Collective Signaling and Political Action

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Sanford C. Gordon
Department of Politics
New York University
sanford.gordon@nyu.edu

Catherine Hafer
Department of Politics
New York University
catherine.hafer@nyu.edu

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Abstract

We develop a model in which firms within an industry can pool their resources to lobby in an association. Our model departs from previous accounts stressing productive efficiencies of collective political action (e.g., sharing fixed administrative costs). Instead, we treat associational lobbying as a means by which firms can credibly convey information to politicians about the distribution of regulatory costs in the industry as a whole, without revealing specific information about the firms themselves when doing so would be disadvantageous. Our results depart from canonical accounts of collective political action based on Olson's (1965) seminal work. In expectation, a regulatory mandate will be *more* stringent (and thus harmful) to firms in an equilibrium with an association than in an equilibrium without an association. Nonetheless, some firms may find it advantageous to create such an association, and others will feel compelled to contribute to one should it exist. We also demonstrate that the provision of selective benefits will tend to expand the scope of an association's membership, but will sometimes simultaneously undermine the efficacy of the group's political activity.

1 Introduction

A common feature of the landscape of politics in the United States is entry into the political arena by corporations in externality-producing industries with the intended purpose of reducing the scope of regulation. In any given industry, however, firms sometimes pursue their deregulatory and regulatory goals separately, and at other times collectively in the form of trade associations, alliances, and ad hoc coalitions. The benefits to firms of "going it alone" (Hojnacki 1997) are straightforward: with respect to the individual firm, political activity may provide private benefits, for example in the form of a legislator's intervention on its behalf with the bureaucracy to obtain a favorable exemption, or a variance or exemption from a general rule. Moreover, corporations are pre-existing, legally recognized entities. As such, they have effectively solved collective action problems that might plague coalitions of firms.

By contrast, and even setting aside the collective action problem, the benefits of collective lobbying within an industry are more ambiguous. First, the motives of firms may be mixed: regulation affecting an entire industry may raise costs for different firms by different amounts; to the extent that profit-maximizing firms seek not only to lower their own costs but also to raise those of their rivals (Salop and Scheffman 1983; Bartel and Thomas 1987), different firms may have very different induced preferences over the appropriate scope of regulation. Second, insofar as many firms maintain their own political presence (through an employee-financed political action committee, in-house lobbyists, or representation by a lobbying firm), it is not clear what benefit comes from funding a trade association if that entails subsidizing the political goals of rivals; in other words, any money spent funding an association's political activities is money not spent funding those of the firm.

In this paper, we consider an informational role for associations and the consequences of that role.[1] Specifically, in a system of separated powers, there are points in the political

[1]While we will use the term "association," our model applies just as easily to industry groups calling themselves, inter alia, alliances, councils, committees, institutes, and coalitions.

process in which it is not in the interest of individual firms within an industry to reveal specific information about themselves to policy makers, though it may be in their collective interest to reveal information about the industry as a whole. For example, firms within an industry may wish to signal to a sympathetic legislature that their costs are high while avoiding revealing information to less-sympathetic regulators information about the magnitude of their externalities. A fear of losing market share, or of forfeiting trade secrets, as a consequence of such a revelation may also induce a firm's reluctance to advertise specific information about itself. Finally, in a series of recent papers, Gordon and Hafer (2005, 2007) argue that political expenditures can also serve as a means for individual firms to credibly reveal the extent of their compliance costs to regulators after the legislature delegates enforcement authority to an agency. The need to make political expenditures as a means of signaling costs to regulators provides those firms with a credible threat to the legislature: if you make the regulatory mandate too high, we will spend all of our individual expenditures on the opposition. However, it is not in the interest of individual firms to reveal their costs *ex ante* delegation, as doing so would eliminate that credible threat.

In each of these examples, it may yet be valuable for firms to convey information to policy makers about the industry as a whole, even as they obscure firm-specific information. This suggests a role of associations as mechanisms of *partial separation*: by funding the lobbying activity of trade associations, firms can shape the beliefs of legislators about the distribution of costs within an industry without revealing too much specific information about themselves when doing so would be disadvantageous. In particular, costly political activity by associations with an anti-regulatory agenda is aimed at convincing legislators that the compliance costs of the *typical* firm are high.

We propose a simple model in which a legislature, in setting a regulatory mandate, trades off between the political benefits associated with smaller regulatory costs and those associated with the benefits of enacting a popular policy. Firms may contribute to an association in the hopes of signaling to the legislature that the cost to a typical firm is high;

the reduction in the size of the mandate set by the legislature that would result from this signaling is therefore a collective benefit to firms within the industry.

The model has several features in common with canonical models of collective action: for example, firms with a higher expected marginal benefit from contributing will be more likely to contribute than those with lower expected marginal benefit, the latter group of firms choosing instead to free-ride on the contributions of the former. Nonetheless, important differences emerge as well. First, contrary to received wisdom, the regulatory mandate will be *higher* in expectation in an equilibrium with an *anti*-regulatory association than in a pooling equilibrium in which no association exists. However, if membership fees are not exorbitant, some firms will contribute to the association if it does exist, and only a strict subset of these firms will actually benefit in expectation from having an association. These features of anti-regulatory associations suggest the endogenous emergence of conflict within an association in spite of consensus about its goals. This conflict takes the form of what we refer to as an "inverse free-rider" problem. In canonical collective action models, individuals prefer that an organization representing their interests exist, but would not contribute to it if it did; in our model, there are firms that prefer that an organization representing their interests *not* exist, but will contribute to one if it does.

The model also suggests a fundamental tradeoff associated with the provision of selective benefits as a means to attract support. Since Olson's (1965, ch. 6)) seminal description of the "by-product" theory of lobbying, it has been taken as a given that increasing selective benefits to an organization's members will increase contributions to the organization and, thus, public good provision. In our model, the direct effect of selective benefits is to increase membership in the association; the indirect effect, however, is to undermine the signaling value of the association. The conjunction of these effects can imply, in certain cases, that increasing selective benefits *harms* the collective enterprise rather than facilitating it.

In what follows, we describe the motivation for our study of associations, and previous research on the subject. Then, we describe the primitives of our model and characterize

equilibrium. Subsequently, we describe the ex ante and intermediate welfare properties of our Association equilibrium, and their consequences for collective action among firms. Finally, we discuss the relationship between selective incentives, firm behavior, and policy.

2 Background

2.1 Trade Associations in U.S. Politics

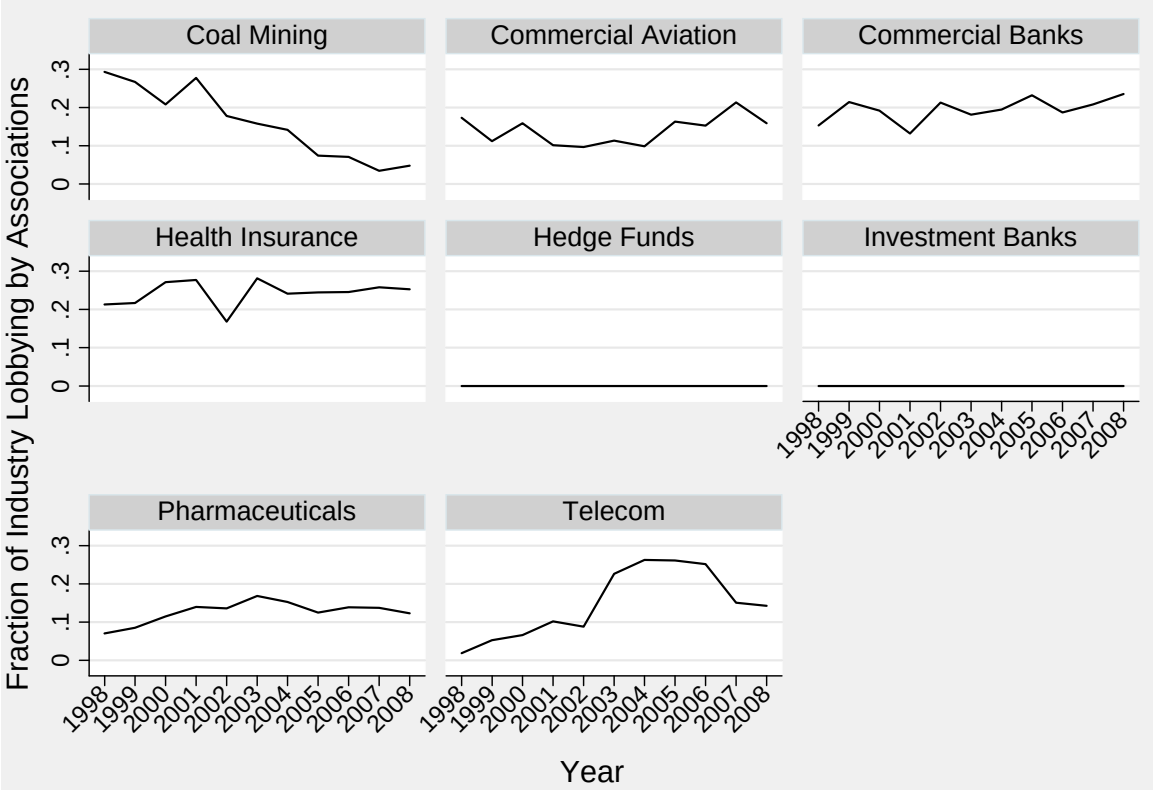
The landscape of political activity varies markedly from industry to industry, both in the amount of money spent and in the extent to which that landscape is dominated by individual firms or trade associations. Moreover, in some industries, a single trade association appears dominant; while in others, multiple associations reflecting different interests within the industry exist.

To get a sense of the variation among industries, we examined lobbying disclosure data compiled by the Center for Responsive Politics for eight industries from 1998 to 2008: coal mining, commercial banks, investment banks, hedge funds, health insurance provision, pharmaceutical manufacturing, commercial aviation, and telecommunications.[2] In 2008 alone, total industry lobbying ranged from a low of $7.1 million (Hedge Funds, with 14 different organizations engaged in lobbying activities) to $158.1 million (Pharmaceuticals, with 146 organizations lobbying).

Figure 1 displays the fraction of total lobbying expenditures within an industry made by associations rather than individual firms or other organizations (e.g., professional societies or groups specifically engaged in protesting the industry). Two of the included industries – hedge funds and investment banks – did not have a trade association engaged in lobbying during this period, so the fraction is zero. In the other six industries, we see several interesting patterns: over this time period, the fraction of associational lobbying in the coal industry fell dramatically – largely because of substantial increases in expenditures by Peabody En-

[2]Full disclosure: this is not a random sample.

Figure 1: Fraction of Total Industry Lobbying Conducted by Associations, 1998-2008



ergy (which, by 2008, was spending $8.4 million on lobbying, compared to $490,000 by the Bituminous Coal Operators Association). By contrast, associational expenditures as a fraction of the total increased dramatically in the telecommunications industry, just around the time that Congress was considering amendments to the landmark 1996 Telecommunications Act.

Variation also exists in the character of the associational landscape. For example, in the aviation industry, there are two major trade associations: the Air Transport Association (ATA), which represents major (as well as some minor) national airlines, and the Air Carrier Association of America (ACAA), which represents discount carriers Spirit, AirTran, and Frontier. The lobbying expenditures of the former, however, dwarf those of the latter: ATA spent $5.8 million lobbying in 2008, while ACAA spent just $70 thousand. By contrast there is no fully dominant trade association in the banking industry: the largest trade

group, the American Bankers Association, spent $8.7 million on lobbying in 2008, while the Independent Community Bankers of America, which represents locally operated banking institutions, spent $4.2 million.

To see the extent of concentration of lobbying expenditures across trade associations within a given industry, we calculated a Herfindahl-type concentration index for each industry from 1998 to 2008. The results are displayed in Figure 2; higher values indicate greater concentration, with a value of 1 implying all expenditures by a single association. As is evident from the figure, the coal mining industry – which has been represented by four or five associations over the period for which we have data – historically has had the lowest concentration of lobbying. Interestingly, two industries have experienced substantial change in the extent of associational concentration over time: pharmaceuticals and telecommunications, which are currently represented by one dominant association (the Pharmaceutical Research and Manufacturers of America and the US Telecom Association, respectively).

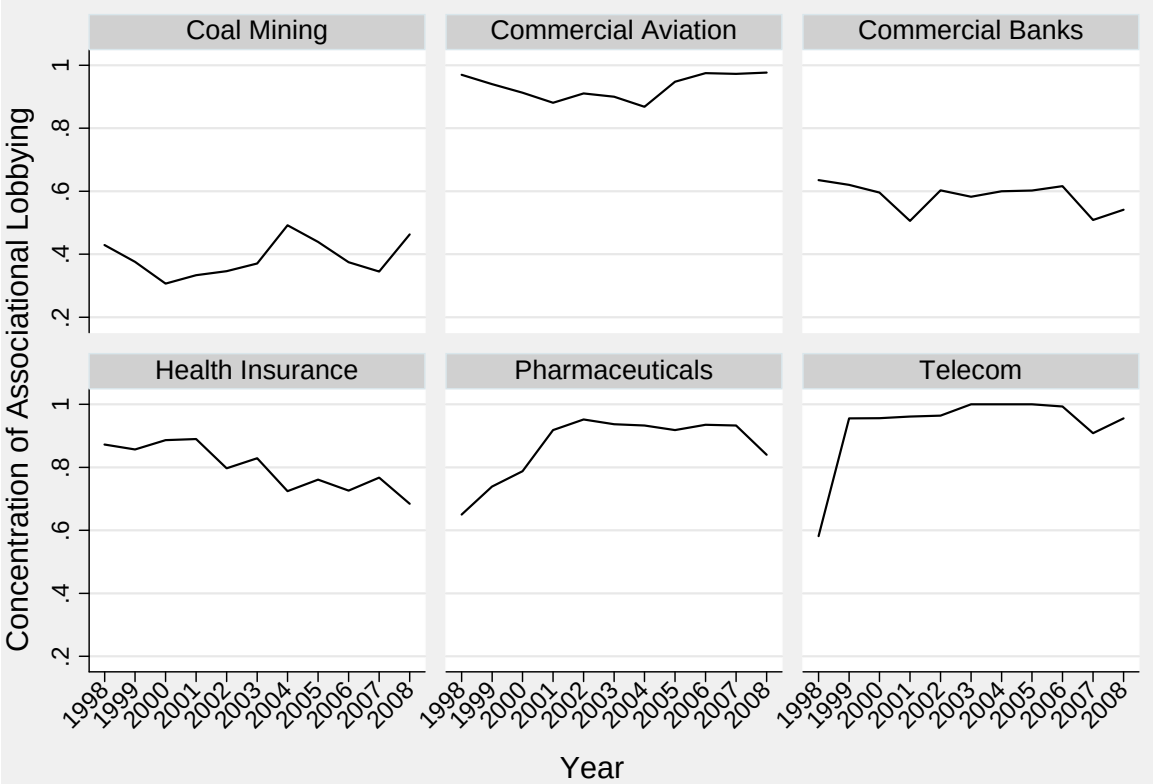
In the United States, trade associations are classified as 501(c)6 organizations under the Internal Revenue Code (Business leagues, chambers of commerce, and real estate boards). Although they must report total membership dues and total political and lobbying expenditures on IRS form 990, 501(c)6 organizations are not required to disclose the individual member contributions to political efforts.[3]

2.2 Previous Accounts of Collective Lobbying

The organizational forms within which collective political activity by firms takes place is a subject that has preoccupied scholars of interest groups for decades. In *Politics, Pressures, and the Tariff* (1935), Schattschneider notes that economic groups have strong incentives to exaggerate unanimity within their membership and to de-emphasize disagreement, but that the internal politics of groups he studied were often oligarchic, characterized by "centers

[3]Thus, for example, if a single member firm assigned staff employees to the association for its political activities, this expenditure would not be specifically disclosed by either the individual firm or the association. For a criticism of the role of trade associations in politics, see Center for Political Accountability (CPA), *Hidden Rivers* (2006).

Figure 2: Concentration of Associational Lobbying by Industry, 1998-2008



of agitation and areas of indifference" (226). An extreme consequence was that individual members would employ the association as a means to mask their own political actions. Schattschneider maintains that such activity could hold explicitly negative consequences for an association's less-active membership, and were in fact a perversion of representation.

Berry (1984) suggests a tension between collective and individual lobbying. Whereas collective lobbying may prove successful in the policy arena (for example, by suggesting unified opposition or coordinating an industry's political activities), by submitting to a collective strategy individual firms forego the opportunity to cultivate independent political reputations that could prove valuable in obtaining selective benefits. Based on a survey of lobbyists in several industry sectors, Hula (2000) concludes that individual groups are more likely to participate in coalitions when attempting to influence general laws, as opposed to more specific regulations. In a finding related to Schattschneider's, he also observes that coalitions tend to gel based on the exchange of benefits of a core of founding members (77).

A rational choice framework for assessing the choice between individual and collective lobbying is provided by De Figueiredo and Tiller (2001). Following Olson (1965), they argue that collective lobbying is conditioned by the commonality of interests of the participants but may be plagued by free-riding problems. Free-riding may be diminished if the benefits of membership in industry groups are excludable (for example, industry statistics to which only members have access). They also argue that a downside of lobbying collectively is the threat that other members will appropriate a firm's proprietary information. Using data on lobbying contacts with the Federal Communications Commission and interviews with regulators, company and trade association representatives, and industry lawyers, the authors find that large firms behave consistently with their theoretical expectations.

Finally, in a recent paper, Bombardini and Trebbi (2009) find that firms in more competitive markets are more likely to lobby collectively through trade associations than firms in industries with high degrees of concentration and more differentiated products. In the former type of market, product-specific protection measures that apply only to one firm would

reduce its profits via substitution by consumers to the products of other firms; in such cases, firms have an interest in lobbying collectively for industry-wide protection. By contrast, in the latter type of market product-specific protection measures can increase profits. In a related paper, Bombardini (2008) demonstrates that given a fixed administrative cost of lobbying, it is efficient for the largest firms in a sector to seek protection for the sector.

The model of costly informational lobbying that we describe is related to Lohmann (1993). In the model described in that paper, a leader takes an action based on the total number of individuals in a society undertaking costly political action with respect to an issue. In both that model and ours, the policy maker observes aggregate political action rather than the specific actions of individuals. The causal mechanism we articulate here is quite different, however: in that model, individuals each observe a binary signal correlated with the true state of the world and condition their action on their observed signal, whereas in the current environment, the firm's type is its own private information and known with certainty to the firm. Also, unlike in that paper, all firms would prefer that the legislature's beliefs about the industry be more extreme than is truly the case.

3 The Model

3.1 Primitives and Solution Concept

The interaction on which we focus is between a legislature L and n firms within an industry, indexed by $i = 1, \ldots, n$. The industry as a whole is characterized by $\Omega \in \mathbb{R}_{++}$, which denotes the total magnitude of an industry's externalities, and is common knowledge to all players. Each firm i within the industry is each characterized by its marginal regulatory cost $t_i \in \mathbb{R}_{+}$. Each firm's t_i is its own private information, and is drawn from a common-knowledge prior distribution with probability density function $p(t)$ and cumulative distribution function $P(t)$. For now, we place no restrictions on the distribution of marginal costs other than to assume that it has (1) full support over the nonnegative real numbers ($p(t) > 0 \quad \forall \quad t \geq 0$) and (2)

finite mean ($0 < E_{p(t)}[t] < \infty$).

The game unfolds as follows: first, firms decide whether to pay an exogenously given and commonly known association fee, φ, to a trade association's lobbying initiative. Next, the legislature observes the lobbying expenditures of the association, if any, and sets a regulatory mandate $\omega \in [0, \Omega]$, which may be thought of as the portion of the industry's total externalities subject to regulation.

Let y_i be an indicator equal to one if firm i contributes to the association and zero otherwise. The firm incurs the cost of the regulatory mandate as well as the cost, if incurred, of its contribution to the association. Firm i's utility is therefore given by

$$u_i(y_i; t_i, \varphi, \omega) = -y_i\varphi - t_i\omega. \tag{1}$$

Payoffs to the legislature come from two sources: the first is the average cost to the industry of complying with regulation ω (under the assumption that imposing regulatory burdens on the industry may lead to adverse consequences for the economy). The second is a public cost increasing in the distance between the regulatory mandate and Ω (under the assumption that compelling firms to internalize production externalities is politically popular). Let $\gamma \in (0, 1)$ be a parameter denoting the relative weight given by the legislature to regulatory cost versus the benefit to the public of the popular policy; for example, industries with larger γ would be those that employ a larger number of individuals, that contribute a large fraction of gross domestic product, or that consist disproportionately of firms located in marginal legislative districts . Let $\beta \in (1, \infty)$ captures the degree of convexity in the political cost to the legislator of average regulatory compliance. The legislature's utility function takes the following form:

$$u_L(\omega; \gamma, \mathbf{t}, \Omega) = -\gamma \left(\frac{1}{n} \sum_{i=1}^{n} t_i\omega \right)^{\beta} - (1 - \gamma) f(\Omega - \omega), \tag{2}$$

where $f(\cdot) : [0, \Omega] \to \mathbb{R}_+$. We assume $f'(\cdot) > 0$, $f''(\cdot) > 0$, and $f'''(\cdot) > 0$.

Two features of the legislator's utility function are of note. First, the legislature does not

directly benefit from the lobbying expenditures of the association: this feature of the model is meant to to highlight our purely informational account of associational lobbying. (We discuss this feature of the model in greater detail below). Second, n, the number of firms within the industry, does not enter into the legislator's payoffs; this assumption permits us to examine the effect of changes in the number of firms holding constant the political importance of the industry.

The solution concept we employ is symmetric weak perfect Bayesian equilibrium. This requires that (a) each player's choices be sequentially rational given her beliefs at the time of choice and other players' strategies; (b) conditional on type, all firms play the same strategy; and (c) beliefs about other players' types be consistent with prior beliefs, equilibrium strategies, and Bayes' Rule on the path of play.

3.2 Equilibrium

Let k denote the number of firms contributing to an association. Before the the legislature chooses the regulatory mandate, it observes the association's lobbying expenditures, $k\varphi$, from which it can infer k. The expected utility to the legislature from a regulatory mandate ω is then given by

$$\begin{aligned} E[u_L(\omega;\gamma,\beta,\Omega,f(\cdot),p(t))] &= -\gamma E[t^\beta|k,\varphi]\omega^\beta - (1-\gamma)f(\Omega-\omega) \\ &= -\gamma E[\tau|k,\varphi]\omega^\beta - (1-\gamma)f(\Omega-\omega), \end{aligned} \tag{3}$$

where $\tau = t^\beta$. Next, let k_{-i} denote the number of firms *other than* firm i contributing to the association. Substituting $\sqrt[\beta]{\tau_i}$ for t_i, the expected utilities to the firm of contributing and not contributing, respectively, to the association are given by

$$\begin{aligned} E[u_i(y_i=1|\varphi,\tau_i,\omega(\cdot))] &= -\varphi - \sqrt[\beta]{\tau_i}E_{k_{-i}}[\omega|k=k_{-i}+1,\varphi] \\ E[u_i(y_i=0|\varphi,\tau_i,\omega(\cdot))] &= -\sqrt[\beta]{\tau_i}E_{k_{-i}}[\omega|k=k_{-i},\varphi]. \end{aligned} \tag{4}$$

Because the firm's marginal cost $t_i > 0$ by assumption, $\tau_i = t_i^{\beta}$ is a monotone transformation of t_i. Therefore, there is no loss in referring henceforth to τ_i as the firm's type. We denote the p.d.f. of τ by $\pi(\tau)$, and the c.d.f. by $\Pi(\tau)$.

The following lemma establishes the monotonicity of firm behavior as a function of type and allows us to impose some structure on the firm's possible equilibrium strategies.

Lemma 1 (Monotonicity of contributions choices) *Given the willingness of a firm of type τ' to contribute to an association, all firms with type $\tau'' > \tau'$ will also be willing to contribute.*

Proofs of all formal results are in the Appendix. In what follows, we label the smallest type willing to contribute to the association $\hat{\tau}$.

We are now in a position to characterize the equilibria of the association game:

Proposition 1 (Equilibrium) *There exist two symmetric strategy profiles that are supported in weak perfect Bayesian equilibrium:*

(1) (No Effective Association) The legislature chooses a regulatory mandate $\omega^*(E[\tau|k,\varphi])$ that solves

$$\beta\gamma E[\tau|k,\varphi]\omega^{\beta-1} = (1-\gamma)f'(\Omega-\omega) \tag{5}$$

where $E[\tau|k,\varphi] = E[\tau]$ on the path of play; and irrespective of type, no firm contributes to the association (k=0). (Legislature's beliefs off the path of play are described in the Appendix.)

(2) (Effective Association) The legislature chooses a regulatory mandate $\omega^*(E[\tau|k,\varphi])$ that solves equation (5); and firm i contributes to an association if and only if $\tau_i > \hat{\tau}(\cdot)$, where $\hat{\tau}$ is a value of τ that solves

$$\varphi = \sqrt[\beta]{\tau}(E_{k_{-i}}[\omega(E[\tau|k_{-i},\varphi]) - \omega(E[\tau|k_{-i}+1,\varphi])], \tag{6}$$

given that for all $j \neq i$, firm j contributes if and only $\tau_j > \hat{\tau}(\cdot)$. The legislature's beliefs are characterized as follows:

$$\begin{aligned}
\pi(\tau|y=1) &= \begin{cases} \frac{\pi(\tau)}{1-\Pi(\hat{\tau})} \text{ if } \tau \geq \hat{\tau}(\cdot) \\ 0 \text{ otherwise,} \end{cases} \\
\pi(\tau|y=0) &= \begin{cases} \frac{\pi(\tau)}{\Pi(\hat{\tau})} \text{ if } \tau \in [0, \hat{\tau}(\cdot)) \\ 0 \text{ otherwise, and} \end{cases} \\
E[\tau|k,\varphi] &= \frac{k}{n} E\left[\tau|\tau \geq \hat{\tau}\right] + \frac{n-k}{n} E\left[\tau|\tau < \hat{\tau}\right]. \qquad (7)
\end{aligned}$$

In the remainder of the paper, we refer to these as the "No Association" and "Association" equilibria. In the first, fully pooling equilibrium to the game, no association forms on the path of play, and the legislature sets the regulatory mandate according to its prior beliefs about the distribution of types in the industry. In the second, partially-separating equilibrium, an association does exist, with firms exceeding a critical type ($\tau_i > \hat{\tau}$) contributing. The legislature makes inferences about the distribution of firm types from the number of firms that contribute to the association. Specifically, the expected firm type is a weighted average of the expected type among contributors and the expected type among non-contributors, with the weight an increasing, linear function of the number of contributors k.

A feature of both equilibria that will prove important in what follows is the manner in which the equilibrium regulatory mandate $\omega^*(\cdot)$ responds to changes in the legislature's beliefs about firm types and the contribution decisions of firms. The next proposition summarizes those relationships:

Proposition 2 (Legislature Beliefs, Contributions, and the Regulatory Mandate) *(1) In both the No Association and Association equilibria of the game, the equilibrium regulatory mandate $\omega^*(\cdot)$ is a strictly decreasing, globally convex function of $E[\tau|\cdot]$. (2) In the Association equilibrium, the regulatory mandate is a strictly decreasing, globally convex*

function of the number of contributors to the association, k.

The first part of the proposition simply reflects the legislature's best response correspondence as defined in equation (5). In balancing between high compliance costs and the popularity of a regulatory program, the legislature responds to an increase in regulatory costs by decreasing the regulatory mandate. However, given the concavity of the legislature's utility function, there are diminishing returns to doing so; this translates into the convexity of the response function in the legislature's beliefs. The second part of the proposition suggests that in an equilibrium with an association, the collective benefit to firms within the industry – a reduced regulatory mandate – is increasing in the number of firms contributing to the association. However, the returns to contributions are diminishing in the number of other firms contributing.

It is important to point out an important distinction between the two equilibria. In the No Association equilibrium, the legislature makes no inferences on the path of play from the absence of contributions ($k = 0$), and sets the regulatory mandate according to its prior beliefs about the expected firm type, $E[\tau]$. In the Association equilibrium, the absence of contributions implies that all firms have type $\tau_i < \hat{\tau}$. In that case, the legislature's posterior beliefs about the expected firm type conditional on no contributions will be strictly less than the prior expected type: $E[\tau|k = 0] = E[\tau|\tau < \hat{\tau}] < E[\tau]$. By Proposition 2, we therefore have the following remark:

Remark 1 (Consequences of No Observed Contributions) *The regulatory mandate will be strictly higher in the Association equilibrium when no contributions are made than in the No Association equilibrium.*

3.3 Ex Ante Welfare of Firms

Having characterized equilibrium behavior and the response of legislative behavior to beliefs about the distribution of firm types within an industry, we are now in a position to compare

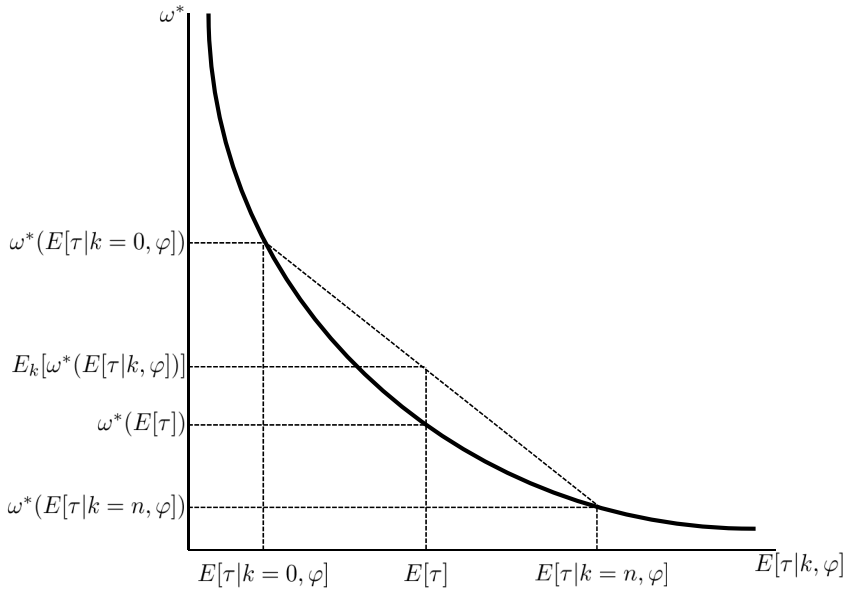
properties of the No Association and Association equilibria. First, we consider the *ex ante* policy and welfare consequences of an association's existence, from the perspective of a firm that does not know its own type, relative to the equilibrium in which an association does not exist:

Proposition 3 (Ex Ante Welfare and Associations) *In expectation, the equilibrium regulatory mandate is strictly higher in the Association equilibrium than in the No Association equilibrium. Consequently, on average, firms within an industry are strictly worse off in expectation in the Association equilibrium than in the No Association equilibrium.*

The first part of the proposition emerges because of the nature of the legislature's response function. Recall that in the Association equilibrium, $\omega^*(\cdot)$ is a decreasing, convex function of the expected firm type, $E[\tau|k,\varphi]$. In the No Association equilibrium, the legislature will calibrate $\omega^*(\cdot)$ to the prior mean of the distribution of firm types, $E[\tau]$. in the Association equilibrium, the posterior mean of firm types depends on the number of contributors to the association, k (as well as φ). *Ex Ante*, however, k is a random variable. Taking expectations over the equilibrium distribution of k, the ex ante expected posterior mean firm type is equal to the prior mean. But the expected regulatory mandate over the distribution of k must exceed the regulatory mandate evaluated at the prior mean, owing to the convexity of $\omega^*(\cdot)$.

Figure 3 displays this intuition graphically. The dark curve in the figure corresponds to the legislature's response function given beliefs $E[\tau|k,\varphi]$. The left-most point labeled on the curve corresponds to the regulatory mandate in the Association equilibrium in which no firm contributes to the association, and the right-most point to the mandate in the Association equilibrium in which all firms contribute. The intermediate point corresponds to beliefs in the No Association equilibrium. Because of the convexity of the response curve, the mandate in the No Association equilibrium lies strictly below the *expected* mandate in the Association equilibrium in which firm types (and thus k) are not known.

Figure 3: Expected Regulatory Mandate in the Presence and Absence of Associations



The second part of the proposition emerge because, in addition to the expected harm from an association from a higher regulatory mandate in expectation, anti-regulatory firms will also pay a fee with positive probability.

3.4 Intermediate Welfare, Free-Riding, and "Inverse" Free Riding

Proposition 3 concerns the welfare of firms behind a veil of ignorance – that is, before they know their specific types. In general, however, firms typically possess private information about their own costs, but not (necessarily) about the costs of other firms in the industry. It is natural, therefore, to ask whether given such knowledge, firms expect to fair better in the Association equilibrium than in the No Association equilibrium. The next result establishes that the answer depends upon the firm's private information about its costs: firms with sufficiently high costs have higher expected utility in the presence of an association, but the opposite is true for lower types:

Proposition 4 (Expected Firm Welfare Given Private Information) *(1) If a firm with type τ' has a higher expected utility in the Association equilibrium than in the No*

Association equilibrium, then all firms with type $\tau'' > \tau'$ have higher expected utility in the Association equilibrium as well. (2) Such types exist if and only if the mandate in the No Association equilibrium exceeds the expected mandate in the Association equilibrium in which at least one firm is known to contribute, that is, $\omega^*(E_\tau[\tau]) > E_{k_{-i}}[\omega^*(E_\tau[\tau|k = k_{-i} + 1, \varphi])]$. Firms that would not contribute in the Association equilibrium always have lower expected utility in the Association equilibrium than in the No Association equilibrium.

This result mirrors the findings presented in Proposition 3: although all firms prefer a lower regulatory mandate to a higher one, and contributing to the association does lower the regulatory mandate relative to not contributing *in the Association equilibrium*, firms with sufficiently low costs have higher expected utility in the No Association equilibrium than in the Association equilibrium. For a firm that does not contribute to the association in the Association equilibrium, knowing that it will certainly not contribute to the association itself insures that its expectation of the mandate in the Association equilibrium is higher than its expectation from the less-informed, ex ante perspective in which it does not know its own type. As already established in Proposition 3, that expectation is, in turn, higher than the mandate in the equilibrium in which there is no association; thus all types of firms that do not contribute in the Association equilibrium are better off in the No Association equilibrium.

The fact that firms that would not contribute in the Association equilibrium are worse off in expectation relative to the No Association equilibrium suggests a certain degree of subtlety in how one should approach the questions of the existence of free-riding among firms. The following two distinctions are useful is shedding light on this issue. First, we should distinguish actual provision of the public good (lowering the mandate) from sustaining the association providing that good. Our results suggest that whether there exists free-riding depends on which of these is understood to be the benefit. The second distinction concerns the relationship between non-contribution and an individual firm's costs and benefits associated with the provision of the public good. One commonly-understood meaning of free-riding is

the tendency of non-contributors to a collective good to benefit from the contributions of others. We will refer to this phenomenon as "weak" free-riding. In contrast, what we will call "strong" free-riding refers to the phenomenon whereby for non-contributors, the marginal cost of contributing is below the benefit received from the public good in equilibrium. Our next result indicates the importance of these distinctions in the current environment.

Proposition 5 (Strong Versus Weak Free-Riding) *Given equilibrium beliefs, non-contributors weakly and possibly strongly free-ride on the provision of the lower mandate in the Association equilibrium.*

To interpret this result, consider how it contrasts with Proposition 4. In that result, we see that because firms that would not contribute in the Association equilibrium are never beneficiaries of its existence, they cannot be said to free-ride even weakly on organizational maintenance by contributors. However, conditional on being in the Association equilibrium, those same non-contributors do benefit from the lowering of the regulatory mandate that results from more contributions to the association. Insofar as their expected utility is increasing in the contributions of others to the association, they may be said to weakly free-ride on the provision of the collective good.

For those types that do contribute to the association in the Association equilibrium, the comparison between equilibria is less immediate. Since such a firm knows that it will itself contribute, its expectation of the mandate is premised on the fact that at least one firm will contribute. Whether a contributing firm is, in expectation, better or worse off in the Association equilibrium relative to the No Association equilibrium depends upon whether the certainty of having at least one contributor in the association equilibrium lowers the mandate relative to the mandate chosen in the No Association equilibrium. If it does, then a firm with sufficiently high unit costs of regulation will save more from the difference in mandates between the two equilibria than it would have to contribute in the Association equilibrium.

While Proposition 4 establishes that if any firms prefer the Association to the No Association equilibrium, it will those with the highest types, it does not tell us whether the set of types with such a preference is the same as the set of types who would *contribute* to the association. As the next result suggests, these two sets are *not* identical:

Proposition 6 (Inverse Free-Riding) *Let $\hat{\hat{\tau}}$ be the type of firm that has the same expected utility in the Association equilibrium and in the No Association equilibrium, such that a firm of type τ_i has higher expected utility in the Association equilibrium if and only if $\tau_i > \hat{\hat{\tau}}$. If $\hat{\hat{\tau}}$ exists, it is strictly greater than the smallest type of firm willing to contribute in the Association equilibrium, $\hat{\tau}$.*

Proposition 6 suggests a surprising feature of the model: some of the firms who suffer (in expectation) from the existence of the association nonetheless join it in the equilibrium in which the association exists. Even in the total absence of any administrative costs for the organization, an organization that recruits members to provide a collective good may be successful in doing so (in the sense that by recruiting more members it does in fact provide more of the collective good) without itself being a collective good for the group. Likewise, the fact that a firm contributes to the organization when the organization exists does not imply that the organization's existence is, in expectation, beneficial for that firm. This feature of the results stands in direct contrast with the well-known free-rider problem, in which firms enjoy the benefits of the existence of an organization without doing their part to support and maintain it. Accordingly, we refer to firms that contribute to the organization even though they do not benefit from its existence as *inverse free-riders*.

It may seem intuitive to suppose that firms will not contribute to the association if they, in some sense, "prefer" that the association not exist at all. However, if the legislature believes the Association equilibrium is being played, then the legislator will infer from a firm's failure to contribute that a firm is a low type, and the legislator will choose a higher mandate accordingly. Thus a firm that bears sufficiently high costs from regulation will prefer to contribute to the association and obtain a drop in the mandate. In contrast, in the

No Association equilibrium, the legislature anticipates that all types of all firms will choose not to contribute, and thus the legislature makes no inferences about firm type from a firm's failure to contribute. Put differently, the legislature's beliefs about the firms' strategies determine its inferences about firm type from a firm's failure to contribute, which in turn determines the choice of mandate. Indeed, it is possible to realize an outcome in the No Association equilibrium in which no firm contributes (because the draw of firms is entirely below the contribution threshold), but the mandate that results is higher than the mandate that results from the same firm behavior in the Association equilibrium because in the former case, the legislature concludes that the firms are all low types, and in the latter case it does not. Because the firms cannot unilaterally change the legislature's beliefs about firm strategies, the firms are not able to obtain the mandate associated with the No Association equilibrium just by adopting firm behaviors that correspond to that equilibrium. Once the expectation that firms of sufficiently high types contribute is created in the legislature's mind, firms of such type must contribute or suffer inflated mandates.

One possible interpretation of the condition defining the types of firms that obtain higher expected utility in the Association equilibrium than in the equilibrium with no association is as a necessary condition for an organizational entrepreneur. While we have not modeled the possibility of an explicit attempt by a firm to create an association (or, in the context of the model here, to determine which equilibrium is being played), it seems uncontroversial that a firm would need to benefit in expectation from the organization's existence in order to be willing to create it. Two countervailing factors, however, complicate this interpretation. First, the costs of the resources needed to create an organization have not been included here, and would have the immediate effect of increasing the minimum type willing to undertake such a task. Second, if the firms are understood to have the opportunity to create an organization and do not avail themselves of it, this in itself is a signal to the legislature that none of the firms are of a high enough type to wish to undertake the effort necessary to create an organization. This would imply that the legislature would update its

beliefs about the average type in the industry downward, making the mandate in the absence of an Association higher than the mandate in the No Association equilibrium of the game we analyze here. This, in turn, would have the immediate effect of making the organization more attractive, lowering the minimum type willing to undertake such a task.

4 Selective Incentives

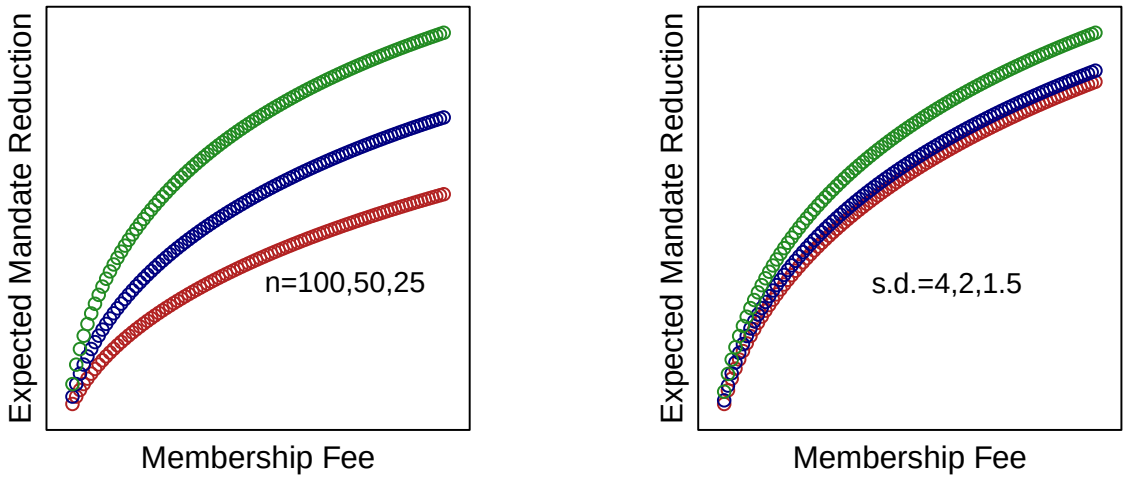
While the prospect of a reduction in the regulatory mandate constitutes a collective benefit to firms in the industry, the membership fee φ constitutes a selective cost. Adding a selective benefit term for membership in the association – in line with Olson's "by-product" theory of lobbying organizations, would therefore be equivalent to reducing the membership fee. In light of existing arguments favoring of the provision of selective benefits as a means to spur contribution, we next consider whether a reduction in the membership fee would have on the provision of the collective benefit (a decrease in the expected regulatory mandate in the Association equilibrium). As the following proposition indicates, the relationship between selective incentives for and collective benefits of an association is not entirely straightforward:

Proposition 7 (Selective Incentives, Contributions, and the Regulatory Mandate) *In the Association equilibrium, a reduction in the membership fee φ sometimes leads to an increase, and sometimes to a decrease, in the expected regulatory mandate.*

A decrease in φ will have two competing effects: the direct effect is to reduce the cost of membership and thereby encourage more firms to join. The indirect effect, however, is to weaken the signaling value of membership within the association. The balance of these two effects on the size of the expected regulatory mandate may therefore yield situations in which the provision of selective benefits, long held to be a necessary tactic for organizational maintenance, can actually *undermine* the collective goals of the organization.

To demonstrate these competing effects graphically, we constructed a simple simulation that examines the consequences of changes in φ given different features of the industry in

Figure 4: The Effect of Changes in Membership Fee on the Expected Marginal Reduction in Regulatory Mandate



In the left panel, the standard deviation of the type distribution is 2; in the right panel, $n = 50$.

the Association equilibrium. In this example, we adopt a quadratic parameterization of the legislator's utility function (i.e., $\beta = 2$, $f(\Omega - \omega) = (\Omega - \omega)^2$), a weighting parameter of $\gamma = 0.05$, and an externality parameter of $\Omega = 100$. The distribution of firm types is $lognormal(\mu, \sigma^2)$, with $\mu = -\sigma^2/2$; this last feature of the simulation fixes the mean firm type at 1, allowing us to examine changes in the variance of types holding the mean constant.[4] We varied the membership fee from $\varphi = 0.01$ to $\varphi = 10$ for different values of n and σ.

We begin by graphing, in Figure4, our measure of the indirect effect described above: the expected marginal reduction in the mandate stemming from a single firm's contribution, as a function of φ. The left panel shows this relationship for different values of n, while the right panel shows the relationship as a function of the standard deviation of the type distribution. Holding constant the firm's type and for the parameter values displayed, the expected marginal benefit of a contribution to the association is *increasing* in the cost of the contribution. When the fee is high, most firms can be expected not to contribute, and the expected type among non-contributors will come to resemble the expected type of all

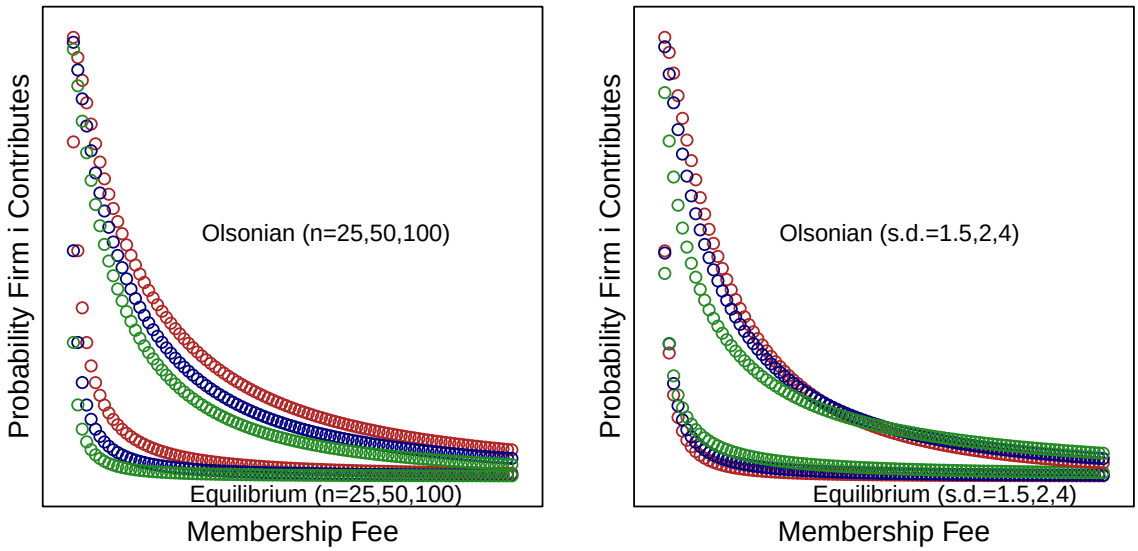
[4]Note that if t is $lognormal(\mu, \sigma)$, then $\tau = t^\beta$ is $lognormal(\beta\mu, \beta\sigma)$.

firms. In the unlikely event that a firm does contribute, such a firm would have a type drawn from the extreme right tail of the prior distribution. These two effects combine to make the "surprise value" of a contribution more potent.

Next, Figure 5 displays how the ex ante probability that a given firm contributes to the association relates to changes in the membership fee. The curves labeled "Equilibrium" correspond to the predictions from the Association equilibrium given the parameter values specified above. These are contrasted with a set of curves corresponding to the predicted probability of contribution to the association *holding fixed* the expected marginal benefit at its equilibrium value for $\varphi = 10$. We label these sets of curves "Olsonian," because they reflect the inelasticity of the marginal benefit to changes in the cost of membership in canonical models of collective action. It is the curves labeled "Olsonian" that reflect the direct effect of changes in the membership fee described above: increasing the fee leads to a decrease in membership. By contrast, the curves labeled "Equilibrium" reflect both the direct and indirect effects. As is clear in the figure, the dropoff in the expected rate of contribution in "Olsonian" simulations is much more gradual than in the equilibrium predictions, reflecting the endogenous determination of the expected marginal benefit of contribution and its effect on the incentives of individual firms to contribute.

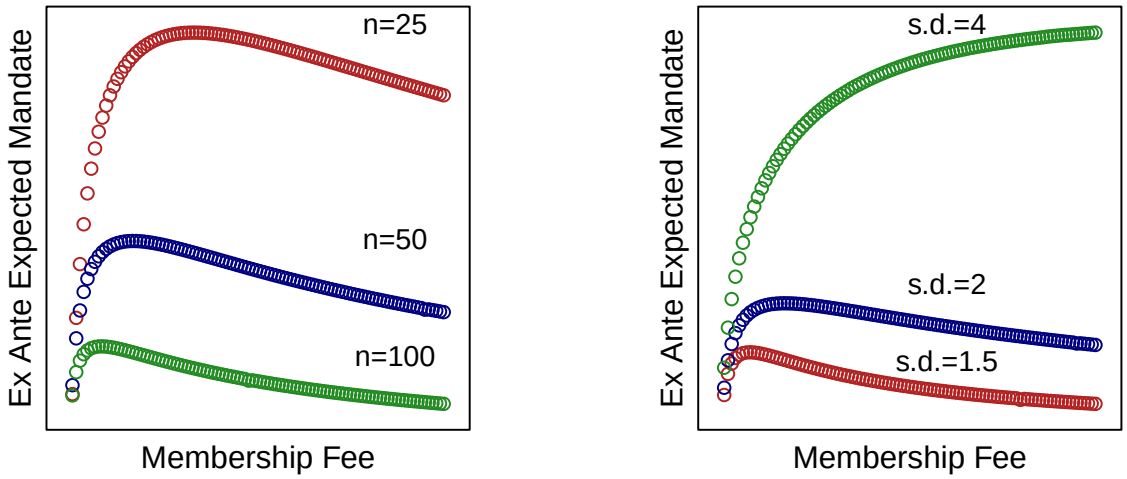
Finally, to show how the direct and indirect effects operate in tandem, Figure 6 displays the ex ante expected regulatory mandate in the Association equilibrium as a function of φ. In five of the six curves displayed in the figure, the relationship is non-monotonic – an increase in φ leads to an increase, and then a decrease, in the expected mandate. The apparent lack of monotonicity in the sixth curve (corresponding to $n = 50, s.d. = 4$), is simply an artifact of the truncation of the horizontal axis. To further explicate the source of the non-monotonicity in the relationship between φ and the expected mandate, consider what happens when φ is either very low or very high. When the membership fee is very low, almost all firms will be willing to join, and further, the posterior expected type among contributors will be very similar to the prior. In expectation, the legislature will set the

Figure 5: The Effect of Changes in Membership Fee on the Probability of Participation



In the left panel, the standard deviation of the type distribution is 2; in the right panel, $n = 50$.

Figure 6: The Effect of Changes in Membership Fee on the Expected Regulatory Mandate



In the left panel, the standard deviation of the type distribution is 2; in the right panel, $n = 50$.

mandate close to its value in the No Association equilibrium. When the membership fee is very high, almost no firms will be willing to join, and the posterior expected type among non-contributors will be very similar to the prior – leading, in expectation, to a mandate close to the No Association mandate. For intermediate values of φ, the expected type of contributors and non-contributors will depart more significantly from the prior mean, and so, by the convexity of the legislature's response function, the expected mandate will be higher than the No Association mandate. In this circumstance, a change in φ can exacerbate the problem for the association.

5 Discussion: "Representation of the One by the Many"

In his classic *Politics, Pressures, and the Tarrif*, Schattschneider (1935), echoing Michels (1915), documents a feature of interest group politics he refers to as "representation of the one by the many." By this he means the tendency of a handful of individuals or firms within an association to pursue goals not in line with those of its broader membership, under the cover afforded by the apparent unanimity of the rank and file. For example, he cites the tendency of trade association officers, when testifying, to exaggerate what fraction of an industry their organization represents. The author calls this phenomenon a "political monstrosity" (271) and attributes its existence to to the desire of all groups to exaggerate their importance, and negligence on the part of Congress.

The idea of representation of the one (or few) by the many may be one of the more profound insights in Schattschneider's extensive research on "pressure" politics. Moreover, the tendency of groups to exaggerate unanimity is surely not a tendency that has not abated since the time he was writing.[5] Still, the concept begs a number of questions: first, why would any firm voluntarily contribute to an association that did not pursue its interests? And second, why would members of Congress be fooled by exaggerated claims of membership?

Our model of association formation and lobbying provides the answers to these ques-

[5]See, for example, McConnell 1966; Bauer, Poole, and Dexter ; and Ainsworth 1993

tions. With respect to the first question, the "inverse free-rider problem" of anti-regulatory associations implies the existence of an inherent conflict between associational entrepreneurs and rank and file members of an association. The rank and file may prefer that an association not exist, as it will make them worse off in expectation. As we describe above, however, those same firms may yet feel compelled to contribute to the association's maintenance if it does exist.

With respect to the second question, in our model, the legislature is not fooled: an association can claim as large a membership as it likes, but the legislature will make its inferences based on the resources the association is in a position to apply to a particular lobbying effort.

6 Conclusion

In this paper, we consider the role of trade associations as a mechanism to partially reveal to the legislature information about politically relevant features of an industry. This selective revelation of information through an association is potentially valuable because stages in the policy making process exist in which it would be either disadvantageous or impossible for individual firms to credibly reveal specific information about themselves.

Despite this potential value, the extent to which trade associations actually "benefit" their members is a somewhat subtle notion. We demonstrate that at least some contributors to an an association seeking reduced regulation of an industry suffer in expectation from the association's existence. Nonetheless, some of those firms might be in a position to benefit from the creation of an association.

Finally, we demonstrate that when associations perform a collective signaling role, the ability of an organization to attract membership through the provision of selective benefits has a significant drawback: making membership less costly undermines the signaling function of the membership decision. In such circumstances, an increase in selective benefits (or reduction in selective costs) can actually undermine the collective goals of the organization.

Appendix: Proofs of Results

Proof of Lemma 1

Comparing the expressions in (4), $y_i(\tau_i) = 1$ if and only if

$$\phi \leq \sqrt[\beta]{\tau_i} E_{k_i}[\omega|k_i, \varphi] - E_{k_i}[\omega|k_i + 1, \varphi] \tag{8}$$

In any informative equilibrium, the expected regulatory mandate must be strictly smaller given firm i's contribution than given no contribution; otherwise, no firm would wish to incur the cost of membership. Therefore, the left side of inequality (8) is a positive constant, and the right side is a positive constant multiplied by a strictly increasing function of τ_i. Thus if the inequality is satisfied for $\tau_i = \tau'$, it will be satisfied for $\tau_i = \tau'' > \tau'$.

Suppose a semi-separating equilibrium in which all firms other than i play the strategy $y_j^*(\tau_j) = \begin{cases} 1 \text{ if } \tau_j \geq \hat{\tau}_j \\ 0 \text{ else} \end{cases}$. Then for every possible $\hat{\tau}_j \in \mathbb{R}_+$, there exists a unique $\hat{\tau}_i(\hat{\tau}_j)$ solving (8) at equality for i. It remains to show that there is a value $\hat{\tau}$ s.t. $\hat{\tau}_i(\hat{\tau}_j = \hat{\tau}) = \hat{\tau}$. First, observe that $\sqrt[\beta]{0} = 0$ and thus, $\hat{\tau}_i = 0$ cannot satisfy (8) at equality given $\varphi > 0$. Further, $\sqrt[\beta]{\tau_i}$ is positive, continuous, and increasing for all $\tau_i > 0$. Second, observe that $\varphi(E_{k_{-i}}[\omega^*(E[\tau|k = k_{-i}, \varphi])] - E_{k_{-i}}[\omega^*(E[\tau|k = k_{-i} + 1, \varphi])])^{-1}$ is positive and continuous for all $\hat{\tau}_j \in \mathbb{R}_+$, and that for $\hat{\tau}_j$ sufficiently large, $(E_{k_{-i}}[\omega^*(E[\tau|k = k_{-i}, \varphi])] - E_{k_{-i}}[\omega^*(E[\tau|k = k_{-i} + 1, \varphi])])^{-1}$ is decreasing. To see the latter, observe that increasing $\hat{\tau}_j$ has two effects on $(E_{k_{-i}}[\omega^*(E[\tau|k = k_{-i}, \varphi])] - E_{k_{-i}}[\omega^*(E[\tau|k = k_{-i} + 1, \varphi])])$: first, it lowers the probability of contributing, thereby increasing the probability of lower values of k_{-i} relative to higher values and thus increasing $(E_{k_{-i}}[\omega^*(E[\tau|k = k_{-i}, \varphi])] - E_{k_{-i}}[\omega^*(E[\tau|k = k_{-i} + 1, \varphi])])$, given the properties of $\omega^*(\cdot)$ established in Proposition 2. Second, it increases both $E[\tau|\tau < \hat{\tau}_j]$ and $E[\tau|\tau \geq \hat{\tau}_j]$; however, for large values of $\hat{\tau}_j$, the effect on $E[\tau|\tau < \hat{\tau}_j]$ is negligible. This insures that for sufficiently large $\hat{\tau}_j$, $\varphi(E_{k_{-i}}[\omega^*(E[\tau|k = k_{-i}, \varphi])] - E_{k_{-i}}[\omega^*(E[\tau|k = k_{-i} + 1, \varphi])])^{-1}$ is decreasing in $\hat{\tau}_j$, guaranteeing the existence of $\hat{\tau}$ s.t. $\hat{\tau}_i(\hat{\tau}_j = \hat{\tau}) = \hat{\tau}$. ■

Proof of Proposition 1

(1) From the text, the legislature chooses a value of ω to maximize its expected utility as given in equation (3). Differentiating with respect to ω and setting to zero yields the legislature's first order condition in equation (5). Concavity of the legislature's utility function guarantees a unique maximum. If the legislature's beliefs do not change from the prior upon observing associational lobbying ($E[\tau|k,\varphi] = E[\tau]\forall k$), then no type of any firm has an incentive to contribute to the lobbying effort ($k = 0$). And given $k = 0$, no additional information about the distribution of firm types is available to the legislature beyond its prior beliefs. Off the path of play, any beliefs such that $E[\tau|k > 0,\varphi] \leq E[\tau]$ support the specified strategy profile. (2) To derive the equilibrium regulatory mandate given the legislature's beliefs, see Part (1). The firms' equilibrium strategy defined in terms of $\hat{\tau}$ is established in Lemma 1. Given $\hat{\tau}(\cdot)$, the posterior density of contributor types is $\pi(\tau)$ left-truncated at $\hat{\tau}$, while the posterior density of non-contributor types is $\pi(\tau)$ right-truncated at $\hat{\tau}$. The posterior mean firm type is, then, a weighted average of the posterior means for non-contributor and contributors, with weights determined by the fraction of firms not contributing and contributing, respectively. All information sets are visited with positive probability on the path of play. ■

Proof of Proposition 2

Implicitly differentiating the legislature's first order condition with respect to $E[\tau|k,\varphi]$ yields

$$-\beta\gamma\omega^{\beta-1} - \beta(\beta-1)\gamma\omega^{\beta-2}E[\tau|k,\varphi]\frac{\partial\omega}{\partial E[\tau|k,\varphi]} = (1-\gamma)f''(\Omega-\omega)\frac{\partial\omega}{\partial E[\tau|k,\varphi]}. \quad (9)$$

Rearranging and solving for $\frac{\partial\omega}{\partial E[\tau|k,\varphi]}$ yields

$$\frac{\partial\omega}{\partial E[\tau|k,\varphi]} = \frac{-\beta\gamma\omega^{\beta-1}}{\beta(\beta-1)\gamma\omega^{\beta-2}E[\tau|k,\varphi] + (1-\gamma)f''(\Omega-\omega)}, \quad (10)$$

which is strictly negative. Implicitly differentiating equation(9) with respect to $E[\tau|k,\varphi]$ and rearranging yields

$$\begin{aligned}&\left(\beta(\beta-1)\gamma\omega^{\beta-2}E[\tau|k,\varphi]+(1-\gamma)f''(\Omega-\omega)\right)\frac{\partial^2\omega}{\partial E[\tau|k,\varphi]^2}\\&=-\frac{\partial\omega}{\partial E[\tau|k,\varphi]}\left[2\beta(\beta-1)\gamma\omega^{\beta-2}+(\beta(\beta-1)(\beta-2)\gamma\omega^{\beta-3}E[\tau|k,\varphi]^2-(1-\gamma)g'''(\Omega-\omega))\frac{\partial\omega}{\partial E[\tau|k,\varphi]}\right].\end{aligned} \tag{11}$$

Both the term multiplying $\frac{\partial^2\omega}{\partial E[\tau|k,\varphi]^2}$ on the right side of equation (11) and the left side of the equation are strictly positive. Therefore $\frac{\partial^2\omega}{\partial E[\tau|k,\varphi]^2}>0$.

From the third line of (7), $E[\tau|k,\varphi]$ is a linear, increasing function of k in the Association equilibrium. Therefore, if $\frac{\partial\omega}{\partial E[\tau|k,\varphi]}<0$ and $\frac{\partial^2\omega}{\partial E[\tau|k,\varphi]^2}>0$, $\frac{\partial\omega}{\partial k}<0$ and $\frac{\partial^2\omega}{\partial k^2}>0$ in that equilibrium. ■

Proof of Remark 5

See text. ■

Proof of Proposition 3

From the first part of Proposition 2, the regulatory mandate is a decreasing, convex function of the expected firm type, $E[\tau|k,\varphi]$. In the No Association equilibrium, the legislature's posterior expectation on τ is simply its prior, $E[\tau]$. To establish the proposition, it is therefore necessary and sufficient to establish that

$$E_k[\omega^*(E_\tau[\tau|k,\varphi])]\geq\omega^*(E_\tau[\tau]). \tag{12}$$

Given the firms' best response of contributing if and only if $\tau_i>\hat{\tau}(\cdot)$, the probability that an individual firm will contribute is $1-\Pi(\hat{\tau})$. Therefore given n firms, k, the number of contributors to the association, is binomially distributed with parameters n and $(1-$

$\Pi(\hat{\tau})$), and $\Pr(k) \in (0,1)$ for all $k \in \{0,1,\ldots,n\}$. From the law of iterated expectations, $E_\tau[\tau] = E_k[E_\tau[\tau|k,\varphi]]$; therefore, $\omega^*(E_\tau[\tau])$ may be expressed as $\omega^*(E_k[E_\tau[\tau|k,\varphi]])$. Having established that $\omega^*(\cdot)$ is convex, substituting into inequality (12), it is immediate that the inequality must hold by the definition of convexity.

Lemma 1 establishes that $\hat{\tau}$ is finite and strictly positive. In addition to the higher mandate in expectation, ex ante, firms will pay φ with some positive probability, which decreases their expected utility further. ■

Proof of Proposition 4

First, recall that $\forall \tau_i < \hat{\tau}$, $y_i(\tau_i) = 0$. Thus, in the Association equilibrium, $E[u_i(\tau_i,\cdot)] = -\sqrt[\beta]{\tau_i} E_{k_{-i}}[\omega^*(E[\tau|k = k_{-i},\varphi])]$. From Proposition 3, $E_{k_{-i}}[\omega^*(E[\tau|k = k_{-i},\varphi])] > E_\tau[E_{k_{-i}}[\omega^*(E[\tau|k = k,\varphi])]] > \omega^*(E[\tau])$. Thus, $\forall \tau_i < \hat{\tau}$, $E[u_i(\tau_i,\cdot)]$ is higher in the No Association equilibrium than in the Associations equilibrium. Consider then $\tau_i \geq \hat{\tau}$. $E[u_i(\tau_i|$ Association$) > E[u_i(\tau_i|$ No Association$)$. Equivalently, $-\varphi - \sqrt[\beta]{\tau_i} E_{k_{-i}}[\omega^*(E[\tau|k = k_{-i}+1,\varphi])] > -\sqrt[\beta]{\tau_i}\omega^*(E[\tau])$. Re-arranging, we have

$$\sqrt[\beta]{\tau_i}(\omega^*(E[\tau]) - E_{k_{-i}}[\omega^*(E[\tau|k = k_{-i}+1,\varphi])] > \varphi. \tag{13}$$

Both φ and $(\omega^*(\cdot) - E_{k_{-i}}[\omega^*(\cdot)])$ are constant in τ_i, and $\sqrt[\beta]{\tau_i}$ is increasing in τ_i, thus establishing part 1. Note next that, given that the support of the distribution of τ_i is $\mathbb{R}_+$, there exists τ_i that satisfies (13) if and only if $(\omega^*(E[\tau]) - E_{k_{-i}}[\omega^*(\cdot)]) > 0$. ■

Proof of Proposition 5

Available from authors upon request. ■

Proof of Proposition 6

Suppose that $(\omega^*(E[\tau]) - E_{k_{-i}}[\omega^*(E_\tau[\tau|k_i+1])]) > 0$ and define $\hat{\hat{\tau}}$ as the value of τ s.t. (13) holds at equality. Comparing (13) to (6), which defines $\hat{\tau}$ and recalling that $E_{k_{-i}}[\omega^*(E[\tau|k = k_{-i}, \varphi])] > (\omega^*(E[\tau])$, establishes that $\hat{\hat{\tau}} > \hat{\tau}$. ■

Proof of Proposition 7

See examples given in text. ■

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