# Environmental Protection and Free Trade: Indirect Competition for Political Influence

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March 19, 1999

**Abstract**

This paper shows that although small or financially constrained environmentalist groups may be in a weak position, relative to polluting industries, in the direct competition for political influence, they can compete indirectly through changing public preferences over environmental quality. However, in a small open economy where the output price is exogenously determined, the value domestic persuasion falls and government environmental policies will be determined by direct political competition. Furthermore, positions of different groups on environmental policy become more extreme and direct competition for political influence becomes more intense. Nevertheless, we show that moving to free trade (at the fixed output price) could increase environmental protection, because the general public becomes greener in an open economy.

Key Words: Environmental policy, International trade, Interest groups.

JEL classification: Q20, Q28, D72

*I am indebted to Jim Brander, Brian Copeland, John Helliwell and Scott Taylor for their guidance and encouragement. I am also grateful to Walter Bossert, Richard Disney, David Greenaway and Gorazd Ruseski for very useful suggestion and comments. The usual disclaimer applies. The author acknowledges financial support from The Leverhulme Trust under Programme Grant F114/BF.

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# 1 Introduction

During the past two decades, political economy approaches have been increasingly used to study the formation of government policies (and trade policy in particular), in responding to the discrepancy between what governments actually practice and what normative studies suggest. The essence of the political economy approaches to the determination of government policies with opposing special interest groups is that these groups are modeled to engage in some kind of (direct) political competition for sharing social welfare and that opposing pressures offset each other.[1] The political strength of a group is often explained by the size of its economic stake in the government policy, the efficiency of its organization in exerting political influence, and the deadweight cost of government policies [e.g. Becker (1983, 1985) and Findlay and Wellisz (1982)].[2] The first two effects are counterbalanced by the third. However, these theories of direct competition for political influence are less convincing when are applied to the determination of environmental policies. How then can we explain why environmental groups have been very successful against polluting industries, when the latter's economic stakes are extremely high and their interests are efficiently organized? This paper develops a theory of indirect competition for political influence to provide an answer to this question.

Environmental movements have made significant progress in many developed countries over the last three decades. For example, environmental protection started to emerge as a policy issue in the United States in the late 1960s but it quickly gained political ground just a decade later, with 21 major federal environmental laws passed during the 1970s (three times the level of the 1960s).[3] This momentum was sustained during the 1980s and environmental issues still remain on the political agenda in the 1990s. As a result, polluting industries have been pushed to increase expenditures on pollution control and abatement by billions of dollars each year, despite significant lobbying efforts. The

[1] For surveys see Hillman (1989)and more recently, Rodrik (1995). One exception is Laffont and Tirole (1993 ,p488-493). In their agency-theoretic framework under asymmetric information, pressures from opposing interest groups may not offset; but rather, they may reinforce each other.

[2] Becker (1985) recognizes the limits of existing theories when they are applied to small groups.

[3] Source: Council on Environmental Quality, Annual Report (1979).

environmental groups which lobby for these laws, however, spend only several millions of dollars each year, a very small amount of money compared to what is spent by polluting industries. In addition, environmental groups' Washington offices staffed by full-time lobbyists started only in the early 1970s but the traditional activity of environmental groups is to educate the public. These groups orient their appeals more to the public than to governments and their activities have greatly increased the public's demand for environmental protection. These aspects in the formation of government environmental policies are captured in this paper in a model of direct and indirect competition for political influence.

A primary feature of our model is to allow two opposing interest groups, the Environmentalists and the Industrialists, to compete both directly and indirectly to influence government policy. By direct competition we mean that interest groups provide political contributions to an incumbent government (or lobby) for favorable government policies; by indirect competition we mean that interest groups influence government policies through changing public preferences. An incumbent government is assumed to care about the total level of political contributions provided by interest groups and about public support of its policy from the public. As a result, both direct and indirect political competition have an impact on government policy.

Some of the main results are as follows. First, with only direct political competition, the financially constrained Environmentalists will have less (if any) political influence on government environmental policy. However, with both direct and indirect competition this is no longer true - a small interest group can always have an influence on government policy. Second, the Environmentalists can benefit from educating the public regardless whether they participate in direct political competition. Third, a sufficient condition is derived for the outcome of indirect political competition to favor the Environmentalists when the Industrialists are also active in indirect political competition.

Fourth, however, in a small open economy where the output price is exogenously determined, the value domestic persuasion falls and government environmental policies is determined by direct political competition. Furthermore, the positions of different

groups on environmental policy become more extreme and direct competition for political influence becomes more intense. Nevertheless, we show that moving to free trade (at the fixed output price) could increase environmental protection, because the general public becomes greener in an open economy. Last, the equilibrium level of pollution emission is increasing in the world price.

There are relatively few studies of indirect competition for political influence. Denzau and Munger (1986) may be the only relevant work, which studies the issue of how unorganized voters can be influenced in a model of legislative elections. In this paper we extend the political-contribution approach of Grossman and Helpman (1994) to incorporate indirect competition for political influence.[4]

The rest of this chapter is organized as follows. Section 2 sets out some preliminaries and the structure of the game in the formation of environmental policy. Section 3 discusses the implications of direct competition for political influence. Section 4 derives the results from a framework of indirect political competition in a closed economy. Section 5 extends the model to a small open economy. Section 6 provides some concluding remarks.

# 2 Some Preliminaries and The Game

Assume that all individuals in the economy have the same utility function, except for different valuations of environmental quality. For example, individual $i$'s utility is given by

$$U_i(x_o, x, q) = u(x) + x_o + \nu_i q(e) \tag{1}$$

where $x_o$ is the consumption of a numeraire good and $u(x)$ $[u'(.) > 0,\ u''(.) < 0]$ is the utility of consuming good $x$ that is produced by a polluting industry. In the third term, $q(.)$ $[q'(.) < 0,\ q''(.) < 0]$ represents environmental quality which, for simplicity, is assumed to depend directly on the government environmental standard: a pollution emission level $e$ $(e \geq 0)$; $\nu_i$ is individual $i$'s valuation of environmental quality.

[4] Another application of the Grossman-Helpman model is the analysis of environmental taxes and can be found in Fredriksson (1997). The environmental policy in our paper is an emission standard but more importantly, we focus on the indirect competition for political influence.

The numeraire good is produced competitively by a constant-returns-to-scale technology, which uses one unit of labor to produce one unit of output by choice of units. This implies that in a competitive equilibrium the wage rate is equal to one. The production of good $x$ requires labor and an industry-specific factor that is in fixed supply. Pollution abatement also requires both labor and the specific capital, so that the cost of abatement is output. For simplicity, the pollution abatement cost is assumed to reduce the productivity of producing the good in a neutral way:[5]

$$X = [1 - \gamma(e)]F, \ \gamma(0) = 1, \gamma(.)' < 0, 0 \leq \gamma(.) \leq 1, \tag{2}$$

where $X$ is net output, and $F$ is gross output (without pollution abatement) and is produced by a constant-returns-to-scale technology. Thus the return to the specific factor, denoted by $\pi(p, e)$, is increasing in the price of the good ($p$) and the environmental policy ($e$). The supply of the good is $X = \partial\pi(p, e)/\partial p$, by Hotelling's Lemma, and is increasing in $e$.

The individual demand function for good $x(p)$ can be derived from the inverse demand function, $p = u'(x)$. Hence, the (inverse) aggregate demand is $p = u(X^d/N)$, where $X^d$ is aggregate consumption. Since consumption is equal to output in a closed economy, the price of the good will depend on the government's environmental policy. More specifically, $dp/de < 0$.

The total population is $N$ and each individual is assumed to supply only one unit of labor. There are three kinds of individuals in the economy: first, the industrialists, each of whom also owns one unit of the specific factor; second, the environmentalists, each of whom place a high utility value on environmental quality; and third, the general public. All industrialists are organized as a special interest group ("Industrialists") with a population of $N_I$.[6] All environmentalists are also organized as a special interest group ("Environmentalists") with a population of $N_E$. We assume that $N_E + N_I < N/2$ to ensure that the median voter is from the general public. The rest of the population,

[5]This kind of pollution abatement costs resembles the iceberg transportation cost in the international trade literature and has been used in Antweiler, Copeland and Taylor (1998) and McAusland (1998).

[6]The subscript $I$ will denote the variables of the Industrialists. Similarly, the subscript $E$ will denote the variables of the Environmentalists.

$N - N_E - N_I$, is the general public and is politically unorganized.

The indirect utility function corresponding to (1) can be obtained as follows:

$$V_i(Y_i, e) = s(e) + Y_i + \nu_i q(e), \tag{3}$$

where $s$ is the consumer surplus $[s(e) = u(x(p(e))) - p(e)x(p(e))]$ from consuming good x, which is increasing in $e$, and $Y^i$ is individual $i$'s income. Therefore, an individual $i$ in the general public has a utility level given by

$$V_i = s(e) + 1 + \nu_i q(e), \tag{4}$$

where $\nu_i \in (\nu_l, \nu_h)$ and is distributed according to a pdf, $\omega(\nu_i)$. The optimal level of $e$ for this individual is

$$e_i = arg\max_e \{V_i = s(e) + 1 + \nu_i q(e)\} \tag{5}$$

$$= \epsilon(\nu_i). \tag{6}$$

Assuming preferences are single-peaked, $\epsilon(.)$ will be a decreasing function in $\nu_i$. Then $e_i$ will be distributed according to a pdf $\phi(.)$ [corresponding to $\omega(.)$] with a support of $(\underline{e}, \bar{e})$, where $\underline{e} = \epsilon(\nu_h)$ and $\bar{e} = \epsilon(\nu_l)$.

All environmentalists are assumed to have the same valuation of environmental quality, $\nu_E$, where $\nu_E = \nu_h$. That is, they are the ones who have the highest value on the environment in the economy. The optimal level of pollution emission for an environmentalist, therefore, is

$$e_E = arg\max_e \{V_E = s(e) + 1 + \nu_E q(e)\} = \underline{e}. \tag{7}$$

The joint welfare of the Environmentalists is $W_E - C_E$, where $C_E$ is their political contribution to the incumbent government, and $W_E$ is their gross joint welfare given by

$$W_E = N_E V_E. \tag{8}$$

All industrialists are also assumed to have the same valuation of environmental quality, $\nu_I$. Therefore, the optimal level of pollution emission for an industrialist (or all industrialists) is

$$e_I = arg\max_e \{V_I = s(e) + 1 + \frac{\pi(p(e), e)}{N_I} + \nu_I q(e)\}. \tag{9}$$

For simplicity, we assume that $\nu_I = \nu_l$. Thus $e_I > \bar{e}$.[7] Then, the joint welfare of the Industrialists is $W_I - C_I$, where $C_I$ is political contributions, and $W_I$ is the gross joint welfare given by

$$W_I = N_I V_I. \tag{10}$$

The incumbent government in the model cares about the total level of political contributions and the 'political cost' of its environmental policy deviating from the median voter's preference. Its objective function (or "political support") takes the form

$$G = C_E + C_I - \theta M(e, e_m), \qquad \theta > 0, \tag{11}$$

where $M(e, e_m)$ is the political cost in the spirit of the median-voter framework and is defined as follows:

$$M(e, e_m) = \frac{1}{2}(N - N_E - N_I)(e - e_m)^2, \tag{12}$$

where $e_m$ is the optimal level of pollution emission for the median voter. The political cost depends on the total population of the general public and is a convex function of the deviation of governmental environmental policy from the median voter's preference. The median voter's preference on the environmental policy, $e_m$, is implicitly given by

$$N_E + (N - N_E - N_I)\int_{\underline{e}}^{e_m} \phi(y)dy = (N - N_E - N_I)\int_{e_m}^{\bar{e}} \phi(y)dy + N_I. \tag{13}$$

Or,

$$\Phi(e_m) = \frac{1}{2} - \frac{N_E - N_I}{N - N_E - N_I}, \tag{14}$$

where $\Phi(.)$ is the cumulative distribution function corresponding to $\phi(.)$. Alternatively, we can write

$$e_m = \Phi^{-1}(\frac{1}{2} - \frac{N_E - N_I}{N - N_E - N_I}). \tag{15}$$

In a benchmark case where the Industrialists and the Environmentalists do not make political contributions, the government would choose $e$ to maximize

$$G = -\theta M(e, e_m). \tag{16}$$

[7] As long as the return from the specific factor is significant compared to the wage income, we can still have $e_I > \bar{e}$ even if $\nu_I > \nu_l$. For convenience we assume that $\nu_I = \nu_l$.

Therefore, $e_m$ will be the equilibrium policy.

The game of environmental formation is a three-stage non-cooperative game. In stage one there is indirect political competition, in which both the Environmentalists and the Industrialists spend their resources to influence the public. In stage two there is direct political Competition, in which each group simultaneously offers the government a political-contribution schedule that is contingent on the environmental policy. In stage three the government sets policy to maximize its objective function.

# 3 Direct Political Competition and The Implications

Most public-choice and political-economy models focus only on direct competition to explain how interest groups compete to influence government policy. In our model, this would mean that we only have a two-stage game: the stage 2 and 3 in our model. We define this two-stage game as a menu-auction problem (with complete information) that is originally studied by Bernheim and Whinston (1986). More specifically, in stage 2 each interest group would simultaneously offer the incumbent government a policy-contingent political contribution schedule $[C_j(e),\ j = E, I]$, taking the other group's strategy as given, to maximize its own joint welfare,

$$W_j(e) - C_j(e). \tag{17}$$

In stage 3 the incumbent government, which cares about the total level of political contributions and the political cost of its policy, would set a level of environmental policy to maximize the objective function defined in (11),[8]

$$G = C_E(e) + C_I(e) - \theta M(e, e_m). \tag{18}$$

Grossman and Helpman (1994, 1995) have also used this structure in a model of characterizing government trade policy. However, in this paper we assume that, in addition to the total level of political contributions, the incumbent government cares about the

[8]Although the government's environmental policy is an emission standard in this model, all of the results would still hold if the policy were a pollution tax. Actually, one of the benefits of the definition in (2) is that the effect of an emission standard is equivalent to a pollution tax in this model.

political cost of its policy instead of social welfare. Following Grossman and Helpman, we focus on the 'truthful contribution schedule', which pays the excess (if any) of an interest group's gross welfare at $e$ relative to some base level of welfare.[9] The subgame-perfect Nash equilibrium can, therefore, be characterized in the following proposition.

**Proposition 1** *(i) The equilibrium environmental policy satisfies:*

$$e^o = arg\max_e \; W_E(e) + W_I(e) - \theta M(e, e_m); \tag{19}$$

*(ii) the equilibrium political contributions are (for $i, j = E, I$):*

$$C_i^o(e^o, b_i^o) = [W_j(e^j) - \theta M(e^j, e_m)] - [W_j(e^o) - \theta M(e^o, e_m)],$$

*where $e^j$ satisfies*

$$e^j = arg\max_e \; W_j(e) - \theta M(e, e_m).$$

**Proof:** See Appendix.

From the first-order condition of (19), the level of the equilibrium environmental policy depends on the two interest groups' stakes involved at the margin: $e^o > e_m$ when $\mid W_F' \mid > \mid W_E' \mid$ and $e^o < e_m$ when $\mid W_F' \mid < \mid W_E' \mid$. This means that if their economic stake involved is larger, the Industrialists will be relative powerful - having relatively strong political influence.

Part (ii) indicates that each interest group has to provide a certain level of political contributions in order to have their interest represented. For example, the political contribution from the Environmentalists must be equal to the difference between what the government and Industrialists could jointly achieve in the absence of the Environmentalists and what they can actually obtain in the full equilibrium:

$$C_E^o(e^o, b_E^o) = [W_I(e^I) - \theta M(e^I, e_m)] - [W_I(e^o) - \theta M(e^o, e_m)]. \tag{20}$$

As often used in other types of political economy models, though the government objective function is linear, most studies assume away the cases of corner solutions - assuming that all interest groups can fully participate in such political competition. However, some interest groups (like environmental groups, for example) are relatively financially

[9] The truthful political contribution schedule is defined as $C_j^T(e, b_j) = \max[0, W_j(e) - b_j]$, where $b_j$ is a constant and is some base level of welfare for interest group $j$.

constrained.[10] In this two-stage game, if the Environmentalists cannot afford the equilibrium amount of political contributions $C_E^o(e^o)$ (or the equilibrium political is zero in another word), the government environmental policy would be $e^I$ instead of $e^o$, where

$$e^I = arg\max_e \ W_I(e) - \theta M(e, e_m). \tag{21}$$

That is, the Environmentalists cannot have any political influence on government environmental policy in this case.

In brief, given the asymmetry between environmentalist groups and polluting industries, the theory of direct competition for political influence cannot provide a convincing explanation to the success of environmental movements.

# 4 Indirect Competition for Political Influence

Some political scientists have suggested that environmental movements succeed because environmental groups can provide block votes with their large memberships [see Smith (1985), for example]. In this section we will demonstrate how interest groups can influence government environmental policy through changing public preferences over environmental quality rather than marshalling block votes.

It is clear in this model that the political cost of government policy depends on the median voter's preference. Hence, any change in the valuation of environmental quality in the public that affects $e_m$ would have an impact on the equilibrium level of the environmental policy. Suppose the Environmentalists can spend their resources to educate the public: that is, to increase $v_i$ [$v_i \in (\underline{v}, \bar{v})$]. By (6) this will in turn lower $e_i$, which will be represented by a first-order-stochastic-dominance shift in $\Phi(e)$. Assuming the effect of the Environmentalists' efforts in educating the public exhibits diminishing returns, we define

$$\Phi(e; \delta(r_E)), \ \Phi_2(.) > 0; \ \delta'(.) > 0, \delta''(.) < 0, \tag{22}$$

where $r_E$ are the resources spent by the Environmentalists in educating the public.

[10] As well, unlike polluting industries, the benefits from a tightening of environmental policy is not exactly pecuniary for environmental groups.

Now even when the Environmentalists cannot afford to pay the equilibrium level of political contributions (i.e. $e^o = e^I$ in this case), they can still influence the government's environmental policy through educating the public. They can reduce the level of $e^I$ by solving the following optimization problem:

$$\max_{r_E} \; W_E(e^I) - r_E. \tag{23}$$

In general, when the Environmentalists are also active in direct political competition, they solve the following optimization problem.

$$\max_{r_E} \; W_E(e^o) - C_E^o - r_E. \tag{24}$$

**Proposition 2** *Through educating the public, the Environmentalists could achieve the following:*

*(i) reducing their political-contribution schedule $C_E^o(e)$ for any given level of $e$; and*

*(ii) reducing the equilibrium level of pollution emission, $e^o$.*

**Proof**: See Appendix.

Educating the public not only reduces the political contribution schedule of the Environmentalists, but can also lower the level of $e^o$. The reason for this is that the increase in the public's demand for a lower level of pollution emission raises the marginal cost of increasing $e$ for the government (i.e., $M_1$).[11] As a result, the government lowers $e^o$.

Of course, the Industrialists would also like to change public preferences in the opposite direction. For simplicity, in this model we assume that the effects on $\Phi(e)$ of these two groups' efforts offset against each other in the following way,

$$\Phi(e; \delta(r_E) - \delta(\gamma r_I)), \;\; \gamma > 0, \tag{25}$$

where $r_I$ is the resource spent by the Industrialists in influencing the public and $\gamma$ represents the relative efficiency of $r_I$ (relative to $r_E$) in persuading the public. It is this kind of competition between the two opposing interest groups in influencing the general

[11] As we show in Appendix, $dM_1/dr_E > 0$. Notice that this result does not depends on whether $e^o$ is greater or less than $e_m$.

public that constitutes another stage of the game prior to the stage in which there is direct political competition.

Thus the model of indirect competition for political influence is again a three-stage game. The last two stages are the same as discussed above. In stage one, the two interest groups simultaneously spend their resources to influence the public, anticipating the outcome of the last two stages of the game. The Environmentalists solve (24). By Proposition 1 (replacing $C_E^o$), the optimization problem in (24) becomes

$$\max_{r_E} \{[W_E(e^o) + W_I(e^o) - \theta M(e^o, e_m)] - [W_I(e^I) - \theta M(e^I, e_m)]\} - r_E. \tag{26}$$

Using the envelope theorem, (12) and (26), we can obtain the following first-order condition,

$$\theta(N - N_E - N_I)(e^I - e^o)\frac{\Phi_2}{\phi}\delta'(r_E) - 1 = 0. \tag{27}$$

Similarly, the Industrialists solve the following problem in stage one,

$$\max_{r_I} \; W_I(e^o) - C_I^o - r_I. \tag{28}$$

The first-order condition following (28) is

$$\theta(N - N_E - N_I)(e^o - e^E)\frac{\Phi_2}{\phi}\gamma\delta'(\gamma r_I) - 1 = 0. \tag{29}$$

From (27) and (29) we can solve for the equilibrium level of $r_E$ and $r_I$ when the second-order and regularity conditions are satisfied. Hence, we can obtain the equilibrium environmental policy and political-contribution schedules of this three-stage game: $\{e^*, C_E^*(e), C_I^*(e)\}$. Compared to the results from the direct political competition, the impact of the indirect political competition (in stage one) on the government environmental policy is characterized by the following proposition.

**Proposition 3** *When the relative efficiency in persuading the public $\gamma$ is smaller than $\tilde{\gamma}$, where $\tilde{\gamma} = (e^I - e^o)/(e^o - e^E)$, the indirect political competition leads to*

*(i) a more stringent environmental policy (i.e. $e^* < e^o$);*

*(ii) a lower political contribution schedule for the Environmentalists (i.e. $C_E^*(e) < C_E^o(e)$); and*

*(iii) a higher political-contribution schedule for the Industrialists (i.e., $C_I^*(e) > C_I^o(e)$).*

**Proof:** See Appendix.

Notice that while $e^o$ is determined when both groups' interests are taken into account, $e^E$ ($e^I$) is determined when only the Environmentalists' (Industrialists') interests are accounted for. Therefore, when $(e^I - e^o)$ is smaller than $(e^o - e^E)$ (i.e., $\tilde{\gamma} < 1$), $e^o$ is closer to $e^I$, which means that the Industrialists are more "influential" than the Environmentalists in direct political competition. This is achieved, of course, through the competition in providing political contributions. From (27) and (29), we can see that in this case the marginal benefit of a change in $e_m$ is actually greater for the Industrialists than for the Environmentalists. If so, then how could it be possible for the outcome of indirect political competition to favor the Environmentalists? The answer is that the Environmentalists must be relatively efficient in persuading the public, compared to the Industrialists (i.e., $\gamma < 1$).[12] Proposition 14 provides us with a sufficient condition.

Why might there be an asymmetry such that the Industrialists are less efficient than the Environmentalists in persuading the public? On the one hand, environmental groups usually do not have a direct monetary interest in the outcome of government environmental regulation, compared to polluting industries. Hence, they are more likely to be assumed to speak for the public rather than pursuing private interests. On other hand, since polluting industries have direct monetary interests in the outcome, thus their credibility in persuading the public is likely to be lower. However, for our results to hold, it is not sufficient that the Environmentalists are more efficient in persuading the public than the Industrialists; their credibility must be sufficiently high to satisfy the condition shown in Proposition 3.

# 5 The Small Open Economy

In the closed-economy case discussed above, the price of the good is directly affected by the government's environmental policy. A more stringent environmental policy would

[12] When the Environmentalists are more "influential" (i.e.,$\tilde{\gamma} > 1$), we still have all the results in Proposition 3 even if two groups are equally efficient in persuading the public (i.e. $\gamma = 1$).

improve environmental quality but also raise output price. Therefore, the general public (as well as the Environmentalists) must arrive at a balance in choosing the optimal level of environmental policy. Such an inter-dependence might become weaker in an open economy since the impact of the government's environmental policy on the output price would be reduced. In this section, we analyze a small-open economy, in which there is no linkage at all between government environmental policy and the price of the good.

Suppose $p^*$ is the world price of good $x$. Since now consumer surplus will not be affected by government environmental policy $e$ in this case, it is easy to show that [from (5)]

$$\begin{aligned} e_i &= arg\max_e \{s(p^*) + 1 + \nu_i q(e)\} \\ &= 0, \ \forall \nu_i \in [\nu_l, \nu_h]. \end{aligned} \tag{30}$$

Similarly, we can show that $e_E = 0$. Hence, the optimal emission level for the median voter is zero (i.e. $e_m = 0$). Notice that any change in the public's valuation of environmental quality now has no effects on the median voter's preference for the level of environmental policy. This implies that the two interest groups in this case will just focus on the direct competition for political influence. The reason for having this result is that in this model consumers do not bear any of the costs of a stringent environmental policy. This will not be true, for example, if more consumers own shares in polluting industries or, if the good is not a homogeneous product (if so, $p$ will depend on $e$).

However, this extreme result captures some more general results. First, when the price of the good is exogenously determined, the value of domestic persuasion falls because it is unnecessary. Second, there is less inter-dependence between groups in an open economy and, therefore, interest groups' positions on environmental policy may become more extreme. Consequently, as we will show next, political competition becomes more intense.

Since the equilibrium environmental policy in a small open economy will be determined by direct political competition. The welfare of the Industrialists is given by

$$W_I(e; p^*) = N_I[s(p^*) + \frac{\pi(p^*, e)}{N_I} + \nu_I q(e)], \tag{31}$$

where $p^*$ is the world price. The marginal benefit of an increase in $e$ for the Industrialists becomes

$$W_I'(e;p^*) = \pi_2(p^*,e) + N_I\nu_I q'(e) \tag{32}$$

in the small open economy but it is

$$W_I'(e) = [N_I s'(p) + \pi_1(p,e)]p'(e) + \pi_2(p,e) + N_I\nu_I q'(e) \tag{33}$$

in the closed economy. The first term in (80) is negative, because $N_I s'(p) + \pi_1(p,e)$ is the supply of the good from the Industrialists (output net of their own consumption) and is clearly positive. Therefore, for the same price, the marginal benefit of an increase in $e$ for the Industrialists in a small open economy is larger than that in the closed economy. The reason for this is that in a small open economy the price of the good does not go down when output increases, which certainly benefits the Industrialists more than in the closed economy. Similarly, the effect of a change in $e$ on the Environmentalists' welfare is

$$W_E'(e;p^*) = N_E\nu_E q'(e) \tag{34}$$

in the small open economy but in the closed economy it is

$$W_E'(e) = N_E s'(p)p'(e) + N_E\nu_E q'(e) \tag{35}$$

in the closed economy. Therefore, the marginal benefit of a decrease in $e$ for the Environmentalists is larger in a small open economy because the price of the good will not increase.

Since the stake involved for both interest groups becomes larger, the direct competition for political influence will become more intense in the small open economy than in the closed economy.[13] The reason for this is that the equilibrium political contribution has the following property (see Footnote 7),

$$C_i^{o'}(e) = W_i'(e),\ i = E, I. \tag{36}$$

That is, the marginal change in political contributions from an interest group matches the effect of the policy change on its welfare. This discussion is summarized in the following proposition.

[13]The net result of this intensified direct political competition will be discussed in a moment.

**Proposition 4** *Compared to the closed economy, in a small open economy (at the same price)*

*(i) the value of domestic persuasion falls and the government environmental policy is determined in direct political competition; and*

*(ii) direct competition for political influence becomes more intense.*

Notice that although environmental policy will be determined only in direction political competition, the results in Proposition 4 do not imply that the level of environmental protection would fall when a country moves to free trade. The reason for this is that the general public becomes greener.

There will be two changes in our model when a country moves to free trade. First, the price of the good becomes exogenously determined. Second, the world price in free trade will be different from the autarky price. In the rest of this section, we isolate each of these two changes to examine how environmental protection in a country would change when it moves to free trade. That is, we first analyze a case in which a country moves to an open economy when the world price is equal to its autarky price. Then, we examine how changes in the world price would affect the environmental policy in this small open economy.

Using (33) and (35), we can obtain the first-order condition of (66) in the closed economy as follows:

$$[N_I s'(p) + \pi_1(p, e^o)]p'(e^o) + \pi_2(p, e^o) + N_I \nu_I q'(e^o)$$

$$+[N_E s'(p)p'(e^o) + N_E \nu_E q'(e^o)] - \theta(N - N_E - N_I)(e^o - e_m) = 0. \tag{37}$$

Therefore,

$$\begin{aligned} e^o - e_m &= \frac{1}{\theta(N - N_E - N_I)}\{\pi_2(p, e^o) + N_I \nu_I q'(e^o) + N_E \nu_E q'(e^o) \\ &\quad + [(N_E + N_I)s'(p) + \pi_1(p, e^o)]p'(e^o)\}. \end{aligned} \tag{38}$$

Notice that $e^o - e_m$ represents the relative strength of the two groups in direct political competition: The larger it is, the more powerful are the Industrialists relative to the Environmentalists. In the open economy we have $p'(e) = 0$ and $e_m = 0$. Therefore the first-order condition becomes

$$\pi_2(p^*, e^f) + N_I \nu_I q'(e^f) + N_E \nu_E q'(e^f) - \theta(N - N_E - N_I)e^f = 0, \tag{39}$$

where $e^f$ is the government's environmental policy in free trade. Corresponding to (38), we have

$$e^f - 0 = \frac{1}{\theta(N - N_E - N_I)}\{\pi_2(p^*, e^f) + N_I \nu_I q'(e^f) + N_E \nu_E q'(e^f)\}. \tag{40}$$

Since $(N_E + N_I)s'(p) + \pi_1(p, e^o) > 0$,[14] when $p^* = p$ we obtain

$$e^f - 0 > e^o - e_m. \tag{41}$$

That is, the Industrialists become more powerful in against the Environmentalists when the economy moves to free trade at the fixed output price.

However, (41) does not imply that $e^f$ is greater than $e^o$, because the median voter becomes greener in free trade. The next proposition characterizes the effect on environmental protection when a country moves to free trade at the fixed output price.

**Proposition 5** *Moving to free trade at the fixed output price would increase (decrease) environmental protection if $e_m > \tilde{e}_m$ ($e_m < \tilde{e}_m$), where*

$$\tilde{e}_m = \frac{-p'(e^o)}{\theta(N - N_E - N_I)}[(N_E + N_I)s'(p) + \pi_1(p, e^o)].$$

**Proof:** Using (38) and (40), it is straightforward to show that

$$e^f < e^o, \text{ if } e_m > \frac{-p'(e^o)}{\theta(N - N_E - N_I)}[(N_E + N_I)s'(p) + \pi_1(p, e^o)]; e^f > e^o, \text{ otherwise. } Q.E.D.$$

Proposition 5 indicates that if the median voter is not very green, environmental protection would increase after the country moves to free trade. However, environmental protection would fall if the median voter is already very green. The reason for this is that there are two effects when the economy moves to free trade at the fixed output price. First, the Industrialists become more powerful in direct political competition relative to the Environmentalists. Second, the general public and the median voter become greener. The first effect tends to increase environmental protection but the second effect tends to

[14] Notice that $(N - N_E - N_I)s'(p) + (N_E + N_I)s'(p) + \pi_1(p, e^o) = 0$ in the closed economy.

reduce it. When the median voter is not very green, the second effect dominates the first. When the median voter is already very green, the first effect will be dominant.

In our model the level of $e_m$ depends on the linkage between government environmental policy and the price of the good. The less open an economy is, the stronger would be this linkage. Therefore, one implication from this result is that moving to free trade would increase environmental protection if an economy were less open.

So far we have fixed the world price at the same level as the autarky price. The next proposition describes how the equilibrium government environmental policy in a small open economy responds to changes in the world market price.

**Proposition 6** *The equilibrium level of the government environment emission standard ($e^f$) is increasing in the world price.*

**Proof:** Totally differentiating (39), we obtain

$$\frac{de^f}{dp^*} = \frac{(d\pi_2)/(dp^*)}{-\Delta} > 0,$$

where $\Delta$ is the second-order condition and is negative. Q.E.D.

The reason for this result is straightforward. Changes in the world market price now only affect the profits of the polluting industry at the margin [i.e. only $\pi_2(p^*, e)$ depends on $p^*$]. An increase in the world market price raises the profit for a given level of inputs and pollution emissions. Therefore, the Industrialists are able to bid for a higher level of pollution emissions. However, the benefits of the Environmentalists and the general public are not affected at the margin. As a result, the equilibrium level of pollution emissions goes up.

# 6 Concluding Remarks

Direct political competition studies how interest groups lobby governments. Indirect political competition, however, studies how interest groups win over the general public. As long as the preferences of the general public are represented to some extent by governments, changing the public's preferences can indirectly influence government policy.

Although the focus of this paper is on explaining how environmentalist groups can be very successful in influencing environmental policies, the model could also be applied to study the formation of other government policies that involve interest groups with different strengths. While the model is a relative simple one, the idea of indirect competition for political influence has a powerful appeal and complements the idea of direct competition for political influence.

The result that environmental policy in a small open economy is determined only in direct political competition is rather extreme because of the special properties of this model. However, it provides insights for some broader implications. For example, when the output prices is exogenously determined, indirect competition for political influence will becomes more intense. Moreover, moving to free trade would increase environmental protection if an economy were less open. These results can provide some testable hypotheses.

# Appendix

**Proof of Proposition 1** Here we only provide a sketch of the argument. Readers should consult Grossman and Helpman (1994, 1995) for further details.

(i) Since the benefits all the parties are maximized, we have

$$C_E^o(e^o) + C_I^o(e^o) - \theta M(e^o, e_m) \geq C_E^o(e) + C_I^o(e) - \theta M(e, e_m) \tag{42}$$

for the government,

$$W_E(e^o) - C_E^o(e^o) \geq W_E(e) - C_E^o(e) \tag{43}$$

for the Environmentalists, and

$$W_I(e^o) - C_I^o(e^o) \geq W_I(e) - C_I^o(e) \tag{44}$$

for the Industrialists. Combining (48) to (50), we obtain

$$W_E(e^o) + W_I(e^o) - \theta M(e^o, e_m) \geq W_E(e) + W_I(e) - \theta M(e, e_m). \tag{45}$$

Q.E.D.

(ii) In equilibrium, we have $C_I^o(e^o) = W_I(e^o) - b_I^o$. As $C_I^o(e^I)$ must also be positive (because $C_I^o(e^I) > C_I^o(e^o)$), we have $C_I^o(e^I) = W_I(e^I) - b_I^o$. Combining these two equations, we obtain

$$C_I^o(e^I) - C_I^o(e^o) = W_I(e^I) - W_I(e^o). \tag{46}$$

Also, the Environmentalists will raise $b_E^o$ until the government is indifferent between choosing $e^o$ and choosing $e^I$ [See the discussion in Grossman and Helpman (1994, p845-6)]. This means

$$C_E^o(e^o, b_E^o) + C_I^o(e^o) - \theta M(e^o, e_m) = C_I^o(e^I) - \theta M(e^I, e_m). \tag{47}$$

From (52) and (53), we have

$$C_E^0(e^0, b_E^0) = [W_I(e^I) - \theta M(e^I, e_m)] - [W_I(e^0) - \theta M(e^0, e_m)]. \tag{48}$$

Accordingly, we can also obtain $C_I^o$. Q.E.D.

**Proof of Proposition 2** (i) Since political contributions cannot be reduced below zero, we are interested in the positive level of $C_E^o(e)$. Using (20), we can derive

$$\begin{aligned} C_E^o(e, b_E^o) &= W_E(e) - b_E^o \\ &= W_E(e) - [W_E(e^o) - C_E^o(e^o)] \\ &= W_E(e) - W_E(e^o) + \{[W_I(e^I) - \theta M(e^I, e_m)] - [W_I(e^0) - \theta M(e^0, e_m)]\} \\ &= W_E(e) + [W_I(e^I) - \theta M(e^I, e_m)] - [W_E(e^o) + W_I(e^0) - \theta M(e^0, e_m)] \end{aligned}$$

By the envelope theorem, we obtain

$$\begin{aligned} \frac{dC_E^o(e, b_E^o)}{dr_E} &= -\theta M_2(e^I, e_m)\frac{de_m}{dr_E} + \theta M_2(e^o, e_m)\frac{de_m}{dr_E} \\ &= \theta(N - N_E - N_F)\frac{de_m}{dr_E}(e^I - e^o) < 0, \end{aligned}$$

where $de_m/dr_E$ is negative shown as follows.

Combining (14) and (22), we have

$$\Phi(e_m, \delta(r_E)) = \frac{1}{2} - \frac{N_E - N_F}{N - N_E - N_F}. \tag{49}$$

Totally differentiating the above equation, we obtain

$$\phi de_m + \Phi_2 \delta' dr_E = 0.$$

Therefore,

$$\frac{de_m}{dr_E} = -\frac{\Phi_2 \delta'}{\phi} (< 0). \tag{50}$$

(ii) From Proposition 1, $e^o$ can be obtained from the following first-order condition:

$$W_E'(e^o) + W_I'(e^o) - \theta M_1(e^o, e_m) = 0. \tag{51}$$

Taking the derivative with respect to $r_E$, we have

$$\Delta \frac{de^o}{dr_E} - \theta \frac{dM_1}{de_m}\frac{de_m}{dr_E} = 0, \tag{52}$$

where $\Delta = (W_E'' + W_F'' - \theta M_{11})$ is the second-order condition and is negative. Since $M(e, e_m) = (N - N_E - N_I)(e - e_m)^2$, we have $dM_1/de_m < 0$. Therefore,

$$\frac{de^o}{dr_E} = \frac{\theta}{\Delta}\frac{dM_1}{de_m}\frac{de_m}{dr_E} (< 0). \tag{53}$$

Q.E.D.

**Proof of Proposition 3** (i) Using (27) and (29), we obtain

$$(e^I - e^o)\delta'(r_E) = (e^o - e^E)\gamma\delta'(\gamma r_I).$$

Since $\gamma < (e^I - e^o)/(e^o - e^E)$, we have

$$\frac{\delta'(r_E)}{\delta'(\gamma r_I)} = \frac{\gamma(e^o - e^E)}{e^I - e^o} < 1.$$

Since $\delta(.)$ is concave, we obtain that $\delta(r_E) - \delta(\gamma r_I) > 0$. Therefore, $e_m$ is lower as the result of the indirect political competition. Also, since $de^o/de_m > 0$ as shown in the proof of Proposition 2, we have that $e^* < e^o$. Part (ii) and (iii) can be proved similarly as in the proof for Proposition 13. Q.E.D.

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