The Economic Analysis of National and Global Interest Politics for International Environmental Standards

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국 문 요 약

본 연구는 정부의 국제환경규범 결정과정에 영향을 줄 수 있는 이익집단들의 정치적 행동을 조감하는 데 필요한 정치경제학 모형을 제시한다. 복잡하고 다양한 이익집단의 집단행동을 분석하기 위해서 본 연구는 최근 유행하는 메뉴 옥션 유형의 선거비용 기부 모형으로부터 시작하여 다수 조정자 - 다수 대리인 이론에 근거하는 국제 이익집단 정치와 더불어 공동 대리인 모형과 다수 조정자 - 다수 대리인 모델이 혼재되어 있는 경우까지 조감하였다.

국제무역이론의 특정생산요소 모형을 바탕으로 다양한 이익집단 정치경제모형에서 결정될 수 있는 균형 환경규범의 수준을 분석하여 근래 점증하는 환경주의자 이익집단의 정치적 역할 등을 가늠하도록 한다. 2국 소국가 개방경제를 가정하여 각국의 일방적인 환경규범입안은 매우 완화된 수준에서 이루어질 것이고 이 때문에 초래되는 외부효과는 정부 간 협력을 통하여 내재화될 수 있다는 종래의 이론적 주장에서 탈피하여 국가 간 협력을 통하여 달성될 수 있는 최적의 국제환경규범 수준이 동일한 이익을 추구하는 각국의 이익집단 간의 협력을 통해서도 가능함을 지적한다.

▌주제어 ▌ 국제 환경 규범, 이익 집단 정치의 경제적 분석, 공동 대리인 모형, 다수 조정자 – 다수 대리인 모형

Abstract

This study presents the political economics models to explore the political landscape of special interest groups influencing the government's decision making process for implementing international environmental standard. Starting with the popular menu-auction types of lobbying frameworks in the literature, the study extends its scope of research to multi-principal and multi-agency based international interest group politics and its hybrid case in order to bring the interaction of the relevant interest politics to the fore.

Within a specific factor model of international trade between 2 small open economies, we compare the political equilibrium environmental standards in different institutional frameworks which can be feasible in the sense of recently growing role of environmental interest group. Although the conventional finding suggests that cooperative bargaining between the two countries can attain the globally optimal level of the standard, the paper rather explains that the cooperation between the national interest groups and the hybrid case also generate the stricter standard then national interest politics usually do.

▌Keywords ▌ international environmental standards, economic analysis of interest group politics, common agency, multi principal - multi agency

I Introduction

This paper analyses the influence of interest group politics on implementing environmental standards in an economy in which so-called 'environmentalists' and 'industrialists' have traded-off interests over the given level of standard.[1] Focusing on emission intensity standard, this paper illustrates how a government's environmental standards policy is determined by lobbying on behalf of environmentalist groups and industrialist groups. Environmental standards regulating the ratio of emission per unit output particularly would have significant effects on the welfare of capital owners, the profits of firms, as well as on the conduct of international trade. Thus, in analyzing the factors that affect the government's policy choice of environmental standards, it would be of importance to take into account the interests of each relevant group.

A usual implication shows that governments often enforce environmental standards unilaterally and without regard to the wider implications. Unilateral policy actions of sovereign governments may result in inefficient outcomes for the global economy, and may even lead to a so-called 'race to the bottom'. The related literature in this context often suggests a demand for inter-governmental cooperation in an attempt to internalize externalities for mutual benefits.[2] That is, concerns over trans-boundary or global environmental issues can lead to inter-country cooperation that is essential to work out the externalities involved. However, the typical hardness in concluding international agreements during negotiations implies that international policy coordination is not a painless agenda for all. The vulnerability of international agreement to free riding problem as well as the absence of a supra national government that is empowered to enforce the coordinated policy are just a few of the problems.

Therefore, faced with these problems associated with inter-governmental cooperation, this paper alternatively examines a way to internalize the externalities over boundaries

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not through cooperation between the nations but rather between the relevant interest groups. The international solidarity between interest groups has become a prevailing issue with a recent speed-up in the globalization with which almost every aspect of human interests are being affected. Particularly, the interests representing environment and labour sector has been come to the forefront since the like-minded population in those sectors in a country often organizes politically motivated pressure groups and even seek out cooperating with the foreign counterpart for fear of their welfare loss. For example, when trade is liberalized, governments may attempt to use the environmental standard to shield favoured interest groups from the competitive pressures of increased trade and this can motivate the role of the international collective actions coordinated by the international solidarities between the pressure groups under the identical interests.

Basic framework of this paper considers a specific factor trade model with perfect competition to capture the strategic interaction of interest groups representing the interest of specific factor holders as well as the externalities generated by the governments' environmental standard policies. On the other hand, the political interaction between the government and interest groups when deciding the level of the emission standard particularly follows the principal-agent structure of campaign contribution, in which they play a two-stage game. It is anticipated that, depending on the facets of interest group politics, a different equilibrium environmental standard would be implemented in equilibrium. Thus, this study investigates the following cases of interest group politics: national interest politics, international interest group politics and a hybrid case which encompasses some aspects of both national and international interest group politics.[3]

The remainder of this paper is planned as follows. Section 2 reviews related literature for the study. Section 3 outlines the essential features of the economic model under a small open economy. Section 4 presents the types of interest politics in the decision process of an environmental standard, focusing on the characterization of each political equilibrium when making campaign contributions to politicians.[4] In section 5, the equilibria characterized in each political regime are compared through comparative statics. Section 6 concludes the paper.

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3) This paper does not include the analysis for international negotiation between the governments. However, result of this political case will be briefly discussed in the sequel of following analysis and the details of the analysis is available upon the requests from the readers.

4) This study will interchangeably use the term 'politician', 'policy maker', and 'government'. All is assumed to be in charge of making environmental standard under consideration.

Ⅱ Related Works

With the publication of menu-auction model by Bernheim and Whinston (1986), interest group politics has now been widely adopted as a basic framework to explain particularly endogenous decision processes for trade and environmental policy area. The political economics linkages between trade and the environment are receiving an increasing attention from related fields of economics literature. Green lobby was initially examined by Hillman and Urpsrung (1992), who found a noticeable implication in a model of endogenous trade policy that "the greens" may or may not lobby for higher tariffs depending on the types of pollution(local or trans-boundary spillover) so as to reduce contamination. Bommer (1996) and Bommer and Schulze (1999) examined the relationship between changes in endogenous environmental policy and international trade opening.

The common agency type of political competition in lobbying models includes Fredriksson (1997) for the political determination of pollution tax, Fredriksson (1999) for pollution tax linked with given trade policy, Aidt (1998) for an output tax and a tax on the polluting input, and Schleich (1999) for the endogenous trade and pollution policy with the more general assumption that all suffer from pollution. They typically use specific factor model to clearly highlight interest of factor owners in the face of government's policy changes and assume a small open economy model. Not only that, most papers commented are confined to the analysis of the role of domestic interest groups in illuminating the political aspects of endogenous environmental policy setting. The assumption of a large open economy is adopted by Schleich and Orden (2000) and Conconi (2003). They extend the framework of common agency model to allow interaction between two large open economies. But the characterization of political equilibrium in their model follows that of the menu auction type originally proposed by Bernheim and Whinston (1986). The recent theoretical contribution by Prat and Rustichini(2003) can enable us eventually to characterize political equilibrium from the model based on multi-principal and multi-agency framework to investigate the political outlook of international interest group politics.

Damania (2001) starts with a framework that is similar to that of Fredriksson (1997) and examines the interest of polluters whose political behaviour in making campaign contribution depends on the efficiency of abatement technology available. Contrary to other papers which usually adopt common agency model to explain the endogenous

mechanisms of environmental policy making, Yu (2000) elaborates the mechanisms by incorporating the median voter theorem to capture the insights on the formation of government environmental policies that involve interest groups with different strengths in their political influence.

Setting the basic general equilibrium model with the consideration of trans-boundary pollution spillover largely benefits from a series of papers by Copeland and Taylor whose contributions on the topics of trade and environment become a cornerstone of this literature. The study especially adopts the international trade frameworks proposed in Copeland and Taylor (1994, 1995, 1997, and 2003). The major features of technology and abatement cost assumed in this study also follows those of Copeland and Taylor (2003).

III. The Basic Model

This analysis is based on a simple general equilibrium model with a three factor - two good - two country model. In the model, a specific factor reward changes with the choice of the policy maker's environmental standard options. Considering the limited scope of the analysis, the environmental standard in this study only refer to the emission intensity that is a ratio of emission per unit of output as a policy option available to the policy maker. For simplicity, it is assumed that the two countries are identical, i.e., they have identical political and economic environments.

1. Technology

The model assumes a world consisting of two small open economies. Each cannot affect current world prices. Each economy is assumed to produce two types of goods; a clean good and a dirty good and only the dirty good to generates polluting emission in the production process. Hence, reward for the specific factor employed to produce the dirty good will be positively related to the changes of the quantity of emission including trans-boundary emission generated from the neighbour country. The production functions for clean good and dirty good are denoted by

$$Q_c = F_c(L_c, H) \text{ and } Q_D = F_D(L_D, K),$$

where subscript C denotes 'clean' and D 'dirty' sector respectively. Production of clean good(Q_C) and dirty good(Q_D) requires labour(L_C, L_D) and factors(H, K) that are specific to each industry. that the production of clean good requires a specific capital H while dirty good utilizes capital K. Technologies exhibit constant returns to scale in each industry. Q_C is taken as the numeraire production. It is also assumed that

$$\frac{\partial F_C(0, H)}{\partial L_C} = \frac{\partial F_D(0, K)}{\partial L_D} = \infty$$

for positive H and K. This implies that, for any positive prices, it is desirable to allocate the mobile factor labour to each competing use. That is, all the goods are produced. Full employment condition in the labour market requires that

$$\overline{L} = L_C + L_D.$$

It is further assumed that there are two economic agents in the economy, each with one unit of labour and a specific production factor, thus, in a competitive equilibrium, the wage rate can be normalized to one ($w = 1$) with CRTS technology assumption. The generic technologies without consideration of pollution to the production process are formally expressed as follows;

$$Q_C = AL_C^a H^{1-a}, \quad Q_D = BL_D^b K^{1-b}. \tag{1}$$

To reduce environmental deterioration, the environmental factor must be conserved, either indirectly through post-pollution clean up processes, or directly in the industrial process by substituting other valuable factors such as labour or capital for the environmental factor. From this rationale, the environmental factor can be incorporated in this setup by adding the environmental standard, e, as one factor in the production of an industry. As defined in Copeland and Taylor (2003), $e = z/Q_D$, where z can be interpreted as depletion of the environment and is measured in tons or some physical quantity of effluent output. In this analysis, z indicates the emission released in the air, generating negative externalities with harmful pollution. Following Copeland and Taylor (2003), to capture the abatement activity in a neat way, suppose it uses the same factor

intensities as production of the dirty good. Then, the cost of abatement is to reduce the output of Q_D:

$$Q_D = (1-\theta)F_D(L_D, K),$$

where $F_D(\cdot)$ is viewed as the potential(gross) output of the dirty goods when pollution abatement is not required as is defined in (1). That is, a firm allocates a fraction of θ of its inputs to the abatement activity. Then Q_D is the net output with pollution abatement and $\theta F_D(L_D, K)$ is the cost of pollution abatement in units of dirty good to meet a specific emission level issued by the policy maker.[5] Since abatement is possible, and emission intensity is a choice variable. Then emission as a joint production technology is shown as

$$z = \varphi(\theta)F_D.$$

A specific functional form is selected for simplicity of the analysis:

$$\varphi(\theta) = (1-\theta)^{\frac{1}{\alpha}}. \tag{2}$$

When the emission intensity with regard to externalities due to emission is incorporated to the technologies, the production functions assume to exhibit the following forms;

$$Q_C = AL_C^a H^{1-a}, \quad Q_D = e^{\frac{\alpha}{1-\alpha}} BL_D^b K_D^{1-b},\text{[6]}$$

where the parameter a, b, and α is any real number which belongs to the interval between 0 and 1. And It is assumed that $A = a^{-a}(1-a)^{a-1}$ and $B = b^{-b}(1-b)^{b-1}$.[7] The assumptions taken to describe the pollution externality - driven technologies are that production of the dirty good pollutes the capital need to produce the clean good and pollution abatement requires both labour and the specific factor.

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5) In this analysis, the policy maker can be viewed as a typical type of politician in the sense that he(she) is elected in the political campaign and serves as a civil servant to design the environmental standard and to regulate the production activities of voters defined in this model.

6) This functional form is derived using (2) and the definition for $e(= z/Q_D)$.

7) This assumption is adopted for the simple expressions of each factor rewards.

All inputs are supplied inelastically at levels $\overline{L} = L_C + L_D$, $\overline{H}$, and $\overline{K}$. In the specific factor model under consideration, the equilibrium factor rewards r_C for the factor employed to produce the clean good and r_D for the dirty good are

$$r_C = P_C^{\frac{1}{1-a}} = 1, \ r_D = e_1^{\frac{\alpha}{1-\alpha}\frac{1}{1-b}} P_D^{\frac{1}{1-b}},$$

where P_C and P_D are fixed international prices for the goods and P_C is normalized to one. Specific factor rewards of the factor for the production of the dirty good is positively related with the changes of emission intensity. This feature implies that the interests of the owners of a specific factor are aligned with the interests of the industry that employs it.[8]

The total population is N (= 2) and each individual is assumed to supply one unit of labour as well as a specific factor. There are two kinds of individuals in the economy according to the specific factor they own: one for the 'industrialists', each of whom owns the specific factor that is used to produce the dirty good and the other for, so called, 'environmentalists', each of whom owns the specific factor to produce the clean good.[9][10] It is assumed that all industrialists are organized as a special interest group with a population of N_D (= 1) and all environmentalists are also organized with a population of N_C (= 1).[11] Each group would politically be active in the government's decision process of the environmental standard.

2. Individual Preference

It is assumed that all individuals in the economy display identical preference except for different valuations of environmental quality and difference in their income due to the implementation of the environmental standard. Individual i of the environmentalists maximizes a transferable utility function with an additive global pollution externality term subject to a budget constraint;

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8) Allowing larger emission intensity benefits the dirty good producers by paying less for pollution abatement facilities when imposing less strict regulation.

9) Otherwise, they may be named as 'physiocrat' rather than as environmentalist according to the specification of the model.

10) As will be clear when analysing political models, the study assumes that each individual with a specific factor organizes an interest group to lobby the government under the process of the environmental standard choice. There is no individual who do not have membership in a lobby group in this analysis.

11) Thus, $N = N_C + N_D$. There are no unorganized individuals as an interest group in the economy. The population of each group is normalized so that the size of the population does not matter in the analysis.

$$\max_{Q_C^i, Q_D^i, z} U_E^i(Q_C^i, Q_D^i, Z) = Q_C^i + u^i(Q_D^i) - h(Z)$$

$$s.t \quad P_C Q_C^i + P_D Q_D^i \le I_C^i$$

An explicit form of the direct utility function of an individual i of environmentalists is assumed;

$$U_E^i(Q_C^i, Q_D^i, Z) = Q_C^i + \ln Q_D^i - \rho Z,$$

where commodities Q_C^i and Q_D^i have the fixed international prices P_C and P_D, and the individual income is I_C^i. ρ is between 0 and 1($0 < \rho < 1$) and indicates marginal disutility of the environmentalists per unit increase of global pollution. Q_j^i denotes the amount of consumption demand for good j by an individual i. It should be also noted that $Z = z_1 + \phi z_2$. ϕ denotes degree of trans-boundary emission affecting the domestic country ($0 \le \phi \le 1$).

The environmental standard under consideration acts as a kind of environmental law or mandated regulation of a public good nature in the sense that no one is excluded from being equally served for. Hence, this leads the individual factor income equal to

$$I_C^i = w + r_C(P_C)H^i = 1 + H^i.$$

Here, the specific factor endowment is assumed to be equally distributed among the holders. Thus, the heterogeneity among individuals comes from the different rewards of the specific factor endowment and its income differential between the individuals in the economy. Then "the policy preference of individual i" follows the form of

$$V_i^E = V_i^E(e_i, e_j) = I_C^i(e_i, e_j) - 1 - \ln P_D - \rho Z.$$

For the industrialists, the direct utility function of an individual i also follows a transferable form;

$$U_I^i = U_C^i(Q_C^i, Q_D^i) = Q_C^i + \ln Q_D^i.$$

It is shown that industrialists do not concern about how much pollution is prevalent around themselves because they have more stake in the earning factor income when increasing production. Thus, the policy preference for the individual of this group is

$$V_i^{I_i}(e_i, e_j) = I_D^i(e_i, e_j) - 1 - ln P_D,$$

where $I_D^i(e_i, e_j) = 1 + r_D(P_D, e_i, e_j)K^i = 1 + e_1^{\frac{\alpha}{1-\alpha}\frac{1}{1-b}} P_D^{\frac{1}{1-b}} K^i$.

By comparing the payoff structures of industrialists and environmentalists, it is clear that the interests of both groups are trade-off in that industrialists are in favour of a high environmental standard while the environmentalists a lower environmental standard. The resolution for this trade-off, when implementing the standards, will see some types of the interest politics in which the interest groups would compete with each other in making campaign contribution to the office-seeking government in the next campaign, who decides on the level of the environmental standard.

IV   Resolving the conflicts

It is assumed in this paper that the owners of each specific factor in each country organize the interest groups and seek influence on the government's decision process for the environmental standard. One way of this influence-seeking political behaviour can be found in offering rewards to the relevant government(s), for which the theoretical foundation was discussed in Bernheim and Winston (1986) and Dixit et al. (1997).

The analysis examines the following interest group politics. In the first case - national interest group politics - environmental standards are decided unilaterally by the two governments and the two interest groups in each country seek influence on that country's policy only by lobbying. In the second case - international interest group politics - each group of specific factor holders organizes an international interest group that through its national subsidiary lobby each of the two governments which, in turn, set its environmental standard unilaterally. The third - hybrid case - studies the same situation but assumes that only the environmentalists organize an international interest group. In the following subsections, we characterize the equilibrium environmental standards in each case.

1. National Interest Group Politics

First of all, let's explore the non-cooperative nature of the environmental standard decision process as case 1 of the interest politics of a country, which may arise in the absence of any international treaty or international institution that have an authority to enforce the environmental standard. We begin our analysis by initially applying the common agency framework to the case for unilateral implementation, through the competition of an environmentalist group and an industrial group in a country. We characterise the "truthful" equilibrium, in which interest groups compete to contribute up to the point where the marginal benefit of the contribution is exactly the same as the marginal cost of them. The assumption of the differentiability of the contribution schedule is prerequisite for the characterisation of local truthfulness of the equilibrium.[12] The non-cooperative nature of the policy maker's unilateral action implies that he does not care about any externalities generated by his own policy choice. The interest groups are indexed by $l \in \{E, I\}$, where E stands for environmentalists group and I stands for industrialist group lobby. The objective of the two lobby groups of country $i = 1, 2$ and $i \neq j$ is to maximize $v_i^l(e_i, e_j) - c_i^l(e_i)$ for $l \in \{E, I\}$, where $c_i^l(e_i)$ is the contribution schedule offered by the interest group l in country i to the government of country i.[13] It is noted that the contributions are contingent on the environmental standard decided by the government in country i only. Each government cares about social welfare and the monetary contributions from the interest groups:

$$G_i^1 = c_i^E(e_i) + c_i^I(e_i) + \delta W_i(e_i, e_j), \ i = 1, 2 \ \text{and} \ i \neq j,$$

where W_i represents social welfare of country i and "1" indicates that case 1 of the interest politics the paper explores. W_i is defined by

$$W_i(e_i, e_j) = v_i^E(e_i, e_j) + v_i^I(e_i, e_j).$$

The parameter $\delta \geq 0$ is the relative weight attached by the government to the social welfare. It can be interpreted as an inverse measure of corruption.

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12) For details, refere to Dixit et al. (1997).

13) Politicians are assumed to be office-seekers and it is also assumed that in the analysis, the financial contributions from the lobby groups are consumed as an expenditure needed for the election campaign.

The strategic interaction between the interest groups in a country and their government can be represented as a common agency game. The solution to this type of game is well-known (see, e.g., Grossman and Helpman, 1995). We shall not provide the details here. It is sufficient to note that the equilibrium environmental standard in the two countries is characterized by the solutions to the following two equations:[14]

$$\phi_i^1(\widehat{e_i}, \widehat{e_j}) = \left\{ \frac{\partial v_i^E(\widehat{e_i}, \widehat{e_j})}{\partial e_i} + \frac{\partial v_i^I(\widehat{e_i}, \widehat{e_j})}{\partial e_i} \right\} = 0, \ i = 1, 2 \ \text{and} \ i \neq j, \tag{3}$$

where "∧" is used to denote equilibrium values. Equation (3) shows that the equilibrium environmental standard in each country maximizes, for a given environmental standard implemented in the other country, a weighted social welfare function. The environmental standard of country i is efficient in the sense that it is not possible, for a given environmental standard in country j, to devise another standard that would make government i or one of the two interest groups in country i better off without reducing the welfare of one of the others. More important, however, is the fact that the political process in country i does not take into account that e_i affects the welfare of citizens in country j. This externality implies that the outcome under national lobbying is inefficient from a global point of view.

2. International Interest Group Politics

Although countries may be better off in cooperating when deciding the environmental standard, coordination between governments is often difficult to achieve because of conflicting economic or political reasons. In considering the endless evolvable political or economical aspects of the current international community, international cooperation or agreements between sovereign nations are likely to be unstable in the long run. These difficulties in international coordination lead us to open our eyes to a more probable or realistic non-cooperative mechanism that could derive an equilibrium that would otherwise be attainable by international cooperation. Hence, the current discussion is dedicated to the introduction of a new aspect for special interest politics in which each group under

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14) Considering the limited space of the paper, the details of the deriving the equations are not presented. Instead, they are available upon request.

a common interest pledge their international solidarity to systematically exert a more consolidated political influence on the governments' policy making. The international solidarity, in this context, implies that the interest groups are tied by the cause of their common interest, and so they cooperate in making a contribution to each government, competing with the other groups.

No cooperation takes place between the two governments; instead interest groups in different countries join forces and coordinate their political strategies through international organizations. The index $\tilde{\iota} \in \{\tilde{E}, \tilde{I}\}$ will be used to indicate the international environmentalist group and the international industrialist group, respectively.

Let $v^E(e_1, e_2) = \sum_{i=1}^{2} v_i^E(e_1, e_2)$ and $v^I(e_1, e_2) = \sum_{i=1}^{2} v_i^I(e_1, e_2)$ be the gross payoffs of the two international interest groups. The net payoffs then are $v^l(e_1, e_2) - c_1^l(e_1; e_2) - c_2^l(e_2; e_1)$. Each interest group offers two contribution schedules $c_i^l(e_i; e_j)$, $i = 1, 2$ and $i \neq j$; one to each government. The schedule offered to government i is a function of the environmental standard implemented in that country, taking as given the environmental standard of the other country. The objective function of government $i = 1, 2$ and $i \neq j$ is

$$G_i^2 = \hat{c}_i^{\;E}(e_i; e_j) + \hat{c}_i^{\;I}(e_i; e_j) + \delta W_i(e_i, e_j).$$

As before, political competition takes place in two stages. First, the two international interest groups simultaneously offer contribution schedules to the two governments. Second, the two governments unilaterally implement an environmental standard taking as given the contribution schedules offered by the two international interest groups. The solution to this type of problem is less well-known in the applied political economics literature than the solutions to the common agency games of case 1, and the analysis, for that reason, shall dwell more on the technical details. Prat and Rustichini (2003) provide an equilibrium characterization that can be adopted to our model.

Lemma 1 (Adopted from Prat and Rustichini, 2003) Let e_j be an arbitrary level of the environmental standard set by country j and let s be a set of environmental standards $\{e_1, e_2\}$. Then a set of feasible non-negative contribution schedules $\{\hat{c}_i^l\}$ and an environmental standard $e_i \in [0, 1]$ constitute an equilibrium response to e_j if

(a) $\quad \widehat{e}_i = \overset{\arg\ \max}{\underset{e_i}{}} \sum_l \widehat{c}_i^{\ l}(e_i; e_j) + \delta W_i(e_i, e_j),$

(b) For every international interest group $\widetilde{l} \in \{\widetilde{E}, \widetilde{I}\}$, there cannot be a feasible contribution schedule $c_i^l(e_i; e_j)$ and an environmental standard e_i^l such that [i]

$$\widehat{e}_i^{\ l} = \overset{\arg\ \max}{\underset{e_i}{}} c_i^l(e_i; e_j) + \widehat{c}_i^{\ -l}(e_i; e_j) + \delta W_i(e_i, e_j)$$

and [ii]

$$v^l(e_i^l, e_j) - \sum_i c_i^l(e_i^l; e_j) > v^l(\widehat{e}_i, e_j) - \sum_i \widehat{c}_i^{\ l}(\widehat{e}_i; e_j)$$

where if $\widetilde{l} = E$ (or I), then $-\widetilde{l} = \widetilde{I}$ (or $\widetilde{E}$).

(c) Each international interest group $\widetilde{l}$ should offer the cost minimizing contribution schedule to each government i, i.e., for $\forall \widetilde{l} \in \{\widetilde{E}, \widetilde{I}\}$ and $i \in \{1, 2\}$,

$$\sum_l \widehat{c}_i^{\ l}(\widehat{e}_i; e_j) + \delta W_i(\widehat{e}_i, e_j) = \overset{\max}{\underset{e_i}{}} (\widehat{c}_i^{\ l}(e_i; e_j) + \delta W_i(e_i, e_j)).$$

The two first conditions of the Lemma are familiar from the common agency games analyzed above. Condition (a) says that each government i chooses the equilibrium environmental standard that maximizes the weighted sum of social welfare and the aggregate contributions offered by the two competing international interest groups. Condition (b) explains that an international interest group $\widetilde{l}$ cannot find a contribution schedule that yields a higher payoff than its equilibrium schedule given the equilibrium contribution schedule of the other international interest group. It follows from conditions (a) and (b) that the equilibrium environmental standard of country i, $\widehat{e}_i$, must maximize the joint welfare of each international interest group and the two governments, respectively. That is,

$$\hat{e}_i = \overset{\arg\ \max}{\underset{e_i}{}} \textit{v}(e_i, e_j) - \hat{c}_i^{\ l}(e_i; e_j) - \hat{c}_j^{\ l}(e_j; e_i) +$$
$$\hat{c}_i^{\ l}(e_i; e_j) + \hat{c}_i^{\ -l}(e_i; e_j) + \delta W_i(e_i, e_j) +$$
$$\hat{c}_j^{\ l}(e_j; e_i) + \hat{c}_j^{\ -l}(e_j; e_i) + \delta W_j(e_j, e_i) \tag{4}$$

for every l and $-l$.

By assuming that the contribution functions are differentiable around the equilibrium and the equilibrium environmental standard is interior, the first order conditions associated with equations (4) generate the following conditions:

$$\frac{\partial \textit{v}^l}{\partial e_i} - \frac{\partial \hat{c}_i^{\ l}}{\partial e_i} + \frac{\partial \hat{c}_j^{\ -l}}{\partial e_i} + \delta \frac{\partial W_j}{\partial e_i} = 0 \ \text{ for } \ \forall l \in \{\tilde{E}, \tilde{I}\}. \tag{5}$$

If we add conditions (5) across l up, then we get

$$\frac{\partial \textit{v}^E}{\partial e_i} + \frac{\partial \textit{v}^I}{\partial e_i} + 2\delta\left(\frac{\partial W_j}{\partial e_i}\right) - \frac{\partial \hat{c}_i^{\ E}}{\partial e_i} - \frac{\partial \hat{c}_i^{\ I}}{\partial e_i} + \frac{\partial \hat{c}_j^{\ E}}{\partial e_i} + \frac{\partial \hat{c}_j^{\ I}}{\partial e_i} = 0. \tag{6}$$

Condition (c), the cost minimization condition, requires that each international interest group offers a contribution schedule such that the cost of implementing $\hat{e}_i$ is minimized. This condition implicitly suggests that there is either no monetary rewards for the equilibrium policy choice, or, there is another policy which gives an exactly equal payoff to a policy maker, so that a group could not reduce its contribution for the equilibrium standard. Each contribution schedule of an international interest group is also assumed to be only contingent on the standard choice to be implemented in that country only. The cost minimizing contribution schedule of an international interest group l can be written as

$$\hat{c}_i^{\ l}(e_i; e_j) = \left\{ \underset{e_i \in e_i}{\max}\ (\hat{c}_i^{\ -l}(e_i) + \delta W_i(e)) \right\} - \left\{ \hat{c}_i^{\ -l}(e_i) + \delta W_i(e) \right\}$$

where e is a vector (e_i, e_j). Since $\underset{e_i}{\max}\ (\hat{c}_i^{\ -l}(e_i) + \delta W_i(e))$ is a constant, evaluated at the equilibrium environmental standards of government i, there will be a further restrictions on the marginal contribution schedules[15]:

$$\frac{\partial \hat{c}_i^E}{\partial e_i} = -\frac{\partial \hat{c}_i^I}{\partial e_i} - \delta \frac{\partial W_i}{\partial e_i} \text{ and } \frac{\partial \hat{c}_j^E}{\partial e_i} = -\frac{\partial \hat{c}_j^I}{\partial e_i} - \delta \frac{\partial W_j}{\partial e_i}.$$ (7)

If we substitute equation (7) into equation (6), the following result is obtained:

$$\frac{\partial v^E}{\partial e_i} + \frac{\partial v^I}{\partial e_i} + \delta \frac{\partial W_i}{\partial e_i} + \delta \frac{\partial W_j}{\partial e_i} = 0 .$$

By further clearing the result, the equilibrium environmental standards in the two countries are finally characterized by the solutions to the following two equations[16]:

$$\phi_i^2(\hat{e}) = \left\{ \frac{\partial v^E(\hat{e})}{\partial e_i} + \frac{\partial v^I(\hat{e})}{\partial e_i} \right\} = 0, \ i = 1, 2 \text{ and } i \neq j,$$ (8)

Although the international interest groups, in nature, behave non-cooperatively with each other when competing in the political market of each country, the contributions offered to each government imply the cooperative efforts to maximise the sum of their net rents, internalizing the global externality.

3. A hybrid case

While the two environmentalist groups have a common interest and would like to see strict environmental standards in both countries, each industrialist group, in fact, would prefer a lax standard at home. This is because the pollution problem being considered in this model is global dimension. Then a reasonable scenario for this is such that the two environmentalists organize an international interest group that offers contribution to each of the two governments while the two industrialist groups do not cooperate but seek influence on their own government separately. The two governments set their environmental standard unilaterally. The objective functions of the two separate industrialist interest groups and the international environmentalist group are $v_i^I(e_i, e_j) - c_i^I(e_i)$, $i = 1, 2$,

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15) This implies that, at equilibrium, the marginal contribution of lobby l corresponds to the lowest possible marginal inducement that the interest group has to provide in order to get government i to choose $\hat{e}_i$.

16) The following equations are in fact identical to the ones derived from cooperation between the incumbent governments, whose interest is not only to collect campaign contributions from the domestic interest groups, but also to enhance the welfare of global society. The outcomes of this case will be efficient from global point of view. As mentioned, this episode is not included in this analysis and the detailed procedure of deriving the equations follows Grossman and Helpman(1995).

and $i \neq j$ and $v^E(e_i, e_j) - c_i^E(e_i; e_j) - c_j^E(e_j; e_i)$ respectively. The objective function of government i is $G_i^3 = \hat{c}_i^{\,I}(e_i) + \hat{c}_i^{\,E}(e_i; e_j) + \delta W_i(e_i, e_j)$. To derive the equilibrium environmental standards, the aspects of case 1(national interest politics) and 2(international interest politics) are needed to be combined. The following lemma explains the idea;

Lemma 2 Following Bernheim and Whinston (1986), Grossman and Helpman (1995) and Prat and Rustichini (2003), a set of feasible contribution

functions $\left\{\hat{c}_i^{\,E}, \hat{c}_i^{\,I}\right\}_{i=1,2}$ and a environmental standard policy $\hat{e}_i$ is an equilibrium

response to the standard e_j taken by the other government j if the following conditions are satisfied: (a) $\forall i$ and $e_i \in \Psi_i$,

$$\hat{c}_i^{\,I}(\hat{e}_i) + \hat{c}_i^{\,E}(\hat{e}_i) + \delta W_i(\hat{e}) \geq \hat{c}_i^{\,I}(e_i) + \hat{c}_i^{\,E}(e_i) + \delta W_i(e).$$

(b) for every interest group in country i, there cannot be a feasible function $c_i^I(e_i; e_j)$ and $c_i^E(e_i; e_j)$ and environmental standards (e_i^I, e_i^E) such that (i) for the international environmentalists group,

$$e_i^E = \operatorname*{arg\ max}_{e_i} \hat{c}_i^{\,I}(e_i; e_j) + c_i^E(e_i; e_j) + \delta W_i(e) \quad \text{and}$$

$$v^E(e_i^E, e_j) - \sum_i c_i^E(e_i^E; e_j) > v^E(\hat{e}_i, e_j) - \sum_i \hat{c}_i^{\,E}(\hat{e}_i; e_j).$$

(ii) for the domestic industrialists group of country i,

$$e_i^I = \operatorname*{arg\ max}_{e_i} c_i^I(e_i; e_j) + \hat{c}_i^{\,E}(e_i; e_j) + \delta W_i(e) \quad \text{and}$$

$$v_i^I(e_i^I, e_j) - c_i^I(e_i^I; e_j) > v_i^I(\hat{e}_i, e_j) - \hat{c}_i^{\,I}(\hat{e}_i; e_j).$$

(c) international environmentalists interest group $\tilde{E}$ should offer the cost-minimising contribution to each government i such that

$$\sum_{E} \hat{c}_i^{\,E}(\hat{e}_i) + \delta W_i(\hat{e}) = \operatorname*{max}_{e_i} (\hat{c}_i^{\,-E}(e_i) + \delta W_i(e)).$$

At equilibrium, the environmental standard of government i, $\hat{e_i}$, must maximize the joint welfare of the international environmentalist group and the two governments, respectively, i.e.,

$$\hat{e_i} = \overset{\arg \max}{\underset{e_i}{}} v^E(e_i, e_j) - \hat{c_i}^E(e_i; e_j) - \hat{c_j}^E(e_j; e_i) +$$
$$\hat{c_i}^E(e_i; e_j) + \hat{c_i}^I(e_i) + \delta W_i(e_i, e_j) +$$
$$\hat{c_j}^E(e_j; e_i) + \hat{c_j}^I(e_j) + \delta W_j(e_j, e_i).$$

At the same time, $\hat{e_i}$ also must maximize the joint welfare of the industrialist group i and government i:

$$\hat{e_i} = \overset{\arg \max}{\underset{e_i}{}} v_i^I(e_i, e_j) - \hat{c_i}^I(e_i) +$$
$$\hat{c_i}^E(e_i; e_j) + \hat{c_i}^I(e_i) + \delta W_i(e_i, e_j).$$

The first order conditions associated with the agent maximization problem and the joint welfare maximization problem for each interest group generate the following conditions;

$$\frac{\partial v^E}{\partial e_i} + \frac{\partial \hat{c_i}^E}{\partial e_i} + \frac{\partial \hat{c_j}^I}{\partial e_i} + \delta \frac{\partial W_j}{\partial e_i} = 0 \text{ and } \frac{\partial v_i^I}{\partial e_i} - \frac{\partial \hat{c_i}^I}{\partial e_i} = 0$$

for $i = 1, 2$ and $i \neq j$. Using that $\partial \hat{c_j}^I(e_j) / \partial e_i = 0$ and adding up yields

$$\frac{\partial v^E}{\partial e_i} - \frac{\partial \hat{c_i}^E}{\partial e_i} + \frac{\partial v_i^I}{\partial e_i} - \frac{\partial \hat{c_i}^I}{\partial e_i} + \delta \frac{\partial W_i}{\partial e_i} = 0. \tag{9}$$

Cost minimization implies that

$$\frac{\partial \hat{c_i}^E}{\partial e_i} = -\frac{\partial \hat{c_i}^E}{\partial e_i} - \delta \frac{\partial W_i}{\partial e_i}. \tag{10}$$

By substituting equation (10) into equation (9), the following two equations for the characterization of the equilibrium environmental standards in the hybrid case are shown;

$$\phi_i^3(\hat{e}\ ) = \delta\frac{\partial v_j^I(\hat{e}\ )}{\partial e_i} + (1+\delta)\left\{\frac{\partial v_i^I(\hat{e}\ )}{\partial e_i} + \frac{\partial v^E(\hat{e}\ )}{\partial e_i}\right\} = 0,$$

$$i = 1, 2 \ \text{and} \ i \neq j, \tag{11}$$

The equilibrium environmental standards in the two countries are then characterized by the solutions to these two equations. This hybrid case for interest group politics may fail to implement globally efficient environmental standards. In particular, the fact that the two industrialist groups do not coordinate their lobbying efforts leads to less strict environmental standards than it is in international interest politics.

V   The Comparative Static Analysis

This section briefly examines how the emission intensity standard as well as the global pollution emission are affected by changes in one of the key parameters of the model, α(efficiency in the abatement technology). In the baseline specification, the following parameters have the fixed values such that P_D = 1.2, β = 0.2, ϕ = 1, θ = 0.1, ρ = 0.8, b = 0.2, δ = 1, K = 3, and H = 3.[17] The economic and political environment of the two countries depicted in the analysis is exactly identical except for the difference in efficiencies of the abatement technologies(α, β). The simulation is performed by vary the value of α from 0.2 to 0.5 when that of the foreign country is fixed at 0.2.[18]

1. Changes in Emission Intensity Standard

Figure 1 shows that emission intensity standard embodied in the three cases of political arena are listed.

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17) This selection implies that the technologies are specific factor intensive; that dirty goods are less expensive that clean good; that the environmentalists are directly affected by level of global pollution; and that there is a technology gap in the abatement efficiency performance between the two countries(α, β).

18) Given the efficient abatement technology($\beta = 0.2$) of the foreign country, the simulation considers the case that the abatement technology of home country is gradually becomes efficient(0.5-)0.2).

Figure1 changes in home emission intensity standard[19]

Home Emission Intensity Standard
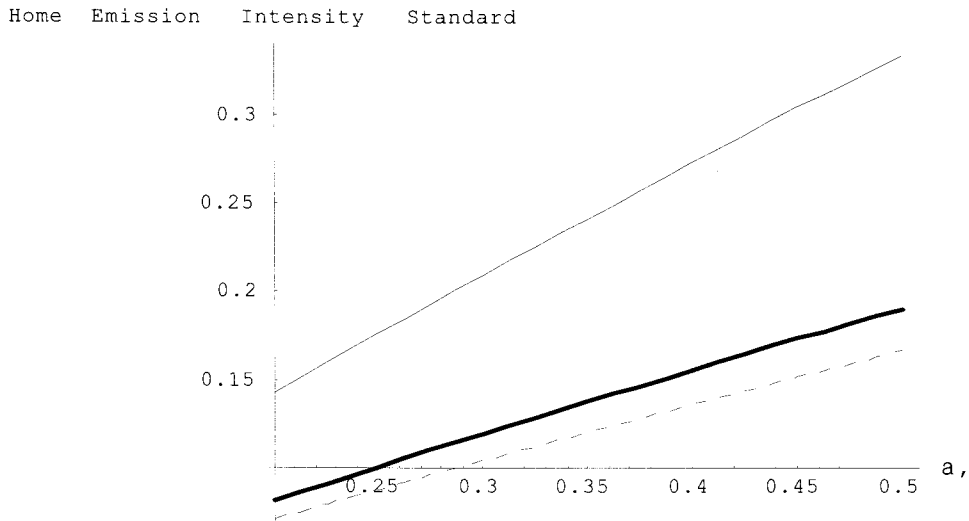
It is shown that the standard decided in the national interest politics is the highest level as it is expected in the theoretical analysis. On the other hand, the emission standard attained through international interest politics shows the strictest level. It is also noticed that, as the efficiency gap between the countries in the abatement technology gets small, differences in the standard in each case gets small accordingly. The major rationale of this observation can be found in the role of the international interest politics which results in the internalization of global externality. In case of the national interest politics which does not consider the externality generated to the other country, the emission standard is the laxest among the three political cases. The emission standard, however, from the hybrid case is far stricter than the one from the national interest politics but less stricter than from the international interest politics. This is certainly because the externality was partially internalized by global cooperation between the two environmental groups. These findings will be again confirmed in the results from the changes in global pollution hereafter.

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19) In the figure, the solid line represents the locus of the emission intensity standard decided in the national interest politics when efficiency parameter in the abatement technology changes. In the same manner, the other two lines which are dashing line and thick line are from international interest politics and the hybrid case respectively.

2. Changes in Global Pollution

   The following figure 2 presents trends of global pollution as the efficiency of abatement technology of the home country changes. This figure can be a supplementary explanation for the implication presented in figure 1 since the pollution of each country is controlled by the emission standard. Global pollution due to the domestic politics is the highest level of all the cases considered with the laxest standard while the international interest politics restricts the global pollution to being minimum. The hybrid case, however, show that the global pollution level is intermediate between the two political cases as expected, but it increases with the abatement technology getting inefficient. This may indicate the fact that each industrialist group is locally organized and with the partial internalization of the externality the emission would be gradually intense with the inefficient abatement technology as well as the less strict standard.

Figure2 changes in global pollution
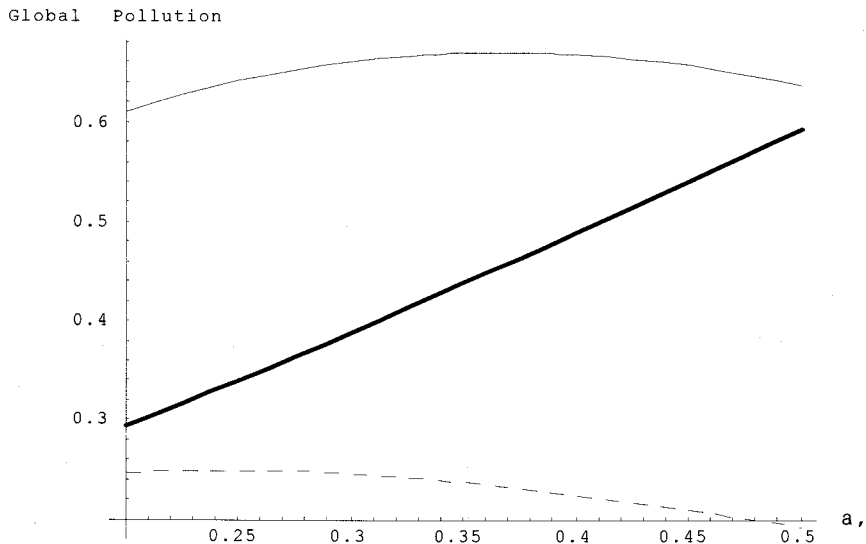
Ⅵ Conclusion

This study provides the comparative models for special interest politics with campaign contribution to highlight a stream of the green political movement which reflects the rising profiles of the environment in politics in the face of the latest growing global concern about a large-scale ecological crisis. Considering that environmental interest groups are presumably the most distinguishable expression of current environmental concern, particular emphasis of this study is put into the examination of political influence of the relevant interest groups in the process of governments' environmental policy making under the national and international perspective. With the help of the theoretical contributions by Bernheim and Whinston (1986), Grossman and Helpman (1995), and Prat and Rustichini (2003), this study adopts those theoretical frameworks in analyzing the political competition between interest groups. It is pointed out in this study that political competition between interest groups making campaign contribution to policy makers embodies political equilibria for the decision of international environmental standard under various types of interest politics. The political equilibria characterized by the interactions of the response functions shown in (3), (8) and (11). Basic implications of those response functions are I) the externality through the choice of the international environmental standard is not fully internalized in (3) while it is globally in (8), and II) the externality is partially internalized from the global point of view.

Thus, the main findings of the political model suggests that national interest politics usually generates the most slack environmental standard due to the unilateral adoption of sovereign governments, which may give rise to externalities across borders while the international interest politics and the hybrid case generates the stricter emission standard. These findings in the theoretical analysis are numerically verified through simulations in which trends of variables such as the emission intensity standard and global pollution are explored in response to changes in the efficiency parameter of the abatement technology.

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