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**Environmental Protection and Free  
Trade: Direct and Indirect Competition  
for Political Influence**

by

**Zhihao Yu**

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## **Abstract**

Why can some environmental groups successfully compete against polluting industries in influencing government environmental policies? This paper suggests an explanation by developing a model of direct and indirect competition for political influence. Among other things, it is shown that moving to free trade increases the level of polarization in political competition. Nevertheless, the less open an economy, the greater the likelihood that free trade will increase domestic environmental protection.

## **Outline**

1. Introduction
2. Some Preliminaries and the Game
3. Implications of Direct Political Competition
4. Indirect Competition for Political Influence
5. The Small Open Economy
6. Concluding Remarks

## **Non-Technical Summary**

How is it that some environmental groups can successfully compete against polluting industries in influencing government environmental policies? The essence of political economy approaches to the determination of government policies with opposing special interest groups is that these groups are modelled as engaging in some kind of direct competition for sharing social welfare and that opposing pressures offset each other. Under these theories the relative political strength of different groups is often explained by the size of their economic stake in the government policy and the efficiency of their organization in exerting political influence. How then can we explain why some environmental groups have been very successful against polluting industries, when the latter's economic stakes are extremely high and their interests are relatively efficiently organized? On the one hand, theories of direct competition for political influence are less convincing when they are applied to the determination of environmental policies. On the other hand, political scientists suggest that the reason for the success of the environmental movement is that environmental groups can provide block votes, given the large membership of these organizations. However, according to Olson (1965), the large membership of an interest group is not necessarily an advantage, and it is still uncertain whether environmental groups are able to mobilise their members to cast votes based on such affiliation. This paper suggests an alternative explanation by developing a model of direct and indirect competition for political influence rather than marshalling block votes.

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). 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 pressed to increase expenditures on pollution control and abatement by billions of dollars each year, despite their significant lobbying efforts. The environmental groups that 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 have staffed full-time lobbyists since only 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 of 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 for influence over government policy. By direct competition we mean that interest groups provide political contributions to an incumbent government (or lobby) for favourable 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 to its policy. As a result, both direct and indirect forms of political competition have an impact on government policy.

The principal results are as follows. When there is only direct political competition the financially constrained Environmentalists will have less (or sometimes even no) political influence on government environmental policy, but this is no longer true when there is also indirect political competition. The Environmentalists can always benefit from educating the public regardless of whether or not they are able to participate in direct political competition. When both the Environmentalists and Industrialists are active in indirect political competition, being more efficient in persuading the public is not enough for the Environmentalists to achieve an outcome of indirect political competition favourable to them. The reason for this is that, on the margin, the benefit of persuading the public is greater for the interest group that is more influential in direct political competition. A sufficient condition for the outcome favourable to the Environmentalists is derived.

Furthermore, in a small open economy where output price is exogenously determined, the value of domestic persuasion falls because the linkage between environmental regulation and the price of the good is broken. Thus, government environmental policy is determined by direct political competition. More importantly, in the open economy the positions of different groups on environmental policy become more extreme and the level of polarisation in competition for political influence increases. The reason for this is that, on the margin, the effects on the benefits of both interest groups of a change in environmental policy become large when output price is fixed. As a result, direct competition for political influence becomes more intense. However, since the general public and the median voter become greener in the open economy when the price effect of domestic environmental regulation disappears, moving to free trade could either increase or decrease domestic environmental protection. Nevertheless, we show that the less open an economy, the greater the likelihood that free trade will increase domestic environmental protection.

We find that environmental policy provides a good application of the model developed in this paper, but the model can also be applied to the formation of other government policies that involve interest groups with different strengths. While the model is relative simple, the idea of indirect competition for political

influence has real-world appeal and complements the idea of direct competition for political influence. A combination of these two forms of competition could be very powerful in analyzing all sorts of government policies.

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

Zhihao Yu\*

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## Abstract

Why can some environmental groups successfully compete against polluting industries in influencing government environmental policies? This paper suggests an explanation by developing a model of direct and indirect competition for political influence. Among other things, it is shown that moving to free trade increases the level of polarization in political competition. Nevertheless, the less open an economy, the greater the likelihood that free trade will increase domestic environmental protection.

Key Words: Environmental protection, International trade, Political economy.

JEL classification: Q20, Q28, F10, D72

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## **Abstract**

Why can some environmental groups successfully compete against polluting industries in influencing government environmental policies? This paper suggests an explanation by developing a model of direct and indirect competition for political influence. Among other things, it is shown that moving to free trade increases the level of polarization in political competition. Nevertheless, the less open an economy, the greater the likelihood that free trade will increase domestic environmental protection.



# 1 Introduction

How is it that some environmental groups can successfully compete against polluting industries in influencing government environmental policies? The essence of political economy approaches to the determination of government policies with opposing special interest groups is that these groups are modeled as engaging in some kind of direct competition for sharing social welfare and that opposing pressures offset each other.<sup>1</sup> Under these theories the relative political strength of different groups is often explained by the size of their economic stake in the government policy and the efficiency of their organization in exerting political influence [e.g. Becker (1983, 1985) and Findlay and Wellisz (1982)].<sup>2</sup> How then can we explain why some environmental groups have been very successful against polluting industries, when the latter's economic stakes are extremely high and their interests are relatively efficiently organized? On the one hand, theories of direct competition for political influence are less convincing when they are applied to the determination of environmental policies. On the other hand, political scientists suggest that the reason for the success of the environmental movement is that environmental groups can provide block votes, given the large membership of these organizations.<sup>3</sup> However, according to Olson (1965), the large membership of an interest group is not necessarily an advantage, and it is still uncertain whether environmental groups are able to mobilize their members to cast votes based on such affiliation. This paper suggests an alternative explanation by developing a model of direct and indirect competition for political influence rather than marshalling block votes.

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

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<sup>1</sup>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 each other; rather, they may reinforce each other. For surveys in political economy models see Hillman (1989) and Rodrik (1995). Milner (1991) also provides a critical review of interest group models.

<sup>2</sup>Becker (1985) recognizes the limits of existing theories when they are applied to small groups.

<sup>3</sup>See Smith (1985) for the reason why environmental groups can have large membership.

1970s (three times the level of the 1960s).<sup>4</sup> This momentum was sustained during the 1980s and environmental issues still remain on the political agenda in the 1990s.<sup>5</sup> As a result, polluting industries have been pressed to increase expenditures on pollution control and abatement by billions of dollars each year, despite their significant lobbying efforts. The environmental groups that 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 have staffed full-time lobbyists since only 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 of 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 for influence over 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 to its policy. As a result, both direct and indirect forms of political competition have an impact on government policy.<sup>6</sup>

The principal results are as follows. When there is only direct political competition the financially constrained Environmentalists will have less (or sometimes even no) political influence on government environmental policy, but this is no longer true when there is also

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<sup>4</sup>Source: U.S. Government Council on Environmental Quality Annual Report (1979).

<sup>5</sup>Symonds (1982, p137) notes that: "Since President Reagan and the first Republican-controlled Senate in a generation took power in Washington, many of the liberal ideas and programs that flourished in the Sixties and Seventies have faltered. One that hasn't is the environmental movement, which has not only hung on to its public support but become so much stronger ...".

<sup>6</sup>Political competition in this paper means competition for political influence among interest groups, which is different from the meaning of the same terminology used for competition among political parties.

indirect political competition. The Environmentalists can always benefit from educating the public regardless of whether or not they are able to participate in direct political competition. When both the Environmentalists and Industrialists are active in indirect political competition, being more efficient in persuading the public is not enough for the Environmentalists to achieve an outcome of indirect political competition favorable to them. The reason for this is that, on the margin, the benefit of persuading the public is greater for the interest group that is more influential in direct political competition. A sufficient condition for the outcome favorable to the Environmentalists is derived.

Furthermore, in a small open economy where output price is exogenously determined, the value of domestic persuasion falls because the linkage between environmental regulation and the price of the good is broken. Thus, government environmental policy is determined by direct political competition. More importantly, in the open economy the positions of different groups on environmental policy become more extreme and the level of polarization in competition for political influence increases. The reason for this is that, on the margin, the effects on the benefits of both interest groups of a change in environmental policy become large when output price is fixed. As a result, direct competition for political influence becomes more intense. However, since the general public and the median voter become greener in the open economy when the price effect of domestic environmental regulation disappears, moving to free trade could either increase or decrease domestic environmental protection. Nevertheless, we show that the less open an economy, the greater the likelihood that free trade will increase domestic environmental protection.

There are relatively few studies on political economy of environmental policy, especially in open economies. Hahn (1990) provides a critical review of the subject in closed economies. Hillman and Ursprung (1992, 1994) focus on the influence of environmental concerns on the political determination of trade policy. Hoekman and Leidy (1992) address the political economy of the choice of instruments in environmental policy in a trading economy.

Fredriksson (1997, 1999) are recent contributions to the literature. In Fredriksson (1999) trade liberalization reduces the level of political polarization in the pollution tax determi-

nation process, because domestic output level falls with the tariff. However, in the model agents who care about the environment do not consume the good and agents who consume the good do not care about the environment. In contrast, in our model all agents care about both the price of the good and the environment. As mentioned above, we show that the level of political polarization increases in the open economy. More importantly, we focus on both direct and indirect political competition in the determination of environmental policy, which is absent from any of the above studies.

There is a growing literature on social learning, which emphasizes the influence of changes in public preference on government policy [See Nelson (1999) for a recent applications in trade policy]. However, this literature focuses on self- and non-strategic learning. Smith (1997) focuses on the issue of how interest groups have interest in presenting policy-relevant information to a legislator (rather than the general public). In Congleton (1996) it is briefly discussed that interest groups may have incentives to subsidize the dissemination of information about environmental policy to voters. A paper more closely related to the issue of indirect competition for political influence is Ursprung (1994), which examines the influence of political propaganda on voters and the implications for the behavior of the interest groups.

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

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 factor, so that the cost of abatement is in terms of output. For simplicity, the pollution abatement cost is assumed to reduce the productivity of producing the good in a neutral way:<sup>7</sup>

$$X = [1 - \gamma(e)]F, \quad \gamma(0) = 1, \gamma(\cdot)' < 0, 0 \leq \gamma(\cdot) \leq 1, \quad (2)$$

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 (inverse) individual demand function for good  $x$  is  $p = u'(x)$ . Hence, the 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.<sup>8</sup> 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 places a high utility value on environmental quality; and third, the general

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<sup>7</sup>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).

<sup>8</sup>Notice that whether output price depends on government environmental regulation is the key difference between a closed and open economy.

public. All industrialists are organized as a special interest group (“Industrialists”) with a population of  $N_I$ .<sup>9</sup> 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,  $N - N_E - N_I$ , is the general public and is politically unorganized.

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

$$V_i(Y_i, e) = s(e) + Y_i + \nu_i q(e), \quad (3)$$

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

$$V_i = s(e) + 1 + \nu_i q(e), \quad (4)$$

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

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

$$= \epsilon(\nu_i). \quad (6)$$

Assuming preferences are single-peaked,  $\epsilon(\cdot)$  will be a decreasing function in  $\nu_i$ . Then  $e_i$  will be distributed according to a pdf  $\phi(\cdot)$  [corresponding to  $\omega(\cdot)$ ] 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

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

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

$$W_E = N_E V_E. \quad (8)$$

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<sup>9</sup>The subscript  $I$  denotes the variables of the Industrialists. Similarly, the subscript  $E$  will denote the variables of the Environmentalists.

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 is

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

For simplicity, we assume that  $\nu_I = \nu_l$ . Thus  $e_I > \bar{e}$ .<sup>10</sup> 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

$$W_I = N_I V_I. \quad (10)$$

The incumbent government in the model cares about the total level of political contributions and the ‘political cost’ of its environmental policy that deviates from the median voter’s preference.<sup>11</sup> Its objective function (or ‘political support’) takes the form

$$G = C_E + C_I - \theta M(e, e_m), \quad \theta > 0, \quad (11)$$

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

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

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

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

Or,

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

where  $\Phi(\cdot)$  is the *CDF* function corresponding to  $\phi(\cdot)$ . Alternatively, we can write

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

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<sup>10</sup>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  $\nu_I = \nu_l$ .

<sup>11</sup>Cahan and Kaempfer (1992) find that their empirical results are supportive of both interest group and median voter models of the political process.

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

$$G = -\theta M(e, e_m). \quad (16)$$

Therefore,  $e_m$  will be the equilibrium policy.

The game of environmental policy 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 Implications of Direct Political Competition

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), which 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,

$$W_j(e) - C_j(e), \quad j = E, I. \quad (17)$$

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),

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

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 also cares about the political cost of its policy that deviates from the median voter's preference (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.<sup>12</sup> The subgame-perfect Nash equilibrium can, therefore, be characterized in the following proposition.

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

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

(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  $|W_I'| > |W_E'|$  and  $e^o < e_m$  when  $|W_I'| < |W_E'|$ . This means that if their economic stake involved is larger, the Industrialists will be relatively 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:

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

As often used in other types of political economy models, since the government objective function is linear, most studies assume away the cases of corner solutions - assuming that

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<sup>12</sup>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  $j$ .

all interest groups can fully participate in such political competition. However, some interest groups (like environmental groups, for example) are relatively financially constrained.<sup>13</sup> 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 level government environmental policy would be  $e^I$  instead of  $e^o$ , where

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

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

In brief, given the asymmetry between environmental 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

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 and increase public demand for environmental quality: 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

$$\Phi(e; \delta(r_E)), \quad \Phi_2(\cdot) > 0; \quad \delta'(\cdot) > 0, \delta''(\cdot) < 0, \quad (22)$$

where  $r_E$  is the resource spent by the Environmentalists in educating the public.

Notice that in this paper we are only interested in the changes in the distribution of  $\Phi(e)$ , rather than the mechanism of how  $v_i$  is affected on the micro level. The former

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<sup>13</sup>As well, unlike polluting industries, the benefits from a tightening of environmental policy is not exactly pecuniary for environmental groups.

is analogous with the issue of how advertising would affect demand, which has been investigated fairly thoroughly in the industrial organization literature.<sup>14</sup>

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  $e^I$  and increase their benefit by solving the following optimization problem:

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

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

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

**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 level of 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.,  $M_1$ ).<sup>15</sup> 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,

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

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<sup>14</sup>For example, see Grossman and Shapiro (1984), Chin and Ong (1989) and Meurer and Stahl, II (1994).

<sup>15</sup>As we show in Appendix,  $dM_1/dr_E > 0$ . Notice that this result does not depend on whether  $e^o$  is greater or less than  $e_m$ .

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

Thus the model of direct and 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

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

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

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

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

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

The first-order condition following (28) is

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

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 level of political contribution schedule for the Environmentalists (i.e.  $C_E^*(e) < C_E^o(e)$ ); and
- (iii) a higher level of 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 the direct political competition. This is achieved by the Industrialists, of course, through the competition in providing political contributions. From (27) and (29), notice that on the margin the benefit of a change in  $e_m$  is greater for the Industrialists than for the Environmentalists. Then, how could it be possible that the Environmentalists can achieve an outcome of indirect political competition favorable to them? The answer is that the Environmentalists must be more efficient in persuading the public than the Industrialists. Proposition 3 provides us with a sufficient condition.<sup>16</sup>

Why might there be an asymmetry such that the Industrialists are less efficient than the Environmentalists in persuading the public? On the one hand, compared to polluting industries environmental groups usually do not have direct monetary interests in the outcome of government environmental regulation. 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 just more efficient in persuading the public than the Industrialists; their (relative) credibility must be sufficiently high to satisfy the condition shown in Proposition 3.

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<sup>16</sup>If the Environmentalists are more "influential" (i.e.,  $e^o - e^E < e^I - e^o$ ), the condition of  $\gamma < \tilde{\gamma}$  is automatically satisfied even when two groups are equally efficient in persuading the public.

## 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 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  $e$ , it is easy to show that [from (5)]

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

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.

However, this extreme outcome captures some more general results. First, when the price of the good is exogenously determined, the value of domestic persuasion falls because it becomes 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 the small open economy will be determined by direct political competition. The welfare of the Industrialists is given by

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

The marginal benefit of an increase in  $e$  for the Industrialists becomes

$$W'_I(e; p^*) = \pi_2(p^*, e) + N_I \nu_I q'(e) \quad (32)$$

in the small open economy but it is

$$W'_I(e) = [N_I s'(p) + \pi_1(p, e)]p'(e) + \pi_2(p, e) + N_I \nu_I q'(e) \quad (33)$$

in the closed economy. The first term in (33) 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 the small open economy is larger than that in the closed economy. The reason for this is that in the 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

$$W'_E(e; p^*) = N_E \nu_E q'(e) \quad (34)$$

in the small open economy but it is

$$W'_E(e) = N_E s'(p)p'(e) + N_E \nu_E q'(e) \quad (35)$$

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 positions of both groups on the environmental policy become more extreme and the level of political polarization increases. Consequently, the direct competition for political influence will become more intense in the small open economy than in the closed economy.<sup>17</sup> The

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<sup>17</sup>The outcome of this intensified political competition will be discussed in a moment.

reason for this is that the equilibrium political contribution has the following property (see Footnote 12),

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

That is, the marginal change in political contributions from an interest group will match the effect of a policy change on its welfare. We summarize the above discussion in the following proposition.

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

- (i) *the value of domestic persuasion falls and the government environmental policy is determined in direct political competition; and*
- (ii) *the level of political polarization increases and direct competition for political influence becomes more intense.*

Notice that although environmental policy will be determined only in direct 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 when the price effect of environmental regulation disappears in the open economy.

When a country moves to free trade, there will be two changes in our model. First, the price of the good becomes exogenously determined. Second, the world price in free trade will be different from the autarky price. 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 (19) in the closed economy as follows:

$$\begin{aligned} & [N_I s'(p) + \pi_1(p, e^o)] p'(e^o) + \pi_2(p, e^o) + N_I \nu_I q'(e^o) \\ & + [N_E s'(p) p'(e^o) + N_E \nu_E q'(e^o)] - \theta(N - N_E - N_I)(e^o - e_m) = 0. \end{aligned} \quad (37)$$



Therefore,

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

Notice that the deviation of  $e^o$  from  $e_m$  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, (37) becomes

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

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

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

Since  $(N_E + N_I) s'(p) + \pi_1(p, e^o) > 0$ ,<sup>18</sup> we obtain

$$e^f - 0 > e^o - e_m \quad (41)$$

when  $p^* = p$ . That is, the Industrialists become more powerful than 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

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

<sup>18</sup>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.

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, compared to the Environmentalists. Second, the general public and the median voter become greener. The first effect tends to reduce environmental protection but the second effect tends to increase 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 becomes 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, the stronger this linkage. Therefore, Proposition 5 has the following corollary.

**Corollary 1** *The less open an economy, the greater the likelihood that free trade will increase domestic environmental protection.*

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 the 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 at the margin only affect the profits of the polluting industry [i.e. only  $\pi_2(p^*, e)$  depends on  $p^*$ ]. An increase in the world 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 competition for political influence studies how interest groups lobby governments. Indirect competition for political influence, however, studies how interest groups win over the general public. As long as the preferences of the general public are, to some extent, taken into account by governments, changing the public's preferences can indirectly influence government policy.

Although we find that environmental policy provides a good application of the model developed in this paper, the model can also be applied to the formation of other government policies that involve interest groups with different strengths. While the model is relative simple, the idea of indirect competition for political influence has real-world appeal and complements the idea of direct competition for political influence. A combination of these two forms of competition could be very powerful in analyzing all sorts of government policies.

The result that environmental policy in a small open economy is determined only in direct competition for political influence is rather extreme because of the special properties of this model. However, it provides insights for some broader implications. For example, when the output price is exogenously determined, the level of polarization in political competition increases and competition for political influence becomes more intense. Moreover, the less open an economy, the greater the likelihood that free trade will increase domestic environmental protection. These results can provide some testable hypotheses.

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## 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

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

for the government,

$$W_E(e^o) - C_E^o(e^o) \geq W_E(e) - C_E^o(e) \quad (43)$$

for the Environmentalists, and

$$W_I(e^o) - C_I^o(e^o) \geq W_I(e) - C_I^o(e) \quad (44)$$

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

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

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

$$C_I^o(e^I) - C_I^o(e^o) = W_I(e^I) - W_I(e^o). \quad (46)$$

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

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

From (46) and (47), we have

$$C_E^o(e^o, b_E^o) = [W_I(e^I) - \theta M(e^I, e_m)] - [W_I(e^o) - \theta M(e^o, e_m)]. \quad (48)$$

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

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

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

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

Totally differentiating the above equation, we obtain

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

Therefore,

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

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

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

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

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

where  $\Delta = (W_E'' + W_I'' - \theta M_{11})$  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,

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



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  $\delta(\cdot)$  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 2. Q.E.D.