The Role of Information Costs in the Political Effectiveness of the Interest Group

Wongun Song
National Assembly Budget Office

Abstract. Since Stigler(1971), it has been always agreed that the interest group which is able to control free riding successfully would be politically powerful. However, most studies following Stigler did rarely focus on the determinants of the organizational efficiency of interest groups. The primary objective of this study is to find the crucial determinants of the organizational efficiency of interest groups to provide the causes of several tendencies of government programs which can be seen in the real world such as a strong tendency for protection of declining industries in many developed countries. The existence of incomplete information within a group should be considered because of the observability of the characteristic that will affect the amount of transfer each member receives. Since a special interest group usually consists of people who share the similar economic interest, a rule for political contribution will not be imposed in an enforceable way. Thus the set-up of a rule for political contribution in a special interest group is modeled as a mechanism design problem. This study shows that the informational problem within a group is the major impediment for this group to be politically effective by inducing the cost of information using a mechanism design approach, which can be a useful theoretical background for the causes of government programs such as the tendency for protection of declining industries in developed countries. The other objective of this study is to examine the idea of small group dominance in the political arena. This study shows that the size will affect the political effectiveness of the group by worsening the informational problem. It indicates that the idea of small group dominance in the political arena is made clearer by introducing the informational problem within a group.

JEL Classification: D71, D72, D82

Keywords: Efficient political contribution; Free-riding; Mechanism design; Group size

As a benevolent social planner, the role of government should be the remedy of market failure and the government intervention should be instituted primarily for the public interest. But in real politics, special interest groups actively participate in the policymaking process to further their own interests by lobbying, political campaigning, voting, etc.

The distinguished aspect of the redistribution from the government to special interests is its public good property. This property will cause the temptation to free-ride among the members of any special interest group. So, overcoming the free-rider problem is the key factor for special interest groups to organize and have influence on the policymaking process effectively.

One of the central stylized facts in trade policies in many developed countries is a strong tendency for protection of declining industries[1]. One of the main reasons for declining industries to get protection from the government is that these industries are successful at organizing interest groups and lobbying the government effectively. For instance, declining industries such as sugar, textile and apparel, and steel industries in U.S. have been very active in lobbying and then protection and subsidies have been provided to these industries. In U.S., the agricultural interest groups are well known to act effectively in the political decision-making process[2]. These industries as special interests might be more adept at overcoming the free-rider problem than others. Grossman and Helpman (1996) provide the theoretical explanation that declining industries are better placed to overcome the free-rider problem in collective political action than growing industries. Their reasoning is that the prospect for free riding may be rare in declining industries since there is no threat of new entrants which cause rent

[1] Marvell and Ray (1983) find that protection was given to politically important industries and industries under threat from imports. Hufbauer and Rosen (1986) shows that the U.S. has given special protection to troubled industries such as sugar, textile and apparel, automobile, and steel industries in the post-Word War II period. Lee and Swagel (1997) find weak industries as well as industries in decline tend to be protected.

[2] U.S. dairy farmers are known to have been very active in encouraging restrictions on competing imports. Brooks, Cameron and Carter (1998) found that sugar PAC contributions affected the 1985 and 1990 votes for sugar legislations in the House and Senate. Lopez (2001) shows that PAC contributions from farm groups and related industries significantly influenced agricultural policies and the investment returns to farm PAC contributors are quite large.

dissipation[3].

According to Olson (1965) a common-interest group is more likely to overcome the free-rider problem if the number of members is small and members of the group are relatively homogeneous. That is, “group size” and “homogeneity between members” are determining factors for an interest group to limit free-riding. Following Olson, Becker (1983) mentions the importance of controlling free-riding when interest groups produce political pressure in the determination of political equilibrium. Grossman and Helpman (1996) offer an analytic explanation of why declining industries are effective at playing the political system[4]. But, here we can point out an important element of political economy they do not cover, which is the informational problem. Thus, we consider the informational problem within a special interest group as the crucial determinant for the organizational efficiency of the group and show that the cost from this informational problem will be the main determinant for the political effectiveness of the group.

People who have the same specific inputs or characteristics usually have common interests and often work together to try to influence government policies. That is the reason why they try to organize a group and set up rules for political contribution. But when group members are not homogeneous, the government policy may result in different members receiving different sized transfers. Members’ heterogeneity implies the existence of a characteristic which causes different amount of transfers among members. The level of a member’s characteristics will influence the amount of transfer the member receives. So when people in the same group set up a rule for political

[3] Brainard and Verdier (1997) claimed that the reasons of biased political process against growing industries are imperfect capital markets, a fixed cost in the lobbying process, and most importantly the ability of overcoming the free-rider problems of lobby formation.

[4] We can interpret the results of Grossman and Helpman (1996) based on the two determining factors we mentioned above as follows. First, in declining industries, members are easily identified since members are relatively homogeneous. Second, since new entrants are rare in those industries, the number of members (group size) is likely to be limited to the existing one.

contribution, the political expenditure assigned to each member should be assigned based on these characteristics. It may be that certain characteristics are not observable by others, and that a member's interest lies in not revealing the level of one of his characteristics. If characteristic levels are assumed not to be observable by others, they are private information. However the assumption that each member's characteristic is not observable cannot be always justified.

Preferences, technology, and resource endowment are characteristics of group members that may or may not be private information. In long-established industries or declining industries, firms have similar technologies and the emergence of new technologies in those kinds of industries is not common in the short-run. Thus, within these industries the degree of observability on technologies is very high and everyone can easily recognize the amount of transfers others will receive from a government program. Another example of when the degree of observability on characteristics is high, is provided by people who have a common form of specific human capital, such as optometrists, architects, beauticians, physicians and so on. In this case, it is very unlikely that the characteristic that affects the amount of each person's transfer from government is private information. But it may be that in newer, developing industries, a firm's technology is relatively private information. So in these industries, the degree of observability of the level of the characteristic that causes different levels of transfer to each firm is very low.

Studies on political economy rarely consider informational problem. Investigating internal informational problem within an interest group might be essential to explain the fact that declining industries get preferential treatment from the government because collusion or overcoming free riding problem is not a serious issue under complete information. Also the potential for free riding caused by possible late entrants is not the only impediment to organize an interest group and lobby the government effectively. Even without the threat of new entrants, the potential for free riding can exist. Incomplete information among people who share economic interests might create barriers for them to organize a group and be effective at playing the political system for various forms of government support. For instance, there might be the case that it is impossible for some group of people to make political contribution which can make the welfare of every member of the group being greater than its reservation welfare (welfare without political contribution) because of the cost of information.

Our contention is that the cost of information is the fundamental determinant of the political efficiency of interest groups, and that group size and homogeneity affect the political effectiveness of the interest group mainly because they affect the cost of transferring information among group members. Thus, the goal of this study is to clarify the role of information in political effectiveness of an interest group and explain why declining industries are successful at playing the political system by using an argument of information cost. We begin our analysis in section 1 by specifying our model of political contribution of an interest group. We also make some basic assumptions and provide a reason for the existence of the center of the group. In section 2, we illustrate the normative and positive rules for political contributions under various circumstances. Section 3 derives the information cost of an interest group when the normative rule for contribution is not always implemented for this group, and looks for the possibility of setting up efficient political contribution rules. Lastly, in section 4, we investigate how group size affects the information cost of the group.

1. The Model

Suppose that government has available for use a policy instrument in the form of per-unit subsidy x to some product. Suppose that there is a set of available levels of per-unit subsidy, $\{x^j | x^1 \le x^j \le x^m\}$, one of which government may select. Call the set of these policies F. Let $C(x^j, n)$ be the minimum lobbying cost necessary for the group to influence the government enough to implement the policy x^j given that the number of members is n. Then let

$$C(x^j, n) = nc(x^j, n), \quad x^j \in \{x^1 \le x \le x^m\},$$

$$\text{where } \frac{\partial c(x^j, n)}{\partial n} > 0, \quad \frac{\partial c(x^j, n)}{\partial x^j} > 0, \text{ and } \frac{\partial^2 c(x^j, n)}{\partial x^{j\,2}} \le 0.$$

Note that lobbying costs depend on group size. The above implies that per capita lobbying cost for distorting policies will increase with the size of the group and the amount of per unit subsidy. This assumption is related to the objective of government and the workings of whole political economy. In the literature on political economy, it is assumed that in the political process of economic policy making, both political contributions of special interests and the aggregate social welfare are greatly considered[5]. The incumbent government will value social welfare because it is more likely to be reelected if voters have been enjoying high standard of living. Since we assume that the policy instrument (per-unit subsidy) government can select for intervention will be distortionary, then the policies that benefit the special interest group will create deadweight costs and then will harm social welfare. Thus, the per capita

[5] See Becker(1983) and Grossman and Helpman(1994).

lobbying cost for distorting policies will increase with the level of intervention (per-unit subsidy), and for given level of per-unit subsidy, the per capita lobbying cost for distorting policies will increase with the size of the group.

Our next step is to describe the process of political contribution. Assuming no informational problem, two kinds of political processes can be considered as the following pictures. First, members of an interest group establish the center for lobbying and make political contributions by the rules set up by this center. Second, people who share economic interest lobby the government by voluntary contribution mechanism. Without transaction costs, political contributions through coordination will be better for all members of the interest group than the ones through voluntary contributions under complete information (See Song(1999)). Also according to Tirole(1992), coordination may not be a serious issue if there is no informational problem given that the neoclassical precept that individuals act in their best interests. So here we assume that the special interest group we consider has the center that sets up the rules for political contributions.

Next we define the transfer each member will receive by a government policy $x^j \in \{x^1 \le x \le x^m\}$. First, we assume that the level of characteristic (preference, technology, resource endowment) of each member that determines the level of transfer to each member might be unobserved. Second, the average per capital transfer form policy x^j, $h(x^j)$, is assumed to be publicly known. Even when the transfer to each member is not observed, average per capita transfer can be induced because the average of characteristic can be derived by the current market price[6]. Third, we assume that β_i

[6] For example, suppose that for a group of producers, the current market price of the product these producers are making is *p* which includes the subsidy from government. And it is also assumed that the amount of output transacted in the market which is the equilibrium output, *Q*, is known to every producer. From this equilibrium output we can derive the average output, $q=Q/n$, and then the average revenue *pq*.

reflects member *i*'s value of the characteristic which affects the value of transfer to him. So $\beta_i h(x^j), \forall i$, is the value of transfer to member *i* when the policy x^j is effective. Hence the information on this characteristic will matter.

Assume that β_i is *i*'s private information. Every member of the group except *i* subjectively holds that β_i is a random variable drawn from the cumulative distribution function (CDF), $F_i(\beta_i)$, and that for all *i* those CDFs are differentiable and the respective densities, $f_i(\beta_i), \forall i$, are assumed to be strictly positive[7]. Also assume the support of β_i to be $B_i = [\underline{\beta}_i, \overline{\beta}_i], \forall i$. From these assumptions, we can derive the group's surplus(excluding lobbying costs) from policy $x^j \in F$, because we know that $nh(x^j) = \sum_{i=1}^{n} \beta_i h(x^j)$ given *n* and x^j. Following our earlier discussion, we assume group members establish a center[8] to set up a rule fro political contribution. The role of the center is to collect the information in order to set up the best rule on which every member can agree. We assume that before setting up a rule for political contribution, the center has to choose the policy which maximizes the group's gain from the political process. Therefore the center has to solve the following problem.

$$\underset{x \in F}{Max} \sum_{i=1}^{n} \beta_i h(x) - C(x,n).$$

Since it is known that $nh(x) = \sum_{i=1}^{n} \beta_i h(x)$ given *n*, then the above problem will be modified as follows.

$$\underset{x \in F}{Max}\, nh(x) - C(x,n).$$

So even though each producer's characteristic that determines the amount of output and revenue is not publicly known, we can derive the average benefit from the subsidy provided by the government.

[7] Here we follow the convention that players' types are independent random variables.

[8] To establish the center also creates costs. That is, members have to pay for the center's activity. Here we ignore these costs. This implies that the center's objective is assumed to maximize the group's total surplus from political behavior.

The most beneficial policy to the group, x^*, will be obtained by solving the above problem. The respective lobbying cost for x^* is $C(x^*, n)$ given *n*. Let x^0 denote the policy when the group does not lobby. The cost of not lobbying is $C(x^0, n) = 0$. So member *i*'s welfare under no lobbying is $\beta_i h(x^0)$, from the current policy x^0.

It may be that no available policy is better for the group than is the policy received when not lobbying: $x^* = x^0$. If this is not the case, then $nh(x^*) - C(x^*, n) \geq nh(x^0)$. If the above holds, then the next step for the center is to provide the rule that all members will follow that will cover the lobbying cost $C(x^*, n)$. In the next section we will consider such rules under various situations.

2. The Rules for Political Contribution

This section investigates the best rules for political contributions of the interest group under various situations and finds the cases when collecting private information is needed. The set of feasible policies[9] the government can adopt is *F*. The following is the condition for the interest group to make political contributions.

$\exists x \in F$ such that $nh(x) - C(x, n) \geq nh(x^0)$ (1)

The center will arrange the rule for political contribution whenever (1) holds, meaning that there exists a policy from which aggregate surplus is greater than that of the policy given without political contribution. Call the set of feasible policies which satisfy (1) *H*. Then we may state

[9] This indicates the set of policies that are technically feasible but not necessarily politically feasible.

$$H = \{x^0\} \Rightarrow g = \begin{pmatrix} 0 \\ \cdot \\ \cdot \\ \cdot \\ 0 \end{pmatrix} \qquad \text{(Rule A)}$$

This indicates that if there is no policy which satisfies (1), then this group will not make any political contribution and the vector of members' contributions will be the zero vector.

The following is the condition under which the center can implement a uniform fee for political contribution to obtain $x \in H$ when H is not empty.

$$\beta_i h(x) - \frac{C(x,n)}{n} \geq \beta_i h(x^0), \forall i, \forall \beta_i \in B_i \qquad (2)$$

The above implies that if some policy x satisfies (2), then implementing a uniform fee for political contribution will be politically feasible because it satisfies individual rationality for every member. Thus the following rule holds.

$$\exists x \in F \text{ such that (2) holds} \Leftrightarrow g = \begin{bmatrix} \frac{C(x,n)}{n} \\ \cdot \\ \cdot \\ \cdot \\ \frac{C(x,n)}{n} \end{bmatrix} \text{ is politically feasible.} \qquad \text{(Rule B)}$$

Call the set of policies which satisfy (2) I. So the set of policies which do not satisfy (2) $H \setminus I$ and $I + H \setminus I = H$, $H \subset F$. (Rule B) will be the rule when $H \setminus I$ is empty, that is, $I = H$. Conversely, when $H \setminus I = H$, that is, I is empty, the normative rule will be as follows.

$I = \phi \Rightarrow$ the elements of g are nonnegative and nonconstant functions of β. (Rule C)

$$x^* \in I \Rightarrow g = \begin{pmatrix} \frac{C(x^*,n)}{n} \\ \cdot \\ \cdot \\ \cdot \\ \frac{C(x^*,n)}{n} \end{pmatrix} \text{ is politically optimal.} \qquad \text{(Rule D)}$$

For obtaining any $x \in H \setminus I$, the center needs to create a rule for political contribution such that the fee to each member will be determined based on his own benefit from the policy. So the following rule should hold unless the informational problem does not exist.

$x^* \in H \setminus I \Rightarrow$ g is a vector of nonnegative and nonconstant functions of β. (Rule E)

Our question is if (Rule C) and (Rule E) will always hold when the informational problem exists. That is, we will investigate if (Rule C) and (Rule E) will be the actual rules for political contribution which the center can implement. Table 1 describes the normative political contribution rule for each possible situation.

As we see in Table 1, the group can have five rules for political contribution. These rules are efficiency rules. Among the above rules, A, B, and D will be both normative(desired) and positive(actual) rules, but C and E will be normative rules but might not be positive rules when the information is not publicly known. Thus we call these rules ex post efficiency rules.

Here we need to mention about the reason why the method of financing the lobbying cost matters. The reason is that each member's characteristic that will affect the amount of transfer he receives is the private information of each member. If every member is better off when the uniform fee is assigned, then the group can obtain the policy without collecting private information. In this case, there is no reason to use a method of financing the lobbying cost other than the uniform fee method because individual rationality is satisfied and the lobbying cost can be covered by assigning a uniform fee. Incomplete information within a group will not hurt the political effectiveness of the group in this case.

Table 1. Rules for Political Contribution

situation	H	I	H \ I	other condition	Rule
A	empty	empty	empty		g=(0…0)
B	nonempty	nonempty	empty		uniform free
C	nonempty	empty	nonempty		variable fee dependent on transfer
D	nonempty	nonempty	nonempty	$\max_{x\in I} nh(x) - C(x,n) = \max_{x\in F} nh(x) - C(x,n)$	uniform fee
E	nonempty	nonempty	nonempty	$\exists\, x \in H \setminus I$ such that $x = \operatorname{argmax}_{x'\in F} nh(x') - C(x',n)$	variable fee dependent on transfer

The practices of strategic trade policies in developed countries have shown that some high-technology industries such as Japanese semiconductor industry, European aircraft industry, and U.S. industries related to military defense have been heavily subsidized even though incomplete information might exist because of rapid innovations in these industries. It is usually thought that high-technology industries such as electronics and aircraft have very high value added per worker and then the growth of these industries will determine the nation's economic competitiveness. This view has been largely shared by politicians, journalists, and other influential commentators on economic affairs, which means that the policies that serve to this view can easily gain political support even though the analytical basis for this view is unclear. Hence the lobbying costs for those policies will be low because political support to those policies is pervasive but political opposition to those is rare. (Rule D) implies that the interest group in which there exists incomplete information among members can be politically effective when the lobbying cost is relatively low. Thus, (Rule D) can explain the reason why some high-technology industries in developed countries have been heavily subsidized for decades.

Financing the lobbying costs by assigning a uniform fee to each member will be impossible if this way of financing violates the individual rationality. This implies that if the lobbying cost for obtaining the policy which is beneficial to the group is relatively high, the center should solve informational problem within the group and the ability to solve this problem is very important to the political effectiveness of this interest group.

(Rule B) and (Rule D) will be both normative and positive rules but (Rule C) and (Rule E) cannot be positive rules for political contribution given that private information exists. So, in this case, the center should set up a rule for political contribution by deriving information from each member of the group. This rule should be incentive compatible to derive true information and should be individually rational for each member to participate and should also cover lobbying cost. However, it is possible that the center cannot design a rule which satisfies the above constraints because of the private nature of information for some beneficial policy to the group. So the probability of obtaining a policy will matter. This probability will depend on the characteristics reported by members. The probability of obtaining some policy is the same as the probability of covering the lobbying cost for obtaining this policy. This probability will be a function of the vector of reported characteristics. So the center should propose the pair of this probability and expenditure to each member as a mechanism which is determined by reported characteristics.

3. Political Effectiveness and the Cost of Information

This section will search for the relationship between the informational problem within the interest group and its political effectiveness. For this we use a mechanism design approach and especially, apply the methods and arguments of Rob (1989) and Maliath and Postlewaite (1990). By using their methods and arguments, it will be shown why information is important to the political effectiveness of the interest group.

In the last section rules for political contribution under various situations were introduced. We have seen that there can exist cases in which incomplete information within a group does not hurt the political effectiveness of the group. If the lobbying cost $C(x^j, n)$ for a technically feasible policy $x^j \in F$ is sufficiently low, which means that $\beta_i h(x^j) - \frac{C(x^j, n)}{n} \geq \beta_i h(x^0), \forall i, \forall \beta_i \in B_i$, then the center can cover this lobbying cost by assigning the uniform fee, $\frac{C(x^j, n)}{n}$, to each member. In this case the center does not have to induce information from each member and this group of people will behave efficiently in the political process. This implies that if, for some group of people, the lobbying cost for obtaining technically feasible polices is very low, then this group can be efficiently lobbying the government even if this group has an informational problem.

In this section we will focus on the cases in which incomplete information will be an impediment to use the uniform fee method for financing the costs of political contribution, that is, when for at least one member i there exist $x^j \in F$ and $\beta_i \in [\underline{\beta}_i, \overline{\beta}_i]$ such that $\beta_i h(x^j) - \frac{C(x^j, n)}{n} < \beta_i h(x^0)$ holds. Among those cases we consider the case in which for any technically feasible policy $x^j \in F$ the following will always hold.

$$\underline{\beta}_i h(x^j) - \frac{C(x^j, n)}{n} < \underline{\beta}_i h(x^0), \forall i .$$

The above indicates the situation in which the center cannot be sure when obtaining any policy $x^j \in F$ that no member will refuse to pay the uniform fee, $\frac{C(x^j, n)}{n}$, which is the same situation as that of (Rule C) in the last section. So, in order for this group to make any technically feasible policy effective, the members who will receive relatively more transfer should spend more than those members who will receive relatively less transfer. Therefore, the center's problem is to design a mechanism which will induce the members to reveal their true information about their characteristics that affect the amount of transfer they receive. So the center has to design a mechanism which could cover the lobbying costs to benefit from any technically feasible policy. To cover this lobbying cost, the center needs to collect the information about each member's characteristic that will affect the amount of transfer he will receive and assign the political expenditure to each member based on this information. If the sum of assigned political expenditure to each member is sufficient to cover the lobbying cost, the probability of obtaining the most beneficial policy will be one. Otherwise, this probability will be zero. Under complete information, for any technically feasible policy, $x^j \in F$, the center is able to design a mechanism which covers the lobbying cost for this policy when this policy serves to the interests of this special interest group, which is the rule for ex post efficiency. We can describe this ex post efficiency rule as follows.

$$\hat{r}\left(x^j\right) = \begin{cases} 1, & \text{if} \quad nh\left(x^j\right) - C\left(x^j, n\right) \geq nh\left(x^0\right) \\ 0, & \text{otherwise} \end{cases},$$

where $\hat{r}\left(x^j\right)$ is the rule for obtaining policy $x^j \in F$ when there is no informational problem within the group.

By introducing the concept of the ex post efficiency rule, we can clarify the center's problem. The center's problem is to design a mechanism which satisfies the ex post efficiency rule[10].

Here we describe the mechanisms the center of the interest group can propose. Let β be the vector of characteristics as $\beta = \left(\beta_1 \quad \cdot \quad \cdot \quad \cdot \quad \beta_n\right)$. So β completely describes a state of nature, but no one knows β. Thus the center should first elicit information on β and then assign a political expenditure to each member based on the reported information. We call the vector of reported characteristics $b = \left(b_1 \quad \cdot \quad \cdot \quad \cdot \quad b_n\right)$, where $b_i \in \left[\underline{\beta}_i, \overline{\beta}_i\right], \forall i$. In order to finance the lobbying costs and satisfy individual rationality for every type of every member, the center of the interest group should determine the proposed level of each member's political expenditure as the way that the assigned political expenditure to member *i* is increasing

[10] The role of the center should be to design a mechanism which satisfies the ex post efficiency rule for obtaining the most beneficial policy because the center's objective is to maximize total surplus to the group from the political process.

in the value of his reported characteristic b_i. With self-interested individuals, every member of the group will try to report a value smaller than the true value of his characteristic (β_i), in order to spend less for political contribution. Hence the probability of obtaining any technically feasible policy would matter when the private nature of information within the group is causing a problem in financing the lobbying costs. This probability will depend on the vector of reported characteristics, *b*.

Given other members' characteristics (b_{-i}), the probability of obtaining some technically feasible policy will be increasing in the level of member *i*'s reported characteristic (b_i). The choices available to the center for obtaining some technically feasible policy $x^j \in F$ are announcements of decision mechanism (*r*, *g*), where $r : F \times \mathop{\mathrm{X}}_i B_i \rightarrow [0,1]$ is the probability of obtaining x^j as a function of the level of policy and the vector of messages from the members about their characteristics, and $g : F \times \mathop{\mathrm{X}}_i B_i \rightarrow \Re^n$ is the vector of political expenditures as a function of the level of policy and the vector of messages from the members about their characteristics.

The next step is to describe the constraints the interest group faces when it designs a mechanism for political contribution. The center has to design a mechanism that will make members to reveal their true information, which means that the mechanism should be incentive compatible. For some $x^j \in F$, a mechanism (*r*, *g*) is incentive compatible if every member wants to reveal his own private information as expressed in *n* incentive compatible constraints.

(IC-1)

$$\int_{\underline{\beta}_2}^{\overline{\beta}_2} \cdots \int_{\underline{\beta}_n}^{\overline{\beta}_n} r\left(x^j, \beta_1, v_2, \cdots, v_n\right)\left[\beta_1 h\left(x^j\right) - g_1\left(x^j, \beta_1, v_2, \cdots, v_n\right)\right] f_2(v_2) \cdots f_n(v_n) dv_2 \cdots dv_n$$

$$\geq \int_{\underline{\beta}_2}^{\overline{\beta}_2} \cdots \int_{\underline{\beta}_n}^{\overline{\beta}_n} r\left(x^j, \hat{\beta}_1, v_2, \cdots, v_n\right)\left[\beta_1 h\left(x^j\right) - g_1\left(x^j, \hat{\beta}_1, v_2, \cdots, v_n\right)\right] f_2(v_2) \cdots f_n(v_n) dv_2 \cdots dv_n,$$

$$\forall \beta_1 \in \left[\underline{\beta}_1, \overline{\beta}_1\right], \forall \hat{\beta}_1 \in \left[\underline{\beta}_1, \overline{\beta}_1\right].$$

.

.

(IC-*n*)

$$\int_{\underline{\beta}_1}^{\overline{\beta}_1} \cdots \int_{\underline{\beta}_{n-1}}^{\overline{\beta}_{n-1}} r\left(x^j, v_1, \cdots, v_{n-1}, \beta_n\right)\left[\beta_n h\left(x^j\right) - g_n\left(x^j, v_1, \cdots, v_{n-1}, \beta_n\right)\right] f_1(v_1) \cdots f_{n-1}(v_{n-1}) dv_1 \cdots dv_{n-1}$$

$$\geq \int_{\underline{\beta}_1}^{\overline{\beta}_1} \cdots \int_{\underline{\beta}_{n-1}}^{\overline{\beta}_{n-1}} r\left(x^j, v_1, \cdots, v_{n-1}, \hat{\beta}_n\right)\left[\beta_n h\left(x^j\right) - g_n\left(x^j, v_1, \cdots, v_{n-1}, \hat{\beta}_n\right)\right] f_1(v_1) \cdots f_{n-1}(v_{n-1}) dv_1 \cdots dv_{n-1}$$

$$\forall \beta_n \in \left[\underline{\beta}_n, \overline{\beta}_n\right], \forall \hat{\beta}_n \in \left[\underline{\beta}_n, \overline{\beta}_n\right].$$

For member *i*, the left-hand side of the above equation (IC-*i*) is the expected utility member *i* will obtain when he reveals the truth level of his characteristic and the right-hand side of the equation is the expected utility he will get by reporting a characteristic level different from the true level. By the revelation principle[11], we lose no generality by restricting attention to incentive-compatible mechanisms. This constraint provides a very important implication to the analysis of the behavior of a special interest group because it is closely related to controlling free-riding. Free-riding results from the tendency that members try to contribute less than desired. If incomplete information exists, members try to spend less by reporting the levels of transfers less than the true ones. So the center's ability to find and provide a mechanism which is incentive compatible can reflect the group's ability to control free-riding.

Any rule for political contribution can be implemented only when every member agrees on that rule. So the center must get an agreement from each member to

---

[11] The "revelation principle" can be explained as follows.
"Without loss of generality it can be assumed that the players communicate with one another through a mediator who first asks each player to reveal his or her private information, and who then gives each player only the minimal information needed to guide his action, in such a way that no player has any incentive to lie or cheat." Myerson(1991) p.260.

participate in the political activity. Since each member has veto power over any rule proposed by the center, the center has to design a rule for political contribution which provides an incentive to each member to agree on that rule. Thus an interim individual rationality constraint (INTIR) is required[12]. The appropriate individual rationality is that the mechanism should provide nonnegative expected gains to each member. In this section it is assumed that the uniform fee cannot be implemented to obtain any technically feasible policy because of informational problem. So the only political activity which can be committed is the one that each member has to make a political contribution based on the amount of transfer each member will receive. If member *i* refuses to participate in this political activity, then the probability of obtaining the policy will be zero given that other members would spend the amount the center assigns. Therefore member *i* will get the same level of utility as the one under the current policy. Thus the utility level of member *i* under the current policy is the level of his reservation utility. Here we assume for simplicity that $\beta_i h(x^0) = 0, \forall i$, that is, the reservation utility of every member of the group is 0[13]. Therefore, the interim individual rationality constraint for any member of the group to make political contribution to obtain some policy $x^j \in F$ is as follows.

(INTIR-1)

$$\int_{\underline{\beta}_2}^{\overline{\beta}_2} \cdots \int_{\underline{\beta}_n}^{\overline{\beta}_n} r(x^j, \beta_1, v_2, \cdots, v_n)[\beta_1 h(x^j) - g_1(x^j, \beta_1, v_2, \cdots, v_n)] f_2(v_2) \cdots f_n(v_n) dv_2 \cdots dv_n \geq 0,$$

$$\forall \beta_1 \in [\underline{\beta}_1, \overline{\beta}_1].$$

---

[12] We assume that everyone is risk neutral. So for this case the requirement of interim individual rationality is appropriate.

[13] Type-dependent reservation utility is excluded by this assumption. Otherwise the reservation utility of some member is increasing with the value of his characteristic. See p.263 in Fudenberg and Tirole (1992) for an explanation of type-dependent reservation utility.

.
.
.

(INTIR-*n*)

$$\int_{\underline{\beta}_1}^{\overline{\beta}_1}\cdots\int_{\underline{\beta}_{n-1}}^{\overline{\beta}_{n-1}} r\left(x^j, v_1, \cdots, v_{n-1}, \beta_n\right)\left[\beta_n h\left(x^j\right) - g_n\left(x^j, v_1, \cdots, v_{n-1}, \beta_n\right)\right] f_1(v_1)\cdots f_{n-1}(v_{n-1})\, dv_1 \cdots dv_{n-1} \geq 0,$$

$$\forall \beta_n \in \left[\underline{\beta}_n, \overline{\beta}_n\right].$$

For member *i*, the left-hand side of the above equation (INTIR-*i*) is the expected utility member *i* will obtain when he participates in the political contribution, and the right-hand side is the reservation utility when he will not participate in the political contribution. Even if some member is not participating in the political activity, he is not excluded from receiving transfer when the policy is effective. Also spending the assigned political expenditure to each member is not assumed to be enforceable. Therefore, for a special interest group to be politically effective, this group should find a rule of political contribution which is individually rational.

The last constraint is the balanced budget constraint. This means that the lobbying cost for obtaining some technically feasible policy $x^j \in F$, $C\left(x^j, n\right)$, should be covered by the members' expenditures. If the required lobbying cost for obtaining this policy is not covered, this group will lobby the government to obtain a less beneficial policy by spending less than this lobbying cost. So this constraint reflects the group's ability to collect sufficient amount of money to influence the government[14].

There are two possible balanced budget constraints. One is the ex post balanced budget constraint, which is relevant if the group does not have access to risk neutral

---

[14] Brooks, Cameron, and Carter (1998) showed that the amount of political contributions of political action committees (PACs) that are related to the sugar industry influence the sugar policy.

credit markets. The following is the ex post balanced budget constraint.

(EXPBB) $$\left[\sum_{i=1}^{n} g_i\left(x^j, \beta_1, \beta_2, \cdots, \beta_n\right) - C\left(x^j, n\right)\right] \geq 0, \forall \beta \in \underset{i}{\mathrm{X}} B_i \,.$$

The above constraint indicates that for any possible state of nature, the sum of assigned expenditure to each member for obtaining policy x^j should cover the required lobbying cost for obtaining policy x^j. However, this is a very strong constraint because it should hold for any possible set of characteristics. A weaker constraint is the ex ante balanced budget constraint. It is relevant if the interest group has access to risk neutral credit markets.

(EABB)

$$\int_{\underline{\beta}_1}^{\overline{\beta}_1}\int_{\underline{\beta}_2}^{\overline{\beta}_2}\cdots\int_{\underline{\beta}_n}^{\overline{\beta}_n} r\left(x^j, v_1, v_2, \cdots, v_n\right)\left[\sum_{i=1}^{n} g_i\left(x^j, v_1, \cdots, v_n\right) - C\left(x^j, n\right)\right] f_1\left(v_1\right)\cdots f_n\left(v_n\right) dv_1 \cdots dv_n \geq 0\,.$$

This constraint shows that the expected sum of the assigned political expenditure to each member to obtain policy x^j in which the expectation is over possible sets of characteristics and the probability of obtaining this policy is considered should cover the required lobbying costs. Since the characteristics are not publicly known, EABB is more appropriate than is EXPBB. Therefore, we consider EABB as a budget constraint[15].

The above three constraints reflect the ways of controlling free riding in the political contributions of the special interest group. Becker (1983) introduced several ways of controlling free riding. Among these ways Becker mentioned the enforcement which is imposed to the members by using ostracism, intimidation, and fines as a way

---

[15] Maliath and Postlewaite (1990) show that if a mechanism satisfies IC, INTIR, and EABB, it also satisfies IC, INTIR, and EXPBB.

of controlling free riding. But it is not realistic to assume that free riding can be controlled by enforcing ways within an interest group. So the above constraints indicate that the way of controlling free riding in the interest group is self-enforcing.

Under incomplete information, the mechanism interest group can impose is a self-enforcing mechanism which satisfies the above three constraints. So the question is if this self-enforcing mechanism can be the first best mechanism. By answering this question we can assess the political effectiveness of the interest group under incomplete information because that this self-enforcing mechanism is equivalent to the first best mechanism implies that this group can behave efficiently in the political process.

The first best mechanism is the one that satisfies the rule for ex post efficiency. As already mentioned, the center knows the amount of transfers from any technically feasible policy to the group even under incomplete information. The ex post efficiency rule for some policy says that the center's decision on lobbying for this policy will be based on the amount of transfers to the group from this policy. So our task is to find if, under incomplete information, the center's decision on lobbying is based on the amount of transfers to the group when the center is designing a mechanism that satisfies the above three constraints (IC, INTIR, EABB)[16]. This implies that we will find the answer to the question if the interest group in which there exists incomplete information can behave efficiently in the political process. That the mechanism that satisfies IC, INTIR, and EABB for the vector of reported characteristics *b*, and the policy x^j will achieve ex

[16] There are several studies on ex post efficiency when incomplete information exists. Myerson and Satterthwaite (1983) studied the bargaining problem between two agents for a single object when each agent has private valuation of the object. They showed the general impossibility of ex post efficiency outcomes without outside subsidies even if there exist incentive compatible and individually rational mechanisms. Cramton, Gibbons, and Klemperer (1987) applied the argument of Myerson and Satterthwaite to the case of dissolving a partnership when each partner has a private valuation for the asset they jointly own. They showed that a partnership cannot be dissolved ex post efficiently if at least one single partner owns too large a share.

post efficiency means that the actual rule for obtaining the policy will be independent of the vector of reported characteristics, *b*. First, we have to characterize the necessary and sufficient conditions for a mechanism (*r*, *g*) to satisfy IC, INTIR, and EABB for any possible vector of characteristics $\beta \in \underset{i}{X} B_i$.

To simplify notation, we offer the following definitions.

$$r_i^j(\beta_i) = \int_{\underline{\beta}_1}^{\overline{\beta}_1} \cdots \int_{\underline{\beta}_{i-1}}^{\overline{\beta}_{i-1}} \int_{\underline{\beta}_{i+1}}^{\overline{\beta}_{i+1}} \cdots \int_{\underline{\beta}_n}^{\overline{\beta}_n} r(x^j, v_1, \cdots, v_{i-1}, \beta_i, v_{i+1}, \cdots, v_n) f_1(v_1) \cdots f_{i-1}(v_{i-1}) f_{i+1}(v_{i+1}) \cdots f_n(v_n)$$
$$dv_1 dv_2 \cdots dv_{i-1} dv_{i+1} \cdots dv_n, \quad \forall \beta_i \in B_i, \forall i.$$

$$g_i^j(\beta_i) = \int_{\underline{\beta}_1}^{\overline{\beta}_1} \cdots \int_{\underline{\beta}_{i-1}}^{\overline{\beta}_{i-1}} \int_{\underline{\beta}_{i+1}}^{\overline{\beta}_{i+1}} \cdots \int_{\underline{\beta}_n}^{\overline{\beta}_n} r(x^j, v_1, \cdots, v_{i-1}, \beta_i, v_{i+1}, \cdots, v_n) g_i(x^j, v_1, \cdots, v_{i-1}, \beta_i, v_{i+1}, \cdots, v_n)$$
$$f_1(v_1) \cdots f_{i-1}(v_{i-1}) f_{i+1}(v_{i+1}) \cdots f_n(v_n) dv_1 dv_2 \cdots dv_{i-1} dv_{i+1} \cdots dv_n, \quad \forall \beta_i \in B_i, \forall i.$$

$$V_i^j(\beta_i) = r_i^j(\beta_i) \beta_i h(x^j) - g_i^j(\beta_i), \quad \forall \beta_i \in B_i, \forall i.$$

$r_i^j(\beta_i)$ indicates the expected probability of obtaining policy x^j to member *i* when *i*'s characteristic is β_i. $g_i^j(\beta_i)$ indicates the expected assigned political expenditure to member *i* to obtain x^j when *i*'s characteristic is β_i. $V_i^j(\beta_i)$ indicates interim utility of member *i* when the expected probability of obtaining policy x^j to member *i* is $r_i^j(\beta_i)$ and the expected assigned political expenditure to member *i* is $g_i^j(\beta_i)$ given that member *i*'s characteristic is β_i. By using these expressions, for some policy $x^j \in F$, we can write the incentive compatibility constraint and the interim individual rationality constraint as follows.

(IC) $V_i^j(\beta_i) \geq r_i^j(\hat{\beta}_i) \beta_i h(x^j) - g_i^j(\hat{\beta}_i), \quad \forall \beta_i, \hat{\beta}_i \in B_i, \forall i.$

(INTIR) $V_i^j(\beta_i) \geq 0$, $\forall \beta_i \in B_i, \forall i$.

We claim a lemma and a theorem that are standard applications of mechanism design techniques[17].

Lemma 1. A mechanism (*r*, *g*) is incentive compatible if and only if the expected marginal benefit to member *i* from the policy x^j, $r_i^j(\beta_i)h(x^j)$ is increasing in β_i and for $\forall \beta_i, \hat{\beta}_i \in B_i, \forall i$, $V_i^j(\beta_i) = V_i^j(\hat{\beta}_i) + \int_{\hat{\beta}_i}^{\beta_i} r_i^j(\tilde{\beta}_i)h(x^j)d\tilde{\beta}_i$.

Proof. See Appendix A.

Lemma 1 specifies the necessary and sufficient condition for a mechanism to be incentive compatible for some technically feasible policy x^j. Next we have to specify the necessary and sufficient condition for a mechanism to satisfy IC, INTIR, and EABB. This is the specification of a general self-enforcing mechanism an interest group in which incomplete information exists can use for political contribution[18]. The following

---

[17] Lemma 1 and Theorem 1 are applications of Myerson (1981) and Myerson and Satterthwaite (1983).
[18] Here we introduce a concept important for this condition, due to Myerson (1981). The level of member *i*'s surplus the center of the group is regarding when the mechanism for achieving policy x^j is designed is $V_i^j(\beta_i) - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\frac{\partial V_i^j(\hat{\beta}_i|\beta_i)}{\partial \beta_i} = r_i^j(\beta_i)\left[\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^j)\right] - g_i^j(\beta_i)$, where $\int_{\underline{\beta}_i}^{\bar{\beta}_i}\int_{\underline{\beta}_i}^{\beta_i}\frac{\partial V_i^j(\tilde{\beta}_i)}{\partial \tilde{\beta}_i}d\tilde{\beta}_i f_i(\beta_i)d\beta_i = \int_{\underline{\beta}_i}^{\bar{\beta}_i}\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\frac{\partial V_i^j(\beta_i)}{\partial \beta_i} f_i(\beta_i)d\beta_i$. Since the center does not have access to each member's private information, it cannot base the mechanism on the members' actual surpluses but will base the mechanism on the surpluses shown above. We need the additional assumption of $\frac{\partial}{\partial \beta_i}\left(\frac{f_i(\beta_i)}{1-F_i(\beta_i)}\right) \geq 0$. This is called the monotone hazard rate condition. The reason why we need this condition is that $\frac{\partial}{\partial \beta_i}\left(r_i^j(\beta_i)h(x^j)\right)$ is positive if $\frac{\partial}{\partial \beta_i}\left(\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right) \leq 0$. Thus we need the monotone hazard rate condition for monotonicity. The monotone hazard rate condition is

theorem will show that the necessary and sufficient condition for a mechanism to satisfy IC, INTIR, and EABB is that the expected total surplus the center is regarding from the political activity for obtaining x^j is greater than the surplus under nonintervention. We claim the following theorem.

Theorem 1. Suppose $r\left(x^j, \beta\right)$ is the rule for obtaining policy x^j which will provide $\beta_i h\left(x^j\right)$ to each member *i* with the characteristic β_i. Also assume that $r_i^j\left(\beta_i\right)h\left(x^j\right)$ is increasing in β_i for each *i*. Then there exists a political contribution scheme *g* for obtaining x^j such that (*r*, *g*) satisfies the incentive compatibility, interim individual rationality, and ex ante balanced budget constraints if and only if

$$E\left\{r\left(x^j, \beta\right)\left[\sum_{i=1}^{n}\left(\beta_i - \frac{1-F_i\left(\beta_i\right)}{f_i\left(\beta_i\right)}\right)h\left(x^j\right)\right] - C\left(x^j, n\right)\right\} \geq 0, \ \forall \beta \in \underset{i}{\mathrm{X}} B_i .$$

Proof. See Appendix B.

This theorem says that the total expected virtual surplus from some technically feasible policy will be nonnegative when the mechanism satisfies IC, INTIR, and EABB. It is important to note that this theorem provides the necessary and sufficient condition for a self-enforcing mechanism the special interest group with the informational problem can use for political contribution. From this theorem we can derive the difference between the actual mechanism and the first best mechanism for political contribution of the interest group with the informational problem. This implies that from this theorem we can infer the political effectiveness of a special interest group

---

equivalent to the reliability function $1-F_i$ being log-concave. This holds if F_i is uniform, normal, logistic, chi-squared, exponential, Laplace, and under some restrictions on the parameters, Weibull, gamma, or beta (See Fudenberg and Tirole (1992), p.267).

with the informational problem and also tell how incomplete information plays an important role for the political effectiveness of the interest group.

In order for the actual rule for obtaining the policy to be ex post efficient, the values of reported individual characteristics should not affect the group's decision on lobbying, which means the informational problem should not affect the rule for political contribution. The ex post efficiency rule is $\hat{r} : F \to [0,1]$, which is the rule for obtaining policy x^j as a function of the level of policy. From the above theorem it is clear that the ex post efficiency rule violates the necessary and sufficient condition for a mechanism to satisfy IC, INTIR, and EABB. This implies that a self-enforcing mechanism the interest group with informational problem can use for political contribution might not be the first mechanism. The interest groups in which internal incomplete information exists might not behave efficiently in the political process. Therefore we can say that internal incomplete information will be a major impediment for a special interest group to be politically effective.

The mechanisms considered in the above are the general ones that satisfy the three constraints. But we need to look for the mechanism that is actually constructed by the agreements within an interest group. So we have to consider the mechanism which satisfies not only the constraints the center will face but also the center's objective. This mechanism will be just a special case of the mechanism we considered above which is induced by using the methods of Rob(1989) and Maliath and Postlewaite(1990).

As already mentioned, the center of the group desires the policy that maximizes the aggregate welfare of the group among all technically feasible policies:

$$\underset{x}{Max}\, nh(x) - C(x,n).$$

Suppose that x^* solves the above problem. Then the center will try to obtain policy

x^*, and has to devise a mechanism for obtaining this policy. The mechanism proposed by the center for obtaining policy x^* should satisfy the following condition.

$$E\left\{r\left(x^*,\beta\right)\left[\sum_{i=1}^{n}\left(\beta_i-\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h\left(x^*\right)\right]-C\left(x^*,n\right)\right\}\geq 0 .$$

When the center of the group chooses to obtain policy x^*, the objective of the group is to maximize the expected aggregate welfare because the group has to consider the possibility of obtaining the policy x^* even if this policy is beneficial to the group[19]. Here we introduce the following definition which was first introduced by Myerson and Satterthwaite (1983).

Definition 1. For $\alpha\in[0,1]$

$$r^{\alpha}\left(x^*,\beta\right)=\begin{cases}1, & \text{if } \sum_{i=1}^{n}\left(\beta_i-\alpha\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h\left(x^*\right)-C\left(x^*,n\right)\geq 0\\ 0, & \text{otherwise}\end{cases}.$$

$r^{\alpha}\left(x^*,\beta\right)$ should satisfy the necessary and sufficient condition for a mechanism which satisfies IC, INTIR, and EABB. $r^{0}\left(x^*,\beta\right)$ is the ex post efficiency rule for obtaining x^* and $r^{1}\left(x^*,\beta\right)$ is the rule that just satisfies the constraints. Here we have to show that there exists a mechanism $\left(r^{\alpha},g\right)$ which maximizes the expected aggregate welfare from political behavior for obtaining the most beneficial policy among all mechanisms that satisfy incentive compatibility, interim individual rationality, and ex ante balanced budget constraints. Thus we claim the following lemma.

[19] Another mechanism satisfying IC, INTIR, and EABB might be considered to investigate if it achieves efficiency. But here following Myerson and Satterthwaite (1983), we restrict our attention to the mechanism which maximizes the expected total surplus. By focusing on this mechanism, our result will be more convincing than we use a general mechanism to satisfy IC, INTIR, and EABB.

Lemma 2. There exists $\alpha \in [0,1]$ such that for obtaining the most beneficial policy, x^*, a mechanism $\left(r^\alpha(x^*,\beta), g(x^*,\beta)\right)$ which is incentive compatible, interim individually rational, and ex ante budget balanced will maximize the expected aggregate welfare.

Proof. Since $\left(r^\alpha(x^*,\beta), g(x^*,\beta)\right)$ is incentive compatible, interim individually rational, and ex ante budget balanced, then this mechanism should satisfy the following.

$$E\left\{r^\alpha(x^*,\beta)\left[\sum_{i=1}^{n}\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)\right] - C(x^*,n)\right\} \geq 0 \tag{3}$$

Thus if the mechanism $\left(r^\alpha(x^*,\beta), g(x^*,\beta)\right)$ maximizes the expected aggregate welfare of the group, then $\left(r^\alpha(x^*,\beta), g(x^*,\beta)\right)$ should be the solution to the following problem.

$$\underset{r^\alpha(x^*,\beta),g(x^*,\beta)}{Max} E\left\{r^\alpha(x^*,\beta)\left[\sum_{i=1}^{n}\beta_i h(x^*) - C(x^*,n)\right]\right\}$$

s.t. $E\left\{r^\alpha(x^*,\beta)\left[\sum_{i=1}^{n}\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)\right] - C(x^*,n)\right\} \geq 0$.

The Lagrangian for this problem is

$$L = E\left\{r^\alpha(x^*,\beta)\left[\sum_{i=1}^{n}\beta_i h(x^*) - C(x^*,n)\right]\right\}$$

$$+\lambda\left\{E\left\{r^\alpha(x^*,\beta)\left[\sum_{i=1}^{n}\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)\right] - C(x^*,n)\right\}\right\}$$

$$= (1+\lambda)E\left\{r^\alpha(x^*,\beta)\left[\sum_{i=1}^{n}\left(\beta_i - \frac{\lambda}{1+\lambda}\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)\right] - C(x^*,n)\right\}.$$

The above Lagrangian will be maximized by $\left(r^\alpha(x^*,\beta), g(x^*,\beta)\right)$ when $\alpha = \dfrac{\lambda}{1+\lambda}$.

Since $\int_{\underline{\beta}_i}^{\overline{\beta}_i}\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)f_i(\beta_i)d\beta_i = \underline{\beta}_i h(x^*) \leq \frac{C(x^*,n)}{n}, \forall i$ by our assumption, then the constraint (3) will be satisfied with equality when the expected aggregate welfare of the group is maximized. We already know that

$$E\left\{r^1(x^*,\beta)\left[\sum_{i=1}^{n}\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)\right] - C(x^*,n)\right\} \geq 0 \text{, but}$$

$$E\left\{r^0(x^*,\beta)\left[\sum_{i=1}^{n}\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)\right] - C(x^*,n)\right\} \leq 0$$

because otherwise $(r^\alpha(x^*,\beta), g(x^*,\beta))$ would be an ex post efficient mechanism which always satisfies the necessary and sufficient condition for a mechanism to be incentive compatible, interim individually rational, and ex ante budget balanced. Thus,

$E\left\{r^\alpha(x^*,\beta)\left[\sum_{i=1}^{n}\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)\right] - C(x^*,n)\right\}$ is increasing in α. Therefore, there must exist some $\alpha \in [0,1]$ such that $r^\alpha(x^*,\beta)$ will satisfy the constraint (3) with equality. Q.E.D.

From the above lemma we can confirm the existence of a mechanism which will maximize the expected aggregate welfare of the group but also satisfy the constraints (IC, INTIR, and EABB). Thus by comparing between this mechanism and the first best mechanism we can infer the political effectiveness of the interest group in which the internal informational problem exists. Here we claim the following proposition.

Proposition 1. Political effectiveness of a special interest group will decline with the cost of information due to internal informational problem such as the observability of the value of specific characteristic within the group.

To claim Proposition 1, we need to describe the actual rule for obtaining the most beneficial policy proposed by the center of the interest group. Even if we lose no generality by restricting attention to the truth-telling equilibrium, the actual mechanism proposed by the center will be designed based on the vector of characteristics reported by the members, and there is no reason that the reports are always truthful. Therefore the mechanism we are considering is the one based on members' reports about their characteristics that are not necessarily the true ones. Suppose that the vector of members' characteristics reported by the members is $b = (b_1 \cdot \cdot \cdot b_n)$. So given b, the rule for obtaining the most beneficial policy x^* which satisfies IC, INTIR, and EABB and maximizes the expected aggregate welfare of the group is

$$r^{\alpha}(x^*, b) = \begin{cases} 1, & \text{if} \quad \sum_{i=1}^{n} \left(b_i - \alpha \frac{1 - F_i(b_i)}{f_i(b_i)} \right) h(x^*) - C(x^*, n) \geq 0 \\ 0, & \text{otherwise} \end{cases}.$$

The above shows that the cost of information for setting up the rule for obtaining the most beneficial policy x^* to this group is $\sum_{i=1}^{n} \alpha \frac{1 - F_i(b_i)}{f_i(b_i)} h(x^*)$. This rule is the same as the ex post efficiency rule except for this cost. By comparing between this rule and the ex post efficiency rule we can induce the cost of information, which can show the fact that the interest group in which internal incomplete information exists does not behave efficiently in the political process. The political effectiveness of the interest group will be highly dependent upon its cost of information. The cost of information that is caused by the difficulty of observing the pertinent characteristics of members is the main impediment for the special interest group to be politically effective.

It is known that the agricultural and clothing industry sectors are heavily protected in most developed countries while the agricultural sector is usually taxed in most developing or the least developed countries. Here our argument about the cost of information can be regarded as the main reason for this observation. For example, U.S. sugar producers are heavily subsidized and protected through the programs which employ a support price and import quotas. As we mentioned previously, according to Brooks, Cameron, and Carter (1998), it is evident that sugar PACs are politically influential and effective. The sugar producers in the U.S. are very homogeneous and so there is little cost of information to set up a rule for political contribution. Thus our argument about the cost of information can provide an explanation of U.S. sugar policy. It also provides an explanation of why the agriculture is usually taxed in developing countries. Farmers in developing countries are scattered and communication among them is expensive. The cost of information is too large to set up a rule for political pressure even though they may be very homogeneous.

According to our approach, incomplete information created by imperfect observability of a specific characteristic, which will affect the amount of transfer to each member, will bother to form a group and set up an efficient rule for political contribution except in the case when the lobbying cost for political contribution is sufficiently low. Thus we can explain why some special interest group can set up an efficient rule for political contribution but others cannot. The preferences of each consumer are not easily observed between consumers, and therefore it will be hard for consumers to form a group. Since each firm has similar technology and the emergence of new technologies is not common in traditional industries, then the specific characteristic that affects the amount of transfer to each firm will be easily observed in these kinds of industries. So the traditional industries are usually well-organized and politically efficient. However, in newer, developing industries the emergence of new technologies is common and each firm's technology will not be easily observed in the short period. Thus, the costs of forming a group and setting up rules for political contribution will be large in these industries. Then, it is very rare that newer, developing industries will form very influential and strong pressure groups. Therefore, our claim that the bargaining cost which depends on the degree of observability of the characteristics that will affect the amount of transfer to each member is the most crucial determinant for being an efficient pressure group can be an appropriate explanation of why some groups are politically efficient and well-organized but others are not.

4. The Group Size Effect

As we showed in the last section, internal incomplete information will be the fundamental constraint in setting up an efficient rule. In this section we will show how group size will affect the informational problem. Here our question is if the probability of achieving efficiency will be smaller as the number of members will increase.

In a special interest group, each member has veto power, i.e., each member can reject the mechanism offered by the center. Even if a member accepts the mechanism offered by the center, it is possible that he is pivotal[20], which means that he can change the probability of obtaining the most beneficial policy by changing reports about his information. However, the probability of being pivotal will get smaller with the number of members. Hence, each member's objective is to minimize his expected political

[20] According to Maliath and Postlewaite (1990), the probability that the agent is pivotal is "the only countervailing incentive not to lie." This means that the announcement of low value of characteristic lowers the probability of obtaining the most beneficial policy.

expenditure. Then every member wants to spend the minimum amount for political contribution. Therefore, the reported value of each member's characteristic will converge to the lowest possible value as group size increases. So as group size increases, it will be harder for the center of the group to assign the political expenditure to each member for covering the lobbying cost for the most beneficial policy, because each member's reported transfer tends to be lower than the per capita lobbying cost, and the expected virtual surplus to the group from this policy tends to be nonpositive. From this argument we suspect that the center will always decide to lobby the government to obtain the policy whenever this policy eventually will be the most beneficial to the group because the center's decision to lobby the government is based on the amount of expected virtual surplus to the group from the policy as we showed in the last section. This is our intuition. Clarifying this intuition is the objective of this section. Here we will use the arguments of inefficiency theorem introduced by Rob (1989) and Maliath and Postlewaite (1990) to analyze the effect of group size on the political effectiveness of a special interest group.

The center's decision to lobby the government to obtain some policy is based on the amount of expected virtual surplus to the group from this policy because each member's actual surplus is his private information. The efficiency rule is that the group should lobby the government to obtain the policy whenever the actual surplus to the group from this policy is beneficial. Our objective here is to look for the effect of group size on the difference between the actual rule of decision to lobby and the efficiency rule.

In order to search for group size effect, here we define the expectation and variance of transfer to each member, $\beta_i h(x^*), \forall i$, and also define the expectation and variance of $\left[\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)\right], \forall i,$ [21] if the most beneficial policy, x^*, is obtained by the group.

$$E\left[\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)\right] = \int_{\underline{\beta}_i}^{\overline{\beta}_i}\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)f_i(\beta_i)d\beta_i = \underline{\beta}_i h(x^*), \forall i.$$

The above shows that the expectation of transfer to each member considered by the center is the same as the lowest possible transfer to each member if x^* is obtained by the group. Let us establish the following definitions.

$$E[\beta_i h(x^*)] = \int_{\underline{\beta}_i}^{\overline{\beta}_i}\beta_i h(x^*)f_i(\beta_i)d\beta_i = \mu_i, \forall i.$$

$$Var\left[\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)\right] = \int_{\underline{\beta}_i}^{\overline{\beta}_i}\left[\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*) - \underline{\beta}_i h(x^*)\right]^2 f_i(\beta_i)d\beta_i = \sigma_i^2, \forall i.$$

$$Var[\beta_i h(x^*)] = \int_{\underline{\beta}_i}^{\overline{\beta}_i}[\beta_i h(x^*) - \mu_i]^2 f_i(\beta_i)d\beta_i = \tau_i^2, \forall i.$$

To make further argument meaningful, it is appropriate to assume that $\underline{\beta}_i h(x^*) \le \mu_i, \forall i$, and $\sigma_i^2 \le \infty, \forall i, \ \ \tau_i^2 \le \infty, \forall i$. And in order to clarify the relationship between the

[21] In the last section we induced that the necessary and sufficient condition for a mechanism to satisfy incentive compatibility, interim individual rationality and ex ante balanced budget constraints is $E\left\{r(x^j,\beta)\left[\sum_{i=1}^{n}\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^j)\right] - C(x^j,n)\right\} \ge 0$. So the center's decision to lobby will depend on the value of $\sum_{i=1}^{n}\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^j) - C(x^j,n)$ given β. Thus in order to analyze the effect of group size on the difference between the actual rule and the efficiency rule for political contribution, we need to know the statistics of $\left[\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)\right], \forall i$ also.

transfer to each member from the policy x^* and the per capital lobbying cost for obtaining x^*, we now add the following assumption.

Assumption 1. Given that per capita lobbying cost for obtaining the most beneficial policy, x^*, is increasing in the number of members,

$$\underline{\beta}_i h(x^*) < \frac{C(x^*, n)}{n} < \overline{\beta}_i h(x^*), \forall i, \text{ if } n \le m, \text{ for some } m,$$

$$\underline{\beta}_i h(x^*) < \overline{\beta}_i h(x^*) < \frac{C(x^*, n)}{n}, \forall i, \text{ if } n > m.$$

The above assumption reveals that the net transfer from the policy x^* to the member whose characteristic is the lowest possible value is always negative when the uniform fee, $\frac{C(x^*, n)}{n}$, is assigned to him. Then the member whose characteristic is the lowest possible value should be charged lower than the uniform fee to satisfy the individual rationality. On the other hand some members whose characteristics are relatively high should be charged greater than this uniform fee to balance the budget. Therefore, every member should be charged according to the value of his characteristic. But if the value of each member's characteristic is private information, then true information should be induced. In order to induce true information we need incentive compatibility constraint. Then we know that the three constraints (IC, INTIR, and EABB) are implicitly included in the above assumption.

The other interesting feature of the above assumption is that it will be harder to set up a rule for political contribution as group size increases. The reason is that since per capita lobbying cost, $\frac{C(x^*, n)}{n}$, will increase with the group size, then every member wants to announce that the value of his characteristic is the lowest, in order to be charged the lowest amount. We have another assumption as follows.

Assumption 2.

1) $\sigma_i^2 < \tau_i^2, \forall i$

2) $\dfrac{\overline{\beta}_i h(x^*) - \mu_i}{\sigma_i} < \dfrac{\overline{\beta}_i h(x^*) - \underline{\beta}_i h(x^*)}{\tau_i}, \forall i$

The above assumption indicates that the variance of actual transfer to each member, $\beta_i h(x^*), \forall i$, is much larger than that of the transfer of each member considered by the center, $\left(\beta_i - \dfrac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*), \forall i.$ We know that $\left(\beta_i - \dfrac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*), \forall i$ is derived considering the information cost due to private nature of information. Therefore, we can argue that the variability of the transfer considered by the center is less than that of actual transfer. By Assumption 2, we will confine our attention to this argument.

Here we emphasize one fact derived from the above assumptions for the group size effect on the probability of achieving efficiency.

Fact 1. For some $\alpha \in [0,1]$ such that $\left(r^{\alpha}(x^*, \beta), g(x^*, \beta)\right)$ maximizes the expected total surplus subject to the constraint (3),

$$\int_{\underline{\beta}_i}^{\overline{\beta}_i} \left(\beta_i - \alpha \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right) h(x^*) f_i(\beta_i) d\beta_i = \alpha \underline{\beta}_i h(x^*) + (1-\alpha)\mu_i \leq \frac{C(x^*, n)}{n}, \forall i.$$

By Assumption 1, $\underline{\beta}_i h(x^*)$ is less than the per capita lobbying cost. Thus, for $(r^\alpha(x^*,\beta), g(x^*,\beta))$ to satisfy the constraint (3) which is the necessary and sufficient condition for a mechanism to be incentive compatible, interim individually rational, and ex ante budget balanced, $\alpha\underline{\beta}_i h(x^*) + (1-\alpha)\mu_i$ should be less than the per capita lobbying cost $\frac{C(x^*,n)}{n}$. Otherwise it is possible that under the mechanism $(r^\alpha(x^*,\beta), g(x^*,\beta))$, while $\sum_{i=1}^{n}\left(\beta_i - \alpha\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*) - C(x^*,n) \geq 0$, but

$\sum_{i=1}^{n}\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*) - C(x^*,n) < 0$, which violates the necessary and sufficient condition for a mechanism to be incentive compatible, interim individually rational, and ex ante budget balanced.

Our next step is to define the probability of efficiency. We will use the following definition for this purpose since we confine our attention to the mechanism that is consistent with the objective of the center for obtaining policy x^*.

Definition 2[22]. The probability of efficiency is defined as

$$P^n = \Pr\left\langle \sum_{i=1}^{n}\left(\beta_i - \alpha\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*) \geq C(x^*,n) \,\middle|\, \sum_{i=1}^{n}\beta_i h(x^*) \geq C(x^*,n)\right\rangle$$

[22] This definition modifies Rob's (1989), except that we consider the mechanism which maximizes the expected total surplus while Rob used what he called the "virtual social loss function," which is equivalent to any mechanism that satisfies IC, INTIR, and EABB.

$$= \frac{\Pr\left[\sum_{i=1}^{n}\left(\beta_i - \alpha\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*) \geq C(x^*, n)\right]}{\Pr\left[\sum_{i=1}^{n}\beta_i h(x^*) \geq C(x^*, n)\right]}$$

P^n is defined as the probability that inefficiency will not occur when there exist n members in the group.

What is analyzed here is if P^n will go to zero as n goes to infinity. This means that as group size increases, what is concerned with is if the probability of efficiency will become smaller. To answer this question in a simplified way, it is assumed that $\beta_i \in [\underline{\beta}, \overline{\beta}], \forall i$, and the distribution functions are identical. So $\mu_i = \mu, \forall i$, $\sigma_i^2 = \sigma^2, \forall i$, and $\tau_i^2 = \tau^2, \forall i$. Now we claim the following theorem.

Theorem 2. Under Assumptions 1 and 2, the probability of efficiency will go to zero as the number of members goes to infinity.

Proof. See Appendix C.

The above theorem confirms that as group size increases the probability that efficiency will occur becomes smaller. Theorems 1 and 2 are the applications of the works of Rob(1989) and Maliath and Postlewaite(1990) to the case of a special interest group. While they focused on the general mechanism, we are focusing on the second best mechanism. Also we assume that per capita cost for political contribution increases as group size increases but they assumed per capita cost is constant. We have different assumption about per capita cost and by proving the above theorem we can strengthen the arguments of Rob, and Maliath and Postlewaite.

By using this approach the cause of different political effectiveness among interest groups can be clarified because the importance of informational problem in the political behavior of the interest groups can be emphasized by introducing mechanism design approach to the area of political economy. Gardner(1987) confirmed the idea of Peltzman(1976) and Becker(1983) on the effect of group size by showing that the increase in farm numbers negatively affects the revenue of government intervention. Theorem 2 not only confirms the idea of Peltzman and Becker but also provide a refined theoretical insight to the argument of Gardner by introducing the informational problem to analyze the effect of group size.

While it may seem that the analysis of this section is a reconfirmation of small group dominance in the political arena which was established by Olson(1965) and the political economists of the Chicago school (Stigler, Peltzman, Becker), our analysis is based on more general and relaxed assumption than in other literature about small group dominance. Stigler(1971) and Becker(1983) did not consider problems created by the asymmetry of information. In this paper, a special interest group with a center whose role is to collect the information and assign a political expenditure to each member is considered. Theorem 2 shows that the difficulty of setting up an efficient rule for political contribution due to the asymmetry of information within a group will increase as group size increases.

As already mentioned, the so-called small group dominance instigated by the Chicago school is based on the analysis of Olson(1965). In Olson's analysis it is assumed that the group has no way of controlling free riding. So Olson showed that the free riding problem will get worse as group size increases under no control of free riding. But as Tirole(1992) pointed out, collusion(cooperation) may not be a serious issue under complete information, which means that free riding may not be a serious issue under complete information. So the argument of the role of the group size will be enriched by including the problem of asymmetry of information. Thus the effect of group size on the group's ability to exert pressure by spending the optimal level of political contribution is made clearer by the introduction of the informational problem. Therefore, the analysis of this section should be helpful in clarifying the effect of group size on the efficiency of political contribution by considering the informational problem within a group because it shows that even if the group has available a way of controlling free riding, group size still matters when there exists asymmetry of information within a group.

***Appendix A*: *Proof of Lemma 1*.**

The incentive compatibility implies that

$$V_i^j(\beta_i) = r_i^j(\beta_i)\left[\beta_i h(x^j) - g_i^j(\beta_i, \beta_{-i})\right] \geq r_i^j(\hat{\beta}_i)\left[\beta_i h(x^j) - g_i^j(\hat{\beta}_i, \beta_{-i})\right],$$

$$V_i^j(\hat{\beta}_i) = r_i^j(\hat{\beta}_i)\left[\hat{\beta}_i h(x^j) - g_i^j(\hat{\beta}_i, \beta_{-i})\right] \geq r_i^j(\beta_i)\left[\hat{\beta}_i h(x^j) - g_i^j(\beta_i, \beta_{-i})\right].$$

The above two inequalities indicate that the following holds.

$$r_i^j(\hat{\beta}_i)h(x^j)(\beta_i - \hat{\beta}_i) \leq V_i^j(\beta_i) - V_i^j(\hat{\beta}_i) \leq r_i^j(\beta_i)h(x^j)(\beta_i - \hat{\beta}_i) \qquad (1).$$

From (1) we know that if $\beta_i > \hat{\beta}_i$, then $r_i^j(\beta_i)h(x^j) \geq r_i^j(\hat{\beta}_i)h(x^j)$, which means that $r_i^j(\beta_i)h(x^j)$ is increasing in β_i. If we divide by $(\beta_i - \hat{\beta}_i)$ and take the limit as $\hat{\beta}_i \to \beta_i$ for $r_i^j(\beta_i)h(x^j) \geq \dfrac{V_i^j(\beta_i) - V_i^j(\hat{\beta}_i)}{\beta_i - \hat{\beta}_i} \geq r_i^j(\hat{\beta}_i)h(x^j)$, then we get

$V_i^j(\beta_i)' = r_i^j(\beta_i)h(x^j), \forall \beta_i \in B_i$. After integrating this, we get

$$V_i^j(\beta_i) = V_i^j(\hat{\beta}_i) + \int_{\hat{\beta}_i}^{\beta_i} r_i^j(\tilde{\beta}_i)h(x^j)d\tilde{\beta}_i, \forall \beta_i, \hat{\beta}_i \in B_i, \forall i. \qquad (2).$$

So far we have shown that the incentive compatibility implies that $r_i^j(\beta_i)h(x^j)$ is increasing in β_i and $V_i^j(\beta_i) = V_i^j(\hat{\beta}_i) + \int_{\hat{\beta}_i}^{\beta_i} r_i^j(\tilde{\beta}_i)h(x^j)d\tilde{\beta}_i, \forall \beta_i, \hat{\beta}_i \in B_i, \forall i$. Now we have to show that the converse holds. (2) implies that

$$V_i^j(\hat{\beta}_i|\beta_i) = r_i^j(\hat{\beta}_i)[\beta_i h(x^j) - g_i^j(\hat{\beta}_i, \beta_{-i})] = V_i^j(\hat{\beta}_i) + r_i^j(\hat{\beta}_i)h(x^j)(\beta_i - \hat{\beta}_i)$$

$$= V_i^j(\beta_i) - \int_{\underline{\beta}_i}^{\beta_i}[r_i^j(\tilde{\beta}_i)h(x^j) - r_i^j(\hat{\beta}_i)h(x^j)]d\tilde{\beta}.$$

If $\beta_i > \hat{\beta}_i$, then the integrand is nonnegative since $r_i^j(\beta_i)h(x^j)$ is increasing in β_i. Therefore, $V_i^j(\beta_i) \geq V_i^j(\hat{\beta}_i|\beta_i)$ when $\beta_i \geq \hat{\beta}_i$. If $\beta_i < \hat{\beta}_i$, then the integrand is nonpositive but the integral is nonnegative, so $V_i^j(\hat{\beta}_i|\beta_i) \leq V_i^j(\beta_i)$. Thus the condition that $r_i^j(\beta_i)h(x^j)$ is increasing in β_i and $V_i^j(\beta_i) = V_i^j(\hat{\beta}_i) + \int_{\hat{\beta}_i}^{\beta_i} r_i^j(\tilde{\beta}_i)h(x^j)d\tilde{\beta}_i$ implies incentive compatibility. Q.E.D.

***Appendix B*: *Proof of Theorem 1*.**

First we show that if a mechanism (*r*, *g*) satisfies incentive compatibility, interim individual rationality, and ex ante budget balance, and if $r_i^j(\beta_i)h(x^j)$ is increasing in β_i for each *i*, then

$$E\left\{r(x^j, \beta)\left[\sum_{i=1}^{n}\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^j)\right] - C(x^j, n)\right\} \geq 0.$$

From Lemma 1, we know that the incentive compatibility means that $r_i^j(\beta_i)h(x^j)$ is increasing in β_i and $V_i^j(\beta_i) = V_i^j(\underline{\beta}_i) + \int_{\underline{\beta}_i}^{\beta_i} r_i^j(\tilde{\beta}_i)h(x^j)d\tilde{\beta}_i$. The expected total virtual surplus from the policy x^j to this group, W^j, is

$$W^j = E\left[\sum_{i=1}^{n} g_i^j(\beta) - r(x^j,\beta)h(x^j) + \sum_{i=1}^{n} V_i^j(\beta_i)\right].$$

By incentive compatibility,

$$W^j = E\left\{\sum_{i=1}^{n} g_i^j(\beta) - r(x^j,\beta)h(x^j) + \sum_{i=1}^{n}\left[V_i^j(\underline{\beta}_i) + \int_{\underline{\beta}_i}^{\beta_i} r_i^j(\tilde{\beta}_i)h(x^j)d\tilde{\beta}_i\right]\right\}$$

$$= E\left[\sum_{i=1}^{n} g_i^j(\beta) - r(x^j,\beta)h(x^j) + \sum_{i=1}^{n} V_i^j(\underline{\beta}_i)\right] + \sum_{i=1}^{n}\int_{\underline{\beta}_i}^{\bar{\beta}_i}\int_{\underline{\beta}_i}^{\beta_i} r_i^j(\beta_i)h(x^j)d\tilde{\beta} f_i(\beta_i)d\beta_i$$

$$= E\left[\sum_{i=1}^{n} g_i^j(\beta) - r(x^j,\beta)h(x^j) + \sum_{i=1}^{n} V_i^j(\underline{\beta}_i)\right] + \sum_{i=1}^{n} E_i\left(\frac{1-F_i(\beta_i)}{f_i(\beta_i)} r_i^j(\beta_i)h(x^j)\right).$$

By the ex ante balanced budget constraint, $E\left[\sum_{i=1}^{n} g_i^j(\beta) - r(x^j,\beta)C(x^j,n)\right] \geq 0$. By interim individual rationality, $V_i^j(\beta_i) \geq 0, \forall \beta_i \in B_i, \forall i$. Then,

$$0 \leq E\left[\sum_{i=1}^{n} V_i^j(\beta_i)\right] = E\left\{\sum_{i=1}^{n}\left[r_i^j(\beta_i)\beta_i h(x^j) - g_i^j(\beta_i)\right]\right\}$$

$$\leq E\left\{\sum_{i=1}^{n}\left[r_i^j(\beta_i)\beta_i h(x^j)\right] - r(x^j,\beta)C(x^j,n)\right\}.$$

Since $V_i^j(\underline{\beta}_i) \geq 0, \forall i$, by interim individual rationality, the above is equivalent to

$$0 \leq E\left\{\sum_{i=1}^{n}\left[V_i^j(\underline{\beta}_i) + \int_{\underline{\beta}_i}^{\beta_i} r_i^j(\tilde{\beta}_i)h(x^j)d\tilde{\beta}_i\right]\right\}$$

$$= E\left[\sum_{i=1}^{n} V_i^j(\underline{\beta}_i)\right] + E\left[\sum_{i=1}^{n}\frac{1-F_i(\beta_i)}{f_i(\beta_i)} r_i^j(\beta_i)h(x^j)\right]$$

$$\leq E\left\{\sum_{i=1}^{n}\left[r_i^j(\beta_i)\beta_i h(x^j)\right] - r(x^j,\beta)C(x^j,n)\right\}.$$

By interim individual rationality $V_i^j(\underline{\beta}_i) \geq 0, \forall \beta \in \mathop{\mathrm{X}}_i B_i$. Integrating by parts implies that

$$E\left\{r(x^j,\beta)\left[\sum_{i=1}^{n}\left(\beta_i - \frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^j)\right] - C(x^j,n)\right\} \geq E\left[\sum_{i=1}^{n} V_i^j(\underline{\beta}_i)\right] \geq 0.$$

This proves "if" part of this theorem. Now we have to prove "only if" part of this theorem, that is, we have to show that the converse holds. So we have to show that if

$$E\left\{r\left(x^j,\beta\right)\left[\sum_{i=1}^{n}\left(\beta_i-\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h\left(x^j\right)\right]-C\left(x^j,n\right)\right\}\geq 0 \qquad (3),$$

then the mechanism (r, g) will satisfy the incentive compatibility, interim individual rationality, and ex ante balanced budget constraint. In order to prove this, here we construct a political contribution scheme, g that is incentive compatible, interim individual rational, and ex ante budget balanced provided that the inequality (3) holds. We propose the following political contribution scheme.

$$g_i^j(\beta_i)=\begin{cases} r_i^j(\beta_i)\beta_i h\left(x^j\right)-\int_{\underline{\beta}_i}^{\beta_i} r_i^j\left(\tilde{\beta}_i\right)h\left(x^j\right)d\tilde{\beta}_i-r_i^j\left(\underline{\beta}_i\right)\underline{\beta}_i h\left(x^j\right), & \text{if } \beta_i>\underline{\beta}_i \\ 0 & \text{, if } \beta_i=\underline{\beta}_i \end{cases}.$$

The above satisfies incentive compatibility. Since $g_i^j\left(\underline{\beta}_i\right)=0$, then

$V_i^j\left(\underline{\beta}_i\right)=r_i^j\left(\underline{\beta}_i\right)\underline{\beta}_i h\left(x^j\right)\geq 0$, which indicates that the mechanism specified by the above political contribution scheme will satisfy interim individual rationality. Finally we have to show that this mechanism will satisfy the ex ante balanced budget constraint. Suppose that the ex ante balanced budget constraint is not satisfied, so

$$E\left[\sum_{i=1}^{n} g_i^j(\beta_i)\right]\leq E\left[r\left(x^j,\beta\right)C\left(x^j,n\right)\right].$$

From the above the following can be induced.

$$E\left\{\sum_{i=1}^{n}\left[r_i^j(\beta_i)\left(\beta_i-\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h\left(x^j\right)\right]-r\left(x^j,\beta\right)C\left(x^j,n\right)\right\}$$

$$\leq E\left\{\sum_{i=1}^{n}\left[r_i^j(\beta_i)\left(\beta_i-\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h\left(x^j\right)-g_i^j(\beta_i)\right]\right\}.$$

By the political contributions scheme we constructed,

$$E\left\{\sum_{i=1}^{n}\left[r_i^j(\beta_i)\left(\beta_i-\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h\left(x^j\right)-g_i^j(\beta_i)\right]\right\}=E\left[\sum_{i=1}^{n} r_i^j\left(\underline{\beta}_i\right)\underline{\beta}_i h\left(x^j\right)\right]\geq 0.$$

Thus we find that if ex ante balanced budget constraint is not satisfied, we cannot guarantee that the inequality (3) holds. If the ex ante balanced budget constraint is satisfied, then

$$E\left\{\sum_{i=1}^{n}\left[r_i^j(\beta_i)\left(\beta_i-\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h\left(x^j\right)\right]-r\left(x^j,\beta\right)C\left(x^j,n\right)\right\}$$

$$\geq E\left\{\sum_{i=1}^{n}\left[r_i^j(\beta_i)\left(\beta_i-\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^j)-g_i^j(\beta_i)\right]\right\}=E\left[\sum_{i=1}^{n}r_i^j(\underline{\beta}_i)\underline{\beta}_i h(x^j)\right]\geq 0\,.$$

Therefore, we know that ex ante balanced budget will be required to be consistent with the inequality (3). Thus we have proved "only if" part of the theorem. Q.E.D.

Appendix C: *Proof of Theorem 2.*

First, denote the probability that inefficiency will not occur as follows.

$$P^n=\Pr\left\langle\sum_{i=1}^{n}\left(\beta_i-\alpha\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)\geq C(x^*,n)\,\middle|\,\sum_{i=1}^{n}\beta_i h(x^*)\geq C(x^*,n)\right\rangle$$

$$=\frac{\Pr\left[\sum_{i=1}^{n}\left(\beta_i-\alpha\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)\geq C(x^*,n)\right]}{\Pr\left[\sum_{i=1}^{n}\beta_i h(x^*)\geq C(x^*,n)\right]}=\frac{e^n}{a^n}\,.$$

Before we go further, we have to define the expectation and the variance of

$\left(\beta_i-\alpha\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)$ here to use the central limit theorem.

$$E\left[\left(\beta_i-\alpha\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)\right]=\int_{\underline{\beta}_i}^{\overline{\beta}_i}\left(\beta_i-\alpha\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)f_i(\beta_i)d\beta_i$$

$$=\alpha\underline{\beta}h(x^*)+(1-\alpha)\mu\,.$$

$$Var\left[\left(\beta_i-\alpha\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)\right]$$

$$=\int_{\underline{\beta}_i}^{\overline{\beta}_i}\left[\left(\beta_i-\alpha\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)-\alpha\underline{\beta}h(x^*)-(1-\alpha)\mu\right]^2 f_i(\beta_i)d\beta_i$$

$$=\int_{\underline{\beta}_i}^{\overline{\beta}_i}\left\{\alpha\left[\left(\beta_i-\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)-\alpha\underline{\beta}h(x^*)\right]+(1-\alpha)[\beta_i h(x^*)-\mu]\right\}^2 f_i(\beta_i)d\beta_i\,.$$

Let $Var\left[\left(\beta_i - \alpha\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*)\right] = \theta^2$. Then we know that $\sigma^2 \le \theta^2 \le \tau^2$ by convexity of $\Re_+$. By the central limit theorem,

$$e^n = \Pr\left[\sum_{i=1}^{n}\left(\beta_i - \alpha\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*) \ge C(x^*,n)\right]$$

$$= \Pr\left[\frac{\sum_{i=1}^{n}\left(\beta_i - \alpha\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*) - n\left[\alpha\underline{\beta}_i h(x^*) + (1-\alpha)\mu\right]}{\sqrt{n}\theta} \ge \frac{n\left[C(x^*,n)/n\right] - n\left[\alpha\underline{\beta}_i h(x^*) + (1-\alpha)\mu\right]}{\sqrt{n}\theta}\right]$$

$$= \Pr\left[\frac{\sum_{i=1}^{n}\left(\beta_i - \alpha\frac{1-F_i(\beta_i)}{f_i(\beta_i)}\right)h(x^*) - n\left[\alpha\underline{\beta}_i h(x^*) + (1-\alpha)\mu\right]}{\sqrt{n}\theta} \ge \sqrt{n}\,\frac{C(x^*,n)/n - \left[\alpha\underline{\beta}_i h(x^*) + (1-\alpha)\mu\right]}{\theta}\right]$$

$$\approx 1 - \Phi\left(\sqrt{n}\,\frac{C(x^*,n)/n - \left[\alpha\underline{\beta}_i h(x^*) + (1-\alpha)\mu\right]}{\theta}\right) = \Phi\left(\sqrt{n}\,\frac{\left[\alpha\underline{\beta}_i h(x^*) + (1-\alpha)\mu\right] - C(x^*,n)/n}{\theta}\right)$$

where Φ is the cumulative distribution function of standard normal variate. Similarly,

$$a^n = \Pr\left[\sum_{i=1}^{n}\beta_i h(x^*) \ge C(x^*,n)\right] = \Pr\left[\frac{\sum_{i=1}^{n}\beta_i h(x^*) - n\mu}{\sqrt{n}\tau} \ge \frac{n\left[C(x^*,n)/n - \mu\right]}{\sqrt{n}\tau}\right]$$

$$\approx 1-\Phi\left(\sqrt{n}\,\frac{C(x^*,n)/n-\mu}{\tau}\right)=\Phi\left(\sqrt{n}\,\frac{\mu-C(x^*,n)/n}{\tau}\right).$$

Then as group size increases, the tendency of the probability of efficiency will be represented as

$$\lim_{n\to\infty}P^n=\lim_{n\to\infty}\frac{e^n}{a^n}\approx\lim_{n\to\infty}\frac{\Phi\left(\sqrt{n}\,\frac{\alpha\underline{\beta}_i h(x^*)+(1-\alpha)\mu-C(x^*,n)/n}{\theta}\right)}{\Phi\left(\sqrt{n}\,\frac{\mu-C(x^*,n)/n}{\tau}\right)}.$$

$\frac{C(x^*,n)}{n}>\alpha\underline{\beta}_i h(x^*)+(1-\alpha)\mu$ and $\frac{C(x^*,n)}{n}>\mu$ for some sufficiently large *n* because it is already assumed that $\frac{\partial\left(C(x^*,n)/n\right)}{\partial n}>0,\ \forall x^j\in F$. So

$$\lim_{n\to\infty}\Phi\left(\sqrt{n}\,\frac{[\alpha\underline{\beta}_i h(x^*)+(1-\alpha)\mu]-C(x^*,n)/n}{\theta}\right)=0 \quad\text{and}\quad \lim_{n\to\infty}\Phi\left(\sqrt{n}\,\frac{\mu-C(x^*,n)/n}{\tau}\right)=0\ .$$

Thus, $\lim_{n\to\infty}P^n=\lim_{n\to\infty}\frac{e^n}{a^n}\approx\lim_{n\to\infty}\frac{\Phi\left(\sqrt{n}\,\frac{\alpha\underline{\beta}_i h(x^*)+(1-\alpha)\mu-C(x^*,n)/n}{\theta}\right)}{\Phi\left(\sqrt{n}\,\frac{\mu-C(x^*,n)/n}{\tau}\right)}=\frac{0}{0}$. Then by L'Hopital's rule $\lim_{n\to\infty}P^n=\lim_{n\to\infty}\frac{e^n}{a^n}=\lim_{n\to\infty}\frac{{e^n}'}{{a^n}'}$.

$$\lim_{n\to\infty}\frac{e^{n\,\prime}}{a^{n\,\prime}}=\lim_{n\to\infty}\frac{\left(\dfrac{\alpha\underline{\beta}_i h(x^*)+(1-\alpha)\mu-C(x^*,n)/n-\dfrac{\partial(C(x^*,n)/n)}{\partial n}}{\theta}\Big/2\sqrt{n}\right)}{\left(\dfrac{\mu-C(x^*,n)/n-\dfrac{\partial(C(x^*,n)/n)}{\partial n}}{\tau}\Big/2\sqrt{n}\right)}$$

$$\times\frac{\phi\left(\sqrt{n}\,\dfrac{\alpha\underline{\beta}_i h(x^*)+(1-\alpha)\mu-C(x^*,n)/n}{\theta}\right)}{\phi\left(\sqrt{n}\,\dfrac{\mu-C(x^*,n)/n}{\tau}\right)}$$

$$=\lim_{n\to\infty}\frac{\tau\left(\alpha\underline{\beta}_i h(x^*)+(1-\alpha)\mu-C(x^*,n)/n-\dfrac{\partial(C(x^*,n)/n)}{\partial n}\right)}{\theta\left(\mu-C(x^*,n)/n-\dfrac{\partial(C(x^*,n)/n)}{\partial n}\right)}$$

$$\times\exp\left\{-\frac{n}{2}\left[\left(\frac{\alpha\underline{\beta}_i h(x^*)+(1-\alpha)\mu-C(x^*,n)/n}{\theta}\right)^2-\left(\frac{\mu-C(x^*,n)/n}{\tau}\right)^2\right]\right\}=\frac{0}{0}.$$

Again by L'Hopital's rule

$$\lim_{n\to\infty}P^n=\lim_{n\to\infty}\frac{e^n}{a^n}=\lim_{n\to\infty}\frac{e^{n\,\prime}}{a^{n\,\prime}}=\lim_{n\to\infty}\frac{e^{n\,\prime\prime}}{a^{n\,\prime\prime}}$$

$$=\lim_{n\to\infty}\frac{\tau\left[\theta\left(\alpha\underline{\beta}_i h(x^*)+(1-\alpha)\mu-C(x^*,n)/n\right)^2-\dfrac{\partial(C(x^*,n)/n)}{\partial n}\right]}{\theta\left[\tau\left(\mu-C(x^*,n)/n\right)^2-\dfrac{\partial(C(x^*,n)/n)}{\partial n}\right]}$$

$$\times \exp\left\{-\frac{n}{2}\left[\left(\frac{\alpha \underline{\beta}_i h(x^*) + (1-\alpha)\mu - {C(x^*,n)}\big/{n}}{\theta}\right)^2 - \left(\frac{\mu - {C(x^*,n)}\big/{n}}{\tau}\right)^2\right]\right\}.$$

In order for the probability of efficiency to converge to zero as *n* goes to infinity, the following should be positive or go to infinity.

$$\left(\frac{\alpha \underline{\beta}_i h(x^*) + (1-\alpha)\mu - {C(x^*,n)}\big/{n}}{\theta}\right)^2 - \left(\frac{\mu - {C(x^*,n)}\big/{n}}{\tau}\right)^2 = q(n).$$

Let us define as $\alpha \underline{\beta}_i h(x^*) + (1-\alpha)\mu = \rho$ and $\frac{C(x^*,n)}{n} = \xi$. So

$$\left(\frac{\alpha \underline{\beta}_i h(x^*) + (1-\alpha)\mu - {C(x^*,n)}\big/{n}}{\theta}\right)^2 = \frac{\rho^2 + \xi^2 - 2\rho\xi}{\theta^2}$$ and

$$\left(\frac{\mu - {C(x^*,n)}\big/{n}}{\tau}\right)^2 = \frac{\mu^2 + \xi^2 - 2\mu\xi}{\tau^2}.$$ Then

$q(n) = \frac{\rho^2}{\theta^2} - \frac{\mu^2}{\tau^2} + \frac{\xi}{\theta^2\tau^2}\left[(\tau^2 - \theta^2)\xi - 2\rho\tau^2 - 2\mu\theta^2\right]$. By Assumption 2, $\tau^2 > \theta^2$ and $\frac{\rho^2}{\theta^2} > \frac{\xi^2}{\tau^2}$. Since $\lim_{n\to\infty} \xi = \infty$, then $\lim_{n\to\infty} q(n) = \infty$. Therefore, $\lim_{n\to\infty} P^n = \lim_{n\to\infty} \frac{e^{n''}}{a^{n''}} = 0$. So the probability of efficiency will converge to zero as group size goes to infinity. Q.E.D.

References

Becker, G. S. (1983). "A theory of competition among pressure groups for political influence," *Quarterly Journal of Economics* 98, 371-400.

Brainard, S., and Verdier, T. (1997). "The political economy of declining industries: Senescent industry collapsed revisited," *Journal of International Economics* 42, 221-37.

Brooks, C., Cameron, A., and Carter, C. (1998). "Political Action Committee

Contributions and U.S. congressional voting on sugar legislation," *American Journal of Agricultural Economics* 80, 441-54.

Cramton, P., Gibbons, R., and Klemperer, P. (1987). "Dissolving a partnership efficiently," *Econometrica* 55, 615-632.

Fudenberg, D., and J. Tirole. (1992). *Game Theory*. The MIT Press.

Gardner, B. (1987). "Causes of U.S. farm commodity programs," *Journal of Political Economy* 95, 290-310.

Grossman, G., and E. Helpman. (1994). "Protection for sale," *American Economic Review* 84, 833-850.

Grossman, G., and E. Helpman. (1996). "Rent dissipation, free riding, and trade policy," *European Economic Review* 40, 795-803.

Hufbauer, G., and H. Rosen. (1986). *Trade policy for troubled industries*, Washington D.C., Institute for International Economics.

Lee, J., and P. Swagel. (1997). "Trade barriers and trade flow across countries and industries," *Review of Economics and Statistics* 79, 372-82.

Maliath, G., and A. Postlewaite. (1990). "Asymmetric information bargaining problems with many agents," *Review of Economic Studies* 57, 351-68.

Marvel, H., and E. Ray. (1983). "The Kennedy Round: Evidence on the regulation of trade in the U.S.," *American Economic Review* 73, 190-97.

Myerson, R. (1981). "Optimal auction design," *Mathematics of Operation Research* 6, 58-73.

Myerson, R. (1991). *Game Theory*. Cambridge, Harvard Univ. Press.

Myerson, R., and M. Satterthwaite. (1983). "Efficient mechanism for bilateral trading," *Journal of Economic Theory* 29, 265-81.

Olson, M. (1965). *The Logic of Collective Action*. Cambridge, Harvard Univ. Press.

Peltzman, S. (1976). "Towards a more general theory of regulation," *Journal of Law and Economics* 19, 211-40.

Rob, R. (1989). "Pollution claim settlements with private information," *Journal of Economic Theory* 47, 307-33.

Song, W. (1999). *Essays on the organizational efficiency of a political pressure group*. Ph.D. dissertation, Univ. of Illinois at Urbana-Champaign.

Stigler, G. (1971). "The theory of economic regulation," *Bell Journal of Economics and Management Science* 2, 1-21.

Tirole, J. (1992). "Collusion and theory of organizations," in J-J Laffont ed, *Advances in Economic Theory*, Sixth World Congress, Vol. II. New York, Cambridge Univ. Press.