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Interest group competition over policy outcomes: Dynamics, strategic behavior, and social costs *

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Abstract. This paper analyzes a two-period model of interest group competition between two groups to affect the policy outcome. The paper characterizes the subgame perfect equilibrium and considers the welfare implications of the model. The subgame perfect equilibrium to this game is allocatively efficient if and only if the initial equilibrium is allocatively efficient and interest groups are equally adept at producing political pressure. When rent seeking is constitutionally protected, the notion of rent-seeking constrained efficiency is defined as the cooperative solution to the rent-seeking game. It is shown that a rent-seeking constrained efficient equilibrium is attainable by forcing winners in political competition to fully compensate losers.

1. Introduction

While some types of political policies mainly affect only a single interest group, many others are hotly contested by highly organized interest groups on each side of the issue. In these cases, a small number of well-defined competing interest groups are much more interested in the policy outcome than the general public, and so have large incentives to engage in rent-seeking activities.

New Zealand fisheries are one example.[1,2] All commercial fisheries in New Zealand were privatized in the mid 1980s by the introduction of "individual transferable quotas". The issue immediately became muddled as the Maori, who inhabited New Zealand prior to the arrival of Europeans, demanded a share of the fisheries based on the 1840 Treaty of Waitangi. There have been several Parliamentary and court decisions that have decisions that have altered the allocation of fish quotas, including a buy-back of fishing quotas to satisfy Maori Treaty demands. The New Zealand case is interesting in that the losers in the political reallocation were actually compensated. The fishing quotas given to the Maori were purchased from non-Maori quota holders by

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the New Zealand government. However, the winners in the political allocation, the Maori, did not pay the compensation to the previous quota holders – the New Zealand government did. Thus, while this system reduced the incentive for rent seeking by existing quota holders (since they were compensated), it did not reduce the incentive for rent seeking by the Maori.

This paper examines interest group competition over policy outcomes in situations characterized by a small number of identifiable interest groups competing over a long period of time. Institutional rigidities mean that current decisions influence the direction future battles must follow. In most cases, no liability is incurred by the winner and no compensation is paid to losers. Thus both winners and losers have an incentive to engage in rent-seeking activities, and because history matters, they have an incentive to behave strategically in their rent seeking.

In an often-cited paper, Becker (1983) examined interest group competition among actors who possessed enough "market power" to affect the behavior of their competitors.[3] Becker's theory is based on a single-period, non-cooperative, simultaneous move game. The focus of recent research is on games that are either implicitly or explicitly dynamic.[4] The first explicitly dynamic model was Cairns (1989), who considered an infinite time dynamic version of Becker's model. He derived the open-loop (Nash) pure strategy equilibria and found comparative statics results similar to those in Becker's static model. This has since been extended by Wirl (1994), who examined a dynamic model of lobbying using a linear-quadratic differential game model in which (unlike Cairns) he was able to solve for the dynamic subgame perfect equilibria. However, Wirl was only able to obtain a closed form solution for the case where the interest groups were identical.

This paper presents a model that is essentially a time-truncated version of the model considered by Cairns (1989) and Wirl (1994). However, unlike Cairns, the present model derives the subgame perfect equilibrium and, unlike Wirl, interest groups are allowed to be heterogeneous in the costs of producing political pressure and/or in the value they place on different policies. This is due to the simplifying that there are only two active periods in the game.

The main question addressed is whether or not the policy outcomes will be efficient. This question stems from Becker's (1983) "efficient redistribution hypothesis" (ERH), which argues that political allocations will be allocatively efficient (in the sense, say, that price equals marginal cost), or will move towards the allocatively efficient policy over time. It is argued that it is unlikely to be the case that political policies are allocatively efficient.[5] This result should not be surprising since groups care about the costs they impose upon other groups only in so far as it affects their own costs, and since interest groups are unlikely to care about or be able to influence policy equally.

However, it is argued that defining efficiency entirely in terms of allocative efficiency focuses on the wrong thing. Following a suggestion by Becker (1983: 388) that "Pareto optimality is attained when one group does not produce any pressure", a "*rent seeking constrained efficient*" equilibrium policy occurs when rent-seeking levels are chosen to minimize joint allocative (dead-weight-loss) costs plus rent-seeking costs. Only one interest group will exert political pressure in this (cooperative) equilibrium. Thus, if the winner in a non-cooperative political competition (relative to the starting point) is required to *fully* compensate the loser, the rent-seeking constrained efficient policy can be achieved. The full compensation result may be somewhat surprising since when interest groups behave strategically, they recognize that increased rent seeking today on their part today will cause increased rent seeking by their competitors in the future since rent seeking in any period is an increasing function of the distance between the actual policy and the ideal policy from the interest group's perspective. However, in the rent-seeking constrained equilibrium, if the losing group is fully compensated for its future loses it has no reason to retaliate in the future by increasing its rent-seeking level. Therefore, even though the winning interest group will have already partially internalized the externality they impose upon the other group, the optimal (Pigouvian) liability is still one-hundred percent of the loses incurred by the loser.

The main policy implication of the model is that even if rent seeking is institutionally protected, the adverse effects of rent seeking can be offset by requiring compensation of losers.[6] This calls for a strict interpretation of rules such as the Fifth Amendment of the U.S. Constitution, which states "private property [shall not] be taken for public use, without just compensation". However, what is "just compensation" has varied considerably. In cases where the property literally changes hands the courts have supported compensation, but in cases where regulations have simply limited the use of property the courts have generally supported no compensation (e.g., Fischel, 1995: 64–99).[7] This model suggests that this distinction needs to be abandoned when rent seeking is taken into account.

2. The model

Suppose there are two interest groups L and R ("left" and "right") competing to affect the (single dimensional) policy outcome $x \in (\bar{x}_L, \bar{x}_R)$. Group L prefers policy $\bar{x}_L$ and group R prefers policy $\bar{x}_R$, where $\bar{x}_L < \bar{x}_R$, and $\bar{x}_L$ and $\bar{x}_R$ are assumed constant over time.[8] In the natural resource quota allocation examples, let X be the total quotas available and x be the quotas granted to group R. So long as neither group is satiated with having the entire quota, group R prefers policy $\bar{x}_R = X$ and group L prefers policy $\bar{x}_L = 0$. For simplicity, assume that no other segment of society is affected by the policy. Thus no other group will rent seek and when we define efficiently below, it is entirely in terms of these two groups.

Each group seeks to alter the policy through rent-seeking activities, which may take the form of legal challenges to existing law or attempts to alter the law through the legislative process. Assume that the rent-seeking game has two active periods, the minimum required to examine strategic behavior. Let the first period policy x_1 be

$$x_1 = x_0 + x_1^R - x_1^L. \tag{1}$$

In (1), $x_0 \in (\bar{x}_L, \bar{x}_R)$ is the *status quo*, or the policy that the legislature would adopt absent rent seeking, and x_1^R and x_1^L are the period one "effective political pressure" applied by groups R and L, respectively.[9] The parameters x_0, $\bar{x}_L$, and $\bar{x}_R$ are constant over time. Equation (1) implies that R seeks to move the policy to the right and L to the left. It also shows that the game is zero-sum in policy influence (Becker, 1983). It is not assumed that the status quo x_0 is necessarily efficient; it is merely the policy which would be adopted by the majority of the legislature absent rent seeking by the interest groups L and R.[10] One interpretation of this is that the politicians may not prefer "efficient" policies since they do not correspond to the median politician's desires, which are driven by the interests of his constituency.[11] Alternatively, it would be that politician's view contributions by interest groups as information about the value the groups place on different policies.[12]

The policy adopted in the second period depends in part on the actions taken by the interest groups in the second period, in part on what occurred in the first period, and in part on the preferences of the legislature. Specifically, the policy in period two is:

$$x_2 = (1-\delta)x_0+\delta x_1+x_2^R-x_2^L = x_0+\delta(x_1^R-x_1^L)+x_2^R-x_2^L \equiv x_0^2+x_2^R-x_2^L. \tag{2}$$

In (2), x_2^i is the second period rent seeking by group i. The parameter $\delta \in [0, 1]$ may be thought of as a "stiffness" parameter measuring the government's inherent propensity to move towards the default policy, x_0. If $\delta = 0$, the policy gains (or loses) from period one depreciate fully in the next period. If $\delta = 1$, there is no drift back towards the initial policy x_0, and the default policy in period two is x_1. Thus as δ increases, the legislature's ability to commit to a policy increases. There is reason to believe that $\delta < 1$ since even unorganized groups are represented indirectly due to a politician's need to satisfy at least fifty percent of the voting constituency (e.g., Denzau and Munger, 1986; Stratmann, 1991, 1992).[13] There is also reason to believe that $\delta > 0$. In Weingast and Marshall's (1988) analysis of the committee system in the U.S. Congress, because committees have exclusive rights over certain policy domains they can prevent unfavorable bills (relative to x_1, say) being considered by the full body, even when such bills have the support of a majority of the Congress.

Now, let us turn to the costs faced by the interest groups. The present value of costs to groups R and L are given by,[14]

$$V^R = c_R(\bar{x}_R - x_1) + w_R(x_1^R) + \beta[c_R(\bar{x}_R - x_2) + w_R(x_2^R)], \tag{3}$$

$$V^L = c_L(x_1 - \bar{x}_L) + w_L(x_1^L) + \beta[c_L(x_2 - \bar{x}_L) + w_L(x_2^L)]. \tag{4}$$

The first two terms are the costs in period one and the terms in square brackets are the costs in period two, discounted at common rate $\beta \in (0, 1)$. Costs are of two types. The *policy costs* to each group are denoted by the c_i functions. These depend upon the distance between the adopted policy x_1 and the group's ideal policy, $\bar{x}_i$, $i = L, R$. It is assumed that $c_i(0) = 0$, $c_i' > 0$ and $c_i'' > 0$ for $\bar{x}_R - x_1 > 0$ and $x_1 - \bar{x}_L > 0$, respectively. The second type of costs are *rent seeking* (or political pressure) costs, denoted by the w_i functions. These costs depend only on the *gross* level of pressure being applied to the legislature. Assume that $w_i(0) = 0$, $w_i' > 0$ and $w_i'' > 0$, $i = L, R$. The convexity of the rent-seeking functions is due to the increasing cost to a politician of violating the wishes of his voting constituency. Following Peltzman (1976), such violations require funds for producing propaganda to obfuscate the effect of the policy on voters. Thus politicians succeed in part by spending money (most of which comes from interest group contributions) on campaign advertising in an effort to convince voters to reelect them.[15]

It is convenient to assume that the cost functions for each group are parameterized as follows[16]

$$c_i(z_i) = \Phi_i c(z_i), \quad \text{and} \quad w_i(x_t^i) = \Theta_i w(x_t^i), \qquad i = L, R. \tag{5}$$

The parameters $\Phi_i > 0$ and $\Theta_i > 0$ are used below in the comparative statics analysis, and the functions w and c are each increasing convex functions in x_t^i and z_i, respectively.

3. Characterization of the rent-seeking equilibrium

3.1. *Nash equilibrium in the second period*

Now consider the minimization problem faced by each group acting individually in the second period of the two-period non-cooperative model taking x_1^R and x_1^L as given. A Nash equilibrium is given by the following:

Definition. A Nash equilibrium in period two of the game are the values of x_2^{R*} and x_2^{L*} that satisfy,

$$V_2^L(x_2^{L*} \mid x_2^{R*}) \leq V_2^L(x_2^L \mid x_2^{R*}) \text{ for } x_2^L \in R_+, \quad \text{and}$$
$$V_2^R(x_2^{R*} \mid x_2^{L*}) \leq V_2^R(x_2^R \mid x_2^{L*}) \text{ for } x_2^R \in R_+.$$

The Nash equilibrium to the second stage is thus the values of x_2^{R*} and x_2^{L*} that minimize second period costs. The necessary conditions require that x_2^{R*} and x_2^{L*} must jointly solve:

$$c_R'(\overline{x}_R - x_2^*) \;=\; w_R'(x_2^{R*}), \tag{6}$$
$$c_L'(x_2^* - \overline{x}_L) \;=\; w_L'(x_2^{L*}), \tag{7}$$

where x_2^* is given by (2) for $x_2^{R*} = x_2^{R*}$ and $x_2^L = x^L{*}_2$. These state that in period two (or a state game) each group rent-seeks to the point where marginal rent-seeking costs equal the marginal policy costs, or that at the margin rents are dissipated, but not infra-marginally. Notice that had (6) and (7) been written with the $\Phi_i c'$ and $\Theta_i w'$ notation instead of the c_i', and w_i' notation, it is clear that the equations in (6) and (7) are homogeneous of degree zero in the Φ_i and Θ_i parameters taken together. That is, if *both* rent seeking and policy costs for either of the interest groups were to double, the equilibrium would not change. Thus, what matters is not the absolute value of the parameters, but the ratio Θ_i/Φ_i.[17]

Equations (6) and (7) implicitly define the reaction (best-reply) functions in the variables x_2^R and x_2^L. The slopes of the reaction functions (e.g., plotted with x_2^L on the horizontal axis and x_2^R on the vertical axis) are given implicitly (with $V_{ij}^i \equiv \partial^2 V^i/\partial x_i^i \partial x_j^i$) by

$$\frac{\partial x_2^R}{\partial x_2^L} \mid V_R^R = 0 \;=\; \frac{-V_{RL}^R}{V_{RR}^R} = \frac{c_R''}{c_R'' + w_R''} < 1, \tag{8}$$

$$\frac{\partial x_2^R}{\partial x_2^L} \mid V_L^L = 0 \;=\; \frac{-V_{LL}^L}{V_{LR}^L} = \frac{c_R'' + w_L''}{c_L''} > 1. \tag{9}$$

These imply that the reaction functions are positively sloped and that they cross "correctly", i.e., when drawn with x_2^R on the vertical axis and x_2^L on the horizontal axis, the slope of the reaction function for R is steeper than that of L, so they are stable (e.g., Becker, 1983: Appendix).

The comparative statics results for optimal second period effective political pressure levels are similar to those for static (or steady state) models (e.g., Becker, 1983; Cairns, 1989; Boyce, 1997).

Lemma. The level of effective political pressure exerted by group i increases as their policy costs increase, decreases as their rent-seeking costs increase, decreases as the initial policy moves towards their preferred position, increases as policy costs to the other group increase, and decreases as the rent-seeking costs to the other group increase.

Proof. See Appendix A.

The Lemma contains the set of directly testable hypotheses from the static model of Becker (1983). The intuition behind the results are as follows. An increase in policy costs means that an adverse policy now has higher marginal policy cost. Thus to minimize total costs, the group will attempt place more pressure on the political system until marginal policy costs are equal to marginal rent-seeking costs. Thus rent seeking will increase. Conversely, if there is an increase in rent-seeking costs, this raises marginal rent-seeking costs and lowers the amount of rent-seeking pressure the group is willing to produce. A movement in the preferred policy by the legislature, x_0, towards the preferred policy of the interest group reduces rent-seeking expenditures by the group because it reduces the policy costs of the initial allocation. Conversely, a movement away from the preferred position of the interest group has the effect of raising policy costs and due to the convexity assumption, of raising them by larger additional increments, thus increasing rent-seeking expenditures.[18] The reason changes in the other group's costs has the same sign as changes in one's own costs stems from the fact that the reaction functions have a positive slope [e.g., (9)]. Thus an increase in the other group's policy costs shifts the reaction curve of the other group away from the origin, increasing both groups rent-seeking activities by the movement up the reaction curve of the group in question. Similarly, an increase in rent-seeking costs for the other group results in a shift towards the origin of the other group's reaction curve and moves down the group whose reaction curve has remained fixed, thus lowering both rent-seeking expenditures. Thus factors which cause one group to increase its rent-seeking activity also cause the other group to increase its rent-seeking activity to counter-balance the first, and *vice versa*.

In stage two of the model, (6) and (7) determine the optimal behavior in the second period for given values of x_1^R and x_1^L and parameters $\alpha \equiv \{x_0, \beta, \delta, \theta_i, \Phi_i\}$. Let the Nash-equilibrium second period rent-seeking levels solving (8) be denoted as $s_2^{R*} = x_2^{R*}(x_1^R, x_1^L, \alpha)$ and $x_2^{L*} = x_2^{L*}(x_1^R, x_1^L, \alpha)$, where the derivatives with respect to the parameters are defined in the Lemma. The effect of first period rent seeking on second period rent seeking by L and R are the following [see (A.6) and (A.7) from Appendix A]:

$$\begin{aligned} \frac{\partial x_2^{R*}}{\partial x_1^R} = \delta\phi^R < 0, \quad \frac{\partial x_2^{R*}}{\partial x_1^L} = \delta\phi^R > 0, \\ \frac{\partial x_2^{L*}}{\partial x_1^L} = \delta\phi^L < 0, \quad \frac{\partial x_2^{L*}}{\partial x_1^R} = \delta\phi^L > 0, \end{aligned} \tag{10}$$

where $\phi^R \equiv w''(x_2^L)\Phi_R c''(\overline{x}_R - x_2^*)/ \mid H \mid$ and $\phi^L \equiv w''(x_2^R)\Phi_L c''(x_2^* - \overline{x}_L)/ \mid H \mid$, where $\mid H \mid$ is the determinant of the Jacobian from the system (6) and (7), which is positive and greater in value than the numerators [see (A.8) in Appendix A]. Thus, $\phi^R, \phi^L \in (0, 1)$.

3.2. *Equilibrium rent-seeking levels in the first period*

Given second period effective political pressure levels defined by x_2^{R*} and x_2^{L*} in (6) and (7), the equilibrium second period policy is given by

$$x_2^* = x_0 + \delta(x_1^R - x_1^L) + x_2^{R*}(x_1^R, x_1^L, \alpha) - x_2^{L*}(x_1^R, x_1^L, \alpha). \tag{11}$$

The present value of discounted costs are thus

$$V^{R*} = c_R(\overline{x}_R - x_1) + w_R(x_1^R) + \beta[c_R(\overline{x}_R - x_2^*) + w_R(x_2^{R*})], \tag{12}$$

$$V^{L*} = c_L(x_1 - \overline{x}_L) + w_L(x_1^L) + \beta[c_L(x_2^* - \overline{x}_L) + w_L(x_2^{L*})], \tag{13}$$

for groups R and L, respectively. Next, we define the equilibrium concept used in the analysis of the first period non-cooperative rent seeking.

Definition. A *subgame perfect* solution to (12) and (13) is the pair $\{x_1^{R*}, x_1^{L*}\}$ that satisfies:

$$V^i(x_1^i \mid x_1^{j*}, x_o) \leq V_1^i(x_1^{i*} \mid x_1^{j*}, x_0) \text{ for all } \{x_1^R, x_1^L\} \in R_+ \times R_+, i \neq j = L, R.$$

The subgame perfect rent-seeking levels in the first period must satisfy the following:

$$w'_R(x_1^{R*}) = c'_R(\overline{x}_R - x_1^*) + \delta\beta c'_R(\overline{x}_R - x_2^*)(1 - \phi^L) \equiv \Psi_R, \quad (14)$$

$$w'_L(x_1^{L*}) = c'_L(x_1^* - \overline{x}_L) + \delta\beta c'_L(x_2^* - \overline{x}_L)(1 - \phi^R) \equiv \Psi_L. \quad (15)$$

These state that marginal rent-seeking costs in period one equal the sum of period one marginal policy costs plus the discounted effect of marginal period one rent seeking on period two policy costs times the change in period two policy resulting from an increase in period one rent seeking. The effect first period rent seeking has on second period policy costs is the sum of two parts: the direct (or dynamic) effect period one rent seeking has on period two policy (the expression $\delta\beta c'_i$) and the indirect (or strategic) effect through x_2^j (the expression $-\phi^j\delta\beta c'_i$). The strategic effect works in the opposite direction of the dynamic effect. The dynamic effect results from the fact that an increase in rent-seeking in the first period decreases future marginal policy costs since it moves the policy closer towards the preferred policy, $\overline{x}_i$. The strategic effect results from the fact that an increase in rent seeking in period one increases opposition by the opponent in period two. Thus the dynamic effect increases rent seeking relative to the static equilibrium rent-seeking level (i.e., which occurs if either β or δ equals zero), and the strategic effect lowers the first period rent-seeking equilibrium moving it closer to the static equilibrium. Since the strategic effect dampens the enthusiasm for rent seeking (by recognizing that too much success today brings a larger retaliation tomorrow), it implies that rent seekers who behave strategically already partially internalize the costs they impose on the other group, even though they behave non-cooperatively.[19]

3.3. *Analysis of the subgame perfect equilibria*

For each problem defined in (12) and (13) to have a unique minimum, each V^{*i} must be convex in x_1^i. This means that second-order conditions require $V_{ii}^{*i} > 0$. However, this alone is not sufficient for the reaction functions to be dynamically stable. For this to occur, the reaction functions must cross "correctly". This is because the slopes of the reaction functions include the V_{ji}^{*i} terms as in (8) and (9). For the reaction functions to cross correctly, the following must hold (Becker, 1983: Appendix; Boyce, 1997),

$$\left|\frac{\partial x_2^R}{\partial x_2^L} \mid V_{R=0}^{*R}\right| \equiv \left|\frac{-V_{RL}^{*R}}{V_{RR}^{*R}}\right| < \left|\frac{V_{LL}^{*L}}{-V_{LR}^{*L}}\right| \equiv \left|\frac{\partial x_2^R}{\partial x_2^L} \mid V_{L=0}^{*L}\right|. \quad (16)$$

In general, the stability condition (16) may not be satisfied. However:

Proposition 1. A sufficient condition for the subgame perfect first-period equilibrium to be stable is that the cost functions are quadratic (i.e., $c_i''' = 0$ and $w_i''' = 0, i = L, R$).

Proof. See Appendix B.

The stronger conditions are required to obtain sufficiency of stability of the subgame perfect equilibrium than convexity of the cost functions. However, convexity assumptions plus the added assumption of quadratic cost functions provides a sufficiency condition for stability.[20]

Next, consider the comparative statics:

Proposition 2. With quadratic cost functions, first-period rent-seeking increases if the policy costs to either group increases in any period, and decreases if the rent-seeking costs increase in any period.

Proof. See Appendix C.

Proposition 2 shows that under the restriction of quadratic cost functions, the comparative statics results in the subgame perfect equilibrium are qualitatively identical to the comparative statics results for the statis equilibrium (see the discussion below the Lemma above). However, this may not hold in general since Proposition 2 depends upon the assumption that the rent-seeking and policy costs are quadratic. This assumption is not required in the static model to obtain the comparative statics results.

4. Rent seeking and allocative efficiency

When considering a government policy, most economists have focused on the policy costs. In cost-benefit analysis, one would ask whether the policy x_t^* minimized the discounted stream of policy costs. For policies x_1 and x_2, the discounted stream of aggregate policy costs is:

$$V^A(x_1, x_2) = c_R(\bar{x}_R - x_1) + c_L(x_1 - \bar{x}_L) + \beta[c_R(\bar{x}_R - x_2) + c_L(x_2 - \bar{x}_L)]. \quad (17)$$

Definition. Allocatively efficient (AE) policies are policies $\{\hat{x}_1, \hat{x}_2\}$ that minimize V^A, implying:

$$c_R'(\bar{x}_R - \hat{x}_t) = c_L'(\hat{x}_t - \bar{x}_L), \qquad t = 1, 2. \quad (18)$$

This simply says that marginal policy costs are equated in each period. When the parameters of the cost function are constant over time, which is assumed, then $\hat{x}_1 = \hat{x}_2 \equiv \hat{x}$.[21] Notice that an AE policy is independent of the status quo x_0 and of the actions of the interest groups in each period, the x_t^i, t = 1, 2, i = L, R. In addition, since each c_i function is convex, as the policy in period t moves away from $\hat{x}$ dead-weight-loss costs increase at an increasing rate. Thus the model is negative sum in policy costs for moves away from the AE policy (Becker, 1983).

Since an AE policy is defined independent of the rent-seeking levels of the two groups, it is of interest to ask whether, for a given status quo policy and individually rational (non-cooperative) rent seeking, rent seeking will move the policy to (or towards) the AE policy. In this sense, we are concerned with Becker's "efficient redistribution hypothesis", which has been described as follows:

> The efficient redistribution hypothesis states that no available government policies are Pareto superior to observed government policies (Bullock, 1995: 1236).

Most discussions of the ERH are in terms of the costs of a particular transfer, which means that they focus on the method of transfer (i.e., Becker's Proposition 4).[22] Here, however, the focus is on the policy itself. This has its antecedent in Becker's Proposition 2 and its corollary, the latter which states that, "political policies that raise efficiency are more likely to be adopted than those that lower efficiency" (1983: 384). In this case, an efficient policy is one which is AE. Thus let us now examine what conditions have to hold for the policies to either be AE (the strong form of the ERH) or to move towards the AE policy (the weak form of the ERH).

4.1. *Allocative efficiency and non-strategic rent seeking*

Let us now characterize the non-cooperative equilibrium policy when there is no strategic behavior. This corresponds to examining the second and final period of the game. As shown above, the equilibrium policy depends on the status quo policy x_0^2 (which depends on rent seeking in period one and the preferred policy of the legislature), and the relative costs of the two groups. Let us begin by considering the strong version of the efficient redistribution hypothesis. What conditions have to hold for the policy to be AE given that rent-seeking levels are chosen to satisfy the non-cooperative equilibrium described in (6) and (7)? Suppose the rent seekers are homogeneous.

Proposition 3. With homogeneous interest groups (e.g., $\theta_R/\Phi_R = \theta_L/\Phi_L = \gamma > 0$), the equilibrium policy will not be AE unless the default policy at the beginning of period two, $x_0^2 = x_0 + \delta(x_1^R + x_1^L)$, is AE.

Proof. First, suppose that $x_0^2 = \hat{x}$, and that $\theta_R/\Phi_R = \theta_L/\Phi_L = \gamma > 0$. The AE policy must satisfy (18) and individually rational rent-seeking levels must satisfy (6) and (7). If all of these conditions hold, then

$$\gamma w'(x_2^{R*}) = c'(\overline{x}_R - \hat{x} - x_2^{R*} + x_2^{L*}) = c'(\hat{x} + x_2^{R*} - x_2^{L*} - \overline{x}_L) = \gamma w'(x_2^{L*}),$$

or that x_2^{R*} must equal x_2^{L*}, as claimed. Thus proving sufficiency.

Necessity is shown by supposing that $x_0^2 \neq \hat{x}$ (e.g., suppose $x_0^2 < \hat{x}$), but that the equilibrium policy is AE. This means that (18) plus (6) and (7) must hold, as before

$$\gamma w'(x_2^{R*}) = c'(\overline{x}_R - x_0^2 - x_2^{R*} + x_2^{L*}) = c'(x_0^2 + x_2^{R*} - x_2^{L*} - \overline{x}_L) = \gamma w'(x_2^{L*}),$$

but this implies $x_0^2 - x_2^{R*} + x_2^{L*} = \hat{x}$, which means that $x_2^{R*} > x_2^{L*}$, which contradicts $w'(x_2^{R*}) = w'(x_2^{L*})$. Q.E.D.

Proposition 3 shows that if the initial equilibrium is not the AE policy, one cannot get to the AE policy except asymptotically, even if the interest groups are homogenous. The next result relaxes the assumption that rent-seeking costs are identical, but retains the assumption that policy costs are identical:

Proposition 4. If rent seeking is homogeneous in policy costs but heterogeneous in rent-seeking costs (e.g., $\theta_R \neq 1, \theta_K = \Phi_L = \Phi_R = 1$), then even if the initial policy x_0^2 is AE, the equilibrium policy will not be.

Proof. Suppose that the initial policy $x_0^2 = \hat{x}$ and the equilibrium is AE, i.e., $x_2^* = \hat{x}$ is AE. This implies that $x_1^{R*} = x_1^{L*}$ for (18) to hold. But (6) and (7) then imply that $\theta_R w'(x_1^{R*}) = w'(x_1^{L*})$, which is a contradiction.Q.E.D.

The next result assumes that one interest group has substantially lower rent-seeking costs relative to policy costs than the other group but equal policy costs.[23]

Proposition 5. If group R has substantially lower rent-seeking costs than group L (e.g., $\theta_R << \theta_L$) but policy costs are identical (e.g., $\Phi_R = \Phi_L = 1$), than it is possible for a policy which initially favors group R (i.e., $x_0^2 > \hat{x}$) to be made to favor group R even more in equilibrium (i.e., $x_2^* > x_0^2 > \hat{x}$).

Proof. The proof proceeds by showing that there exists a $\lambda, 0 < \lambda < 1$, such $\lambda\theta_L w'(x_2^{R*}) < \theta_L w'(x_2^{L*})$, for $x_2^{R*} > x_2^{L*}$, which implies that $x_2^* > x_0^2 > \hat{x}$, where $\theta_R = \lambda\theta_L$. The conditions on the policies are

$$c'(\bar{x}_R - x_0^2 - x_2^{R*} + x_2^{L*}) < c'(\bar{x}_R - x_0^2), c'(x_0^2 - \bar{x}_l) < c'(x_0^2 + x_2^{R*} - x_2^{L*} - \bar{x}_L),$$

where the inner inequality is the condition that the initial policy x_0^2 is to the right of $\hat{x}$, and the outer inequalities are the result of the policy moving farther to the right, i.e., $x_2^* > x_0^2$. Assuming that these conditions hold, and using (6) and (7) results in

$$\lambda w'(x_2^{R*}) < w'(x_2^{L*}), \quad \text{for } x_2^{R*} > x_2^{L*},$$

where the θ_L's have canceled out. Since $w''(\cdot) > 0$, it implies that $w'(x_2^{R*}) > w'(x_2^{L*})$ for $x_2^{R*} > x_2^{L*}$. This implies that there exists a $0 < \lambda < 1$ such that that $\lambda w'(x\lambda R*_2) < w'(x_2^{L*})$, thus proving the proposition. Q.E.D.

Becker (1983: 384) claims that "political policies that raise efficiency are more likely to be adopted than policies that lower efficiency", Corollary to his Proposition 2), which he bases on the increasing marginal *policy costs* of the two groups for policies moving away from their ideal policy. What Proposition 5 shows is that Becker's claim requires that a particular interest group not be too efficient (relative to the other group) at producing political pressure.

These results together show that the conditions required to obtain the strong version of the ERH, that the equilibrium political allocation will be AE, are quite stringent in the static model. Furthermore, even the weaker form of the hypothesis, that the equilibrium policy will move *towards* the AE policy, requires that each interest group be similarly adept at producing political pressure. Work by Olson (1965), Stigler (1971), and a number of others suggests that this is not the case.[24]

4.2. *Allocative efficiency and strategic rent seeking*

It is possible to obtain corollaries to the propositions just stated for the static case for the more complicated case where rent seekers behave strategically.

Corollary to Proposition 3. With homogeneous interest groups (e.g., $\theta_R/\Phi_R = \theta_L/\Phi_L = \gamma > 0$) and quadratic cost functions (i.e., $c''' = w''' = 0$), the equilibrium policy in periods one and two will be AE if and only if the default policy at the beginning of period one, x_0, is AE.

Proof. Proposition 3 shows that the policy at the beginning of period two must be AE for the policy x_2^* to be AE. Thus, all that is necessary is to show that for $x_0 \neq \hat{x}$, that the equilibrium policy x_1^* does not equal $\hat{x}$, and that if $x_0 = \hat{x}$, that the equilibrium policy x_1^* equals $\hat{x}$. First, consider sufficiency. Suppose that $x_0 = \hat{x}$. Then for $x_1^* = \hat{x}$, using (18) and the equilibrium conditions (14) and (15), it must be that

$$\gamma w'(x_1^{L*}) = \Psi_L(x_1^*) = \Psi_L(x_0) = \Psi_R(x_0) = \Psi_R(x_1^*) = \gamma w'(x_2^{R*}),$$

where Ψ_i are defined in (14) and (15), and the argument refers to the equilibrium policy in period one. This condition is satisfied only if $x_1^{L*} = x_2^{R*}$, proving sufficiency.

Next, suppose that $x_0 < \hat{x}$ but that $x_1^* = x_0$. Using (18) and the equilibrium conditions (14) and (15), and the equilibrium condition that $x_1^{L*} > x_2^{R*}$, we obtain:

$$\gamma w'(x_1^{L*}) = \Psi_L(x_1^*) < \Psi_L(x_0) < \Psi_R(x_0) < \Psi_R(x_1^*) = \gamma w'(x_2^{R*}),$$

where we have used the notion that Ψ_i is convex in x_1 to obtain our result (which is implied by quadratic cost functions). Thus, $w'(x_1^{L*}) < w'(x_2^{R*})$. But this contradicts $x_1^{L*} > x_2^{R*}$ since $w''(\cdot) > 0$. Similarly, suppose that $x_1 > \hat{x}$. This means that $x_1^L > x_2^R$, which means that

$$w'(x_1^{L*}) = \Psi_L(x_1^*) > \Psi_R(x_1^*) = w'(x_2^{R*}),$$

which contradicts $x_1^{L*} > x_2^{R*}$. Q.E.D.

It should be clear that the proof to the corollary to Proposition 3 is identical to that of Proposition 3 and is based on the fact that the Ψ_i functions are qualitatively similar to the c_i' functions. Thus we can provide similar corollaries to Propositions 4 and 5:

Corollary to Proposition 4. If rent seeking are homogeneous in policy costs but heterogeneous in rent-seeking costs (e.g., $\theta_R \neq 1, \theta_L = \Phi_R = \Phi_L = 1$) and the cost functions are quadratic (i.e., $c''' = w''' = 0$), then even if the initial policy x_0 is AE, the equilibrium policy will not be.

Proof. Identical to Proposition 4. Q.E.D.

Corollary to Proposition 5. If group R has substantially lower rent-seeking costs than group L (e.g., $\theta_R << \theta_L$) and the cost functions are quadratic (i.e., $c''' = w''' = 0$) but policy costs are identical (e.g., $\Phi_R = \Phi_L = 1$), then it is possible for a policy which initially favors group R (i.e., $x_0 > \hat{x}$) to be made in favor group R even more in equilibrium (i.e., $x_1^* > x_0 > \hat{x}$).

Proof. Identical to Proposition 5. Q.E.D.

Thus, the subgame perfect equilibrium in the first period is qualitatively similar to the static equilibrium in the second period. When interest groups are similar enough in producing rent-seeking costs relative to their policy costs, the equilibrium will move towards the allocatively efficient equilibrium, although it will not actually get there, and if groups are sufficiently heterogeneous, the policy may move away from the allocatively efficient equilibrium.

5. Rent-seeking constrained efficiency

An alternative view of efficiency that appears more useful than allocative efficiency, assumes that rent seeking is institutionally protected.[25] For arbitrary rent-seeking levels x_t^R and x_t^L, the costs to society are

$$V^S(x_1, x_2) = V^A(x_1, x_2) + w_L(x_1^L) + w_R(x_1^R) + \beta[w_L(x_2^L) + w_R(x_2^R)]. \quad (19)$$

Thus V^S includes rent-seeking expenditures as part of social costs since rent seeking is assumed to be part of social costs. We now define a *rent-seeking constrained efficient* (RSCE) policy:

Definition. Rent-seeking constrained efficient policies, $x_t^{\#}(\alpha), t = 1, 2$, are a sequence of policies satisfying (1) and (2) given a sequence of rent-seeking levels $\{x_t^{R\#}(\alpha), x_t^{L\#}(\alpha)\}$ and that minimize V^S in a dynamically consistent fashion.

Unlike the case of an AE policy, we cannot simply differentiate V^S with respect to x_1 and x_2 to define a RSCE policy, since it depends upon the actions of the rent seekers.[26] In addition, while an AE policy is independent of the status quo, a RSCE policy depends on the status quo.

A RSCE equilibrium involves rent seeking in each period by *only* one group. As Becker (1983: 387–388) notes, the intuition for this result is that "reduced pressure by both groups could maintain their influence, and hence would raise both their net incomes by economizing on political pressures". Let us now show this result formally. In the second period, the (interior) necessary conditions for minimizing V^S are:

$$w_R'(x_2^{R\#}) = c_R'(\bar{x}_R - x_2^{\#}) - c_L'(x_2^{\#} - \bar{x}_L), \quad (20)$$
$$w_L'(x_2^{L\#}) = c_L'(x_2^{\#} - \bar{x}_L) - c_R'(\bar{x}_R - x_2^{\#}). \quad (21)$$

Both of these equalities cannot simultaneously hold so long as $w_i' > 0$ since the right-hand-side of (20) is the negative of the right-hand-side of (21).

Furthermore, if $w' > 0$, it implies that the right-hand-side is positive of whichever of (20) or (21) holds as a strict equality. Thus if (20) holds as an equality (i.e., $x_2^{L\#} = 0$ and $x_2^{R\#} > 0$), then $c_R' > C_L'$, and similarly for the converse.

The next proposition characterizes a RSCE policy $x_2^{\#}$ relative to the (unique) AE policy $\hat{x}$.

Proposition 6. A RSCE policy in period two will be AE if and only if the initial policy, x_2^0, is AE. However, for $x_2^0 \neq \hat{x}$, the RSCE policy will move towards the AE policy.

Proof. For the RSCE policy $x_2^{\#}$ to be AE, it must be that the right-hand-side of both (20) and (21) must be zero. Therefore, neither $x_2^{L\#}$ nor $x_2^{R\#}$ can be positive, which implies that the original equilibrium must have been AE. Now, suppose that $x_2^0 < \hat{x}$. Then $c_R'(\overline{x}_R - x_2^0) > c_L'(x_2^0 - \overline{x}_L)$. Thus from (20) and (21), $x_2^{L\#} = 0$ and $x_2^{R\#} > 0$. However, $w_R' > 0$ implies that $c_R'(\overline{x}_R - x_2^0 - x_2^{R\#}) > c_L'(x_2^0 + x_2^{R\#} - \overline{x}_L)$, thus $x_2^0 < x_2^{\#} < \hat{x}$. When $x_2^0 > \hat{x}$, (20) and (21) imply that $x_2^{L\#} > 0$ and $x_2^{R\#} = 0$. Thus $c_R'(\overline{x}_R - x_2^0 + x_2^{L\#}) < c_L'(x_2^0 - x_2^{L\#} - \overline{x}_L)$, which means that $\hat{x} < x_2^{\#} < x_2^0$.
Q.E.D.

Proposition 6 shows that if x_2^0 is inefficient (recall that x_2^0 is the policy the legislature will choose absent rent-seeking pressure by groups L and R), then the RSCE policy will not be AE. It is interesting to compare Propositions 3 and 6. Both show that an initial equilibrium away from an AE policy will not be AE. This shows that strong versions of the efficient redistribution hypothesis may not hold even in the favorable (and unrealistic) case where the rent seekers cooperate. The question that remains is whether the equilibrium at the beginning of period two will equal the AE policy $\hat{x}$ due to actions taken in the first period.

The dynamically consistent first period cooperative rent-seeking levels must satisfy:

$$\begin{aligned} w_R'(x_1^{R\#}) &= c_R'(\overline{x}_R - x_1^{\#}) + \delta\beta c_R'(\overline{x}_R - x_2^{\#}) - \\ &\quad [c_L'(x_1^{\#} - \overline{x}_L) + \delta\beta c_L'(x_2^{\#} - \overline{x}_L)], \end{aligned} \tag{22}$$

$$\begin{aligned} w_L'(x_1^{L\#}) &= c_L'(x_1^{\#} - \overline{x}_L) + \delta\beta c_L'(x_2^{\#} - \overline{x}_L) - \\ &\quad [c_R'(\overline{x}_R - x_1^{\#}) + \delta\beta c_R'(\overline{x}_R - x_2^{\#})]. \end{aligned} \tag{23}$$

Again, both $x_1^{R\#}$ and $x_1^{L\#}$ cannot be positive since the right-hand-side of (22) is the negative of the right-hand-side of (23). Suppose second period marginal policy costs are identical for each interest group, which means that in period two the initial policy is AE, and so by Proposition 6, remains AE. Then all but the $x_R'(\overline{x}_R - x_1) - c_L'(x_1 - \overline{x}_L)$ terms will vanish on the right-hand-side of (22) and (23). However, these terms cannot be positive in both equations since $w_i' > 0$. Hence,

Proposition 7. For the RSCE policy to be AE, the policy adopted by the legislature absent of rent-seeking pressure must be AE, i.e., for $x_t^\# = \hat{x}, t = 1, 2$, it must be that $x_0 = \hat{x}$.

Proof. Identical to Proposition 6. Q.E.D.

Propositions 6 and 7 show that if the initial policy is to the left of the AE policy $\hat{x}$, then in each period, only $x_t^{R\#}$ is positive in equilibrium and that the RSCE policy $x_t^\# < \hat{x}$. Similarly, if $x_0 > \hat{x}$, then $x_t^\# > \hat{x}$ and only $x_t^{L\#} > 0$ in each period. The only case where the RSCE policy is AE is where the status quo policy x_0 is AE.

6. Regulating rent seeking

If rent seeking is protected and one wished to devise a policy under which the RSCE policies would be adopted, how might one go about it? The answer is a compensation scheme whereby the "winner" in the political equilibrium compensates the loser. An example where compensation of losers has historically occurred, discussed above, is the case of the transfer of fishing quotas to New Zealand Maori. The existing quota holders were compensated at the market price for quotas by the New Zealand government. This has the effect of reducing the rent seeking by the losers, but does not have the same effect on the "winners".

Boyce (1997) has shown that in a static (one period game) both a liability must be incurred by the winners as well as compensation of losers to achieve efficiency in the political equilibrium. This can be seen by considering the optimal liability in the second period (where there is no strategic behavior). Suppose that group R is the "winner" in the equilibrium political redistribution. Then the second period cost functions of the groups are:

$$V_2^R = c_R(\overline{x}_R - x_2) + w_R(x_2^R) + k_2^R[c_L(x_2 - \overline{x}_L) - c_L(x_2^0 - \overline{x}_L)] \quad (24)$$

$$V_2^L = c_L(x_2 - \overline{x}_L) + w_L(x_2^L) - k_2^L[c_R(\overline{x}_R - x_2) - c_R(\overline{x}_R - x_2^0)] \quad (25)$$

The expression in square brackets is the cost to group L of policy x_2 relative to x_2^0, given that R is the winner, i.e.: $x_2^0 < x_2$. The parameters k_2^i are the proportion of the cost to L that is paid by R(i = R) and received by L(i = L). In the case where $k_2^R = k_2^L = 1$, L has no incentive to rent seek (since he is not able to pay for losses to R). Furthermore, R's first-order condition yields (20). Thus the RSCE will be achieved for a given initial policy x_2^0. This is the *full* compensation result of Boyce (1997) for the static case.

The question is how does the introduction of strategic behavior affect this result?[27] Consider the first period costs given that the second period rent seeking follows (20) and (21). The costs are:

$$\begin{aligned} V^R &= c_R(\bar{x}_R - x_1) + w_R(x_1^R) + \beta[c_R(\bar{x}_R - x_2) + w_R(x_2^{R\#})] \\ &\quad + \beta[c_L(x_2 - \bar{x}_L) - c_L(x_2^0 - \bar{x}_1)] \\ &\quad + k_1^R[c_L(x_1 - \bar{x}_L) - c_L(x_0 - \bar{x}_L)], \end{aligned} \tag{26}$$

$$\begin{aligned} V^L &= c_L(x_1 - \bar{x}_L) + w_L(x_1^L + \beta c_L(x_2^0 - \bar{x}_L) \\ &\quad - k_1^L[c_L(x_1 - \bar{x}_L) - c_L(x_0 - \bar{x}_L)]. \end{aligned} \tag{27}$$

In this case, the cost function for L in (27) incorporates the optimal second period outcome (i.e., $x_2^{L\#} = 0$ and compensation by R), as does R's objective function (26). What values of k_1^R and k_1^L have to be chosen to obtain the RSCE conditions in (22) and (23)? Since the optimal response by L in the second period is exactly zero rent seeking (due to the full compensation for losses), it is clear that there no longer exists a strategic effect. Thus, the optimal compensation levels are $k_1^R = k_1^L = 1$.

Proposition 8. If the winner in the political redistribution fully compensates the loser for the losers loses in each period, then the RSCE equilibrium is attained.

Most economists have come to accept that political redistributions need only satisfy a *potential* Pareto improvement criteria, i.e., the Hicks-Kaldor criterion, rather than the stronger Pareto-improvement criteria. What this model suggests is that an *actual compensation criteria* needs to be used rent seeking is taken into account. If the actual compensation equal the marginal cost to the loser (times the change in the policy), then Proposition 8 shows that both the winner and loser will behave optimally. In the natural resource quota allocations, this implies that if the winners compensate the losers at the marginal value the losers place on the last unit of quota they receive for each unit of quota lost in the allocation, then both the winners and losers will fully internalize the social costs of their rent seeking.[28]

7. Conclusions

This paper examines a two-period extension of the non-cooperative political pressure group competition model of Becker (1983). Unlike previous attempts to formulate the Becker model in a dynamic context, this paper derives the subgame perfect equilibria for the general case of heterogeneous interest groups, although it does so at the expense of reducing the dynamics to two active periods. For the case where policy costs and rent-seeking costs are quadratic, the comparative statics are shown to be identical in sign to the comparative statics of the single period model of Becker. In the subgame perfect equilibrium, interest groups only partially ignore the future costs they impose on other interest groups. The reason is that groups behaving strategically recognize that since the force of the opposition increases with the costs to the opposition, that too much success today invites retaliation tomorrow. Thus, rent seeking is dampened by behaving strategically.

The government in this model is assumed to use rent seeking partially as a source of information, though information it responds to only through the avenue of campaign contributions. Thus absent rent seeking, the government's choice of policy may or may not be efficient. (It may still not be allocatively efficient if the interest groups have different costs or organizing their rent-seeking pressure.) However, even if rent seeking is required to provide information, because it is costly, society would wish to minimize the amount of rent seeking required.

It is shown that when interest groups rent seek in a non-cooperative fashion, that if the initial policy is not allocatively efficient, the policy resulting from political pressure group competition will also not likely be allocatively efficient. Even in the event that the policy the government would choose absent of rent-seeking pressure is allocatively efficient, if the interest groups have differences in abilities of producing rent-seeking pressure, the equilibrium policy may not be allocatively efficient. Thus strong versions of Becker's efficient redistribution hypothesis which argue that the policy will be allocatively efficient hold only under very restrictive conditions, as do weak versions which argue that it will necessarily move towards the allocatively efficient equilibrium.

However, when rent seeking is institutionally protected (e.g., by a constitutional requirement that groups can present grievances to the government), then even though allocative efficiency may be unobtainable, a rent-seeking constrained efficient outcome is attainable. If the interest group that wins in the political reallocation fully compensates the losing group, then both groups have an incentive to behave in a socially optimal fashion. This suggests that the Hicks-Kaldor *potential compensation criteria* for public policy needs to be abandoned in the presence of rent seeking.

Notes

1. See Clark, Major, and Mollet (1988) and Memon and Cullen (1992) for discussions of these issues.
2. Other examples from the recent literature include competition between commercial, sport and Alaskan Natives over hunting and fishing rights (Boyce, 1997), competition between the banking, securities, and insurance industries for access to each other's markets (Kroszner and Stratmann, 1998), competition between the crude oil industry and environmentalists over the export of Alaskan crude oil (Splitstoser, 1998).
3. See also Tullock (1980). Tullock's model assumed a prize (e.g., monopoly profits) was being granted in a winner-take-all contest. Rent-seeking expenditures by i increase the odds that i will win. In Becker's model, rent-seeking expenditures increase the *share* of the prize being contested. Becker (1983: 378, footnote 5) also cites several earlier papers in which a Nash equilibrium is assumed in political competition.
4. Linster (1993) considered the effect of Stackelberg competition (i.e., non-simultaneous moves) in a Tullock rent-seeking model. Leininger (1993) derived the conditions under which a unique Stackelberg leader-follower relationship results. Ellingsen (1991) examined a model with sequential moves between rent seekers and found that rent-seeking expenditures by losing groups can reduce the rent seeking by winning groups. His result is based, on part, on strategic behavior considerations. We report a similar finding below. Leininger and Yang (1994) analyzed rent-seeking games in which competitors for a rent can act and react finitely or infinitely often. Linster (1994) derived the cooperative equilibrium to an infinite horizon model using trigger strategies.
5. Most of the papers examining Becker's hypothesis focus on whether the policy selected transfers wealth to a particular group at the lowest cost (his Proposition 4). For example, whether or not the policy involves a direct transfer or a hidden transfer (e.g., Gardner, 1987).
6. In the "takings" literature some authors have argued that compensation should not be paid to landowners, but the logic is that landowners are a concentrated economic group with much at stake, and so should do well in the political arena (see Fischel, 1995: 316–317).
7. This interpretation is consistent with the recent U.S. Supreme Court in *Lucas* v. *South Carolina Coastal Council* (1992: 112 S.Ct. 2886). The Court ruled that the state of South Carolina was required to compensate Lucas for a regulation which prohibited him from developing his property. See Miceli and Segerson (1994) for a discussion of this case and a general discussion of economic criteria (excluding rent seeking) for compensation.
8. It is possible that $x_l \notin [\bar{x}_L, \bar{x}_R]$, but we rule this out in competition with two interest groups. For example in the allocation of hunting or fishing permits it is difficult to imagine a policy more extreme than full allocation to one of the groups. Similarly, with policies such as abortion, it is difficult to conceive of policies more extreme than a complete ban on abortions on one side or freely available abortions on the other.
9. In Becker's model, the status quo x_0 plays no part. However, more formal models of legislatures (e.g., Weingast and Marshall, 1988) recognize that the default policy is the status quo, since any policy must be able to defeat the status quo in a one-on-one pairing.
10. We do not explicitly include voters in this model. However, implicit in our model is the notion that increased expenditures by the interest groups allow the members of the legislature to influence voters (e.g., Peltzman, 1976). In this way, voters may remain "biased" in their perceptions of policy effects.
11. Boyce (1997) argues that if bureaucrats benefit from the rent-seeking activities (e.g., if controversy means larger budgets to gather information), then an agenda controlling

bureaucracy may prefer a policy that maximizes rent seeking. This turns out to be an "all or none" equilibrium, with the group that has the most value for the allocation getting zero share since they are most willing to engage in rent seeking at the margin.

12. Boyce (1998) has shown that this interpretation is consistent with the specifications of (1) given the policy cost functions derived below. In particular, if the policy costs to the two interest groups are $c_R(\bar{x}_R - x_I)$ and $c_L(x_L - \bar{x}_L)$, respectively, as defined below, then a politician will choose the policy according to (1) if the politician's utility is of the form $c_P(x) = c_R(\bar{x}_R = x_R - x_L - x) + c_L(x - x_R + x_L + \bar{x}_L)$. In this case, the policy that minimizes the politician's costs satisfied (1) as a first order approximation. Note that the politician's cost function as defined essentially treats $x_R - X_L$ as the net movement of the policy preferences of the two interest groups. In the event that $x_R > x_L$, the politician treats both groups as having preferred policies located $x_R - x_L$ units in policy space to the right of $\bar{x}_r$ and $\bar{x}_L$.
13. Both Cairns (1989) and Wirl (1994) implicitly assume that $\delta = 1$.
14. An earlier version of the paper considers a more general case in which there was a "scrap value" term that was the sum of future policy costs (so rent seeking only occurred in the first two periods). So long as this policy cost function is constant over time, the results are not substantially affected.
15. Stratmann (1991, 1992) shows that interest groups strategically spend their resources by buying off politicians with the lowest opportunity cost for voting against her constituency.
16. In an earlier version of the paper the cost function parameters were to be period specific. The results reported below do not depend on the assumption that these parameters are constant in each time period.
17. Becker (1983: 380, Corollary to Proposition 1 and note 8) makes a similar point.
18. This is what leads Becker (1983) to conclude that policies will be driven towards the efficient policy: Each interest group faces increasing marginal policy costs as the policy moves away from their preferred policy.
19. A number of economists have tried to explain Tullock's (1989) observation that the rent-seeking levels appear to be less one would expect given the size of the transfers. The strategic effect lowers the rent-seeking level relative to what would occur if agents were behaving dynamically, but not strategically.
20. Recall that Wirl (1994) assumes quadratic objective functions in an infinite time horizon model. The present model is thus comparable to this for the case where each group has identical policy rent-seeking costs. The assumption of homogeneity is not present in this model, but we are not solving an infinite time horizon model.
21. In the natural resource quota allocations example given in the text, let group R get quota x and group L get quota $X - x$, where X is the total number of quotas. Suppose that the value each group places on the marginal quota is $p_i(q_i)$, $i = L, R$, and $q_R = x$ and $q_L = Q - x$, where p_i is i's Marshallian demand for the good. So long as each group places a positive value on the last quota available, the preferred policies are $\bar{x}_R = X$ and $\bar{x}_L = 0$ (i.e., both L and R prefer that *they* get entire quota). Then the AE policy is to allocate quotas such that the marginal benefits are equated across the groups, i.e., at $\hat{x}$, $p_R(\hat{x}) = p_L(\hat{x})$.
22. Boyce (1997), who considers a static (single period) version of this model, addresses the issue of the efficiency of the *method* of redistribution. He argues that the method of allocation (not just who gets a larger share of the pie) was not necessarily efficient. For example, while similar decisions over indigenous peoples' rights for the taking of marine mammals were made in both Alaska and Canada, the rights were specified differently in Canada than in the U.S. In both the indigenous peoples were given exclusive hunting rights to marine mammals such as polar bears. However, Canadians are allowed to transfer

the right to hunt a particular animal to sport hunters. Such trades are not allowed in the U.S.

23. Note that it is assumed that the policy costs are equal in the proposition. However, as we noted above, it is the ratio of rent-seeking costs to policy costs that matters. A more general proposition can be shown where the result is that $\theta_R/\phi_R << \theta_L/\Phi_L$ is what is required.
24. Becker (1983: 382) recognizes this possibility when he states, "Proposition 2 implies some 'tyranny of the status quo' because the political sector would not interfere much with the private distribution of income even when groups benefiting from the interference are better politically organized than the groups harmed, *as long as they are not much better organized*", (emphasis added).
25. The First Amendment of the U.S. Constitution states "Congress shall make no law ...abridging the freedom of speech ... or the right of the people ... to petition the Government for a redress of grievances". This has been interpreted by the courts to mean that campaign contributions by individuals may be limited (because of corruption implications), but that campaign expenditures by politicians cannot be limited (*Buckley* v. *Valeo* 424 U.S. 1, 1976). See Levit (1993) for a discussion of this case.
26. Thus it is assumed that institutional rigidity causes it to be costly to move to $\hat{x}$, say at cost $w_i(x_0 - \hat{x})$ for $x_0 > \hat{x}$. These costs could include the information acquisition costs, the costs of rewriting the regulations, or the costs of raising awareness of the public.
27. It might be thought that the optimal liability can be obtained directly by comparing the equilibrium first-order conditions for the RSCE policy and for the non-cooperative equilibrium. In this case, the argument below the subgame perfect equilibrium conditions suggest that since the strategic behaving rent seeker already partially internalizes some of the costs he imposes on the losing group that the optimal liability should be less than full compensation of the loser. However, this is incorrect, as will be shown.
28. Note also that the information requirement here is no different from that to conduct a cost-benefit analysis. That is, all that is required is information about the marginal value L and R place on different levels of the policy. This is identical to the information needed to conduct a potential Pareto improvement test.

Mathematical appendices

A. Proof of the Lemma

The total differential of (6) and (7) is

$$\begin{pmatrix} c''_R + w''_R & -c''_R \\ -c''_L & c''_L + w''_L \end{pmatrix}\begin{pmatrix} dx_2^R \\ dx_2^L \end{pmatrix} =$$

$$\begin{pmatrix} c'(\overline{x}_R - x_2) & -w(x_2^R) & 0 & 0 \\ & & & \\ 0 & 0 & c'(x_2 - \overline{x}_L) & -w'(x_2^L) \end{pmatrix}\begin{pmatrix} d\Phi_R \\ d\theta_R \\ d\Phi_L \\ d\theta_L \end{pmatrix} + \begin{pmatrix} -c''_R \frac{\partial x_2}{\partial x_0^2} \\ \\ c''_L \frac{\partial x_2}{\partial x_0^2} \end{pmatrix} dx_0^2, \tag{A.1}$$

where the derivative of x_2 with respect to x_0^2 is obtained from (2). By applying Cramer's Rule we obtain the following:

$$\frac{\partial x_2^i}{\partial \phi_2^i} = \frac{c'(z_i)[c''_i + w''_i]}{|\,H\,|} > 0, \qquad \text{for } i = L, R, \tag{A.2}$$

$$\frac{\partial x_2^i}{\partial \theta_2^i} = \frac{-w'(x_2^i)[c''_i + w''_i]}{|\,H\,|} < 0, \qquad \text{for } i = L, R, \tag{A.3}$$

$$\frac{\partial x_2^i}{\partial \phi_2^j} = \frac{c'(z_i)c''_i}{|\,H\,|} > 0, \qquad \text{for } i = L, R, i \neq j, \tag{A.4}$$

$$\frac{\partial x_2^i}{\partial \theta_2^j} = \frac{-w'(x_2^i)c''_i}{|\,H\,|} < 0, \qquad \text{for } i = L, R, i \neq j, \tag{A.5}$$

$$\frac{\partial x_2^R}{\partial x_0^2} = \frac{-c''_i w''_i}{|\,H\,|} < 0, \qquad \text{for } i = L, R, i \neq j, \tag{A.6}$$

$$\frac{\partial x_2^L}{\partial x_0^2} = \frac{c''_i w''_i}{|\,H\,|} > 0, \qquad \text{for } i = L, R, i \neq j, \tag{A.7}$$

where $x_0^2 = \delta x_0 + \delta(x_1^R)$, $z_t^R = \overline{x}_R = x_t$, $z_t^L = x_t - \overline{x}_l$, and, where $|\,H\,|$ is the determinant of the Jacobian of the system of Equations (6) and (7),

$$|\,H\,| = V_{RR}^R V_{LL}^L - V_{RL}^R V_{LR}^L = (c''_R + w''_R)(c''_L + w''_L) - c''_R c''_L > 0. \tag{A.8}$$

The lemma is shown by noting that the signs of the derivative is identical in each time period. Q.E.D.

B. Proof of Proposition 1

Differentiate the system of first-order conditions (14) and (15) with respect to x_1^L and x_1^R:

$$\begin{aligned} V_{RR}^{*R} = &\ \{c_R''(\cdot) + w_R''(x_1^R)\} + \{\delta^2\beta c_R''(\cdot)[1-\phi^L][1-\phi^R-\phi^L]\} \\ &+ \{\delta\beta c_R'(\cdot)\phi_R^R\} \equiv a_R + b_R + e_R, \end{aligned} \tag{B.1}$$

$$V_{RL}^{*R} = -\{\delta^2\beta c_R''(\cdot)[1-\phi^L][1-\phi^R+\phi^L]\} - \{\delta\beta c_R'(\cdot)\phi_L^R\} \equiv -b_R - f_R, \tag{B.2}$$

$$\begin{aligned} V_{LL}^{*L} = &\ \{c_L''(\cdot) + w_L''(x_1^L)\} + \{\delta^2\beta c_L''(\cdot)[1-\phi^R][1-\phi^R-\phi^L]\} + \{\delta\beta c_L''(\cdot)\phi_L^L\} \\ &\equiv a_L + b_L + e_L, \end{aligned} \tag{B.3}$$

$$V_{LR}^{*L} = -\{\delta^2\beta c_L''(\cdot)[1-\phi^R][1-\phi^R+\phi^L]\} - \{\delta\beta c_L'(\cdot)\phi_R^L\} \equiv -b_L - f_L. \tag{B.4}$$

where $\phi_j^i \equiv \partial\phi^i/\partial x_2^j$, and the letters $a_i, b_i, \ldots, f_i$, refer to each consecutive term in the "{}" brackets, respectively, and where the period is determined by the β^{t-1}, $t = 1, 2, 3$ term. The necessary condition for an anterior solution to each group's cost minimization objective is that $V_{RR}^{R*} > 0$ and $V_{LL}^{L*} > 0$. Assume that these conditions hold. The stability condition (16) may be rewritten as:

$$\left|\frac{b_R + f_R}{a_R + b_R + e_R}\right| < \left|\frac{a_L + b_L + e_L}{b_L + f_L}\right| \tag{B.5}$$

Since $e_R = e_L = f_R = f_L = 0$ when $c_i''' = w_i''' = 0$, (B.5) collapses to:

$$\left|\frac{b_R}{a_R + b_R}\right| < \left|\frac{a_L + b_L}{b_L}\right|, \tag{B.6}$$

which is satisfied since each a_i and b_i term is greater than zero. Q.E.D.

C. Proof of Proposition 2

In the proof, we separate out the effect of a change in parameter Φ_R or θ_R and Φ_L or θ_L in periods one and two. The results of the lemma are obtained by noting that the signs are the same for each period. Furthermore, we consider only changes with respect to the parameters for group R, assuming the parameters for group L are equal to unity in both periods and for both cost functions (since only differences in the ratio θ_R/Φ_R to θ_L/Φ_L matter). Assuming quadratic cost functions, differentiating (14) and (15) with respect to Φ_t and θ_t (the cost function shifters on c_R and w_R, respectively, for period t) yields,

$$V^{*R}_{R\theta_1} = -c'_R(\overline{x}_R - x_1) < 0, \tag{C.1}$$

$$\begin{aligned} V^{*R}_{R\theta_2} = &\ -\delta\beta c'_R(\cdot)[(1-\phi^L) + \Phi_2\phi^L_\Phi \\ &= -\delta\beta c'_R(\cdot)(1-\phi^L) - \delta\beta c'_R(\cdot)(\theta_2 c''_R w''_L c''_L w''_R/H^{*2}) < 0, \end{aligned} \tag{C.2}$$

$$V^{*R}_{R\theta_1} = w'(x^R_1) > 0, \tag{C.3}$$

$$V^{*R}_{R\theta_2} = \delta\beta\phi_2 c'_R(\overline{x}_R = x_1)\phi_2 c''_R w''_L c''_L w''_R/H^* > 0, \tag{C.4}$$

$$V^{*R}_{L\theta_1} = 0, \tag{C.5}$$

$$V^{*L}_{L\Phi_2} = \delta\beta c'_L(x^*_2 - \overline{x}_L)\phi^R_{\Phi_2} = \delta\beta c'_L(x^*_2 - \overline{x}_L)\left(\frac{c''_R w''_R w''_L(c''_L + w''_L)}{H^{*2}}\right) > 0, \tag{C.6}$$

$$V^{*L}_{L\theta_1} = 0, \tag{C.7}$$

$$V^{*L}_{L\theta_2} = -\delta\beta c'_L(x^*_2 - \overline{x}_L)\phi^R_{\theta_2} = -\delta\beta c'_L(x^*_2 - \overline{x}_L)\left(\frac{c''_R w''_R w''_L(c''_L + w''_L)}{H^{*2}}\right) < 0. \tag{C.8}$$

By Cramer's rule,

$$\frac{\partial x^R_1}{\partial \Phi_1} = \begin{vmatrix} -V^{*R}_{R\Phi_1} & V^{*L}_{LR} \\ -V^{*L}_{L\Phi_1} & V^{*L}_{LL} \end{vmatrix} /H^* = (-V^{*L}_{LL}V^{*R}_{R\Phi_1})/H^* > 0, \tag{C.9}$$

where $H^* = V^{*R}_{RR}V^{*L}_{LL} - V^{*R}_{RL}V^{*L}_{LR} > 0$ [see (B.6)]. Similarly,

$$\frac{\partial x^R_1}{\partial \Phi_2} = (-V^{*R}_{R\Phi_2}V^{*L}_{LL} + V^{*L}_{LR}V^{*L}_{L\Phi_2})/H^* > 0, \tag{C.10}$$

$$\frac{\partial x^R_1}{\partial \theta_1} = (-V^{*L}_{LL}V^{*R}_{R\theta_1}/H^* > 0, \tag{C.11}$$

$$\frac{\partial x^R_1}{\partial \theta_2} = (-V^{*R}_{R\theta_2}V^{*L}_{LL} + V^{*L}_{LR}V^{*L}_{L\theta_2})/H^* > 0. \tag{C.12}$$

For x^L_1, the comparative statics are:

$$\frac{\partial x^L_1}{\partial \Phi_1} = -V^{*R}_{RR}V^{*L}_{L\Phi_1} + V^{*R}_{RL}V^{*R}_{R\Phi_1} > 0. \tag{C.13}$$

$$\frac{\partial x^L_1}{\partial \Phi_2} = -V^{*R}_{RR}V^{*L}_{L\Phi_2} + V^{*R}_{RL}V^{*R}_{R\Phi_2} > 0. \tag{C.14}$$

$$\frac{\partial x^L_1}{\partial \theta_1} = -V^{*R}_{RR}V^{*L}_{L\theta_1} + V^{*R}_{RL}V^{*R}_{R\theta_1} < 0. \tag{C.15}$$

$$\frac{\partial x_1^L}{\partial \theta_2} = -V_{RR}^{*R} V_{L\theta_2}^{*L} + V_{RL}^{*R} V_{R\theta_2}^{*R} < 0. \tag{C.16}$$

The claims regarding a change in the Φ_t or θ_t parameters in *both* periods (i.e., $\Phi_1 = \Phi_2 = \Phi$, or $\theta_1 = \theta_2 = \theta$) can be shown by noting that $V_{L\phi}^{*L} = V_{L\Phi_1}^{*L} + V_{L\Phi_2}^{*L}$, and so on. Since the sign of each $V_{L\phi}^{*L}$ term is identical, the sign of $\partial x_2^i / \partial \Phi$ equals the sign of $\partial x_2^i / \partial \Phi_t$, and similarly for the θ parameters. Q.E.D.

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