# Japanese Special Interest Politics and Trade Policies on Recyclable Materials*

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## 1 Introduction

In order to achieve sustainable growth, recycling is promoted around the world. Promotion of recycling, in part, reflects increasing concerns for waste disposal for its environmental and health effects, and an urgent need to reduce the cost of waste treatment of landfills. Higher recycling rates successfully prolonged the life of landfills and reducing the cost of waste treatment. However, the recycling systems are now facing new challenges in the globalized economy.

As the prices of natural resources rise, the international trade in recyclable materials has increased rapidly. Recyclable materials are no longer perceived as “wastes”, but rather as resources. Being close substitutes for virgin materials, recyclable materials are traded to meet the growing resource demands in developing countries.[1)]

The recyclable materials are mainly traded from the developed countries to the developing countries. In particular, trade in recyclable materi-

* I would like to thank Profs. M. Stake and Linask and seminar participants at Western Economic Association International 2011 for helpful comments. Remaining errors are solely mine.

1) The world trade volume of recyclable aluminum, lead zinc, copper and paper combined increased from 2.5 million tons in 1970 to 21.5 million tons in 1997. See Van Beukering (2001). The trade to output ratio for the recycled copper, paper and aluminum nearly tripled in the same period.

als is eminent in Asian countries experiencing rapid economic growth. Newly industrializing Asian countries have become the major importers of recyclable materials in the world. In contrast to the trade patterns of natural resources, recyclable materials are traded from the North to the South.

Japan's exports of recyclable materials, for example, are primarily destined for China in the recent decades. Exports of plastic wastes in 2009 increased by 36 times in weight tones compared to the year 1990, and scrap iron and copper increased by 24 times and 30 times respectively.[2)] A rapid expansion of trade in recyclable materials is starving domestic recycling sectors of input materials and putting them at risk of closing down.

Trade policies associated with recyclable materials have shifted its emphasis on import restriction on "wastes" to suppressing the outflows of recyclable materials. When recycling was perceived as part of waste management, the main concern related to trade in recyclable materials was on pollution dumping. In the 1980's, exports of recyclable materials from the developed to developing countries contained hazardous wastes and created serious concerns for the environmental damages in the developing countries. This resulted in the enactment of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (so called the Basel Convention) in 1992, which prohibits transboundary movements of unrecoverable wastes and hazardous recyclable wastes.

As the importance of recyclable materials as resources is realized, it is now the exporting countries that attempt to impose trade restrictions. In response to the rising prices and exports of recyclable materials, Japan,

2) See Satake and Saito (2010) and Kojima (2005) for Japan's current trade patterns of recyclable materials.

for example, amended the recycling law to discourage exports of used plastic bottles to protect the domestic recycling system. The new recycling law for containers and packaging encourages “smooth delivery of waste plastic bottles for sound recycling”; Local municipalities are expected to transfer used plastic bottles to the domestic recyclers and not to the exporters.

Yet, little is known theoretically on the optimality and the effects of such trade policies on recyclable materials. Copeland (1991) examined the effects of import tariff on wastes that generate externalities, however, trading of wastes are no longer allowed under the Basel Convention. Yamashige (2011) examined the optimal export taxes on recyclable materials, as opposed to wastes. It has been shown that it is optimal to subsidize exports of recyclable materials which is produced by using consumption wastes in a simple one factor model.

It is a puzzle, why exports of recyclable materials, which may be optimal theoretically to subsidize, is in fact restricted in Japan. In this paper, we characterize recyclable materials as traded intermediate goods which are produced by using production wastes, and examine the optimal export tax rate on recyclable materials in a specific factor framework. Then, we try to explain why restrictive export policies on recyclable materials are adopted by looking at endogenous policy making processes. In particular, we look at the Japanese policy making process and formalize how trade policies on recyclable materials are endogenously determined through rent seeking activities among the special interest groups.

The paper is organized as follows. In the following section, Japanese policymaking process is portrayed with a special reference to the policy formation on recycling. In section 3, a simple trade theoretic model is

presented to characterize the special interests associated with recycling. An optimal export tax on the recyclable material is then analyzed in section 4. In section 5, the endogenous trade policy formation through rent seeking is discussed in two types of policy making processes; the fragmented policy making process and the non-fragmented process. We will show that fragmented special interest politics as is observed in Japan may lead to more protective trade policies in the recycling sector.

## 2　Special Interest Politics and Recycling in Japan

In some society, such as in the U.S., it is the politicians who play central role in policymaking, hence, special interest groups lobby legislature. However, there are other societies in which it is not necessarily the case, and Japan is one of them. In Japan, bureaucrats play the dominant role in framing and implementing policies. They articulate and mediate conflicting interests through informal consultation; bureaucrats, without facing accountability, control access to the policy making process, and may even discourage the formation of interest groups that might disrupt the process. Hence, for special interest groups, gaining an access to administration is crucial. Participating in consultative council provides such opportunity.

In the Japanese policy making process, consultative councils, called *Shingikai,* play a crucial role. Hundreds of consultative councils, composed of business people, bureaucrats, scholars, journalists, union members, and others, deliberate on virtually every aspect of public policy.[3)] Policies are in many cases, discussed and formulated by the councils, not by the legislature. Although councils were originally intended to introduce

3)　See Schwartz (1998) for an insightful discussion on the role of councils in the political process of Japan.

new ideas and pluralize participation in the policy making process, participation is somewhat limited.

Japanese interest group politics is characterizes a “bureaucratically led form of neopluralism”.[4] As Schwartz (1998, p. 41) puts it; “What exists in Japan is not a single policymaking process pitting bureaucrats, politicians, private interests, and other concerned parties against one another, but an assortment of distinct, fairly self-contained policymaking processes that bring predictable sets of these actors together.” Councils bring together well-organized and narrowly focused state and social actors and dominate relatively self-contained policy domains by privatizing conflicts and resorting to informal decision-making. The Japanese policy making process, carried out in a fragmented policy domain which coincides with ministerial jurisdiction, is not fully pluralized in a sense that bureaucrats select certain interests to be represented in the councils.

Facing an urgent need to prolong the life of landfills, Japan has been actively promoting recycling by enacting a series of recycling laws. Under the recycling laws in Japan, containers and packaging, home appliances, food, construction material, and end-of-life vehicles are subject to obligatory recycling. Based on the Extended Producers Responsibility principle, producers are made responsible for their product’s end-of-life environmental impacts, and are obligated to pay recycling fees.[5] The recycling laws were discussed in councils and subcommittees such as the Waste Prevention and Recycling Subcommittee, within the Industrial Structure

4) Neopluralists argue that as the government’s roles expand, policy making process became more fragmented and specialized. The policy-making decisions are made by relatively autonomous groups of policy experts sharing a specific policy focus.

5) Note that they do not pay for the collection costs, which are instead covered by the municipalities.

Council, which is organized by the Ministry of Economy, Trade and Industry (METI) and the Central Environment Council, organized by the Ministry of Environment. Their reports subsequently materialized to such laws as the Basic Law for Promoting the Creation of a Recycling-oriented Society, and the Law for Promotion of Sorted Collection and Recycling of Containers and Packaging.

The recycling system thus established did not assume the existence of the international movement of recyclable materials and presumed the recycling process to be completed domestically. In reaction to the rapid increase in exports of recyclable materials, the new councils concerned with the international aspect of the recycling system were organized. In the working group for the recycling of containers and packaging, composed of scholars (but no trade theorist), researchers, representatives of the business groups (producers and retailers using the packaging) and consumer groups, formed a consensus among the members that exports of used plastic bottles need to be discouraged to secure stable supplies of waste materials to the domestic recyclers.

In discussing the international aspect of the recycling system, the METI council argues that there are concerns for an open system of recycling because it might induce trade in improperly processed recyclable materials, which results in exporting pollution, and also because of the unstable market demand for recyclable materials abroad. Although the council realizes the importance of enhancing effective utilization of resources, it places a priority over an environmental concern. In response to increased exports of used plastic bottles, the council subsequently concluded that the amendment of the recycling law for containers and packaging was necessary. The amendment addresses the “smooth delivery

of waste plastic bottles for sound recycling" which encourages local municipalities to deliver used plastic bottles to the designated (domestic) recyclers and not to the non-designated recyclers who export them.[6)]

In order to examine the effects of the restrictive export policies on recyclable materials adopted by the council, the basic trade theoretic model is presented in the following section.

## 3 A Model

We consider a small open economy consists of three sectors producing two final goods $X_i$ ($i = 1, 2$) and a recyclable material, $R$. Final goods and the recyclable material are both traded internationally. The price of the recyclable material, $P_R$, and the prices of final goods $P_i$'s are both given exogenously. In this section, we first lay out the basic structure of the model in the absence of trade taxes, hence $P_R$ and $P_i$ are considered as international prices. Each final good sector uses a mobile factor, labor, and a specific factor as inputs. The specific factor used in sector 1 is capital denoted by $K$, and the specific factor used in sector 2 is a natural resource denoted by $N$.

Materials are recycled in sector 2 alone. Wastes generated in the process of producing good 2 is recycled, and the recyclable materials (secondary materials), $R$, are used as inputs in the production of good 2.[7)] The production functions for the final goods are;

$$X_1 = F_1(L_1, K) \tag{1}$$

6) For details of the recycling system of used plastic bottles, see Satake et. al (2010).

7) For example, used plastic bottles are used as inputs to produce recyclable materials such as plastic flakes or pellets.

$$X_2 = F_2(L_2, R_2, N) \tag{2}$$

where $L_i$ denotes the labor input in sector $i$, and $R_2$ the recyclable materials used as inputs in the production of good 2. $F_i$ is assumed to exhibit constant returns to scale and diminishing returns to each factor including the recyclable material.

In the process of producing $X_2$, wastes, $Z_R$, are generated in a fixed proportion $\alpha$ to the output level;

$$Z_R = \alpha X_2, \tag{3}$$

where $\alpha, 0 < \alpha < 1$ may be considered as the recycling rate.[8] Non-recycled wastes are assumed to be disposed of at no cost (including the environmental costs). $Z_R$ is then processed by using labor to become recycled materials according to the Leontief technology of the form;

$$R = F_R(L_R, Z_R) = min\left(\frac{L_R}{a_{LR}}, \frac{Z_R}{a_{ZR}}\right) \tag{4}$$

where $L_R$ denotes labor employed in the recycling sector, and $a_{jR}$ is the input requirement of factor $j$ for the production the recyclable materials. The recyclable materials are either to be used as inputs in the production of the final good 2 or to be exported.

We first analyze the effect of a change in the output prices on the distribution of income and the composition of outputs. In a competitive market, we can write down the unit-cost equations as

$$a_{L1}w + a_{K1}r_K = P_1 \tag{5}$$

8) Endogenously determining $\alpha$ is beyond the scope of the paper. The consumer's problem of choosing between garbage disposals and recycling is discussed, say, in Fullerton and Kinnaman (1995).

$$a_{L2}\, w + a_{N2} r_N + a_{R2} P_R = P_2 \tag{6}$$

$$a_{LR}\, w + a_{ZR} r_Z = P_R \tag{7}$$

where $a_{ji}$ is the input requirement of factor $j$ for the production of commodity $i$.

Cost minimization implies the following;

$$\theta_{L1}\hat{a}_{L1} + \theta_{K1}\hat{a}_{K1} = 0 \tag{8}$$

$$\theta_{L2}\hat{a}_{L2} + \theta_{N2}\hat{a}_{N2} + \theta_{R2}\hat{a}_{R2} = 0 \tag{9}$$

The hat notation indicates the rate of change in that variable such that $\hat{x} = d\,x/x$, and $\theta_{ji}$ is the factor payment share of $j$ in commodity $i$. Techniques of production in each sector depend on factor prices; $a_{j1} = a_{j1}(w, r_K)$, $a_{j2} = a_{j2}(w, r_N, P_R)$. We define $\sigma_1 = \frac{\hat{a}_{K1} - \hat{a}_{L1}}{\hat{w} - \hat{r}_K}$ to be the elasticity of substitution between labor and capital, with $\hat{a}_{L1} = -\theta_{K1}\sigma_1(\hat{w} - \hat{r}_K)$, $\hat{a}_{K1} = \theta_{L1}\sigma_1(\hat{w} - \hat{r}_K)$.

With three factors of production being used in the production of good 2, we need to define three elasticities of factor substitution. Following the notations used by Jones and Easton (1983), we define $E_{j2}^{v} \equiv \frac{\hat{a}_{ji}}{\hat{w}_v}$ to reflect the effect on $a_{j2}$ of a rise only in the factor price of $j$ with other two factor prices being held constant.

$$\hat{a}_{j2} = E_{j2}^{L}\hat{w} + E_{j2}^{N}\hat{r}_N + E_{j2}^{R}\hat{P}_R, \qquad j = L, N, R \tag{10}$$

$E_{j2}^{v}$ captures the substitutability or complementarity between factors $j$ and $v$, with own substitution effect $E_{j2}^{j}$ negative. Zero homogeneity of $a_{ji}$ functions and the general envelope property imply that

$$E_{j2}^{L} + E_{j2}^{N} + E_{j2}^{R} = 0 \tag{11}$$

$$\theta_{L2}E_{L2}^{j} + \theta_{N2}E_{N2}^{j} + \theta_{R2}E_{R2}^{j} = 0 \tag{12}$$

Upon totally differentiating the unit-cost equations,[9] we obtain

$$\theta_{L1}\hat{w} + \theta_{k1}\hat{r}_K = \hat{P}_1 \tag{13}$$

$$\theta_{L2}\hat{w} + \theta_{N2}\hat{r}_N + \theta_{R2}\hat{P}_R = \hat{P}_2 \tag{14}$$

$$\theta_{LR}\hat{w} + \theta_{ZR}\hat{r}_Z = \hat{P}_R \tag{15}$$

In a specific factor model, factor prices cannot be determined by output prices alone, so we now turn to resource constraints for labor, specific factors, and the recyclable material:

$$a_{L1}X_1 + a_{L2}X_2 + a_{LR}R = \bar{L} \tag{16}$$

$$a_{k1}X_1 = \bar{K} \tag{17}$$

$$a_{N2}X_2 = \bar{N} \tag{18}$$

$$a_{R2}X_2 + R_E = R \tag{19}$$

$$a_{ZR}R = \alpha X_2 \tag{20}$$

where $\bar{L}$ is the amount of labor supply and $R_E$ is the export of the recyclable material. By substituting (17), (18) and (19) into (16) and totally differentiating, we obtain

9) Cost minimization implies $\theta_{L1}\hat{a}_{L1} + \theta_{K1}\hat{a}_{K1} = 0$, and $\theta_{L2}\hat{a}_{L2} + \theta_{N2}\hat{a}_{N2} + \theta_{R2}\hat{P}_R = 0$.

$$\lambda_{L1}(\hat{a}_{L1} - \hat{a}_{K1}) + \lambda_{L2}(\hat{a}_{L2} - \hat{a}_{N2}) + \lambda_{LR}(\alpha\hat{a}_{N2}) = \hat{\bar{L}} - (\lambda_{L1}\hat{\bar{K}} + \lambda_{L2}\hat{\bar{N}}) \qquad (21)$$

Assuming $\hat{\bar{K}} = \hat{\bar{N}} = 0$, and by substituting the expressions for $a_{ji}$s;

$$\phi_L \hat{w} + \phi_1 \hat{r}_K + \phi_2 \hat{r}_N = \hat{\bar{L}} + \phi_R \hat{P}_R \qquad (22)$$

$$\phi_L = -\lambda_{L1}\sigma_1 + \lambda_{L2}(E^L_{L2} - E^L_{N2}) - \alpha\lambda_{LR}E^L_{N2}$$

$$\phi_K = \lambda_{L1}\sigma_1$$

$$\phi_N = \lambda_{L1}\sigma_1 + \lambda_{L2}(E^N_{L2} - E^N_{N2}) - \alpha\lambda_{LR}E^N_{N2}$$

$$\phi_R = -\lambda_{L2}(E^R_{L2} - E^R_{N2}) + \alpha\lambda_{LR}E^R_{N2}$$

where $\phi_j$ indicates the economy-wide substitution effect on labor as the factor price of $j$ increases. It consists of labor substitution in sector 1 and sector 2 (represented by the direct substitution effect $E^j_{j2}$) and the cross substitution effects ($E^v_{j2}$, $j \neq v$). Since the direct substitution effect is negative, i.e., $E^j_{j2} < 0$, the signs of $\phi_j$ s are: $\phi_L < 0$, $\phi_K > 0$, $\phi_N > 0$.

To further proceed, we impose an assumption that $N$ and the recycled material are strong substitutes such that the following condition holds.

**Definition 1** *$N$ and $R$ are strong substitutes iff $E^R_{L2} < E^R_{N2}$.*

If $N$ and $R$ are close substitutes, $\phi_R > 0$.

The equilibrium conditions are summarized by (13), (14), (22), and (15). The system of equations (13), (14), and (22) allow us solve for factor prices, $w$, $r_K$ and $r_N$ , and (15) determines $r_z$ . Output compositions are, then, determined through (16) to (20).

In a matrix form, the equilibrium conditions are given by

$$\begin{bmatrix} \theta_{L1} & \theta_{K1} & 0 \\ \theta_{L2} & 0 & \theta_{N2} \\ \phi_L & \phi_K & \phi_N \end{bmatrix} \begin{bmatrix} \hat{w} \\ \hat{r}_K \\ \hat{r}_N \end{bmatrix} = \begin{bmatrix} \hat{P}_1 \\ \hat{P}_2 - \theta_{R2}\hat{\underset{\sim}{P}}_R \\ \phi_R P_R + L \end{bmatrix} \tag{23}$$

Solutions of the system give us the following.

$$\begin{bmatrix} \hat{w} \\ \hat{r}_K \\ \hat{r}_N \end{bmatrix} = \frac{1}{D} \begin{bmatrix} \theta_{k1}\phi_1 & \theta_{k1}\phi_N & \theta_{K1}\theta_{N2} \\ -\theta_{L2}\phi_N + \theta_{N2}\phi_L & \theta_{L1}\phi_N & -\theta_{L1}\theta_{N2} \\ \theta_{k2}\phi_K & -\theta_{L1}\phi_K + \theta_{K1}\phi_L & -\theta_{L2}\theta_{K1} \end{bmatrix} \begin{bmatrix} \hat{P}_1 \\ \hat{P}_2 - \theta_{R2}\hat{P}_R \\ \phi_R \hat{P}_R + \hat{\bar{L}} \end{bmatrix} \tag{24}$$

where $D$ is the determinant of 3 by 3 matrix; $D = \theta_{K1}\theta_{N2}\phi_L - \theta_{L1}\theta_{N2}\phi_K - \theta_{K1}\theta_{L2}\phi_N < 0$.

It is useful to write down the effects of the change in output prices on factor prices, which characterize the underlying conflicts of interests among the special interest groups;

$$\frac{\hat{w}}{\hat{P}_1} = \frac{1}{D}(-\theta_{N2}\phi_K) > 0 \tag{25}$$

$$\frac{\hat{r}_K}{\hat{P}_1} = \frac{1}{D}(-\theta_{L2}\phi_N + \theta_{N2}\phi_L) > 0 \tag{26}$$

$$\frac{\hat{r}_N}{\hat{P}_1} = \frac{1}{D}\theta_{L2}\phi_K < 0 \tag{27}$$

$$\frac{\hat{w}}{\hat{P}_1} = \frac{1}{D}(-\theta_{K1}\phi_N) > 0 \tag{28}$$

$$\frac{\hat{r}_K}{\hat{P}_2} = \frac{1}{D}\theta_{L1}\phi_N < 0 \tag{29}$$

$$\frac{\hat{r}_N}{\hat{P}_2} = \frac{1}{D}(-\theta_{L1}\phi_K + \theta_{K1}\phi_L) > 0 \tag{30}$$

The wage rate positively responds to the changes in both output prices; As $P_i$ increases, labor is attracted from other sectors and the economy-wide value of marginal productivity is increased. The return to the specific factor in the $i$ th industry must increase if $P_i$ increases with other prices remain unchanged. An increase in other output price, $P_s$ ($s \neq i$) raises the return on the mobile factor, $w$, hence reduces the return on the $i$ th industry's specific factor. From (20), we obtain $\hat{r}_Z = -\frac{\theta_{LR}}{\theta_{ZR}}\hat{w} + \frac{1}{\theta_{ZR}}\hat{P}_R$ hence, we can infer the directions of the change in the international price of the recyclable material to be; $\frac{\hat{r}_Z}{\hat{P}_1} < 0$, $\frac{\hat{r}_Z}{\hat{P}_2} < 0$. If output prices rise, $w$ is increased while $P_R$ is held constant, which necessarily erodes the reward on $Z$.

The effects of the change in the price of recyclable material are less straightforward.

$$\frac{\hat{w}}{\hat{P}_R} = \frac{1}{D}(\theta_{K1}\theta_{R2}\phi_N + \theta_{K1}\theta_{N2}\phi_R) < 0 \tag{31}$$

$$\frac{\hat{r}_K}{\hat{P}_R} = \frac{1}{D}(-\theta_{L1}\theta_{R2}\phi_N + \theta_{L1}\theta_{N2}\phi_R) > 0 \tag{32}$$

$$\frac{\hat{r}_N}{\hat{P}_R} = \frac{1}{D}(-\theta_{R2}(\theta_{L1}\phi_K + \theta_{K1}\phi_L) - \theta_{L2}\theta_{K1}\phi_R) \tag{33}$$

An increase in the price of recyclable material, while output prices being held constant, reduces $w$ and raises $r_K$. The reward earned from wastes $r_Z$ is positively related to $P_R$ because of the decline in $w$. The rise in $P_R$ reduces $r_N$ if $\theta_{R2}\phi_L + \theta_{L2}\phi_R < 0$. The condition is likely to hold if *i)* the own substitution effect is larger that the cross substitution effect, i.e., $(E_{L2}^L - E_{N2}^L) > (E_{L2}^R - E_{N2}^R)$, and *ii)* sector 2 is more $R$ intensive in the

sense that $\theta_{R2} > \theta_{L2}$. A decrease in $P_R$, under certain conditions, will increase $w$ and $r_N$ while decreas $r_K$ and $r_Z$.

## 4 An Optimal Export Tax on Recyclable Materials

In this section, we analyze the welfare effects of export taxes on the recyclable materials. In order to distinguish the domestic price and the international price, we introduce the notation $*$ to indicate the international price. Let $P_R^*$ be the international price of recyclable material and $P_R$ be the domestic price of the recyclable material. Suppose an export tax on the recyclable materials is imposed at a rate $t$ such that $P_R^* = (1+t)P_R$, and the final goods are traded freely; $P_i^* = P_i$. If $dP_i^* = dP_R^* = 0$, and $d\mathcal{L} = 0$, then $(1+t)dP_R + P_R\,dt = dP_R^* = 0$, or by using the hat notations, $\hat{t} = -\hat{P}_R$, where $\hat{t} = \frac{dt}{1+t}$.

As a benchmark, we first consider a case where government acts benevolently. Let $g(P_1, P_2, u; P_R)$ be the minimum expenditure required to attain the welfare level $u$ at domestic prices $P_i$ and $P_R$. When export taxes are imposed, we can write the national income-expenditure identity as follows:

$$\begin{aligned} g(P_1, P_2, u; P_R) &= P_1^* X_1 + P_2^* X_2 + (1+t)P_R R_E - tP_R R_E \\ &= P_1^* F_1(L_1, \bar{K}) + P_2^* F_2(L_2, \bar{N}, R_2) \\ &\quad + (1+t)P_R[F_R(L_R, Z_R) - R_E] - tP_R R_E \end{aligned} \tag{34}$$

The minimum expenditure function is assumed to be equipped with the following properties: *i)* positively homogeneous of degree one in $P_i$, *ii)* concave in $P_i$, and *iii)* $\frac{\partial g}{\partial P_i} = C_i$.

By differentiating (34) with respect to $t$,

$$g_0 \frac{du}{dt} = \sigma_i P_i^* \frac{dX_i}{dt} + (1+t)P_R \frac{dR_E}{dt} - tP_R \frac{dR_E}{dt} \tag{35}$$

$$= (1+t)P_R \frac{\partial F_R}{\partial Z}\frac{\partial Z_R}{\partial t} - t\frac{\partial R_E}{\partial t} = P_Z \frac{\partial Z_R}{\partial t} - tP_R \frac{\partial R_E}{\partial t} \tag{36}$$

The optimal export tax on the recyclable material, $t^*$, can be derived by setting $g_0 \frac{du}{dt} = 0$. The optimal tax rate can now be expressed as;

$$t^* = \frac{P_Z \frac{\partial Z_R}{\partial t}}{P_R \frac{\partial R_E}{\partial t}} = \frac{P_z Z_R}{P_R R_E}\frac{\hat{Z}_R/\hat{t}}{\hat{R}_E/\hat{t}} = \frac{P_z Z_R}{P_R R_E}\frac{\alpha\hat{X}_2/\hat{t}}{\hat{R}_E/\hat{t}} \tag{37}$$

Since an export tax on the recyclable material, under certain conditions, increases $X_2$ , the optimal export tax on recyclable material is positive if it also increases an export of the recyclable materials, and negative if otherwise.[10)]

## 5 Rent-Seeking and An Export Tax on Recyclable Materials

In this section, an export tax on recyclable materials is to be determined, not by the benevolent government, but by the councils. In the council, the consensus is formed through voting or other method of reaching an agreement. Although we do not explicitly formalize the consensus building process within the council, participants of the council representing special interest groups absorb scarce resources to influence the council's decisions to promote or to protect their interests. The special interest politics in the Japanese policy making process is thus characterized as rent seeking activities of the special interest groups in the councils.

Rent seeking activities take place in councils that are organized in a fragmented policy domain. Special interests to be represented in the

10) See Appendix for the analysis on the changes in $X_2$ and $R_E$ .

councils on recycling policies are confined to a rather narrowly defined recycling related sector. Recyclers and recyclable material using sectors were selected as members of the council, but, intentionally or not, sectors not using recyclable materials were excluded.

In the following subsection, we characterize the export tax on recyclable materials endogenously determined through the rent seeking activities within the councils confined to a fragmented policy domain. We call the equilibrium, the fragmented equilibrium. We then turn to the non-fragmented equilibrium, in which the council is organized in the more broader policy domain. Special interests representing all the sectors in the economy are incorporated in the council. We will compare the two equilibria.

### 5.1 Fragmented Equilibrium

Suppose the council consists of special interest groups representing the recycling sector and the output sector 2 using the recyclable materials as inputs. An export tax on recyclable material is to be determined endogenously via tariff formation function formalized by Findlay and Wellisz (1982);

$$t = t(L_N, L_Z) \tag{38}$$

where $L_N$ and $L_Z$ are resources devoted to the rent-seeking activities by the final good sector 2 and the recycling sector respectively. (16) is now modified as

$$a_{L1}X_1 + a_{L2}X_2 + a_{LR}R + L_N + L_Z = \bar{L} \tag{39}$$

As we have seen in section 3, the specific factor $N$ in the final good sec-

tor is in favor of imposing an export tax on the recyclable materials, while the recycling sector represented by factor $Z$ is against it. By assuming the "diminishing returns" to rent seeking activities;

$$\frac{\partial t}{\partial L_N} > 0, \quad \frac{\partial^2 t}{\partial L_N^2} < 0 \tag{40}$$

$$\frac{\partial t}{\partial L_Z} < 0, \quad \frac{\partial^2 t}{\partial L_Z^2} > 0 \tag{41}$$

The export tax is then determined through a Cournot game between the two special interest groups with payoff functions $\pi_N$ and $\pi_Z$

$$\pi_N(L_N, L_Z) = r_N(t)\bar{N} - r_N^*(P_R^*)\bar{N} - wL_N \tag{42}$$

$$\pi_Z(L_Z, L_N) = r_Z(t)Z_R(t) - r_Z^*(P_R^*)Z^* - wL_Z \tag{43}$$

where $r_j(\cdot)$ is the reward on the specific factor $j$, $j = N, Z$ in the presence of an export tax, and $r_j^*(\cdot)$ is the factor reward under free trade.[11] $\pi_N$ and $\pi_Z$ are considered as rents from an export tax earned by the special interest groups. Each interest group, taking other groups rent seeking activity as given, will expend labor up to a point where the wage is equal to the marginal return from rent seeking:

$$\frac{\partial \pi_Z}{\partial r_Z}\frac{\partial r_Z}{\partial t}\frac{\partial t}{\partial L_Z} = \frac{\partial \pi_N}{\partial r_N}\frac{\partial r_N}{\partial t}\frac{\partial t}{\partial L_N} = w \tag{44}$$

The Nash equilibrium, assuming to exist, determines $\tilde{t}$, $\tilde{L}_N$ and $\tilde{L}_Z$

11) We assume that the tax revenue is distributed to consumers in a lump-sum fashion so that it does not affect the rents sought by the special interest groups. In the Japanese recycling system, the revenue from export tax is collected by the national government, while the garbage collection and waste treatment costs are born by the local government and producers. Public expenditures on waste management and landfills may be financed through the tax revenue, in which case the rent seeking activity is affected by such public expenditure.

through (38) and (44).

### 5.2 Non-Fragmented Equilibrium

Suppose instead that the special interest group associated with capital, the specific factor in sector 1, also joins the council to protect their interests. Tariff formation function, then, becomes

$$t = t(L_K, L_N, L_Z), \quad \frac{\partial t}{\partial L_K} < 0, \quad \frac{\partial^2 t}{\partial L_K^2} > 0 \tag{45}$$

with capital's payoff function

$$\pi_K(L_K, L_N, L_Z) = r_K(t)\bar{K} - r_K^*(P_R^*)\bar{K} - wL_K \tag{46}$$

which gives us the reaction function for capital to be $\frac{\partial \pi_K}{\partial r_K}\frac{\partial r_K}{\partial t}\frac{\partial t}{\partial L_K} = w$. It is worth spending $L_K$ in rent seeking activities to protect the capital owner's rent.

Among the three special interest groups, the capital and the waste owners lose from an export tax on recyclable materials, while natural resource owners gain from it. With the participation of the capital owners in the rent seeking activities, the reaction function of $N$ will be affected in such a way that for each $L_Z$, the smaller $L_N$ is chosen, as an increase in $L_K$ is interpreted as an increase in $L_Z$. The reaction function of $Z$, on the other hand, will be altered such that larger $L_Z$ will be chosen for each $L_N$, as an increase in $L_K$ be interpreted as reduction on $L_N$. Hence, it is likely that the export tax on the recyclable material determined by the three interest groups' rent seeking activities be lower than that determined by the two interest groups. Characterizing Nash equilibria with three asymmetric players would portray more general results, however, further conditions must be imposed to get some insights, which is beyond the scope of the

paper.

## 6 Conclusion

In this paper, we analyzed the effects of export taxes on recyclable materials in a specific factor model with recyclable materials, which are formalized as traded intermediate goods produced by using production wastes. Because recyclable materials are both used as inputs domestically or being exported, the optimal export tax on recyclable materials was shown to be either positive or negative depending on whether exports of recyclable materials expands. We also examined the effect of an export tax on the recyclable material on income distribution; it reduces the income of capital owners and waste owners, while increases the wage and the reward on the natural resource, which is a close substitute to the recyclable material.

Based on the distributive effects of the export tax on recyclable materials, we illustrated how the export tax on recyclable material are endogenously determined through rent seeking activities in the councils with particular reference to the Japanese special interest politics. Negotiations within the councils were incorporated by using the tariff formation function, and showed the possibility that it is the fragmented special interests represented in the council that leads to the adoption of restrictive trade policy on recyclable materials. Although the council claims the importance of environmental considerations, the rent seeking behavior in a fragmented policy making process can be attributed to explaining the adoption of an export tax on recyclable materials.

In this paper, the Japanese special interest politics was incorporated to show how the rent seeking behavior in the Japanese bureaucratically organized councils form the outcome of the trade policy on recyclable

materials. With a very simple characterization of tariff formation allowed us to highlight the role of councils in coordinating special interests. The complexity of the Japanese special interest politics, however, is not adequately captured yet. It has been often the case that foreign influences (called "foreign pressure" in Japanese) played non-negligible roles in the policy making process. Considering foreign factor ownership, for example, in rent seeking behavior may be worthwhile to examine.

The tariff formation approach, lacking the formal analysis of the individual's political behavior, does not provide any insights on how the consensus is formed within the councils. Conflicts of interests are often manipulated or contrived to reach the agreement, and bureaucrats are involved in the process. Formalization of bureaucrats' behavior, needless to say the more sophisticated depiction of the interaction between the special interest groups and the legislature, need to be addressed as well.

## 7 Appendix: Output Changes

In order to examine the changes in the output level of good 2 and the amount of export of the recyclable material, we need to examine closely the effects of factor substitutions between the three factors of production. The effect of an export tax on recyclable materials (or equivalently, a reduction in $P_R$) on $X_2$ is

$$\frac{\hat{X}_2}{\hat{t}} = -\frac{\hat{a}_{N2}}{\hat{t}} = -(E^L_{N2}\frac{\hat{w}}{\hat{t}} + E^N_{N2}\frac{\hat{r}_N}{\hat{t}} + E^R_{N2}) \tag{47}$$

An export tax on good 2 increases its output, $\frac{\hat{X}_2}{\hat{t}} > 0$, if the elasticity of substitution between the recyclable material and the natural resource $E^R_{N2}$ is sufficiently elastic, or if the own substitution effect of the natural resource dominates the cross substitution effects.

The effect on $R_E$ is less clear-cut. By totally differentiating (19) and by using (20) and (47),

$$\beta_2(\hat{a}_{R2} - \hat{a}_{N2}) + \beta_E \hat{R}_E = \alpha \hat{X}_2 \tag{48}$$

where $\beta_2 = \frac{R_2}{R}$ is the share of recyclable materials domestically used in the production of good 2, and $\beta_E = \frac{R_E}{R}$ is the export share of recyclable materials. We can observe that

$$\frac{\hat{R}_E}{\hat{t}} = \frac{\alpha}{\beta_E}\frac{\hat{X}_2}{\hat{t}} - \frac{\beta_2}{\beta_E}\frac{(\hat{a}_{R2} - \hat{a}_{N2})}{\hat{t}} \tag{49}$$

The first term on the right hand side of the equation represents the supply effect of the recyclable materials and the second term the factor demand effect. If the demand effect exceeds the supply effect, the export decreases as a result of an export tax, however, the export increases if the supply effect exceeds the demand effect. Note that with higher $\alpha$, the supply effect dominates, and the export expands, while with higher $\beta_2$, the demand effect dominates, which reduces exports.

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