a production externality. To reduce the externality caused by domestic production, a government imposes an import subsidy or an export tax. But to decrease the externality generated in the other country, an import tax or an export subsidy is required to lower the world price, and hence foreign production. To address an externality generated by domestic consumption, each government applies an import tariff or an export subsidy. But to reduce consumption abroad, governments apply import subsidies or export taxes that raise the world price and thus the price consumers have to pay abroad. Hence, since trade policies can affect the other country's policies only through a change in the world price, a policy that decreases the domestically generated externality, automatically increases the externality generated abroad.

4.6. Conclusions

This paper characterizes the structure of endogenous industry and environmental protection when production or consumption externalities exist, and when governments noncooperatively or cooperatively decide on domestic and trade policies. The political equilibrium policies are expressed as the sum of distinct political support, terms-of-trade, and local and global environmental effects. Whether these effects reinforce or counterbalance each other generally depends on whether the externality is caused by production or consumption, whether governments cooperate, whether the industry is organized, and whether the good is imported or exported. In extending the original Grossman-Helpman model to consider domestic together with trade policies it is shown that the results of Grossman and Helpman (1995) for the noncooperative and the cooperative scenarios arise as special cases when governments have only trade policies available. Also, allowing for production or consumption and trade policies yields more realistic predictions for the cooperative scenario than Grossman and Helpman: politically powerful industries will enjoy high levels of support in both countries. In this case, a production subsidy that benefits domestic organized industries hurts the industry abroad only indirectly through a decrease in the offshore price. When only consumption policies are available under cooperation, home and foreign industries are no longer rivals since protection for the home industry increases with the political power of the foreign industry. Both industries benefit from consumption subsidies that increase the offshore price of the good and industry support across countries will be the same.

From an environmental standpoint, the results for a local or a global consumption externality indicate the importance of allowing negotiations over domestic *and* trade policies. Because organized industries lobby for industry protection, negotiations over one instrument only fail to provide the socially optimal level of the consumption externality. When domestic and trade policies are available environmental quality will be socially optimal. Thus, political competition leads to the complete internalization of a local or global consumption externality. However, this does not imply overall allocative efficiency, since too much is produced in the country with the politically stronger industry. By contrast, for a local or a global production externality, the cooperative outcomes generally yield a level of environmental quality that is lower than socially optimal.

It is further shown that for a global production or consumption externality, when governments have only trade policies available, in the cooperative scenario, differences in industry protection across countries is only due to differences in the political strength of the lobbies, and--in contrast to the noncooperative scenario--not due to differences in population size or environmental sensitivity. It is also demonstrated that, when countries have only consumption policy available, the cooperative policy outcomes for a global consumption externality are identical across countries.

The findings for the noncooperative scenario indicate that, unlike in a normative model, the endogenously chosen output tax for a local production externality might be lower than the standard Pigouvian tax if the country is an exporter because the production policy is also used to target the lobbies. Similarly, for a local consumption externality, the consumption tax in the political equilibrium might be lower than the standard Pigouvian tax if the good is imported because the government uses a consumption subsidy to address the lobbies.

Finally, it is argued that in the small-country or large-country model, trade policy alone can lead to higher environmental quality than a more direct domestic policy. Whether this is the case in the large-country model depends in part on the terms-of trade-effect. The terms-of-trade effects for the domestic and the trade policy either both reinforce the environmental effects or both oppose the environmental effects. Since the relevant terms-of-trade effects for the trade policy and the domestic policy are evaluated at different points, no general conclusion can be drawn as to whether the terms-of-trade effect increases or decreases the chances that trade policy alone will lead to higher environmental quality than domestic policy alone. However, when the foreign import demand elasticity is constant, or when the equilibrium imports under the domestic and the trade policy are identical, the question can be answered. For a production externality, the terms-of-trade effect will increase (decrease) the chances that trade policy alone will lead to higher environmental quality than production policy alone when the good is exported (imported). For a consumption externality, the terms-of-trade effect will increase (decrease) the chances that trade policy alone will lead to higher environmental quality than consumption policy alone when the good is imported (exported).

In evaluating the results in this paper, the Grossman-Helpman model and its extensions herein may appear restrictive because of the underlying assumptions about production and preferences. However, the basic conclusions drawn about the political equilibrium choice of policies will hold for less restrictive specifications of supply and demand behavior. The assumed structures facilitate the derivation of implicit expressions for the equilibrium interventions, but comparable results can be derived for given parameterizations of more general functional forms. Since the equilibrium policies can only be determined implicitly for the general specification, it cannot be concluded whether cooperation leads to more or less industry protection than noncooperation. Similarly, it cannot be inferred whether cooperation or noncooperation leads to higher environmental quality without further specifications. However, for specific functional forms, the political support effects, which will generally differ between noncooperation and cooperation, can be evaluated. Hence, using particular specifications, the "political economy" impact of whether trade negotiations lead to higher or lower environmental quality could be assessed.

The structure of the models developed herein is flexible enough to accommodate a variety of modifications to provide further insight into the little-explored political economy of trade and environmental policies. For example, the production externality can be generated by an input instead of an output, and the set of available policies can include input taxes and subsidies. Alternatively, organized environmental groups making contributions to the government can compete with organized industries for environmental protection versus higher profits. After all, representatives of four leading environmental organizations participated in the Advisory Committee for Trade Policy and Negotiations for NAFTA.[81] The political equilibrium policies under this latter scenario will reflect environmental concerns through the impact of the environmental groups. Of course, adding organized environmental groups to the present model, would lead to higher environmental protection but the main structure the results derived in this paper would not be altered.

In another dimension, political equilibrium policies could be analyzed in an extensive form game, where--instead of setting domestic and trade policies simultaneously--one policy is chosen before the other. While the outcome would depend on the order in which policies are chosen, this extension would produce further insight into the strategic aspects between domestic environmental and trade policies.

[81] These environmental groups are the Audubon Society, the National Wildlife Federation, the National Resources Defense Council, and the World Wildlife Fund.

4.7. References

Aidt, Toke (1997a). "Political Internalization of Economic Externalities. The Case of Environmental Policy in a Politico-Economic Model with Lobby Groups." University of Aarhus Working Paper.

Aidt, Toke (1997b). "Political Internalization of Economic Externalities and Environmental Policy." University of Aarhus Working Paper.

Bernheim, Douglas. B. and Whinston, Michael D. (1986). "Menu Auctions, Resource Allocation, and Economic Influence." *Quarterly Journal of Economics* 101, pp. 1-31.

Bommer, Rolf (1996). "Environmental Regulation of Production Processes in the European Union: A Political-Economy Approach." *Aussenwirtschaft* 51, pp. 559-582.

Bommer, Rolf and Schulze, Guenther G. (1996). "Economic Integration and Environmental Policy: Does NAFTA Increase Pollution ?" University of Konstanz Working Paper.

Bhagwati, Jagdish, N. (1971). "The Generalized Theory of Distortions and Welfare." In *Trade. Balance of Payments and Growth: Papers in International Economics in Honor of Charles P. Kindleberger,* edited by Jagdish N. Bhagwati, Ronald W. Jones, Robert A. Mundell and Jaroslav Vanek. Amsterdam: North-Holland.

Dixit, Avinash K. (1996). "Special Interest Lobbying and Endogenous Commodity Taxation." *Eastern Economic Journal* 22, pp. 375-388.

Dixit, Avinash K., Grossman, Gene M., and Helpman, Elhanan (1997). "Common Agency and Coordination: General Theory and Application to Tax Policy." *Journal of Political Economy*, forthcoming.

Esty, Daniel C., "Making Trade and Environmental Policies Work Together: Lessons from NAFTA." *Aussenwirtschaft* 49, pp. 59-79.

Fredriksson, Per G. (1997). "The Political Economy of Pollution Taxes in a Small Open Economy." *Journal of Environmental Economics and Management,* forthcoming.

Grossman, Gene M., and Helpman, Elhanan. (1994). "Protection for Sale." *American Economic Review* 84, pp. 675-708.

Grossman, Gene M., and Helpman, Elhanan. (1995). "Trade Wars and Trade Talks." *Journal of Political Economy* 103, pp. 675-708.

Hillman, Ayre L. (1989). *The Political Economy of Protection*. Chur: Harwood Academic Publishers.

Hillman, Ayre L., and Moser, Peter (1995). "Trade Liberalization as Politically Optimal Exchange of Market Access." in *The New Transatlantic Economy* edited by Matthew Canconieri et al. Cambridge: Cambridge University Press.

Hillman, Ayre L., and Ursprung Heinrich W.(1992). "The Influence of Environmental Concerns on the Political Determination of Trade Policy." in *The Greening of the World Trade Issue*, edited by Kym Anderson and Richard Blackhurst (1992). Ann Arbor: University of Michigan Press.

Krutilla, Kerry (1989). "Environmental Regulation in an Open Economy." *Journal of Environmental Economics and Management 20*, pp. 127-142.

Olson, Mancur (1965). *The Logic of Collective Action*. Cambridge: Harvard University Press.

Orden, David (1994). "Agricultural Interest Groups and the North American Free Trade Agreement. *National Bureau of Economic Research Working Paper No. 4790.*

Peltzman, Sam (1976). "Toward a More General Theory of Regulation." *Journal of Law and Economics* 19, pp. 211-240.

Rodrik, Dani (1995). "Political Economy of Trade Policy." In *Handbook of International Economics*, vol. III, edited by Gene M. Grossman and Kenneth Rogoff. Amsterdam: Elsevier Science B.V..

Schleich, Joachim and Orden, David (1996). "Efficient Choice Among Domestic and Trade Policies in the Grossman-Helpman Interest-Group Model." The Center for Political Economy Bulletin 96-3, University of Minnesota.

Schleich, Joachim (1997)."Environmental Protection with Policies for Sale." International Trade and Research Consortium Working Paper # 97-2.

Sorsa, Piritta (1992). "GATT and Environment." *The World Economy* 15 (1), pp. 115-133.

Stigler, George (1971). "The Theory of Economic Regulation." *Bell Journal of Economics* 2, pp. 3-21.

OECD (1995). Environmental Taxes in OECD Countries. Paris.

Wilkinson, Derrick G. (1994). "NAFTA and Environment: Some Lessons for the Next Round of GATT Negotiations" *The World Economy* 17 (1), pp. 395-412.