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INFLUENCE IN DECLINE: LOBBYING IN CONTRACTING INDUSTRIES

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ABSTRACT

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Recent empirical work suggests that declining industries lobby more successfully for policy concessions than do growing industries. This paper presents a novel and simple explanation for this phenomenon. It is shown that an industry in decline is constrained in its ability to raise revenue through production and therefore has a greater incentive to protect profits by lobbying for more favorable treatment. However, greater lobbying only translates into policy concessions if the lobbying technology satisfies certain conditions. Accordingly, the paper seeks to determine whether the conventional models of government behaviour are consistent with these restrictions. The results suggest that declining industries are most successful at gaining concessions when an incumbent government does not confront an immediate election (as in the political support models). In contrast, where policies are determined in an election context, the outcome is more uncertain and depends on certain critical parameters. The results appear to be broadly consistent with observed behaviour.

Key words: Lobbying, Political Influence, Protection

JEL Codes: A10, H1, Q28

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NON-TECHNICAL SUMMARY

A substantial body of empirical literature suggests that declining industries are generally more successful at forming lobby groups and securing policy concessions from governments, than are industries in growing sectors of the economy. Theoretically, this finding is somewhat paradoxical. Growing industries with more resources at their disposal, ought to be better placed to lobby effectively and garner favorable treatment. This paper presents a novel and simple explanation for this phenomenon. It is shown that an industry in decline is constrained in its ability to raise revenue through production and therefore has a greater incentive to protect profits by lobbying for more favorable treatment. However, greater lobbying only translates into policy concessions under certain political conditions. It is demonstrated that declining industries are most successful at gaining concessions when an incumbent government does not confront an immediate election. In contrast, where policies are determined in an election context, the outcome is more uncertain and depends on the level of support for the industry in the wider electorate. The results therefore suggest that a temporal pattern of lobbying is likely to be observed over the political cycle.

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I. Introduction:

A substantial body of empirical literature suggests that declining industries are generally more successful at forming lobby groups and securing policy concessions from governments, than are industries in growing sectors of the economy.[1] Theoretically, this finding is somewhat paradoxical. Growing industries with more resources at their disposal, ought to be better placed to lobby effectively and garner favorable treatment.

Recent attempts to explain this asymmetry in the lobbying success of rising and declining sectors focus upon the consequences of entry in a growing industry. For instance, Baldwin (1993) suggests that firms in industries with rising demand have less incentive to lobby for concessions, since the resulting increased profits would be eroded by new entrants. In contrast, Grossman and Helpmann (1996) argue that it is the potential for free riding that makes lobbying more difficult in an expanding industry. Specifically, in a growing industry new entrants will benefit from the lobbying efforts of incumbents, without contributing to the costs of lobbying. This paper seeks to augment the existing theoretical literature by outlining a hitherto unrecognised mechanism which explains why declining industries lobby more successfully.

The analysis is based on a simple framework which deals with the case of a polluting industry which lobbies for less stringent environmental regulations. Consider a symmetric homogenous good duopoly, which emits pollution emissions. The firms are assumed to interact for a finite number of periods over which industry demand varies. Industry growth and contraction is represented through either monotonically rising or falling demand. These variations in demand are assumed to be common knowledge to all players.

Pollution emissions generated by firms adversely affect a widely dispersed subset of individuals in the economy. The government regulates pollution levels through a tax levied on emissions. Lobbying is introduced in to this framework by drawing on the familiar assumption that a self-interested government (or political party) seeks to maximise its chances of remaining in office. Since winning an election, depends on the funds available for campaigning, the government is assumed

[1] The lobbying prowess of declining industries appears to be one of the more robust empirical findings which emerge from both inter-industry studies of lobbying (El-Agraa (1987)) and more specific industry studies. Some examples cited in the literature include the policy concessions and protection given to the agricultural sector in developed countries (Anderson (1995)), textiles in the USA (Dixit and Londregan (1995)), iron and steel and forestry (Mitchell (1998)).

to care about the political contributions received from lobby groups. This allows special interest groups to influence policy decisions by making political donations which are linked to the policies proposed by the government. Accordingly we assume that firms seek to minimise the tax burden, by forming a lobby group which offers political contributions to the government. The contributions are contingent on the emission tax policy implemented by the government. Since the analysis focuses upon firms' lobbying incentives, the role of an opposing environmental lobby group is suppressed. This may be justified by assuming that pollution damage is so widely dispersed that it does not induce the affected individuals to form a lobby group. In the parlance of Baron (1994) this represents a *particularist* policy, where the benefits of a tax concession are concentrated, while the environmental costs are insufficient to induce individuals to form an opposing lobby.

The analysis is based on a three-stage game, which is solved sequentially. The first stage represents the political equilibrium in which firms' offer the government a contribution schedule, which is contingent upon the tax rate, given knowledge of demand variations. The government then sets the tax rate which maximises its payoffs. In the next stage firms interact in a Cournot game, given knowledge of the tax rate and changes in demand.[2]

Within this framework we explore the impact of variations in demand on firms' incentives to contribute to the lobby group. It is demonstrated that under certain circumstances, the opportunity costs of lobbying are lower when demand is depressed so that there is less incentive to free ride on lobby group contributions. Intuitively, this reflects the fact that when demand is low the ability to raise profits through the output market is limited. Hence, firms have a greater incentive to protect their profits by lobbying for lower taxes. Political contributions therefore rise when demand is expected to decline. If the tax rate set by the government is decreasing in the level of political contributions, firms in declining sectors will secure lower taxes.

This outcome depends critically upon the manner in which the payoffs to lobbying vary with political contributions. It is shown that firms in declining industries secure greater protection, only if the tax rate set by the government declines with contributions, at a decreasing rate. Firms therefore experience diminishing returns to their political contributions. This, of course, implies that the tax schedule is concave in contributions. To see why concavity is essential to the results, consider an industry with growing demand. Clearly, with rising demand the rewards from production will be increasing over time, while concavity of the tax schedule implies that the payoffs from lobbying exhibit diminishing returns. It follows, that firms in growing sectors will have less incentive to expend resources on lobbying, than those in declining sectors.

Since diminishing returns to political contributions (i.e. concavity of the tax schedule) are central to the results, it is clearly of interest to determine the circumstances under which this condition holds. Accordingly, in Section IV we explore the properties of the tax schedule which results from the two main competing models of government behaviour.

[2] The tax rate having been set in the prior political equilibrium is assumed to be invariant over the output stage.

The first model is based on the *political support* approach pioneered by Grossman and Helpman (1994). In this framework, an incumbent government is assumed to increase its chances of re-election by maximising a weighted sum of political donations and social welfare. Political contributions from lobby groups influence the government's decisions, because of their many uses, including funding campaigns, retiring debt from past elections and deterring rivals. In what follows, we demonstrate that under very general conditions the political support model yields a tax schedule which is concave in contributions. Intuitively, this reflects the fact that the objective function being maximised by the government is a weighted sum of political donations and social welfare. As the emissions tax rate declines in response to political donations, the welfare loss from pollution rises at an increasing rate, thereby mitigating the government's desire to further lower taxes.

We also consider a simplified model of government behaviour based upon the *political competition* approach. Under this framework, two rival political parties seek to maximise votes in an electorate which is partitioned into distinct sets consisting of informed and uninformed voters. The informed voters have full knowledge of each party's policies. As is well established, this induces both parties to present policies which converge to the preferences of the median voter (Laffont (1989)). However, the presence of an uninformed consitituency alters the partys' vote maximising strategies. It is assumed that the uninformed voters are persuaded to support a particular party through campaign advertisements. A novel aspect of the analysis is the introduction of an explicit model of political advertising which draws on the Industrial Organisation literature. The donations received from lobby groups are used to fund advertising messages which are sent to the uninformed voters. In the analysis we identify the conditions under which this generates a concave tax schedule and thus induces firms in declining industries to lobby more aggressively. The results reveal that much depends on the effectiveness of advertising. If advertising costs are not excessively large, then the advertising campaign succeeds in capturing a sufficient proportion of the uninformed votes. If this compensates for the loss of support from the informed electors, the party supported by the firm lobby group has an incentive to lower taxes below the level preferred by the median voter. The resulting tax schedule is shown to be concave in contributions.[3] This result suggests that with political competition, the declining industries which obtain the greatest concessions are those which gain sufficient support from the wider (uninformed) community. Thus arguments for concessions are typically couched in terms of broader objectives such as employment effects, regional development, etc.

The remainder of this paper is organised as follows. Section II outlines the basic structure of the model, while Section III deals with the incentives for firms to contribute to a lobby group. Section IV analysis two political equilibria; one corresponding to the political support approach and the other the political competition framework. Finally, Section V concludes the paper.

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[3] This is because the loss of votes from the informed electorate constrains the ability of the party to lower taxes.

II The Model

Consider a symmetric homogenous good duopoly where firms labeled i and j interact over a known finite period of time. Industry demand in period $\tau \in [1, T]$ is represented by $Q_\tau(P)$ and has the following properties.

Assumption 1: $Q_\tau(P)$: $\Re_+ \rightarrow \Re_+$ is a continuous bounded function, $\forall\ \tau \in [1, T]$.
Assumption 2: There exists a $\tilde{P}_\tau$ such that $Q_\tau(P) = 0$ if and only if $P \geq \tilde{P}_\tau$, $\forall\ \tau \in [1, T]$.
Assumption 3: $Q_\tau(P)$ is decreasing in P $\forall$ $P \in [0, P_\tau^*]$, $\forall\ \tau \in [1, T]$.

For a one-shot Cournot-Nash equilibrium to exist, it must be assumed that a firm's marginal revenue does not rise with its rival's output. This condition implies (see Shapiro (1990)):

Assumption 4: $\dfrac{\partial P(Q)}{\partial q_i} + q_i \dfrac{\partial^2 P(Q)}{\partial {q_i}^2} < 0$; where q_τ^f = output of firm f (f =i, j)

To investigate the impact of anticipated growth or decline in the industry we impose a particular structure upon the movement of demand over time. Let $Q_\tau(P) \succ Q_{\tau+1}(P)$ denote that $\tilde{P}_\tau \geq \tilde{P}_{\tau+1}$ and $Q_\tau(P) > Q_{\tau+1}(P)$ $\forall$ $P \in (0,\ \tilde{P}_\tau)$[4].

> *Assumption 5*: If the industry is experiencing growth in demand then:
> $Q_T(P) \succ Q_{T-1}(P) \succ \ldots\ldots\ldots.. \succ Q_1(P)$.
> Conversely, if the industry is experiencing a contraction in demand then:
> $Q_1(P) \succ Q_2(P) \succ \ldots\ldots\ldots.. \succ Q_T(P)$.

This implies that demand is either consistently rising or declining over time. It is supposed that these changes in demand are known to all players. Hence, we model a growing (contracting) industry as one with rising (falling) demand.

> *Assumption 6*: There is neither entry nor exit in the industry.

This assumption implies that the variations in demand are not so large that they induce entry or exit of firms.[5]

Having specified the basic assumptions relating to demand, we now outline the remaining structure of the model. Production of good Q_τ results in pollution emissions, denoted E_τ, which adversely affect a subset of individuals termed environmentalists. The pollution damage suffered by environmentalists is defined by the damage function $D_\tau(E_\tau)$, with $\partial D_\tau/\partial E > 0$ and $\partial^2 D_\tau/\partial E^2 > 0$. Pollution emissions which are related to production levels are given by:

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[4] This implies that we allow for both a shift in demand and a pivoting of the demand curve.
[5] As noted by Scherer (1980) this assumption may be reasonable for many industries in the manufacturing sector which have been able to endure secular movements in demand without structural changes.

$$E_\tau = \theta Q_\tau(P), \qquad (1)$$

where θ is the emission coefficient of output.[6]

In order to regulate pollution levels, the government levies a tax on pollution emissions at a rate t. The tax rate is determined in stage 1 in the political equilibrium and is held constant over the duration of the output stage of the game. As is well known, emission taxes provide firms with an incentive to abate emissions. Following Conrad (1993) we assume that the cost function denoted $H^f(q_\tau^f, c, v(a^f,), t)$ (for f = i, j, i ≠ j) contains three distinct components: the production costs (c), the cost of abating emissions $v(a^i)$ and the tax paid on unabated emissions (t):

$$H_\tau^f(q_\tau^f, c, v(a_\tau^f)) = [c + \{t(1 - a_\tau^f) + v(a_\tau^f)\}\theta]q_\tau^f \qquad (f = i,j); \ (\tau = 1,..T)$$
(2a)

where: c is the unit cost of production; a^f is the degree of pollution abatement activity; $v(a^f)$ is the unit cost of pollution abatement which depends on the degree of abatement activity undertaken by firm f (a^f); t is the tax on unabated emissions and θ is the emission coefficient resulting from output q^f. We assume that: $c_a^a > 0, c_{aa}^a > 0$.

In the absence of lobbying, the profits of firm f, f=i,j, in any period $\tau \in [1,T]$ are defined as:

$$\Pi^i = P(Q)q^i - C^i(q^i, c^i, t) \qquad (f = i,j)\ (\tau = 1,..T) \qquad (3)$$

We begin by solving the final stage of the game in which output levels are determined. Taking the tax and contribution schedules as given, equilibrium output in each period is given by the solution to the first order condition:

$$P(Q) + \frac{\partial P}{\partial q^i} q^i - c^o = (t(1 - a_\tau^f) + v(a_\tau^f)a_\tau^f)\theta \qquad (f = i,j)\ (\tau = 1,..T)$$
(4c)

Let $q_\tau^n = q_\tau^i = q_\tau^j$ denote the solution to (4c) in a symmetric Cournot equilibrium[7].

Clearly, firms will choose abatement levels to minimise costs, given knowledge of the emission tax rate (t) and abatement costs (v). Thus, for a given level of output, abatement levels are determined by the solution to[8]:

$$\underset{a}{\text{Min}}\ H_\tau(q_\tau^n, c, v(a_\tau,), t) \qquad (5a)$$

[6] We implicitly assume that emissions and the consequent damage is non-cumulative in its impact.

[7] Given the structure of the problem, by backward induction the solution in each period τ = 1,..,T is defined by the one-shot Nash equilibrium of the game.

[8] Since we are dealing with symmetric equilibria, firm superscripts are ignored.

The first-order condition is:

$$\frac{dC^i}{da} = c^a_a a + c^a - t = 0 \qquad (\tau = 1,..,T) \qquad (5b)$$

Equation (5b) summarises the familiar result that firms abate emissions up to the point where the marginal costs of abatement ($\frac{dC^i}{da} = c^a_a a + c^a - t$) equal the tax rate (t). Moreover, total pollution emissions in each period are now given by:

$$E_\tau = (1 - a^i_\tau)\theta q^i_\tau + (1 - a^j_\tau)\theta q^j_\tau \qquad (\tau = 1,..,T) \qquad (5c)$$

For completeness Lemma 1 outlines a useful property of the duopoly. The proofs are relegated to the Appendix.

Lemma 1 $\frac{dq^n}{dt} < 0, \frac{da^i}{dt} > 0$.

Lemma 1 informs us that firms respond to higher emission taxes by lowering output and raising abatement levels.

III Lobby Group Contributions

Having determined the equilibrium in the output stage of the game we now turn to the political equilibrium in the preceding stage. We begin by specifying the individually rational contribution levels of each firm to the lobby group, given its rival's contribution.

Since taxes adversely affect profit levels, firms have an incentive to form themselves into a lobby group to persuade the government (or a political party) to lower the tax burden. Thus, it is assumed that in the contributions stage of the game the firms jointly offer the government contributions (C(t)) as an inducement to lower the tax rate. It is supposed that the contribution schedule is offered before the output game commences and that the resulting tax rate is therefore held constant over the output stage. The only restriction placed on the contribution schedule is that contributions are declining in t and are thus contingent on the tax rate set by the government (i.e. $dC(t)/dt < 0$). Given this not unreasonable assumption, we explore the conditions under which declining demand is likely to induce firms to increase their lobbying contributions.

Without loss of generality, let the output stage extend over 2 periods (i.e. T = 2). Then, given the contribution of a rival firm k = i, j ($i \neq j$), the individually rational contribution of firm $f \neq k$ to the lobby group is defined by:

$$C^f(t) \in \text{Argmax } \Pi^n_1 + \delta\Pi^n_2 + C^f(t) \qquad (6a)$$

Where: δ = discount rate, $C^f(t)$ = contribution of firm $f \neq k$ (f, k = i,j; $i \neq j$)

The associated first order condition is[9]:

$$-\theta\frac{dt}{dC^f}((1-a_1)q_1^n+\delta(1-a_2)q_2^n)-1=0 \qquad (6b)$$

Thus, each firm contributes up to the point where the marginal benefits to the firm resulting from a lower tax, equals the marginal cost of the contribution. Clearly, the marginal benefits accruing to a firm from a reduction in taxes depends, on amongst other things, the level of demand. It follows that contributions are likely to vary with demand. Proposition 1 below outlines with accuracy the circumstances under which falling demand induces firms to increase their contributions.

Define $C(t) = C^i(t) + C^j(t)$. Let $\overline{C}(t)$ be the equilibrium industry contribution which satisfies (6b) when there is growing demand, and let $\underline{C}(t)$ be the equilibrium industry contribution which satisfies (6b) when there is falling demand. Then:

Proposition 1: $\underline{C}(t) > \overline{C}(t)$, iff $\frac{d^2t}{dC^2} < 0$.

Proof: Let $(1-a_2)\overline{q}_2^n\theta=\overline{E}_2$ be the level of emissions in period 2 under growing demand and let $((1-a_2)\underline{q}_2^n\theta=\underline{E}_2$ be the level of emissions in period 2 under declining demand. Then the FOCs under growing and falling demand respectively are:

$$-\frac{dt(\overline{C})}{dC}(E_1+\delta\overline{E}_2)-1=0 \qquad (I)$$

$$-\frac{dt(\underline{C})}{dC}(E_1+\delta\underline{E}_2)-1=0 \qquad (II)$$

Since $\overline{Q}_2>\underline{Q}_2$ then $(E_1+\delta\overline{E}_2) > (E_1+\delta\underline{E}_2)$, thus (I) and (II) requires that

$$-\frac{dt(\overline{C})}{dC} < -\frac{dt(\underline{C})}{dC} \qquad (III)$$

Since $\frac{dt(C)}{dC}$ <0[10] it follows that (III) holds iff $\frac{d^2t(C)}{dC^2}$ < 0. Which implies that $\overline{C}<\underline{C}$.

Q.E.D

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[9] We impose the natural assumption in this context of Cournot conjectures with respect to a rival's contribution (i.e. $\partial C^i(t)/\partial C^j(t) = 0$ $(i \neq j)$). This assumption is widely employed in determining the Nash equilibrium in such contexts.

[10] If this were not the case, then from (6b) a corner solution obtains with zero contributions. Intuitively, if higher contributions do not yield any benefits to firms in the form of lower taxes, they have little incentive to lobby.

Proposition 1 reveals that the political contributions of a declining industry exceed those of an industry facing rising demand, only if the tax schedule set by the government is *concave* in contribution levels (i.e. $\frac{d^2 t(C)}{dC^2} < 0$). This, of course, implies that taxes decline with contributions at a diminishing rate and firms therefore experience diminishing returns to their political contributions. Intuitively, when demand is low the ability to raise profits through the output market is limited. Hence, firms have a greater incentive to protect their profits by lobbying for lower taxes. Stated differently, the opportunity costs of lobbying are lower when demand is depressed, so that there is less incentive to free ride on lobby group contributions. Political contributions therefore rise when demand is expected to decline. Moreover, since $dt/dC < 0$, then firms in declining industries will secure lower taxes.

This result relies critically on the unsubstantiated assumption that the tax schedule is concave in contributions. While this restriction may appear to be reasonable, for completeness it is necessary to explore whether the conventional models of government behaviour generate such a tax schedule. This issue is discussed in greater detail in the following Section.

IV The Political Equilibrium

In this Section we consider the tax schedule which results from two alternative models of government behaviour. The first is based on the *political support* approach pioneered by Grossman and Helpman (1994), and the other the usual *political competition* framework.

(a) Political Support:

In the political support model, an incumbent government is assumed to have some measure of flexibility in making policy choices. The government is assumed to value both social welfare and political contributions (Grossman and Helpman (*op cit*)). Political contributions are desired because of their many uses, such as funding campaigns, deterring rivals, etc. Contributions of each firm to the lobby group are defined by the solution to the first-order condition in (6b) and are contingent upon the tax rate chosen by the government.

Social welfare gross-of contributions, is given by the sum of profits, consumers' surplus, pollution tax revenues and the damage suffered from pollution emissions:

$$W(t) \equiv \int_0^{Q^c} P(Q^c)dQ - qtQ^c - D(E) + qtQ^c \quad (7a)$$[11]

where $Q = q^i + q^j$ is industry output.

For future reference we define the welfare maximizing level of emission taxes:

[11] Since we are dealing with symmetric equilibria, firm superscripts are ignored for notational convenience.

$$t^{w} \in \text{Argmax } W(t) \qquad (7b)$$

Following Grossman and Helpman (*op cit*), the government's objective function is assumed to be given by a weighted sum of political contributions and social welfare.

$$G(t) = C(t) + \alpha W(t) \qquad (7c)$$

Where: $C(t) = C^{i}(t) + C^{j}(t)$ are political contributions, α is the weight given to aggregate social welfare relative to political contributions.

A subgame perfect Nash equilibrium for this game is a set of contribution schedules, for the lobby group and a tax policy t*, such that: *(i)* the contribution schedule is feasible; (*ii*) the policy t* maximizes the government's welfare, $G(t)$, taking the contribution schedules as given.

From Lemma 2 of Bernheim and Whinston (1986) the following necessary conditions yield a subgame perfect Nash equilibrium {C(t*),t*}:

$$t^{*} \in \text{Argmax } G(t) = C(t) + \alpha W(t); \qquad (SI)$$
$$t^{*} \in \text{Argmax } \pi_i^c(t) + \pi_j^c(t) + G(t) \qquad (SII)$$

Condition (SI) asserts that the equilibrium tax t* must maximize the government's payoff, given the contribution schedules offered by the lobby group. Condition (SII) requires that t* must also maximize the joint payoff of each lobby group and the government. If this condition is not satisfied, the lobby group will have an incentive to alter its strategy to induce the government to change the tax rate, and capture close to all the surplus. Maximizing (SI) - (SII), and performing the appropriate substitutions, reveals that in equilibrium the contribution schedule of the lobby group satisfies:

$$\frac{\partial(\pi_i^c(t) + \pi_j^c(t))}{\partial t} = \frac{\partial S^{*}(t^{*})}{\partial t}. \qquad (8)$$

Equation (8) informs us that in equilibrium, the change in the lobby group's contribution equals the effect of the tax on the payoffs of the lobby group. Thus, as noted by Grossman and Helpman (1994), the political contribution schedules are locally truthful. As in Bernheim and Whinston (1986), this concept can be extended to a contribution schedule that is globally truthful. This type of schedule accurately represents the preferences of the special interest group at all policy points.

Grossman and Helpman further demonstrate that with one lobby group, the level of political contributions is given by the difference in social welfare when the tax is set at the welfare maximising level (t^{w}) and at the political equilibrium (t*):

$$C(t) = \alpha(W(t^{w}) - W(t^{*})) \qquad (9)$$

Where $W(t^w)$ is welfare at the welfare maximising tax rate t^w and $W(t^*)$ is welfare when the tax is set at t^*.

Observe that the lobby group exactly compensates the government for the welfare loss arising from a decline in the tax rate. The welfare loss is weighted by the factor α to adjust for its importance in the government's objective function.

Having defined the equilibrium level of contributions, we now explore the properties of the implied tax schedule. In the Appendix it is demonstrated that when the tax rate set by the government is declining in contribution levels, then the resulting equilibrium tax schedule must be concave in contribution levels. This result is summarised in the following proposition.

Proposition 2: If $\frac{dt}{dC} < 0$ then $\frac{d^2t}{dC^2} < 0$.

Proof: See Appendix.

Proposition 2 reflects the fact that the government sets the tax rate that maximises a weighted sum of political contributions and social welfare. As the tax rate declines in response to higher donations, the welfare loss from pollution rises at an increasing rate[12]. This in turn mitigates the government's desire to further lower taxes. Combined with Proposition 1, this result implies that the political support model generates a tax schedule which induces firms in declining industries to lobby more than those in growing sectors. As a result these firms secure greater policy concessions. This finding implies that when a government is unconstrained by electoral competition, declining industries are likely to gain greater support.

(b) Political Competition[13]*:*

We now outline a simplified model of political competition between two parties labeled x and y. To investigate the impact of electoral competition on industries the model focuses on the role of a single firm lobby group which is allied to one of the parties. Without loss of generality let the firm lobby group contribute funds to party x. Following the existing literature it is assumed that electoral competition is based on a single policy dimension – the emission tax rate. There are a continuum of voters with the total number normalised to unity. Voters are of two types. A proportion $(1 - \lambda)$ are perfectly informed about policies and their consequences, while λ are uninformed and are thus influenced by campaign advertisements.

The preferences of informed voters are uniformly distributed over the policy space and represented by the usual quadratic utility function:

$$Un = (t_n - t_s)^2 \qquad (s = x, y) \qquad (10)$$

Where: t_s is the tax proposed by party s = x, y; t_n is the ideal point of voter n

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[12] This reflects the concavity of W in Q.

[13] The model outlined here is similar to that of Baron (1994).

The informed voters will vote for the party whose tax rate is closest to their ideal point. The electoral pressures which result, are the same as those of the familiar median voter theorem and lead to a convergence of tax rates to the preferences of the median voter. For future reference define the midpoint as:

$$\mu = (t_x + t_y)/2 \qquad (11)$$

It can readily be shown that those with ideal points to the left (right) of μ will vote for party x (party y).[14]

Uninformed voters have no knowledge of the parties policies or their effects. They receive messages from those parties which obtain lobby group funding. The advertisements are designed to inform and persuade these electors to vote for a particular party. Members of the uninformed electorate will vote for a party only if they receive an advertisement from it. Let ρ denote the fraction of voters who receive an advertisement from party x. Following Grossman and Shapiro (1984) the cost of advertisements is increasing in the fraction ρ of voters reached and is given by $A(\rho)$, with $\partial A/\partial\rho > 0$. The success of the campaign in persuading the uninformed electors to vote for party s is defined by:

$$\Gamma_s = \Gamma(\rho, t_s) \qquad (s = x, y) \qquad (12)$$

It is assumed that: $\partial\Gamma/\partial\rho > 0$; $\partial\Gamma/\partial t_s > (\leq)\ 0$; $\partial^2\Gamma/\partial\rho^2 < 0$; $\partial^2\Gamma/\partial t_s^2 \leq 0$; $\partial^2\Gamma/\partial t_s\partial\rho > (\leq)\ 0$. Thus, the number of electors who are persuaded to vote for party s = x, y is increasing in the fraction of voters reached (i.e. $\partial\Gamma/\partial\rho > 0$), and also depends on any potential *ex ante* views on pollution (i.e. $\partial\Gamma/\partial t_s > (\leq)\ 0$). If $\partial\Gamma/\partial t_s > 0$ the uninformed electorate may be deemed to be environmentally biased with a preference for less pollution and higher taxes ($\partial^2\Gamma/\partial t_s\partial\rho > 0$). Conversely, if $\partial\Gamma/\partial t_s < 0$ these voters have preferences which are allied to those of firms and they therefore prefer lower emission taxes ($\partial^2\Gamma/\partial t_s\partial\rho < 0$).

The advertisements are funded through the political donations of lobby groups. In what follows, we focus on the case a single firm lobby group and ignore the role of an opposing environmental lobby[15]. Thus, party x receives contributions from the firm lobby group and chooses a tax rate (t_x) and an advertising reach (ρ) to maximise the number of votes. Specifically:

$$\text{Max } \Phi_x = (1 - \lambda)\mu + \lambda\Gamma_x \qquad (13a)$$

$$\text{Subject to: } A(\rho) - C(t_x) = 0 \qquad (13b)$$

Where: $C(t_x)$ is the contribution schedule offered to party x by the firm lobby group.

[14] Specifically, the boundary point which defines the indifferent voter is given by that level of t´which satisfies: $(t_n - t_x)^2 = (t_n - t_y)^2$. Solving for t_n yields: $(t_x + t_y)/2$.

[15] The results are unaffected by the introduction of a symmetric rival lobby group which contributes to party y.

At this level of generality it is impossible to deduce either the slope or the shape of the resulting tax schedule. We therefore introduce more specific functional forms in order to highlight the critical parameters which determine the properties of the equilibrium tax schedule.

For simplicity let the advertising cost function be given by: $A(\rho) = \rho^a$ $(a > 0)$. The success of the advertising campaign in capturing the votes of the uninformed electors is defined by: $\Gamma = (\beta\rho + \gamma t_x)$; $\beta > 0$. Clearly if $\gamma >$ (<) 0 then it is easier to gain the support of the uninformed electors if taxes are higher (lower). In the Appendix it is demonstrated that the first-order condition from maximising Φ_x is:

$$\frac{d\Phi_x}{dt_x} = (1-\lambda) + \lambda(C(t_x)^{\frac{1-a}{a}}\frac{\partial C(t)}{\partial t} + b) = 0 \qquad (14)$$

Totally differentiating (14) and solving:

$$\frac{dt_x}{dC(t_x)} = -\frac{\partial^2\Phi/\partial(t_x\partial C(t_x))}{\partial^2\Phi/(\partial t_x\partial t_x)} \qquad (15)$$

In the Appendix we demonstrate that $\frac{dt_x}{dC(t_x)} < 0$ iff $a < 1$. This implies that party x lowers the tax rate in response to political donations only if advertising costs do not rise too rapidly with the fraction of targeted voters (ρ)[16]. When this condition is not satisfied, party x has no incentive to lower taxes in response to political donations. This occurs because the advertising campaign fails to capture a sufficient number of votes from the uninformed electorate, to compensate for the loss of support from the informed voters.

In the Appendix we further demonstrate that when $a < 1$ the tax schedule is concave in contributions. Specifically:

Proposition 3 $a < 1$ is a sufficient condition for $\frac{d^2t_x}{dC(t_x)^2} < 0$.

Intuitively, the presence of informed voters limits the ability of party x to lower taxes in response to political contributions, so that taxes decline at a diminishing rate as contributions rise. Combined with the results in Proposition 1, this finding suggests that lobbying in declining industries is likely to be greatest in cases where it is easier for political parties to convince uninformed voters that a policy concession is desirable.

V Conclusions

This paper has outlined a simple and intuitive mechanism which explains why industries in declining sectors often lobby more successfully for policy concessions.

[16] Observe that $a < 1$ implies that there are increasing returns to advertising.

An industry in decline is constrained in its ability to raise revenue through production. There is therefore a greater incentive to protect profits by lobbying for policy concessions. However, greater lobbying only translates into higher levels of support and protection under certain assumptions about the technology of lobbying. The paper thus explored whether these assumptions are consistent with the two main approaches to modeling political behaviour: the political support framework and the political competition paradigm. The results suggest that lobby groups in declining industries always succeed in gaining greater concessions when an incumbent government does not confront an immediate election, as in the political support models. In contrast, where policies are determined in an election context, the outcome is more uncertain and depends critically upon the effectiveness of campaign spending in capturing votes.

These results have interesting implications. If the level of electoral competition is assumed to be correlated with the degree of democracy, the analysis suggests that declining industries in less democratic regimes will secure greater support than in polities with vigorous electoral competition. The results further imply that an intertemporal pattern of lobbying may be observed over the political cycle. Lobby groups in declining industries will be most successful at securing concessions when an incumbent government is not confronted by an immediate election. In periods of intense political competition, it is likely to be more difficult for lobby groups to obtain support, unless the electorate is sympathetic to the needs of the lobby group. Thus lobbying for industry support is typically expressed in terms of broader social and economic objectives, such as employment protection and cultural identity, in order to capture wider electoral support[17].

The results are also consistent with the explanation for senescent industry collapse proposed by Cassing and Hillman (1986), who find that industries decline smoothly up to some point, after which there is a sudden loss of policy concessions which accompanies industry collapse. In the current model this would occur if the industry contracts to a point where the benefits of support are less visible to electors, while the costs rise and become more obvious. Thus, political advertising costs would increase substantially thereby rendering support for the collapsing industry too costly for a political party in terms of lost votes.

[17] *The Economist*, November, 1998.

APPENDIX

Proof of Lemma 1:

q^n solves the first order condition:

$$P(Q) + \frac{\partial P}{\partial q^i} q^i - c^o \;=\; (t(1 - a_\tau^f) + v(a_\tau^f)a_\tau^f)\theta \qquad \text{(A1)}$$

Totally differentiate and solve, using (5b):

$$\frac{dq^n}{dt} = \frac{(1-a)\theta}{\partial^2 P/\partial q^2 + 2(\partial P/\partial q)} < 0 \qquad \text{(A2)}$$

The sign of A2 follows from the fact that by Assumption 4 the denominator is negative, while $(1\text{-}a)\theta > 0$.

Similarly using (5b):

$$\frac{da}{dt} = \frac{1}{1 + \partial^2 v/\partial a^2 + 2(\partial v/\partial a)} > 0. \qquad \text{(A3)}$$

Proof of Proposition 2:

From (9):

$$C(t) = \alpha(W(t^w) - W(t^*)) \qquad \text{(A4)}$$

Totally differentiating:

$$dC(t) = \alpha\left(\frac{\partial W(t^w)}{\partial t} dt^w - \frac{\partial W(t^*)}{\partial t} dt^*\right) \qquad \text{(A5)}$$

By (7b) $\frac{\partial W(t^w)}{\partial t} = 0$. Thus:

$$\frac{dt^*}{dC(t)} = -\frac{1}{\alpha(\partial W(t^*)/\partial t)} < 0 \qquad \text{(A6)}$$

Where the sign of (A6) follows from the fact that $t^* < t^w$ and for a maximum to exist we require that W(t) is concave, hence $\partial W(t^*)/\partial t > 0$.

Differentiating (A6):

$$\frac{d^2 t^*}{dC(t)^2} = \frac{\partial^2 W(t^*)/(\partial t \partial C)}{[\alpha(\partial W(t^*)/\partial t)]^2} \qquad \text{(A7)}$$

Since $(\partial W(t^*)/\partial t)^2 > 0$ it follows that: Sign $\frac{d^2 t^*}{dC(t)^2}$ = Sign $\partial^2 W(t^*)/(\partial t \partial C)$.

We now establish that if dC(t)/dt < 0 then $\partial^2 W(t^*)/(\partial t \partial C) < 0$.
Condition (SI) implies that for an equilibrium we require that:

$$\frac{dG}{dt} = -E + \alpha \frac{\partial W(t)}{\partial t} = 0 \qquad \text{(A8)}$$

(Where we have used (8) together with Shephard's Lemma so that $\frac{\partial C^f(t)}{\partial t} = \frac{\partial \Pi^f}{\partial t}$ = -E^f.)
Totally differentiating:

$$d\left(\frac{dG}{dt}\right) = \frac{\partial^2 G}{\partial t^2} dt + \alpha \frac{\partial^2 W(t)}{\partial t \partial C(t)} dC(t) = 0 \qquad \text{(A9)}$$

Thus:

$$\frac{dC(t)}{dt} = -\frac{\partial^2 G / \partial t^2}{\alpha(\partial^2 W / \partial t \partial C(t))} \qquad \text{(A10)}$$

Since $\partial^2 G / \partial t^2 < 0$ for a maximum, and $\frac{dC(t)}{dt} < 0$ by assumption, it follows that $(\partial^2 W / \partial t \partial C(t)) < 0$. Thus: $\frac{d^2 t^*}{dC(t)^2} = \frac{\partial^2 W(t^*)/(\partial t \partial C)}{\alpha(\partial W(t^*)/\partial t)^2} < 0$. *Q.E.D.*

Proof of Proposition 3:
Since the constraint in (12b) binds:

$$\rho^a = C(t) \qquad \text{(A11)}$$

Rearranging:

$$\rho = (C(t))^{1/a} \qquad \text{(A12)}$$

Substituting into the objective function:

$$\Phi_x = (1 - \lambda)\mu + \lambda(\beta(C(t))^{1/a} + \gamma t_x) \qquad \text{(A13)}$$

The resulting first order condition is:

$$\frac{d\Phi_x}{dt_x} = (1-\lambda) + \lambda\left(\frac{\beta}{a}(C(t))^{\frac{1-a}{a}} \frac{\partial C(t)}{\partial t_x} + \gamma\right) = 0 \qquad \text{(A14)}$$

Totally differentiating and rearranging:

$$\frac{dt_x}{dC(t)} = -\frac{(\partial^2\Phi / \partial t_x \partial C(t))}{\partial^2\Phi / \partial t^2} \qquad \text{(A15)}$$

where: $\frac{\partial^2\Phi_x}{\partial t_x \partial C(t)} = \lambda(\frac{\beta(1-a)}{a^2} C(t)^{\frac{1-2a}{a}} \frac{\partial C(t)}{\partial t_x})$ < 0 iff a < 1 (since $\frac{\partial C(t)}{\partial t_x}$ < 0).

Since $\partial^2\Phi / \partial t^2 < 0$ it follows that $dt_x/dC(t) < 0$ iff a < 1.

Differentiating (A15):

$$\frac{d^2 t_x}{dC(t_x)^2} = \frac{(\partial^2\Phi_x / \partial t_x \partial C(t))(\partial^3\Phi_x / \partial t_x \partial t_x dC(t)) - (\partial^2\Phi_x / \partial t_x \partial t_x)((\partial^3\Phi_x / \partial t_x \partial C(t) \partial C(t))}{(\partial^2\Phi_x / \partial t_x \partial t_x)^2} \qquad \text{(A16)}$$

where: $\frac{\partial^3\Phi_x}{\partial t_x \partial C(t) \partial C(t)} = \lambda(\frac{\beta(1-a)(1-2a)}{a^3} C(t)^{\frac{1-3a}{a}} \frac{\partial C(t)}{\partial t_x}) \leq 0$ if a < 1

$\frac{\partial^3\Phi_x}{\partial t_x \partial t_x \partial C(t)} = \lambda(\frac{\partial^3\Phi_x}{\partial t_x \partial C(t) \partial C(t)} \frac{\partial C(t)}{\partial t_x} + \frac{\partial^2\Phi_x}{\partial t_x \partial C(t)} \frac{\partial^2 C(t)}{\partial t_x^2}) > 0$ if a < 1

Thus: $\frac{d^2 t_x}{dC(t_x)^2}$ < 0 if a < 1.

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