

Impacts of interest groups: Endogenous interaction and lobbying limits[☆]

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Abstract

This paper investigates how the predetermined prices in a regulated utility can affect interest groups' political activities and cause further changes in the regulatory policies. Interest groups can strategically choose their forms of interaction, and both predetermined prices and lobbying limits are considered in the lobbying influence function. Our main result shows that, the predetermined prices in the product market do have significant impacts on each group's lobbying incentives, but neither predetermined prices nor lobbying limits can affect groups' decisions on the forms of interaction, and therefore might not have any impact on the regulatory policies.

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1. Introduction

It is well known that interest groups participate directly or indirectly in the formation of public policies or regulation on public utilities. There has been a considerable literature investigating how the associated pressure groups can affect regulatory policies through provision of monetary transfers to politicians, and change the relative surpluses in their favor (see [Tullock, 1967](#); [Posner, 1975](#); [Becker, 1983](#)). For instance, the probabilistic influence model suggests that, if we denote x_i

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as group i 's lobbying expenditure, then there will be a probability $\frac{x_i}{\sum_i x_i}$ that group i can change the policy to its benefit. An important assumption behind this line of models is that, interest groups are competitive in lobbying, so there will be a “*purely wasteful expenditure*, used up in an attempt to resist the transfer of wealth (Tullock, 1967, p. 228)”.

The evidence from Germany and the Scandinavian countries, however, shows an interesting alternative to this competitive setting; namely, interest groups can also cooperate in lobbying in a so-called *corporatist* style. Rechtman et al. (1998) described that “the largest corporatist structure seems to have been accepted in the political culture and no organization protested against it; because all relevant stakeholders were involved at some time in the process, they had no reason to complain.” Similar evidence of cooperation is found in Japan, where “Japanese interest groups tend to follow the European model of corporatist politics with access to governmental decision making based on cemented long-term relationships (Hrebendar et al., 1998)”. The *coexistence* of both competition and cooperation among interest groups is not the end of discussion. The evidence also shows that *the form of interaction might change with the surrounding environments*. For example, Rechtman et al. (1998) observed that, “lately, the external environment has changed...so what we are seeing is the adaptation of the political system to the changing structures and a new political reality.”

In most existing papers, the interacting form among interest groups has been assumed exogenously, either cooperative¹ or competitive. The changeable forms observed in the evidence indicate that, a setting that allows the interest groups to freely choose the form of interaction could probably fit in the reality more. In this paper, we attempt to characterize this endogeneity of interaction, by considering a simple regulatory game where two interest groups, the monopolist and consumers, can invest resources to influence the product market price determined by a regulator, and each of them can strategically choose whether to cooperate or to compete in lobbying.

When it comes to endogenous choices on cooperation, the first impression will be the prisoner dilemma like story; namely, although cooperation reaches Pareto efficiency, the extra benefit from unilateral deviation will prevent the cooperative outcome to be equilibrium. The key behind this line of argument is that cooperation takes a form of non-binding commitment on each group's lobbying efforts. This non-binding assumption, however, seems different from the fact that oftentimes cooperation among political parties or unions involves several rounds of negotiations and complicated bargaining, and if there is unilateral backing out, negotiations will often be terminated. This suggests that the extra benefit of unilateral deviation might not exist and that cooperation will not necessarily be violated. In our model, we use a *coalition form game* (von Neumann and Morgenstern, 1944; Shapley and Shubik, 1953; Aumann and Peleg, 1960) to analyze interest groups' utilities in cooperation, where if one group unilaterally deviates from mutual cooperation, both groups return to the status of mutual competition. Cooperation can be part of equilibrium in our model.

In addition to stressing endogenous interaction, we address two more questions in the hope to provide different aspects about the impacts of interest groups. First, the existing models have explained how political processes affect (regulatory) policies in the product market, but can the current policies themselves stimulate alterations in political activities, which in turn give rise to further changes to these policies? Besley and Coate (2003) provided a positive answer by concluding in a *public interest* model² that after providing a public good (a new instrument),

¹ For a recent example of cooperative lobbying, see Aidt (1997).

² Laffont and Tirole (1991) develop an agency theoretic approach to interest group politics, providing a bridge between the public interest (by using the agency model) and interest group theories of regulation.

voters will indeed change their decisions in the political game, which further influences the original probability distribution over redistributions in the society. Our model will be an *interest groups* interpretation, addressing how the *initial prices* in a regulated utility can influence pressure groups' political activities, and cause further changes in the regulatory prices. Initial prices here can be interpreted as the current regulatory prices or prices inherited from last period. As noted by Young (2001) in a study on British regulations, "the original prices were set in secret, their levels dictated by political as much as economic considerations" (p. 40).

Second, most lobbying regulation has imposed expenditure limitations on lobbying to avoid *wasteful expenditures* due to competition. For example, in a study on the federal Lobbying Disclosure Act, Troyer and Varley (2003) pointed out that public charities may spend up to 20% of the first \$500,000 of their program budget on lobbying. Another example can be found in Japan, where the Political Funds Regulations Law allows corporate contributions to political parties based on the size of organization (Hrebenar et al., 1998). Our concern is that, these limitations on lobbying activities are meant to reduce competitive waste in the first place, but *will they definitely improve interest groups' welfare in the product market?* The proba-bilistic model predicts that, if group i 's expenditure is bound by the limit, group i 's winning probability will be biased and hence its utility in the product market will actually decrease. Later in this paper, we will show that such a limitation can be welfare (the sum of all groups' utilities) improving for low enough initial prices.

Our model uses a two-stage framework to combine the monopolist and consumers' choices of interacting form and the actual interaction in the political market. The decisions are characterized for each possible economic status quo as well as the lobbying limits. In the first stage of the game, two groups choose whether to compete or to cooperate in lobbying. If the decision is to compete, then both groups choose their lobbying efforts independently and simultaneously (*the lobbying subgame*); if the decision is to cooperate, then both groups determine together the amount of effort to be put into the political market to achieve the greatest joint benefit (*the coalition subgame*). A subgame perfect equilibrium describes each group's *compete/cooperate* decision in the first stage, and the lobbying efforts and the regulatory prices in the associated subgame.

The major message of this paper is that initial prices in the product market do have significant impacts on each group's lobbying incentives, but neither initial prices nor lobbying limits can affect which of the equilibria obtains in the decisions of interacting form, and therefore might not have any impact on the regulatory policies! Stated in more details, our specific findings include the following. First, if the initial prices are low, in the lobbying subgame the post lobbying prices are higher than initial prices; and the result is reversed when initial prices are high enough. In other words, whatever the initial price is, the "efficiency" that is achieved by marginal pricing cannot be achieved in regulation with interest groups! In the coalition subgame, however, we show that the core is non-empty for all level of initial prices. This indicates that in the first stage, there exist two equilibria for the forms of interaction: both compete or both cooperate. Mutual cooperation is the weakly dominant, risk dominant and Pareto efficient equilibrium. Hence it is more likely to be the focal equilibrium. Since the core exists for all initial prices, the decision on the form of interaction will be independent of initial prices, and hence the final regulatory prices might not be affected by the initial prices.

Second, limitations on lobbying expenditures are welfare improving only for sufficiently low initial prices. The reason is intuitive. When the initial price is low, only the monopolist's lobbying effort is bound by the limit. Our analysis shows that the consumer group will react by increasing their effort. Together, the regulatory price will still increase but in a smaller extent. Since the sum of groups' utilities are decreasing with prices, this means that such a limitation is welfare improving.

Third, the pricing scheme under cooperation is one of two-part tariffs, where the variable fee is the regulatory price determined by joint lobbying effort, and the fixed fee is determined endogenously and implicitly in the coalition subgame. As an example of this tariff, imagine that the producer issues special vouchers or purchasing cards, with which the customers can purchase products at very low prices. Moreover, since cooperation is Pareto efficient, we have demonstrated that a two-part tariff is Pareto efficient even under the pressure of interest groups. Although two-part tariffs are commonly used in public utilities, such as water, gas, phone and electricity, most of the existing literature³ has concentrated on the discussion of “uniform pricing”. Our result thus provides an interest group interpretation for two-part tariffs.

The rest of this paper is organized as follows. Section 2 presents the structure of the game and the subgame when both interest groups compete in lobbying. We characterize the equilibria in cases without and with lobbying limits binding. Section 3 is the subgame when both groups agree upon cooperation. A coalition game is defined and we use “the core” as the solution for payoff distribution. Section 4 discusses the subgame perfect equilibria of the whole game, problem, followed by concluding remarks in the last section. All proofs are presented in the Appendix.

2. The model

In this section, we describe the two-stage game of endogenous interaction, in which interest groups can affect the determination of regulatory prices and the initial prices will in turn change each group’s political activities.

Consider a monopolistic public utility which is subjected to a price regulation and the regulatory price is determined by a regulatory authority that is open to lobbying by interest groups. The supporting evidence for this setting can be found in Prosser (1997), which studied the resetting of X in the PRI- X control in the UK and concluded that “no formula can be immune from public and political pressure.” Let P denote the regulatory price, whose explicit definition will be given shortly. There are only two interest groups under concern: the monopolist (M) and consumers’ (S) groups in the market.⁴ The market demand is characterized by a general, continuous and concave⁵ demand function of the regulatory price: $f(P)$, with an intercept α . The production cost⁶ is simply a constant marginal cost $c > 0$, where $\alpha > c$. Each group’s utility is defined in the conventional way; namely, group M receives a profit given by $u_M(P) := (P - c)f(P)$ and group S receives a consumer surplus given by $u_S(P) := \int_P^\alpha f(p)dp$. For further reference, denote p^m as the price to maximize $u_M(P)$.

The simple two stage game proceeds as follows. In the first stage, each group strategically chooses whether to compete or to cooperate in lobbying.⁷ If the simultaneously chosen form is to compete, then two groups lobbying efforts are determined independently and simultaneously in the *lobbying subgame*; If the decisions are to cooperate, then both groups determine together the joint effort to be put into the political market, to achieve the greatest joint benefit in the *coalition*

³ Kahana and Katz (1990) and Cheung and Wang (1996) analyzed the third-degree price discrimination.

⁴ We consider a partial equilibrium analysis, rather than a general equilibrium setting where producers or consumers from other market might participate in the political market.

⁵ The concavity of the demand function denotes the property of decrease in the increment of marginal utility of consumers (i.e., the third derivative of the utility function is negative).

⁶ A more general assumption will not change the structure of the analysis.

⁷ To focus on the competitive/cooperative decisions, the supply side and the free rider problems are not analyzed in this model. The issues of replication are also not included in the present paper, but are left for further research.

subgame. A subgame perfect equilibrium describes each group's *decisions on interacting form* in the first stage, and *the lobbying efforts and outputs* in each subgame. By backward induction, we firstly characterize the outcomes for each subgame, and leave the determination of interacting forms in the first stage till Section 4.

2.1. The lobbying subgame

This subsection considers the case where both interest groups have decided to compete in the political market. In association with the two questions raised in the Introduction, the following discussion explains (i) how the status quo of policies can affect each group's incentives in lobbying and accordingly, the outcomes in the product market; and (ii) how the expenditure limitations on lobbying affect the outcomes. We will define an influence function, describing how interest groups' lobbying efforts can influence the regulatory price. Then through maximization, we define each group's *lobbying incentive* to be the best replied lobbying effort. An equilibrium in the political market is a pair of lobbying efforts satisfying mutually best response.

Following Coggins et al. (1991), we describe the benefit and cost of lobbying by a pricing (influence) and a cost function, respectively. Denote $x_i \in R$, for $i=M, S$, to be group i 's lobbying effort. By putting in effort x_i , group i can bribe the committee members to change the price in group i 's favor. That is, given a pair of efforts (x_M, x_S) and a initial price p , the pricing function⁸ is defined by $P(x_M, \beta x_S, p)$, where $p \in [c, p^m]$. $P(x_M, \beta x_S, p)$ is strictly increasing (decreasing) in x_M (in x_S , respectively) and $P(0, 0, p) = p$. In particular, we consider the following explicit⁹ form: $P(x_M, \beta x_S, p) = p + x_M - \beta x_S$. Another example is given by Groseclose and Snyder (1996), where $P(x_M, \beta x_S, p)$ is a function of p and $\max\{x_M, -x_S\}$. Since the influence function is a black box and we are concerned mainly on the sign of x_i , the first linear setting can serve our purpose properly, and therefore will be assumed throughout the paper. The lobbying cost function of effort x_i is defined by $l(x_i)$, which has the usual properties of continuity, monotonicity, convexity and $l(0) = 0$.

Two points are worth noticing concerning the setting of $P(x_M, \beta x_S, p)$. First, the inclusion of the initial price is crucial for studying the effect of the status quo. The initial price¹⁰ is better interpreted as a price determined in the previous period, or a price determined by a benevolent government which ignores the power from interest groups. As noted by Young (2001) in a study on British regulations, "the original prices were set in secret, and their levels were dictated by political as much as economic considerations" (p. 40). Similar settings, which connect an endogenous variable with an initial state, can be also found in dynamic programming or dynamical system. Second, the consumer group often consists of a large number of consumers, and therefore may exhibit various organizing abilities across industries. For example, in a survey on public utilities in Britain, Young (2001) concluded that the influence of consumer committees varies across the gas, water, electricity and telecoms industries. To cope with this observation,

⁸ We assume that there is no difference to the lobbies between the legislatures and the staff. Moreover, to simplify, we assume there is only one consumer group, but use a parameter to denote its ability in mobilizing its members. (For example, Cheung and Wang (1996) and Fabella (1993) analyzed cases with many consumer groups.

⁹ The author is grateful for an anonymous referee for suggesting this point.

¹⁰ Each group's best reply should describe its best reply to the rival under every possible circumstance. But since the regulatory price above p^m is rarely observed in real life. The discussion presented focus on the case with $p \in [0, p^m]$. The part $p \in [0, c]$ refers to the cases where the market can be cross-subsidized. And the discussion for the case with $p \in [p^m, \alpha]$ is available upon request.

we adopt a parameter $\beta \in [0, 1]$ to measure how successfully group S could mobilize¹¹ its members (see also Cheung and Wang, 1996). A higher value of β indicates higher organizing ability, and this reflects the conclusions by Stigler (1971) and Becker (1983) that the more concentrated the benefit is to consumers, the stronger is the pressure coming from them.

Each interest group chooses its lobbying effort to maximize utility subject to the expenditure limits on efforts. That is, for a initial price p and a given pair of efforts (x_M, x_S) , the post-lobbying payoff for group i is $u_i(P(x_M, \beta x_S, p))$. Both groups now face simultaneously with the problems

$$\max_{x_i} u_i(P(x_M, \beta x_S, p)) - l(x_i) \quad (1)$$

$$\text{S.T. } x_i \leq L^i, \quad \text{for } i = M, S,$$

where L^i denotes group i 's upper limit on lobbying expenditure.

The first-order conditions of maximization determine each group's lobbying incentive implicitly, and the second-order conditions are satisfied with a sufficiently elastic demand function or a sufficiently convex cost function. In the following discussion, we will first characterize the equilibrium where the limits are not binding, and then the cases where the equilibrium efforts might exceed the limits.

2.1.1. When limits are not binding

Each group's *lobbying incentive* is defined to be the best replied lobbying effort. That is, denote $x_M(x_S, p)$ and $x_S(x_M, p)$ as group M and S's lobbying incentives. The first-order conditions of the maximization problems determine $x_M(x_S, p)$ and $x_S(x_M, p)$ implicitly:

$$\frac{\partial u_i(P(\cdot))}{\partial P} \frac{\partial P(x_M, \beta x_S, p)}{\partial x_i} = \frac{\partial l(x_i)}{\partial x_i}, \quad \text{for } i = M, S. \quad (2)$$

The second-order conditions are $\frac{\partial^2 u_i(P(\cdot))}{\partial^2 P} \left(\frac{\partial P(x_M, \beta x_S, p)}{\partial x_i} \right)^2 - \frac{\partial^2 l(x_i)}{\partial x_i^2} < 0$, for $i = M, S$, which are satisfied if either $f'(P)$ is sufficiently big or $l''(x_i)$ is sufficiently big. To proceed with the discussion on equilibrium, we assume that either one of these conditions will hold.

Next, examining the properties of *lobbying incentives* helps us understand how the status quo of policies can affect each group's incentives in lobbying and accordingly the equilibria in the political and product markets. First of all, the relation between lobbying incentives and initial prices can be easily checked from the first and second order conditions of maximization. That is, by assumption, the following conditions will hold: $\frac{\partial u_S(P(\cdot))}{\partial P} < 0$ and $\frac{\partial^2 u_S(P(\cdot))}{\partial^2 P} > 0$ for the consumers; and $\frac{\partial u_M(P(\cdot))}{\partial P} > 0$ and $\frac{\partial^2 u_M(P(\cdot))}{\partial^2 P} < 0$ for the producer. Then, by applying the implicit function theorem, one can show¹² that both $\frac{\partial x_S(x_M, p)}{\partial p} < 0$ and $\frac{\partial x_M(x_S, p)}{\partial p} < 0$.

¹¹ Alternatively, one can replace β by assuming different levels of $\frac{\partial P(\cdot)}{\partial x_S}$. However, the introduction of β helps simplify the analysis and avoids confusion with the effects from x_S or $\frac{\partial P(\cdot)}{\partial x_S}$.

¹² Define F as $F := \frac{\partial P}{\partial x_S} \frac{\partial P(x_M, \beta x_S, p)}{\partial x_S} - \frac{\partial l(x_S)}{\partial x_S}$. Since $\frac{\partial P(x_M, \beta x_S, p)}{\partial x_S} < 0$ together with the second-order condition, we can check that $\frac{\partial x_S}{\partial p} = \frac{\frac{\partial F}{\partial p}}{\frac{\partial F}{\partial x_S}} = -\frac{\frac{\partial P(x_M, \beta x_S, p)}{\partial x_S} \frac{\partial^2 u_S(P(\cdot))}{\partial^2 P} \frac{\partial P(x_M, \beta x_S, p)}{\partial p}}{\frac{\partial^2 u_S(P(\cdot))}{\partial^2 P} \left(\frac{\partial P(x_M, \beta x_S, p)}{\partial x_S} \right)^2 - \frac{\partial^2 l(x_S)}{\partial x_S^2}} = -\frac{(-\beta) \frac{\partial^2 u_S(P(\cdot))}{\partial^2 P} (1)}{\frac{\partial^2 u_S(P(\cdot))}{\partial^2 P} (-\beta)^2 - \frac{\partial^2 l(x_S)}{\partial x_S^2}} < 0$. Similarly, define H as $H := \frac{\partial P(x_M, \beta x_S, p)}{\partial P} \frac{\partial P(x_M, \beta x_S, p)}{\partial x_M} - \frac{\partial l(x_M)}{\partial x_M}$. Since $\frac{\partial P(x_M, \beta x_S, p)}{\partial x_M} > 0$, we can check that $\frac{\partial x_M}{\partial p} = \frac{\frac{\partial H}{\partial p}}{\frac{\partial H}{\partial x_M}} = -\frac{\frac{\partial P(x_M, \beta x_S, p)}{\partial x_M} \frac{\partial^2 u_M(P(\cdot))}{\partial^2 P} \frac{\partial P(x_M, \beta x_S, p)}{\partial p}}{\frac{\partial^2 u_M(P(\cdot))}{\partial^2 P} \left(\frac{\partial P(x_M, \beta x_S, p)}{\partial x_M} \right)^2 - \frac{\partial^2 l(x_M)}{\partial x_M^2}} = \frac{(1) \frac{\partial^2 u_M(P(\cdot))}{\partial^2 P} (1)}{\frac{\partial^2 u_M(P(\cdot))}{\partial^2 P} (1)^2 - \frac{\partial^2 l(x_M)}{\partial x_M^2}} < 0$.

Rather non-intuitively, both the consumer group's and the producer's lobbying incentives are decreasing (as illustrated in Fig. 1) with the initial price. It is usually believed that a higher current price would provoke more severe opposition from consumers, while the negative slope of $x_S(x_M, p)$ has demonstrated the opposite. An interpretation can be that, because the demand function is decreasing and concave in price, when the price is higher, the effectiveness of lobbying down the price becomes smaller, and thus decreases x_S .

Second, Fig. 1 depicts each group's best reply for an arbitrary pair of (\bar{x}_M, \bar{x}_S) .

Lemma 1 summarizes and proves that two groups' best replies will intersect at a price smaller than p^m , and that even at their favorite regulatory prices each group still has positive incentives to lobby against the other.

Lemma 1. For an arbitrary pair of \bar{x}_M, \bar{x}_S , if $\frac{\partial P(\cdot)}{\partial x_S} = -\beta \frac{\partial P(\cdot)}{\partial x_M}$ and $0 < \beta < 1$, then (1) $x_S(\bar{x}_M, c) > 0$ and $x_M(\bar{x}_S, p^m) > 0$; (2) there exists a unique initial price $p^\#(\bar{x}_M, \bar{x}_S) < p^m$ such that $x_S(\bar{x}_M, p^\#) = x_M(\bar{x}_S, p^\#)$.

Part (1) of this lemma explains an intuitive result that, if the initial price is at the consumer group's favorite price c , group M has the incentive to pull up the price. To counteract such an effect, the consumer group has to spend resources to prevent the price to be pulled up too high, and hence $x_S(\bar{x}_M, c) > 0$. The case for $x_M(\bar{x}_S, p^m) > 0$ can be interpreted similarly. This result helps to illustrate the *wasteful expenditure* in lobbying activities; that is, even in extreme cases like $p=c$ or p^m , the most-favored group (i.e., group M when $p=p^m$; group S when $p=c$) will still put in lobbying effort. According to Tullock (1967), this amount of expenditures are used up in an attempt to resist the transfer of wealth (p. 228), and regulation on lobbying activities is expected to help decrease the waste by imposing rules on lobbying objectives, the number of lobbyists and in particular the amount of lobbying expenditures. The effects of such restraints will be discussed in details shortly.

Since both $x_S(x_M, p)$ and $x_M(x_S, p)$ are negatively sloped and together with the fact that $x_S(\bar{x}_M, c) < x_M(\bar{x}_S, c)$ and $x_S(\bar{x}_M, p^m) > x_M(\bar{x}_S, p^m)$, part (2) of Lemma 1 explains that the two incentive functions will intersect at a unique price $p^\# < p^m$. The existence and uniqueness of $p^\#$ follow from the continuity of lobbying incentive functions and that $x_M(x_S, p)$ is steeper than $x_S(x_M, p)$ in Fig. 1. The necessary condition for the latter is that $|\frac{\partial^2 u_S(P(\cdot))}{\partial^2 p} \frac{\partial P(x_M, \beta x_S, p)}{\partial x_S}| < |\frac{\partial^2 u_M(P(\cdot))}{\partial^2 p} \frac{\partial P(x_M, \beta x_S, p)}{\partial x_M}|$, which is true with our assumptions. This condition requires both the lobbying ability and lobbying effectiveness of the producer to be better than those of the consumer group. Furthermore, Fig. 1 shows that there could be cases where the post regulatory prices are identical for different initial prices. That is, consider $p^1 < p^\# < p^2$, and denote the associated lobbying

lobbying incentives

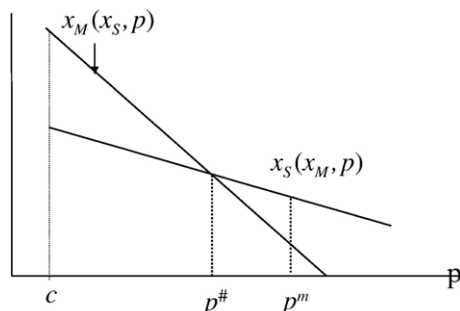


Fig. 1. Lobbying incentives in the effort–initial price diagram.

incentives as x_S^i, x_M^i , for $i=1, 2$. The necessary conditions for $P(x_M^1, \beta x_S^1, p^1) = P(x_M^2, \beta x_S^2, p^2)$ are $x_M^1 > x_M^2$ and $x_S^1 < x_S^2$, both of which are possible as depicted in Fig. 1.

Third, the monopolist and consumer groups have conflicting interests for $p \in [c, p^m]$; i.e., the producer prefers higher prices while consumers like lower prices. Nevertheless, Lemma 2 shows that they are not substitutes from the strategic point of view. Fig. 2 describes both groups' lobbying incentives in the x_M – x_S diagram.

Lemma 2. *Although the two interest groups have conflicting interests, the producer will increase its lobbying efforts when the consumers increase efforts, but the consumers will reduce their efforts when the producer increases efforts.*

Intuitively, since two interest groups have conflicting interests, one would expect them to be strategic complements. Lemma 2, however, shows that they are *neither complements nor substitutes* from the strategic point of view; the two reaction functions actually have reverse slopes (see for example, Dixit, 1987). In the proof, it is demonstrated that this is simply due to the concavity of the profit function and the convexity of consumer surplus, i.e., $\frac{\partial^2 u_M(P(\cdot))}{\partial^2 p} < 0$ and $\frac{\partial^2 u_S(P(\cdot))}{\partial^2 p} > 0$. An interpretation is provided here: for the consumer group, when the monopolist partially increases its lobbying effort, the regulatory price is supposed to be pulled up ($\frac{\partial P(x_M, \beta x_S, p)}{\partial x_M} > 0$). Since a higher price can increase its lobbying effectiveness, measured by $\frac{\partial^2 u_S(P(\cdot))}{\partial p^2} > 0$, the consumer group needs to put in a smaller effort to counteract. On the other hand, for the producer group, when consumers partially increase their lobbying effort, the regulatory price is supposed to be driven down. Since a smaller price will increase its lobbying effectiveness, measured by $\frac{\partial^2 u_M(P(\cdot))}{\partial p^2} < 0$, the producer needs to put in more effort to counteract.

In the lobbying subgame, the equilibrium of the political market consists of a pair of lobbying efforts that induce no unilateral deviation.

Definition 3. In the lobbying subgame, a pair $(x_M^*(p), x_S^*(p))$ is the equilibrium of the political market for a initial price $p \in (c, p^m)$ iff $x_M^*(p) = x_M(x_S^*(p), p)$ and $x_S^*(p) = x_S(x_M^*(p), p)$.

Fig. 2 depicts the equilibrium (point E) for an initial price p . The existence of equilibrium is ensured by the results that $\frac{\partial x_S(x_M, p)}{\partial x_M} < 0$ and $\frac{\partial x_M(x_S, p)}{\partial x_S} > 0$ from the Proof of Lemma 1, and by the observation that $x_S(\bar{x}_M, c) > 0$ and $x_M(\bar{x}_S, p^m) > 0$. A change in the status quo of price will move the equilibrium; for example a higher price, say $p' > p$ will shift both $x_S(x_M, p)$ and $x_M(x_S, p)$ downward and hence move the equilibrium to point E' , associating with a smaller level of x_M but a greater x_S . Lemma 4 generalizes the comparative statics of the equilibrium for different initial prices.

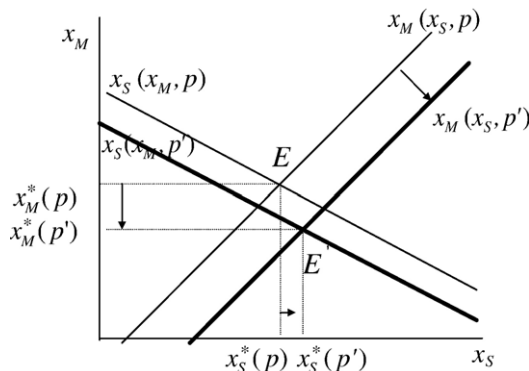


Fig. 2. Lobbying incentives in the x_M – x_S diagram.

Lemma 4. (1) When $p = p^\#(x_M^*, x_S^*)$, $x_M^*(p) = x_S^*(p)$. (2) If then $x_S^*(p)$ increases with p but $x_M^*(p)$ decreases with p .

In the proof, we demonstrate that $x_S(x_M, p)$ is flatter than $x_M(x_S, p)$ in the $x_M - x_S$ diagram, and the same conditions ensure that $x_S(x_M, p)$ is flatter than $x_M(x_S, p)$ in the effort–price diagram. The main message of this lemma is that, the equilibrium effort $x_M^*(p)$ will decrease with p but $x_S^*(p)$ will increase with p . Although in Fig. 1, we have presented that both $x_S(x_M, p)$ and $x_M(x_S, p)$ will be decreasing in p , here we see that the consumers’ best reply $x_S(x_M, p)$ and equilibrium effort $x_S^*(p)$ move in an opposite direction with the initial price!

This controversy can be explained intuitively as follows. Notice that each group’s best reply in Fig. 1 is depicted for an arbitrary pair (\bar{x}_M, \bar{x}_S) , which indicates that only a partial effect of initial price is presented in Fig. 1. Hence, when the initial price is higher, Fig. 1 shows that $x_S(\bar{x}_M, p)$ is smaller. But further as x_S decreases, x_M will decrease because $\frac{\partial x_M(x_S, p)}{\partial x_S} > 0$. So $x_M^*(p)$ will decrease with p . Similarly, when the initial price is higher, $x_M(\bar{x}_S, p)$ is smaller. But further as x_M decreases, x_S will increase because $\frac{\partial x_S(x_M, p)}{\partial x_M} < 0$. So the equilibrium effort $x_S^*(p)$ will increase with p .

Finally, Proposition 5 describes how the post-lobbying regulatory prices will be different from the initial prices, and Fig. 3 can help understand the equilibrium lobbying efforts in the effort–initial price diagram. Recall that $p^\#$ is the initial price where $x_M^*(p^\#) = x_S^*(p^\#)$. Here another critical value \hat{p} for $\hat{p} > p^\#$ is defined by $x_M^*(\hat{p}) = \beta x_S^*(\hat{p})$, and the existence of \hat{p} is ensured by the fact that $(x_M^* - \beta x_S^*)$ is decreasing in p .

Proposition 5. Given $\hat{p} \in (c, p^m)$ and $0 < \beta < 1$, (1) the post lobbying price is above the initial price and the difference will be decreasing in p and β for $p < \hat{p}$; however, the post lobbying price is below the initial price, and the difference will be increasing in p and β for $p > \hat{p}$.

Fig. 2 has presented an example where $x_S^*(p)$ will increase with p and $x_M^*(p)$ decreases with p , and Fig. 3 generalizes the impacts on the regulatory price for all initial prices. The main message is that, if the current price is sufficiently low, the regulatory price will increase but the extent of this increase becomes smaller as p approaches \hat{p} ; On the other hand, if the current price is sufficiently high, the regulatory price will decrease but the extent of this decrease becomes smaller as p approaches \hat{p} .

An implication from Proposition 5 is that, whatever the initial price is, the regulatory price with lobbying activities will never reach p^m or c . It is well known that marginal pricing ensures efficiency, and Proposition 5 indicates that regulation with lobbying activities always bring inefficiency in the regulated market! However, Proposition 5 also implies that the *inefficiency* in

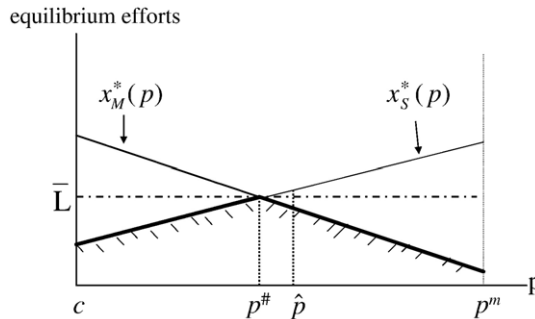


Fig. 3. Equilibrium efforts in the effort–initial price diagram.

product market can be possibly improved by lobbying activities, but only for initial prices that are sufficiently high (i.e., $p > \hat{p}$).

In addition, there are two kinds of “waste” in lobbying activities. One is the purely *wasteful expenditures*, used up in an attempt to *resist* the transfer of wealth (Tullock, 1967, p228); the other is the waste of expenditure due to the bad organizing of consumers. The latter is obvious in Fig. 3, since $\hat{p} > p^\#$ and there is $(1 - \beta)x_S^*(p)$ wasted for every p . The former is indicated by the area under the bolded line in Fig. 3. The maximal level of waste occurs at the price $p^\#$, where one group’s lobbying effort exactly counteracts the effort of the other. It is believed that regulation on lobbying activities such as the number of lobbyists and lobbying expenditures can reduce the sort of waste in the political market.

The restrictions on lobbying activities can prevent or reduce duplication of expenditure, but they also affect the equilibrium prices in the regulated market. To see the overall effect of such restrictions, we need to check the sum of every group’s net utility, that is, $\sum_{i=M,S} \{u_i(P(x_M^*, \beta x_S^*, p)) - l(x_i^*)\}$. This term is complicated because the lobbying efforts x_i^* will be endogenously determined in the equilibrium. The envelope theorem helps us see how the initial price affects this term. That is, the partial differentiation of the term $\sum_{i=M,S} \{u_i(P(x_M^*, \beta x_S^*, p)) - l(x_i^*)\}$ with respect to p is $\frac{\partial u_M(P(x_M^*, \beta x_S^*, p))}{\partial p} + \frac{\partial u_S(P(x_M^*, \beta x_S^*, p))}{\partial p}$, which is $(P(x_M^*, \beta x_S^*, p) - c)f'(P(x_M^*, \beta x_S^*, p))$ and is negative. The next section investigates how a limitation in lobbying expenditure can change this sum.

2.1.2. When limits are binding

Many regulatory laws impose various limitations on interest groups’ lobbying activities. Troyer and Varley (2003) stated that for organizations with larger budgets, the permitted lobbying percentage decreases as the size of the budget increases, reaching a maximum lobbying expenditure limit of \$1 million for organizations with charitable budgets of \$17 million or more. Another example of such a limitation is the campaign finance regulation on the extent of contributions during legislative sessions (Thomas, 1998). To simplify the analysis, it is assumed that the limitation takes the form of a restraint on the lobbying expenditure. That is, in Eq. (1), assume $L_i = \bar{L}$ for $i = M, S$, to be the restraint on lobbying expenditure imposed by the regulatory law (on lobbying), and without loss of generality, we consider the simplest case: $\bar{L} = x_i^*(p^\#)$, $i = M, S$, as illustrated in Fig. 3.

According to the existing probabilistic model, if group i ’s expenditure is bound by the lobbying limit, group i ’s winning probability will be biased and hence its utility in the product market will decrease. Here, Proposition 6 summarizes the overall effect of imposing such a limitation. The term “welfare” in the proposition refers to the sum of each group’s net utility in the market, i.e. $\sum_{i=M,S} \{u_i(P(x_M^*, \beta x_S^*, p)) - l(x_i^*)\}$. Notice that the income of the authority is not included in calculation.

Proposition 6. *Limitation on lobbying activities can improve welfare if the initial price is sufficiently low (i.e., $p < p^\#$).*

We need to compare the welfare for before and after imposing such a limit. Firstly in Fig. 3, if the lobbying expenditure is bound by \bar{L} , then only $x_M^*(p)$ for $p < p^\#$ and $x_S^*(p)$ for $p > p^\#$ will be affected. The affected group’s lobbying effort will be reduced, and the unaffected group’s lobbying effort will also change through its reaction functions. The overall impacts on welfare will vary with the level of initial prices.

For $p < p^\#$, the producer’s lobbying effort is cut down due to this restraint, but x_S will increase as $\frac{\partial x_S(x_M, p)}{\partial x_M} < 0$. But since $|\frac{\partial x_S(x_M, p)}{\partial x_M}| > |\frac{\partial x_M(x_S, p)}{\partial x_S}|$, the increase in x_S is greater than the decrease in x_M . In Fig. 4, the equilibrium efforts (without limitations) for an initial price $p^1 < p^\#$ are denoted by

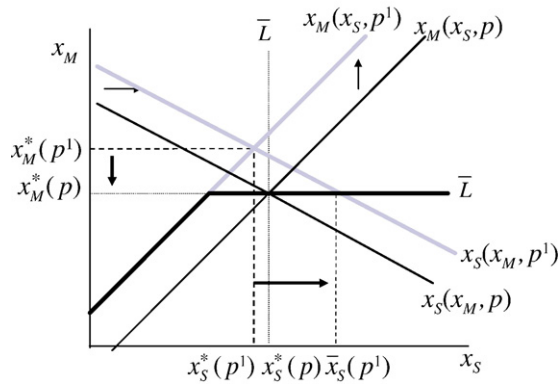


Fig. 4. Effects of lobbying limits for $p < p^\#$.

$x_M^*(p^1)$ and $x_S^*(p^1)$. Due to the lobbying limit, group M 's reaction function becomes the kinked and bolded line and group S 's best reply to group M 's lobbying limit \bar{L} is denoted by $\bar{x}_S(p^1)$. The decrease of group M 's effort decrease due to the lobbying limit is denoted by $|x_M^*(p^1) - x_M^*(p)|$ and the increase of group S 's best replied effort due to the lobbying limit is denoted by $|x_S^*(p^1) - \bar{x}_S(p^1)|$. Fig. 4 shows that $|x_M^*(p^1) - x_M^*(p)|$ explaining that “the extent of the increase in x_S through best response function is greater.” However, as depicted in Fig. 4, the increased effort level for group S will be higher than \bar{L} , meaning that x_S will also be bound by this limit. Since $0 < \beta < 1$, this indicates that the post lobbying price will go up but in a smaller extent than without limitations. Because $\sum_{i=M,S} u_i(P(x_M^*, \beta x_S^*, p))$ decreases with $P(x_M^*, \beta x_S^*, p)$ and the increase on $x_S^*(p)$ is smaller the decrease on $x_M^*(p)$, it can be concluded that the imposing of \bar{L} can improve the welfare.

However, the result for $p > p^\#$ is ambiguous. The consumers lobbying effort is cut down due to this restraint. Since $\frac{\partial x_M(x_S, p)}{\partial x_S} > 0$ and $|\frac{\partial x_S(x_M, p)}{\partial x_M}| > |\frac{\partial x_M(x_S, p)}{\partial x_S}|$, the extent of the decrease in x_M through best response function is smaller, which indicates that $\sum_{i=M,S} u_i(P(x_M^*, \beta x_S^*, p))$ does not increase as much as described by Proposition 5. It is hence ambiguous to tell which effect (utility or expenditure) will dominate. In Fig. 5, the equilibrium efforts (without limitations) for an initial price $p^2 > p^\#$ are denoted by $x_M^*(p^2)$ and $x_S^*(p^2)$. Due to the lobbying limit, group S 's reaction

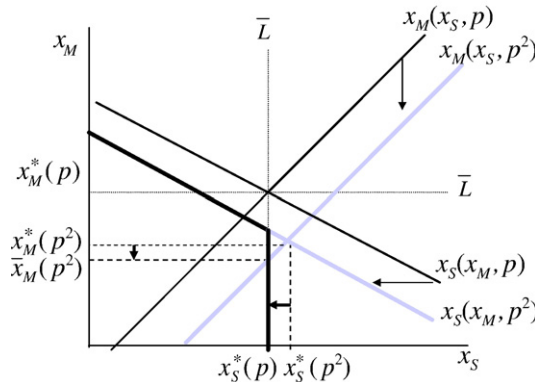


Fig. 5. Effects of lobbying limits for $p < p^\#$.

function is the kinked and bolded line and group M's best reply to group S's lobbying limit \bar{L} is denoted by $\bar{x}_M(p^2)$. The extent of group S's effort decrease due to the lobbying limit is denoted by $|x_S^*(p^2) - x_S^*(p)|$, and the decrease of group M's best replied effort due to the lobbying limit is denoted by $|x_M^*(p^2) - \bar{x}_M(p^2)|$. Fig. 5 shows that $|x_M^*(p^2) - \bar{x}_M(p^2)| < |x_S^*(p^2) - x_S^*(p)|$, explaining that “the extent of the decrease in x_M through best response function is smaller.” In Fig. 6, the bolded line summarises the changes in the “unaffected” group's efforts due to the binding lobbying limits. $\bar{x}_S(p)$ denotes group S's best response to the binding lobby limits on x_M for $p < p^\#$, and $\bar{x}_M(p)$ denotes group M's best response to the binding lobby limits on x_S for $p > p^\#$.

In the next section, we turn to the alternative form of interaction—cooperation. This *corporatist* style relationship prevails in Germany, the Scandinavian countries, and Japan. Intuitively, cooperation between interest groups will reduce duplicated waste from competitive lobbying, and hence ought to be preferred by all interest groups. In the next section, however, we demonstrate that this result is not conclusive, as there can be two subgame perfect equilibria in this regulation game.

3. The coalition subgame

When two groups decide to cooperate, they work together to achieve the maximum of the joint profit. The key concern is to see if there is a way to distribute the maximal profit so that each group will not deviate from this cooperative relationship. In the terms of the cooperative game theory, we will define a coalition game (von Neumann and Morgenstern, 1944; Shapley and Shubik, 1953; Aumann and Peleg, 1960) for this situation and check for the existence of “the core” (Gillies, 1959; Shapley and Shubik, 1953), which contains distributions on the maximal profit that can ensure individual and group rationality.

We firstly describe the joint profit of two groups, and then define the coalition game and check for the conditions of the core. The joint profit of the two groups is defined as the sum of consumer surplus and producer profit minus the cost of joint lobbying. In order to incorporate this cooperative effort and make it comparable with the previous section, we rewrite the post-lobbying price as $P(x_M, \beta x_S, x_C, p)$, where x_C is the coalition's lobbying effort and $P(x_M, \beta x_S, x_C, p)$ is decreasing in x_C . Without loss of generality, one can consider the explicit form: $P(x_M, \beta x_S, x_C, p) = p + x_M - \beta x_S - x_C$. On the other hand, it is reasonable to expect that cooperation between the two interest groups will incur coordination costs like the bills for communicating via faxes and phones or meals in meetings, but at the same time it can reduce lobbying costs as better connection brings in a more efficient approach of lobbying. Therefore, to summarize these two effects, the joint

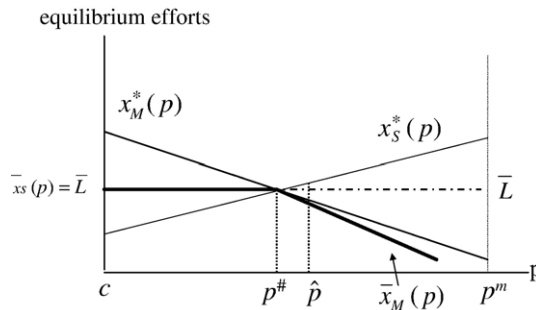


Fig. 6. Changes in the unaffected group's efforts due to the binding lobbying limits.

lobbying cost function is assumed to remain $l(\cdot)$, the properties of which are the same as in Section 2. The joint payoff is hence defined by

$$\int_{P(0,0,x_C,p)}^{\alpha} f(p)dp + (P(0,0,x_C,p) - c)f(P(0,0,x_C,p)) - l(x_C). \quad (3)$$

The joint group seeks for an optimal value of x_C to achieve the maximal value of Eq. (3). This process is standard and we denote the optimal value by x_C^* . $P(0,0,x_C^*,p)$ is smaller than the initial price since the deadweight loss is reduced and the joint profit will be increased. It is worth noticing that, although the nominal post-lobbying price is $P(0,0,x_C^*,p)$, the actual price takes the form of a two-part tariff, where the fixed fee is determined endogenously by each group's relative bargaining power over the joint payoff. That is, the share of the joint payoff, denoted by $\phi_i(\beta, p)$ and to be determined below, contains each group's share on lobbying cost and their utilities. When the difference between $\phi_i(\beta, p)$ and $u_i(P(0,0,x_C^*,p))$ is larger, group i shares a smaller proportion of the joint cost. Thus in the two-part tariff, the fixed fee is negatively related to this difference, and the variable fee is $P(0,0,x_C^*,p)$. For a picture of the two-part tariff in real life, imagine that the producer issues a special voucher or purchasing card, with which customers can purchase products at a very low price. For example, some water companies help the poor by issuing water vouchers (The Economist, 2003). With these vouchers, which are a product of coordination among interest groups, the poor will be charged with large discounts.

Next, the sustainability of this cooperative relationship depends on whether the joint profit can be distributed properly to avoid deviation. To search for qualified ways of distributing the profit, we adopt the solution concept of *the core* (Gillies, 1959; Shapley and Shubik, 1953) from the cooperative game theory. The core, when compared to another generally adopted Nash bargaining solution (see for example Aidt, 1997), can be more easily applied to multilateral cooperation. The first step in finding the solution is to formulate a coalition game, which includes a set of coalitions and the characteristic function (see e.g., Friedman, 1991). A coalition is a subset of the player set, and the characteristic function defines a value that members of the coalition can earn without any help from the players outside of the coalition. In our framework with only two groups, each group's value when acting alone is exactly the utility obtained in the lobbying subgame. That is, let $P(x_M^*, \beta, x_S^*, 0, p)$ be the post-lobbying price settled in the lobbying subgame. Group M's value is defined by $v(\{M\}, \beta, p) := u_M(P(\cdot)) - l(x_M^*)$, and group S's value is defined by $v(\{S\}, \beta, p) := u_S(P(\cdot)) - l(x_S^*)$. The value of the coalition $\{M, S\}$ is the maximal joint payoff at price $P(0,0,x_C^*,p)$ and hence $v(\{M, S\}, p) := \int_{P(\cdot)}^{\alpha} f(p)dp + (P(\cdot) - c)f(P(\cdot)) - l(x_C^*)$. The coalition form of the cooperative game is thus denoted as $\Gamma^c := (\{M, S\}, v)$.

Denote by $\phi_i(\beta, p)$, $i = M, S$ group i 's payoff (share of the joint profit) determined in Γ^c . The conditions for a non-empty core are hence

$$\begin{aligned} \phi_M(\beta, p) &\geq v(\{M\}, \beta, p), \\ \phi_S(\beta, p) &\geq v(\{S\}, \beta, p), \\ \phi_M(\beta, p) + \phi_S(\beta, p) &= v(\{M, S\}, p). \end{aligned} \quad (4)$$

The non-emptiness of the core means that there are efficient ways to distribute the joint payoff that can avoid unilateral deviation. Indeed, the first two lines of Eq. (4) are the individual rationality conditions, requiring each group's "net" payoff determined in Γ^c to be at least its characteristic value. These conditions will exclude each group's incentives to deviate. The last line then denotes the condition for distribution, efficiency. All these conditions can be

summarized as: $v(\{M, S\}, p) \geq v(\{M\}, \beta, p) + v(\{S\}, \beta, p)$, indicating that the superadditivity of the value function will guarantee the existence of the core.

By applying the envelope theorem, we have the following comparative results regarding to the core in Proposition 7:

Proposition 7. (1) *The core exists for all initial prices.* (2) *The size of the core increases with the initial price, and the extent of the increase will be lower if the limitation is imposed.* (3) *The size of the core increases with consumers' organizing ability.*

Part (1) of the proposition is obvious from the fact that cooperation can reduce excess rent-seeking expenditures, a similar argument also found in Aidt (1997). The size of the core is measured by the extent that $v(\{M, S\}, p)$ is greater than $(\{M\}, \beta, p) + v(\{S\}, \beta, p)$, and the marginal effect of prices on the size of the core is hence obtained by checking the relative sizes of partial differentiation on these two terms with respect to p . Part (2) of the proposition says that, although the initial price has the same marginal effect on both terms, since this marginal effect will decrease with p and $P(0, 0, x_C^*, p) < P(x_M^*, x_S^*, p)$ for all p , the size of the core will increase with the initial price. Finally, consumers' organizing ability will reinforce the competition in the lobbying subgame, and hence increase the extent that cooperation can improve on the welfare of the coalition.

4. To cooperate or to compete?

So far, we have solved by backward induction about how, given a form of interaction, each group will act in the political market, and what further outcomes will appear in the regulatory prices. Next, we will solve the first-stage choices on the forms of interaction, which are summarized in the following simple bi-matrix.

		S	
		cooperate	compete
M	cooperate	(ϕ_M, ϕ_S)	(v_M, v_S)
	compete	(v_M, v_S)	(v_M, v_S)

The terms v_M and v_S are abbreviations for $v(\{M\}, \beta, p)$ and $v(\{S\}, \beta, p)$, respectively. Note from the previous section that ϕ_i , $i=M, S$ denotes group i 's share of the joint payoff, and v_i , $i=M, S$ denotes the payoff from competitive lobbying. Also recall the assumption that any unilateral deviation from cooperation will cause a breakdown in this relationship, which implies that asymmetric profiles such as <cooperate, compete> will bring exactly the same payoffs as they would when both groups compete.

Given the result in Proposition 7 that the core exists for any initial price, there exist two equilibria for this simple game: to cooperate or to compete together. The equilibrium of cooperation is both Pareto efficient, weakly dominant and risk dominant. Hence, the focal-point effect (by Schelling, 1960) predicts that cooperation (or competition) may become a focal equilibrium if it is perceived to be the status quo. In our model, the long prevailing *corporatist* style interest relations in Germany and the Scandinavian countries may have originated for historical reasons in the first place, but the no-deviating property of equilibrium has helped it prevail. The interacting form, however, can change with other external factors. Rechtman et al. (1998) describe that “lately, the external environment has changed. More and more groups want influence in the political making process, ... so what we are seeing is the adaptation of the political

system to the changing structures and a new political reality.” Put in our model, when the number of groups increase, the coordinating costs may increase to such an extent that $l(\cdot)$ will no longer represent the cost of cooperative lobbying. The core may not exist for all initial prices, and hence the problem of multiple equilibrium would disappear, which then imply that both initial prices and lobbying limitations would have impacts on the final regulatory prices.

5. Concluding remarks

This paper examines how current policies in the product market can affect interest groups’ lobbying incentives and cause further adjustments in the regulatory policies. Two structural modifications distinguish the present paper from existing studies. First, rather than exogenously assuming a competitive or cooperative form, it is assumed that interest groups can strategically choose to compete or cooperate. Second, both the initial prices and the lobbying limits are taken into account in the lobbying influence function. These modifications enable us to investigate the effects of the status quo in the product market and the lobbying limitations. Most importantly, we can explain the coexistence of both forms of interaction in reality.

In a similar flavour but different approach to Besley and Coate (2003), our findings show that, in the lobbying subgame, initial prices do have significant impacts on the pressure groups’ lobbying incentives and the post-lobbying regulatory prices. However, if the decisions regarding the form of interaction are considered, then it is not always true that the initial prices will affect the final regulatory prices. Rather, through the selection of an equilibrium, final regulatory prices will mostly be affected by exogenous factors like the focal point effects or the coalition’s lobbying cost.

Finally, the introduction of lobbying limits resembles the resource endowments in Coggins et al. (1991) in a trading economy, where each agent’s bribe to a government is bound by its endowment. An alternative approach is to consider a subjective lobbying limit. For example, the consumers’ greatest willingness to pay for lobbying is the extra payoff from the initial price to the marginal cost, or in our notation, $\int_c^p f(p)dp$. This specific form will help judge the binding area. Other possible and interesting extensions of our model include: (1) taking into consideration a decreasing average production cost for the monopolist in order to more fully reflect the property of a utility; (2) taking into consideration more than one interest group on either side.

Appendix A

Proof of Lemma 1. (1) Since $\frac{\partial P(x_M, \beta x_S, p)}{\partial x_S} < 0$ and $\frac{\partial P(x_M, \beta x_S, p)}{\partial x_M} > 0$, the post-lobbying price will be $P(0, \beta x_S, p^M) < p^M$ and $P(x_M, \beta 0, 0) > 0$, given $0 < \beta < 1$. Because $\frac{\partial u_M(P(\cdot))}{\partial P} > 0$ and $\frac{\partial u_S(P(\cdot))}{\partial P} < 0$, we have $x_M(x_S, p^M) > 0$ and $x_S(x_M, 0) > 0$. (2) The existence of p is guaranteed by the fact that both of them are monotonic in initial prices. Our main concern, however, is to show that $p^\# < p^m$. First note that given the supposition that $\frac{\partial P(\cdot)}{\partial x_S} = -\beta \frac{\partial P(\cdot)}{\partial x_M}$, the condition for $x_S(x_M, p) = x_M(x_S, p)$ becomes $-\beta \frac{\partial u_S(P(\cdot))}{\partial P} = \frac{\partial u_M(P(\cdot))}{\partial P}$, which can be further derived as: $\beta f(p) = [pf'(p) + f(p)]$, or in another form $\frac{pf'(p)}{f(p)} = \beta - 1$. There are three possibilities: (a) If $p^\# = p^m$, then by definition of p^m , we have $p^m f'(p^m) + f(p^m) = 0$. The condition for $x_S(x_M, p) = x_M(x_S, p)$ thus becomes $-1 = \beta - 1$, which is unlikely to happen for $0 < \beta < 1$; (b) The case of $p^\# > p^m$ is excluded, since $pf'(p) + f(p) < 0$; (c) If $p^\# < p^m$, then because both $f(p)$ and $[pf'(p) + f(p)]$ are increasing in p , there will be a $p^\#$ such that $x_S(x_M, p^\#) = x_M(x_S, p^\#)$. Since $x_M(x_S, p)$ and $x_S(x_M, p)$ are monotonic in p , this initial price $p^\#$ is unique, and $p^\# < p^m$. \square

Proof of Lemma 2. (1) Recall the definitions of F and H from Footnote 12. The second order condition of the utility maximization implies that $\frac{\partial^2 u_i(P(\cdot))}{\partial^2 P} \left(\frac{\partial P(x_M, \beta x_S, p)}{\partial x_S} \right)^2 - l'' < 0$, for $i = M, S$. Recall the assumption that $\frac{\partial P(x_M, \beta x_S, p)}{\partial x_S} = -\beta < 0$, $\frac{\partial P(x_M, \beta x_S, p)}{\partial x_M} = 1 > 0$ and $\frac{\partial^2 u_i(P(\cdot))}{\partial^2 P}$ for $i = M, S$. For any initial p by applying the implicit function theorem we have: $\frac{\partial x_S(x_M, p)}{\partial x_M} = -\frac{\frac{\partial P(x_M, \beta x_S, p)}{\partial x_S} \frac{\partial^2 u_S(P(\cdot))}{\partial^2 P} \frac{\partial P(x_M, \beta x_S, p)}{\partial x_M}}{\frac{\partial^2 u_S(P(\cdot))}{\partial^2 P} \left(\frac{\partial P(x_M, \beta x_S, p)}{\partial x_S} \right)^2 - l''} = -\frac{(-\beta)(1) \frac{\partial^2 u_S(P(\cdot))}{\partial^2 P}}{\frac{\partial^2 u_S(P(\cdot))}{\partial^2 P} (-\beta)^2 - l''} < 0$ and $\frac{\partial x_M(x_S, p)}{\partial x_S} = -\frac{\frac{\partial P(x_M, \beta x_S, p)}{\partial x_M} \frac{\partial^2 u_M(P(\cdot))}{\partial^2 P} \frac{\partial P(x_M, \beta x_S, p)}{\partial x_S}}{\frac{\partial^2 u_M(P(\cdot))}{\partial^2 P} \left(\frac{\partial P(x_M, \beta x_S, p)}{\partial x_M} \right)^2 - l''} = -\frac{(1)(-\beta) \frac{\partial^2 u_M(P(\cdot))}{\partial^2 P}}{\frac{\partial^2 u_M(P(\cdot))}{\partial^2 P} (1)^2 - l''} > 0$. That is, both $x_S(x_M, p)$ and $x_M(x_S, p)$ are increasing in the $x_M - x_S$ diagram. \square

Proof of Lemma 3. (1) It is obvious from the definition of $p^\#$. (2) In Fig. 2, a higher $p' > p$ will move both $x_M(x_S, p)$ and $x_S(x_M, p)$ downwards. We first show that $x_S(x_M, p)$ is flatter than $x_M(x_S, p)$ in the $x_M - x_S$ diagram. From the Proof of Lemma 2, the condition for $\left| \frac{\partial x_S(x_M, p)}{\partial x_M} \right| > \left| \frac{\partial x_M(x_S, p)}{\partial x_S} \right|$ is that $\left| \left(\frac{\partial P(x_M, \beta x_S, p)}{\partial x_S} \right)^2 - \frac{l''}{\frac{\partial^2 u_S(P(\cdot))}{\partial^2 P}} \right| > \left| \left(\frac{\partial P(x_M, \beta x_S, p)}{\partial x_M} \right)^2 - \frac{l''}{\frac{\partial^2 u_M(P(\cdot))}{\partial^2 P}} \right|$, which is true under the assumption that $\left| \frac{\partial^2 u_S(P(\cdot))}{\partial^2 P} \frac{\partial P(x_M, \beta x_S, p)}{\partial x_S} \right| < \left| \frac{\partial^2 u_M(P(\cdot))}{\partial^2 P} \frac{\partial P(x_M, \beta x_S, p)}{\partial x_M} \right|$ i.e., $\left| \frac{\partial^2 u_S(P(\cdot))}{\partial^2 P} (-\beta) \right| < \left| \frac{\partial^2 u_M(P(\cdot))}{\partial^2 P} (1) \right|$. (1) Finally, the decrease in $x_M(x_S, p)$ is more than that in $x_S(x_M, p)$, since the same condition ensures that $x_S(x_M, p)$ is flatter in the effort-price space. \square

Proof of Proposition 5. It can be checked that $(x_M^* - \beta x_S^*)$ is decreasing in p . In the case where $p < \hat{p}$ the net effect on $P(x_M, \beta x_S, p)$ is positive, but this effect is decreasing in p and decreases to 0 at $p = \hat{p}$. So $P(x_M^*, \beta x_S^*, p) > p$ and $|P(x_M^*, \beta x_S^*, p) - p|$ is decreasing in p . On the contrary, for $p > \hat{p}$ the net effect on $P(x_M, \beta x_S, p)$ is negative, so $P(x_M^*, \beta x_S^*, p) < p$ and $|P(x_M^*, \beta x_S^*, p) - p|$ is increasing in p . Next, since the net effort term $(x_M^* - \beta x_S^*)$ is decreasing with β , $|P(x_M^*, \beta x_S^*, p) - p|$ decreases with β for $p < \hat{p}$ and increases with β for $p > \hat{p}$. \square

Proof of Proposition 7. (1) For $p > p^\#$, even with the same (as in the case of the competitive lobbying) level of effective lobbying $(\beta x_S^* - x_M^*)$, the cost with cooperative lobbying is smaller, i.e. $l(\beta x_S^* - x_M^*) < l(x_S^*) + l(x_M^*)$. Similarly, for $p < p^\#$, the same amount (as the competitive lobbying) of effective lobbying will increase the joint pay-off (instead of it decreasing in the competitive lobbying case). (2) By the envelope theorem, $\frac{\partial v(\{M, S\}, p)}{\partial p} = [(P - c)f'(P)] \frac{\partial P(0, 0, x_C^*, p)}{\partial p} < 0$, and $\frac{\partial v(\{S\}, p)}{\partial p} + \frac{\partial v(\{M, S\}, p)}{\partial p} = [(P - c)f'(P)] \frac{\partial P(x_M^*, \beta x_S^*, 0, p)}{\partial p} \leq 0$. Since the term $[(P - c)f'(P)]$ decreases with p : $\frac{\partial [(P - c)f'(P)]}{\partial p} = f'(P) + (P - c)f''(P) < 0$, and $P(0, 0, x_C^*, p) < P(x_M^*, x_S^*, p)$ for all p , if $\frac{\partial P(0, 0, x_C^*, p)}{\partial p} = \frac{\partial P(x_M^*, \beta x_S^*, 0, p)}{\partial p}$ are linear, $\frac{\partial v(\{M, S\}, p)}{\partial p} > \frac{\partial v(\{S\}, p)}{\partial p} + \frac{\partial v(\{M, S\}, p)}{\partial p}$. That is, the size of the core is increasing with the initial price. Moreover, the effect of imposing a limitation at $\bar{L} = x_i^*(p^\#)$, $i = M, S$ can be calculated as follows. First, from the above analysis, we have $P(x_M^*, x_S^*, p) < P(x_M^*, \bar{L}, p)$ for $p > p^\#$ and $P(x_M^*, x_S^*, p) > P(\bar{L}, x_S^*, p)$ for $p < p^\#$. Hence, it is also true that $P(x_M^*, x_S^*, p) - P(0, 0, x_C^*, p) < P(x_M^*, \bar{L}, p) - P(0, 0, x_C^*, p)$ for $p > p^\#$ and $P(x_M^*, x_S^*, p) - P(0, 0, x_C^*, p) > P(\bar{L}, x_S^*, p) - P(0, 0, x_C^*, p)$ for $p < p^\#$. Then using the same argument above, it can be concluded that the increase in the size of the core due to the higher price is smaller with x_S bounded by \bar{L} , and the increase in the size of the core due to the higher price is smaller with x_M bounded by \bar{L} . (3) Similarly, since $\frac{\partial v(\{M, S\}, p)}{\partial \beta} = 0$ and $\frac{\partial v(\{S\}, p)}{\partial \beta} + \frac{\partial v(\{M, S\}, p)}{\partial \beta} = [(P - c)f'(P)] \frac{\partial P(x_M^*, \beta x_S^*, p)}{\partial \beta} \leq 0$. As consumers' organizing ability increases, the size of the core will increase as well. \square

References

- Aidt, T.S., 1997. Cooperative lobbying and endogenous trade policy. *Public Choice* 93, 455–475.
- Aumann, R., Peleg, B., 1960. Von Neumann–Morgenstern solutions to cooperative games without side payments. *Bulletin of the American Mathematical Society* 66, 173–179.
- Becker, G.S., 1983. A theory of competition among pressure groups for political influence. *Quarterly Journal of Economics* 98, 371–400.
- Besley, T., Coate, S., 2003. On the public choice critique of welfare economics. *Public Choice* 114, 253–273.
- Cheung, F.K., Wang, X., 1996. Price discrimination in a rent-seeking economy. *Public Choice* 86, 103–116.
- Coggins, J.S., Graham-Tomasi, T., Toe, T.L., 1991. Existence of equilibrium in a lobbying economy. *International Economic Review* 32 (3), 533–550.
- Dixit, A.K., 1987. Strategic behavior in contests. *American Economic Review* 77 (5), 891–898.
- Fabella, R.V., 1993. Consumer resistance and monopoly behavior under franchise contestability. *Public Choice* 76, 263–271.
- Friedman, J.W., 1991. *Game Theory with Applications to Economics*. Oxford University Press.
- Gillies, D., 1959. Solutions to general non-zero-sum games. *Contributions to the Theory of Games*, vol. IV. Princeton University Press, pp. 47–85.
- Groseclose, T., Snyder Jr., J., 1996. Buying supermajorities. *American Political Science Review* 90, 303–315.
- Hrebenar, R.J., Nakamura, Akira, Nakamura, Akio, 1998. Lobby regulation in the Japanese diet. *Parliamentary Affairs* 51 (4), 551–558.
- Kahana, N., Katz, E., 1990. Monopoly, price discrimination and rent seeking. *Public Choice* 64, 93–100.
- Laffont, J.J., Tirole, J., 1991. The politics of government decision-making: a theory of regulatory capture. *Quarterly Journal of Economics* 106 (4), 1089–1127.
- Posner, R.A., 1975. The social cost of monopoly and regulation. *Journal of Political Economy* 83, 322–340.
- Prosser, T., 1997. *Law and the Regulators*. Oxford University Press.
- Rechtman, R., Larsen-Ledet, Panumm, J., 1998. Regulation of lobbyists in Scandinavia—a Danish perspective. *Parliamentary Affairs* 51 (4), 579–586.
- Schelling, T.C., 1960. *The Strategy of Conflict*. Harvard University Press, Cambridge, Mass.
- Shapley, L., Shubik, M., 1953. Solutions of N-person games with ordinal utilities. *Econometrica* 21, 348–349.
- Stigler, G.J., 1971. The economic theory of regulation. *The Bell Journal of Economics* 2, 3–21.
- The Economist, 2003. Leaders: bogged down. *Water* 366 (8316), 15 (Mar 22).
- Thomas, C.S., 1998. Interest group regulation across the United States: rationale, development and consequences. *Parliamentary Affairs* 51 (4), 500–515.
- Troyer, T.A., Varley, D., 2003. Private foundations and policy making. *The Practical Tax Lawyer* 17 (4), 39.
- Tullock, G., 1967. The welfare costs of tariffs, monopolies, and theft. *Western Economic Journal* 5, 224–232.
- von Neumann, J., Morgenstern, O., 1944. *Theory of Games and Economic Behavior*. Princeton University Press.
- Young, A., 2001. *The Politics of Regulation: Privatized Utilities in Britain*. Palgrave.