Meetings with costly participation: An empirical analysis

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ABSTRACT: *Using data from the Mid-Atlantic surf clam and ocean quahog fishery, we find that firms with a preference for extreme, rather than moderate, policies are much more likely to participate in public meetings where regulation is determined. We also find that participation rates are higher for larger, closer, and more influential firms. These results; (1) improve our understanding of a very common institution for resource allocation, 'meetings with costly participation', (2) they refine our intuition about regulatory capture, (3) they provide broad confirmation of the recent theoretical literature predicting that polarization and bipartisanship should emerge under a variety of democratic institutions, and finally, (4) they may help to explain management problems in US fisheries.*

Key words: meetings, committees, regulation, fisheries.
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1. Introduction

We analyze a firm's decision to participate in public meetings which determine regulation.[1] Using data from the Mid-Atlantic surf clam and ocean quahog fishery, we find that firms with a preference for extreme policies are much more likely to participate in public meetings than firms with a preference for moderate policies. We also find that participation rates are higher for larger, closer, and more influential firms. These results are of interest for several reasons.

Voluntary meetings with costly participation are ubiquitous as an institution for resource allocation. Examples include; faculty meetings, parent teacher association meetings, and condominium association meetings. Moreover, the requirement that regulators allow and encourage public participation is an almost universal feature of the US regulatory process.[2] Yet, despite their importance, meetings with costly participation are little studied, and basic questions about them are unanswered: Who goes? Does participation vary with observable characteristics? Do meeting participants represent the interested population? Our analysis of the Mid-Atlantic clam fishery answers these questions: large, nearby extremists participate in meetings with costly participation.

It is clear that these findings improve our understanding of voluntary participation in costly meetings, and hence of most regulatory decisions taken in the United States. However, they also suggest a refinement in our intuition about regulatory capture. At least where regulation is determined in a participatory process, we should expect regulation to reflect the interests of firms whose tastes are extreme.

An immediate consequence of our results is that laws designed to encourage public participation in the regulatory process, like those in the US, do not serve to elicit information about the preferences of a representative or average member of the public. To the contrary, such laws elicit the opinions of individuals most interested in the regulation, and individuals with the most extreme tastes. A review of the available theoretical literature suggests that such over-participation of extremists is undesirable.

[1]We thank seminar participants at the Hoover Institution, University of Maryland, University of Toronto, SUNY Buffalo, University of Alberta, and University of Calgary for helpful comments and suggestions. Special thanks to Henning Bunzel, Dave Wallace and Clay Heaton for helpful comments and discussions. We are also grateful to two anonymous referees and the editor of this *Journal* for helpful suggestions.

[2]The Administrative Procedure Act requires that all US federal regulatory agencies "shall give interested persons an opportunity to participate in the rule making through submission of written data, views, or arguments with or without the opportunity for oral presentation"(Title 5 *U.S. Code* §553(c), 1988 edition.). In *Corrosion Proof Fittings v. Environmental Protection Agency* the Supreme Court showed its willingness to require that public opinion be adequately consulted. (In this case, the court vacated proposed regulation because the Environmental Protection Agency prematurely ended public hearings and deprived the public of sufficient opportunity to "comment [on], analyze, and influence the [regulatory] proceedings". In this case public participation is mandated by the Toxic Substances Control Act rather than the Administrative Procedure Act.)

Domination of public meetings by extremists may partially explain management problems in US fisheries. In 2002, the National Marine Fisheries Service,[3] reported that 93 of the 304 fish populations under its jurisdiction were either overfished or exploited at unsustainable levels, a situation which places the federal government in violation the Magnuson Act's injunction against overfishing.[4] The regional 'management councils' which formulate most regulation for federal fisheries bear much of the responsibility for this situation. These councils have a statutory obligation to solicit the opinions of industry by holding public meetings. Since pervasive problems of regulatory capture are alleged (Pew Ocean Commission, 2003; see also Johnson and Libecap, 1982), and since fisheries regulation is determined at meetings with costly participation, our results suggest that if US fisheries regulators are captured, it is most likely by firms whose tastes are extreme even among the population of regulated firms. In all, this suggests that the current administration's proposals for "streamlining the public comment [process]"[5] for fisheries regulation can be improved. Such streamlining involves marginal changes in participation costs rather than a qualitative change in the nature of the participation decision, and as such, should not be expected to reduce the influence of extremists.

Finally, our findings confirm recent theoretical results requiring political polarization and bipartisanship to emerge in democratic institutions.

The paper proceeds as follows. The next section surveys the relevant theoretical literature on political participation. Section 3 presents background information about the Mid-Atlantic clam fishery and the way the fishery is regulated. Sections 4-5 establish a link between our data and participation patterns predicted by the theoretical literature. Descriptive statistics, the econometric model, and results are presented in sections 6-8. The remaining sections interpret the empirical results, discuss policy implications, and summarize the key findings.

2. Relevant literature and its implications

Relatively few papers provide positive analyses of patterns of participation. Osborne, Rosenthal, and Turner (2000) analyze participation patterns at meetings where participation is costly and the outcome is a compromise among those who attend. Feddersen (1992) analyzes costly voting in majority rule 'elections' where agents simultaneously choose a policy and whether or not to vote. Although these authors consider different institutions, basic features of their models and results are similar.

[3] The National Marine Fisheries Service is the federal agency principally responsible for monitoring the status of fisheries in federal waters.

[4] Title 16 *U.S. Code* §1851(a)(1), 1996 edition.

[5] NOAA press release, NOAA 03-081, June 27, 2003.

Both papers consider ’spatial models’. That is, an outcome or policy is a point in space and agents have preferences over these points. Each agent’s utility is maximized at a single policy and declines as the selected policy is further from this bliss point. In both papers participation is costly and an agent decides to participate on the basis of how much his participation affects the outcome, taking as given the participation behavior of other agents. If and only if the value of the change in outcome associated with participation is greater than the participation cost does the agent participate. All else equal, agents with lower participation costs will be more likely to participate, agents whose participation causes a larger shift in the outcome will be more likely to participate, and agents who value a marginal change in the outcome more highly will be more likely to attend.

Osborne *et al.* (2000) argue that, in equilibrium, agents whose bliss points are near the anticipated outcome are less likely to participate than those whose bliss points are far from the outcome. That is, agents with moderate preferences do not participate in meetings. Intuitively, participation by agents close to the outcome does not move the outcome enough to justify their participation costs. Feddersen (1992) shows that, in equilibrium, agents in a region adjacent to the outcome do not participate. This results in patterns of participation similar to those predicted by Osborne *et al.* (2000).

In a related paper, Campbell (1999) considers elections in which agents may cast a costly vote for one of two exogenously fixed alternatives when both the size of the electorate and the bliss point of any given voter is random. This analysis, too, concludes that a democratic process with voluntary participation is likely to be dominated by extremists.

Another related inquiry examines the way that various collective choice institutions aggregate private information about an uncertain state of the world. While much of this literature does not allow for endogenous participation, there are two noteworthy exceptions, Feddersen and Pesendorfer (1996) and Li, Rosen and Suen (2001).

Feddersen and Pesendorfer (1996) consider the ability of elections, with costless voting, to aggregate private information when abstention is possible. They find that only agents who do not strongly prefer one outcome to another ever abstain from voting. Li, Rosen and Suen (2001) consider the ability of a quite different institution, committees, to aggregate information. Like Feddersen and Pesendorfer (1996), when abstention is permitted, Li *et al.* (2001) find that agents who strictly prefer one outcome or have an unambiguous signal in favor of one outcome, are more likely to participate in committee meetings. Thus, like Osborne *et al.* (2000) and Feddersen (1992) both Feddersen and Pesendorfer (1996) and Li *et al.* (2001) find that agents who prefer extreme outcomes are more likely to participate in a collective decision.

In sum, several different models of the participation decision indicate that agents with extreme positions in the policy space are more likely to attend meetings and participate in regulatory decisions than are their more moderate counterparts. Another way of stating this conclusion is that a polarized political process is a natural consequence of democracy. If we are willing to regard the two extreme factions of participants as nascent political parties, these models provide an explanation for the emergence of a two-party political process. Thus, it is worth noting that political scientists do observe polarization in national politics, (McCarty, Poole and Rosenthal (2001)), and that the two party state is a common feature of economic models, e.g., Alesina (1990) and Biais and Perotti (2002).

There is, to our knowledge, only one empirical paper examining patterns of participation at public meetings. Bulkley, Miles, Pearson, and Bernhard (1999) find that members of England's House of Lords are less likely to participate in house meetings and vote if they are not affiliated with a party than if they are affiliated with a party. If we posit that unaffiliated Lords are more politically moderate than party members this may be evidence that meetings are attended by extremists. On the other hand, one probable function of parties is to 'get out the vote', so that this conclusion is not compelling.

There is also anecdotal evidence to suggest that meetings tend to attract extremists. The regulation of New England federal fisheries and Rhode Island state fisheries depends on the results of regulatory meetings which are open to public participation. Allen (1991) describes a conflict between conservation-minded sport fishers and extraction-minded commercial fishers in Rhode Island. Both groups took fairly extreme positions and the attendance at two successive public hearings was lopsided in different directions, producing a policy that was first pro-conservation and then pro-extraction. Similarly, the record of the public hearings held by the New England Fishery Management Council (1985, p. 9.45) describes a conflict between two different groups of fishers (gillnetters and trawlers), who attended successive public hearings in lopsided proportions. As in Rhode Island, the result was a policy that first favored one group, then the other.

In sum, the anecdotal evidence suggests that public participation affects the decisions taken at regulatory meetings, and that participants at these meetings appear to have preferences for policies that are extreme relative to those of the affected population.

3. Background

To more thoroughly investigate participation in costly meetings we collected firm-level data from the Mid-Atlantic surf clam and ocean quahog fishery during the period 1990 to 1998. These data are well suited to our inquiry into participation behavior for three reasons. First, they describe the universe of firms affected by the regulatory outcome, whether they participate in the regulatory process or not. Without data on all firms affected by the regulation, an analysis of the participation decision is impossible. To our knowledge similar data has not been considered elsewhere, although analyses of firm characteristics conditional on participation in the regulatory process have been conducted, e.g., Ando (1999), Cropper *et al.* (1992). Second, our data allow us to identify individual 'fishing firms', collections of vessels, processing plants and harvest permits (or 'individual tradable quota'), with a common owner. Enumerating the assets that comprise a firm is essential to an investigation of how firm characteristics influence participation. Finally, as we will argue below, the nature of regulatory decisions in this fishery is particularly simple and corresponds closely to models used in theoretical analyses of participation decisions.

The Mid-Atlantic clam fishery targets surf clams and ocean quahogs in state and federal waters off the coasts of Virginia, Maryland, Delaware, and New Jersey. Vessels harvest clams year round by towing dredges across the underwater clam beds and then pumping the clams to the surface using hydraulic pumps. Vessels deliver unshelled clams to land-based processing plants. Processing plants extract the clam meat. After resale, clam meat is used primarily in chowder and seafood soups. Surf clam and ocean quahog landings in the Mid-Atlantic region in 1998 had an ex-vessel value of $23.65 million and $16.56 million, respectively.

Prior to October 1990, the Mid-Atlantic Fisheries Management Council regulated the fishery with vessel entry limitations and harvest time restrictions. Since October 1990 the fishery has been regulated with an individual tradable quota program. At the inception of this program regulators distributed quota shares to vessel owners according to a formula that increased both with vessel size and historic harvest levels. In each year the regulatory process determines a total allowable catch for both clam species. Resource users are allowed to harvest a share of the total allowable catch determined by the amount of individual tradable quota that they own or rent.

We compile our data primarily from three sources. First, National Marine Fisheries Service logbook data that records all fishing and processing activity in the clam fishery. Logbook data record every vessel's harvests, along with the processing plant which purchases each trip's harvest. Thus, these data identify all active vessels and processing plants in the fishery during the 1990-98 study period.

The second data source is a public record of individual tradable quota ownership maintained by the Mid-Atlantic Fishery Management Council. This record lists the name of each person or firm that owns quota and the number of shares held. Using this information, together with supplementary vessel and plant ownership information from the Mid-Atlantic Fishery Management Council, the National Marine Fisheries Service, and industry members, we matched vessels, processing plants and quota holdings to firms.

Our third data source is the minutes of regulatory meetings where total allowable catches are discussed. From these minutes we extract a list of participants at each meeting, along with information about what was said at each meeting. When the firm affiliation of a meeting participant was not clear from the minutes, we consulted industry members to

	Physical Assets					Quota Assets				All Assets
	1	2	3	4	5	6	7	8	9	10
Year	Harvest Firms	Vessels	Process. Firms	Process. Plants	Unique Firms	SC	OQ	Unique Firms	Pure Quota Owners	Unique Firms
1990	36	124	18	22	48	54	54	54	21	69
1991	32	76	16	20	42	48	37	53	25	67
1992	30	66	17	20	42	47	37	52	24	66
1993	29	62	18	21	42	47	36	52	25	67
1994	25	57	14	17	34	45	35	51	29	63
1995	25	59	13	16	33	41	31	50	27	60
1996	24	53	11	13	30	44	31	52	30	60
1997	21	50	11	14	27	44	29	49	30	57
1998	21	47	7	9	23	45	30	50	31	54

Table 1: Capital and quota ownership in the Mid-Atlantic clam fishery. Columns describe: 1 - Firms that own fishing vessels. 2 - Active vessels in the fleet. 3 - Firms that own processing plants. 4 - Active processing plants. 5 - Firms that own physical capital. 6 - Firms that own surf clam quota. 7 - Firms that own ocean quahog quota. 8 - Firms that own quota. 9 - Firms that own quota but not physical capital. 10 - Total firms active in fishery.

match meeting participants to the correct firms.

Industry organization

Any US citizen may own tradable quota, and few restrictions are placed on quota trading other than a requirement that no individual own more than 20% of the total available quota for each clam species. The market for the sale of quota has been active throughout the 1990-98 study period. Quota rental is also common. A detailed description of the operation of the individual tradable quota program in this fishery is available in Committee to Review Individual Fishing Quotas (1999).

Table 1 describes the ownership of fishing vessels, processing plants, and quota in the final year of the limited entry management program (1990) and the first eight years of the individual tradable quota program (1991-1998). Columns 1-5 show that many firms own both fishing vessels and a processing facility. This table also shows that the numbers of harvesting, processing, and quota owning firms all declined under the individual tradable quota program. Physical capital employed in the fishery also decreases: The number of vessels decreases from 124 to 47 and the number of processing plants from 22 to 9.[6] Firms owning quota in 1998 were more likely to specialize in surf clams or quahogs than they were in 1990.

Lastly, the individual tradable quota program has allowed the emergence of a class of pure quota owners who own quota but do not own physical capital (column 9). Many of these firms harvested clams prior to the individual tradable quota management program and so were allocated quota, but subsequently sold their vessel(s). About one third of firms in 1990 and over half in 1998 fall into this class. Pure quota owners are much smaller than other firms on average. Not only do they not own physical capital, but their holdings of quota are also small. An average pure quota owner holds 23,468 bushels of surf clam quota, and 35,337 bushels of ocean quahog quota, versus 50,302 bushels of surf clam and 105,412 bushels of ocean quahog quota for an average firm that also owns physical capital.

Regulatory process

All fisheries operating in federal waters along the middle Atlantic coast are regulated by the Mid-Atlantic Fishery Management Council.[7] A subcommittee of this council, the Surf Clam and Ocean Quahog Committee, is responsible for recommending total allowable catches for the surf clam and ocean quahog fisheries to the council. The Surf Clam and Ocean Quahog Committee convenes a Science and Statistics Committee to review the available scientific information and formulate a policy recommendation. In each year, the Science and Statistics Committee recommends a total allowable catch to the Surf Clam and Ocean Quahog Committee which accepts or amends the recommendation (or calls for more research), and passes it to the full council.[8] The full council then accepts or amends the recommendation, or asks for more research to be done. After the council accepts a regulation, it is passed to the Secretary of Commerce for a final and nearly automatic approval.

Table 2 shows the total allowable catch for each species for each year, and the proportion of this total allowable catch that was eventually harvested. During the early years of the study period the industry consistently harvested the entire surf clam total allowable catch.

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[6]Rumors that the initial allocation of individual tradable quotas would depend on historical catch records may have delayed the abandonment of some vessels until the individual tradable quota program was in place. Many of the exiting vessels were scrapped.

[7] Council members are selected by the governors of the affected states and are approved by the Secretary of Commerce. Broadly, council members are industry representatives, representatives of state fisheries and environmental bureaucracies, and academics. For details of the selection and appointment process see Title 16 *U.S. Code* §1852, 1988 edition.

[8]A Science and Statistics Committee meeting is not convened in years where the scientific information available to the Surf Clam and Ocean Quahog committee about stock abundance is easy to interpret.

	Surf Clam		Ocean Quahog	
Year	**Total Allowable Catch**	**% Harvested**	**Total Allowable Catch**	**% Harvested**
1990	2.850*	109%	5.300	87%
1991	2.850*	94%	5.300	91%
1992	2.850*	99%	5.300	93%
1993	2.850*	99%	5.400	89%
1994	2.850*	100%	5.400	85%
1995	2.565*	99%	4.900	94%
1996	2.565*	100%	4.450*	99%
1997	2.565	94%	4.317*	99%
1998	2.565	92%	4.000*	99%

Table 2: Total allowable catch levels, 1990-1998 (from Mid-Atlantic Fisheries Management Council, August 1998). '*' indicates a binding total allowable catch. Harvest in excess of the total allowable catch of surf clams in 1990 is a consequence of administrative problems at the inception of the individual tradable quota program.

On the other hand, the ocean quahog total allowable catch is only fully harvested towards the end of the sample. We will later argue that attendance behavior should be different during years when the total allowable catch is binding than in years when it is not. With an eye to tests of this hypothesis we designate years 1990-96 as years when the surf clam total allowable catch was binding, and 1996-98 as years when the ocean quahog total allowable catch was binding. Note that we class 1991 as a binding year for surf clams, despite the fact that Table 2 indicates that only 94% of the total allowable catch was harvested. In fact, all of the available total allowable catch was harvested, and the apparent surplus reflects an *ex post* revision of accounting practices (Mid-Atlantic Fisheries Management Council (1992)).

Table 3 provides summary information about the meetings where the total allowable catch for surf clams or ocean quahogs was discussed between 1990 and 1998. The council and its subordinate committees reach decisions according to a carefully followed process wherein a motion must be introduced by a voting member, seconded, debated, and put to a vote. Members of the public who participate in a council meeting are usually permitted to speak only during a question and answer period. Meetings of the Surf Clam and Ocean Quahog Committee are often less formal. Public participants in the regulatory meetings are not compensated and must bear their own transportation costs.

A small number of individuals have special status as 'industry advisors' to the council. When these individuals participate in a council or committee meeting in their role as advisors, they are permitted to participate in council or committee debates, but not vote. Industry advisors are compensated for travel to those meetings where the council requests their presence. According to industry sources, when the council selects industry advisors, it does so by soliciting volunteers. Nearly all volunteers are accepted,[9] and the term of an advisor is typically three to five years. Since volunteering to be an advisor is essentially an offer to participate in many meetings, we expect that the same factors that influence a firm's decision to participate in a meeting also affect its decision to become an advisor. Therefore we will correct for the probable endogeneity of advisor status in our econometric analysis.

In all, the administrative record indicates that 197 individuals attended a meeting. 53 of these individuals are linked to a particular clam fishing firm, 84 are bureaucrats, 40 are linked to other fisheries, 9 are academics, 2 are environmentalists and 9 are of unknown affiliation. Firms are usually represented by a principal or employee, although firms hire lobbyists occasionally.

The 40 individuals linked to other fisheries appear exclusively at meetings of the Mid-Atlantic Fishery Management Council, meetings where only part of the agenda is devoted

[9] Lee Anderson, (personal communication 2000).

Date	Location	Represented Firms	Represented Firms (% of year’s total)
8/13/90	Essington, PA	6	8.7%
9/19/90	Hauppauge, NY	8	11.6%
8/19/91	Dover, DE	4	6.0%
9/05/91	Philadelphia, PA	1	1.5%
8/27/92	Essington, PA	10	15.2%
9/16/92	Essington, PA	6	9.1%
5/05/93	Essington, PA	11	16.7%
6/02/93	Norfolk, VA	3	4.5%
12/15/93	Virginia Beach, VA	0	0%
9/12/94	Essington, PA	17	27.0%
9/24/94	Philadelphia, PA	10	15.9%
7/18/95	Essington, PA	12	20.0%
8/3/95	Wilmington, DE	9	15.0%
9/20/95	Philadelphia, PA	6	10.0%
9/4/96	Philadelphia, PA	10	15.0%
9/19/96	Philadelphia, PA	9	15.0%
8/12/97	Philadelphia, PA	9	15.8%
8/6/98	Claymont, DE	9	16.7%
8/19/98	Philadelphia, PA	9	16.7%

Table 3: Public attendance at meetings where the total allowable catch for surf clams and ocean quahogs was selected.

to the clam fishery. Although our record of attendance does not specify which of the several sessions of the full council meeting that an individual attends, we have no record that any of the individuals linked to other fisheries ever commented during the sessions devoted to the clam fishery. Thus it is highly probable that these individuals did not attend sessions addressing clam issues at all, and we make no further effort to analyze their attendance behavior.

4. Conformance of fact to theory

Relationship between participation and outcome

The details of the relationship between participation and outcome vary considerably from one theoretical analysis to another. For example, Osborne *et al.* (2000) consider an axiomatic description of reduced form 'compromise functions' which relate participation to outcomes, while Feddersen and Pesendorfer (1992) consider median voting. However the requirement that participation affect the choice of policy with some probability is universal.

In the real policy making process, only council members vote on the total allowable catch, and only committee members vote on recommendations that are passed to the council. Public participation can affect policy outcomes only if it leads voting members to introduce motions or causes them to change their votes on existing motions. The public record and feedback from industry members suggest that firm participation at meetings does, in fact, influence meeting outcomes through precisely this channel.

The minutes of the Mid-Atlantic Fisheries Management Council meeting of September 28, 1994 show that a council member introduced a successful motion for a higher ocean quahog total allowable catch in response to industry outcry. The council's behavior in this instance is broadly consistent with reports from members of the council: "Industry input is always considered very seriously by the Council. For example, the staff recommended a 5% increase in the surf clam quota for the year 2002. Primarily at the request of industry, the Council voted to increase it by 10%."[10] Perhaps more important, members of industry believe that their participation affects the outcome of regulatory meetings. An industry source tell us that a 10% reduction in surf clam total allowable catch in 1994, and a 500,000 bushel increase in ocean quahog total allowable catch in 1998 were in response to industry requests.[11]

[10]Clay Heaton, personal communication (2001).

[11]Dave Wallace, personal correspondence (2000).

While it is not uncommon for a firm to attend a meeting and not say anything that is recorded in the administrative record,[12] the converse is also true. Firms do speak on the record, often to advocate a choice of total allowable catch for one or both clam species. Consistent with the assumptions of the theoretical literature, it appears that such firm participation can induce a voting member to introduce or change his vote on a motion, and thereby affects the outcome of a meeting.[13]

Policy space

The theoretical literature analyzing participation in democratic institutions typically considers 'spatial' policy decisions that involve the choice of one or more real numbers (e.g., Osborne *et al.*, 2000; Feddersen, 1992). Since a choice of total allowable catches for surf clams and ocean quahogs is a choice of two real numbers, the policy space is a subset of the real plane. Thus, the actual policy space appears to correspond precisely to those commonly considered in the theoretical literature.

This conclusion is complicated by the fact that in some years choices on transitory issues that are not real numbers are required. For example, in one year policy makers determined the details of enforcement policy, in other years they debated whether an experimental fishery for Maine clams was in fact an allowable experiment or an attempt by a (very remote) fishery to operate outside the individual tradable quota program. Given that the council often makes two separate decisions, one on a transitory issue and one on the total allowable catches, the reasonableness of our decision to analyze only the choice of total allowable catches hinges on the two decisions being made independent of each other.

The administrative record indicates that the two decisions are, in all likelihood, independent. First, transitory issues are often discussed at meetings where they are the sole topic of debate (we exclude such meetings from our sample). Second, we do not see transitory issues linked to the choice of total allowable catch in debate, e.g., statements such as, "The decision on the total allowable catch depends on the decision on the transitory issue" do not appear in the administrative record. Thus, on the basis of the administrative record, it is reasonable to think that firms' preferences over the total allowable catch do not change very much with the decision made on the transitory issue. This conclusion is also consistent with the nature of the transitory decisions, for example, refinements of enforcement procedures or the inclusion or exclusion of the relatively small and remote

[12]The administrative record consists primarily of minutes for the various meetings. The quality of these minutes varies from a complete verbatim transcript, to partial summaries of what was said. Thus, our record of comments directed to the council is somewhat incomplete. Comments made off the record are, by definition, not recorded. (We note that meeting attendance and meeting minutes are typically recorded separately.)

[13]An econometric examination of the relationship between the characteristics of attendees (or statements made by attendees) and changes in the total allowable catch proved uninformative.

Maine clam fishery in the individual tradable quota program. Since these are decisions that should have only a minor impact on most firms, for most firms the decisions on these transitory issues will also have only minor effects on the marginal profits of quota, and hence on their preferences over the choice of total allowable catch.

Preferences

Finally, in the theoretical literature, e.g., Osborne *et al*. (2000), heterogeneity in the agents' preferences is completely described by the heterogeneity of their bliss points. Less formally, the disutility of a given deviation from an agent's bliss point does not vary with the agent's position. This is probably not true for the firms in our sample. All else equal, a given deviation away from its profit maximizing total allowable catch will be more costly for a large firm than a small firm. In response to this discrepancy, our econometric analysis controls for the importance of a firm's position, holding other firm characteristics constant.

5. Measuring Extremism

To examine the hypothesis that firms with more extreme positions are more likely to participate in meetings, we must first address the problem of measuring the 'extremeness' of a firm's preferred or profit maximizing choice of total allowable catch. Since we do not observe firms' preferences directly, we face the difficult problem of constructing an index which co-varies with these preferences. Our premise is that a firm which is more specialized in physical capital (vessels and processing plants) or quota, will have more extreme preferences over the total allowable catch than a firm which is more diversified.

Our premise is consistent with the simple model of rent division illustrated in Figure 1. Q denotes the quantity of clams harvested, $S(Q)$ the industry supply, and P the price for processed clam meats.[14] There is one clam species, one extraction sector, and all markets are competitive. The total allowable catch is $\overline{Q}$. In equilibrium, firms bid-up the price of quota, $r(Q)$, until the marginal cost of harvesting a unit of clams just equals the market price, P, minus the quota price, $r(Q)$. In Figure 1, Q^* denotes the total allowable catch at which the marginal profit from extraction is zero. At Q^* the quota rental price is zero. With the introduction of a binding total allowable catch, $\overline{Q} < Q^*$, the rental price of quota is strictly positive, $r(\overline{Q}) = P - S(\overline{Q}) > 0$.

In Figure 1, at total allowable catch level $\overline{Q}$, rents for the extraction sector are given by the shaded area, while rents for the quota owners are given by the hatched area. Rents for the extraction sector are *increasing* in Q and reach a maximum when $Q = Q^*$. Rents

[14] Figure 1 depicts a constant price for clam meats. While the Mid-Atlantic surf clam and ocean quahog fishery accounts for a substantial share of US clam production, competition from imports, other types of clams, and other clam substitutes suggests that the demand for processed clams is elastic.

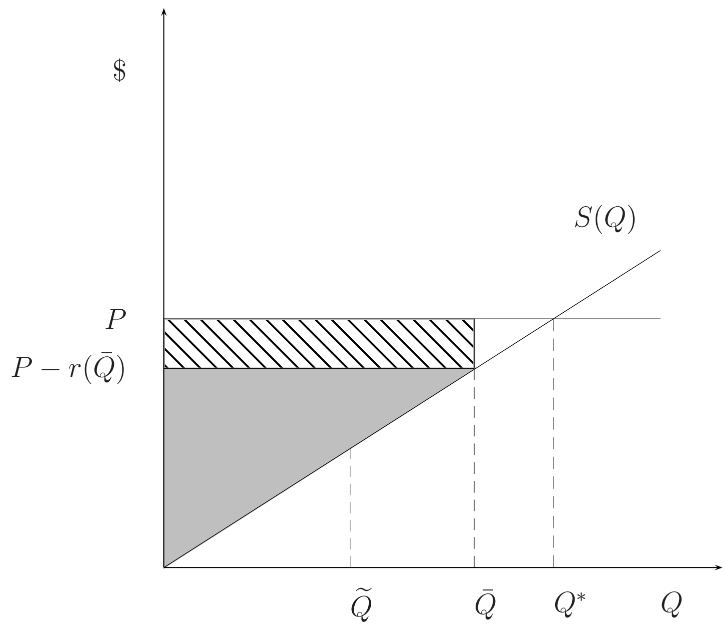

Figure 1: A simple model of rent division. $S(Q)$ is industry supply, P the price for processed clam meats. The total allowable catch is $\overline{Q}$, and $r(Q)$ the rental price for a unit of quota. Q^* denotes the quantity of clams at which the marginal profits from extraction declines to zero. At total allowable catch $\overline{Q}$, rents for the extraction sector are given by the shaded area, while rents for quota owners are given by the hatched area.

for quota owners are maximized when $r(Q)Q$ is maximized. This occurs at a value of $\widetilde{Q}$ which is strictly smaller than Q^*. Given $\widetilde{Q} < Q < Q^*$, quota owner rents are *decreasing* in Q. Thus, for $\widetilde{Q} < Q < Q^*$, quota owners prefer marginal decreases in the total allowable catch while owners of physical capital oppose them. Therefore, this model implies that, when the total allowable catch is binding, a firm's preferences over the total allowable catch will vary with specialization into physical capital or individual tradable quota. In particular, firms that are more specialized in quota support a marginal decrease in the total allowable catch, while firms that are more specialized in physical capital prefer the opposite.

The assumption which drives the disagreement between quota owners and capital owners is that the supply curve is upward sloping, at least in the short run.[15] Possible reasons for such a positive slope are specificity of clam harvesting and processing capital, or capital adjustment costs.

The model also suggests that more and less specialized firms will not disagree about marginal changes to the total allowable catch when the total allowable catch is not binding: If the total allowable catch is strictly larger than Q^* then the price of quota is zero and all

[15]Otherwise, extracting firms make zero profits at all levels of the total allowable catch and would not disagree with the quota owners about the level of the total allowable catch.

Surf Clam Stated Position	Average Surf Clam Position Index	Ocean Quahog Stated Position	Average Ocean Quahog Position Index
1 = Increase (n=23)	0.425	1 = Increase (n=30)	0.292
0 = No Change (n=11)	0.159	0 = No Change (n=13)	0.028
-1 = Decrease (n=9)	0.529	-1 = Decrease (n=18)	-0.395

Table 4: *Position* conditional on *stated position*.

firms assign a zero value to a marginal change in the total allowable catch.

A comment in Mid-Atlantic Fisheries Management Council (1998, p. 23) indicates that an understanding of this model is widespread among regulators and firms: "Some consider it a matter of basic equity that quotas under an individual tradable quota fishery not be set far in excess of market needs, so that the majority of holders will be able to sell their share of the quota". The description of firms' preferences derived from our model of rent division is also consistent with the description of preferences given by meeting participants at the September 1992 meeting in Essington, PA, "If you own allocation, you want a small quota, and if you don't own allocation you want a bigger quota, ...". That is, preferences over the total allowable catch vary with the degree of specialization in physical capital versus quota. Another participant at this meeting gives a less complete description consistent with similar preferences, "If you have a lot of quota that you control, the less of it there is the more valuable."

We make use of the following index to measure the extent to which a firm is specialized in physical capital or quota ownership,

$$position = \frac{\max\{\text{Harvested bushels, Processed bushels}\} - \text{Bushels of quota owned}}{\max\{\text{Harvested bushels, Processed bushels}\} + \text{Bushels of quota owned}}.$$

This index ranges between -1 for a firm that owns only quota, to 1 for a firm owning only physical capital. Thus, *position* exhibits the requisite property of assigning a more extreme value to firms that are more specialized in quota or physical capital. We normalize the position index by a measure of firm size. In principle, this will allow us to distinguish between the effects of size and position on firm attendance behavior. Since we are concerned with a two dimensional policy space, a choice of total allowable catch for surf clams and for ocean quahogs, we calculate firm position indices for each species.

If the position index and firms' statements at meetings both reflect the firms' underlying preferences over policies, then we should see firms' statements varying systematically with their position. More specifically, if our model is correct we should see that firms with smaller (larger) position indices are more likely to advocate for smaller (larger) total allowable catch's.

Since we have access to the minutes of meetings at which the total allowable catches were selected, we are able test this hypothesis. For each meeting and species, for the subsample of firms for whom a partisan statement about the total allowable catch appears in the administrative record, we construct a variable *stated position* which takes the values -1, 1, or 0 according to whether the statement advocates a decrease, increase, or no change in whichever total allowable catch is under consideration. Thus, for a subsample of firms, *stated position* provides us with a measure of firms' stated preferences over the total allowable catch.

To test the relationship between *position* and *stated position* Table 4 reports means of *position* conditional on *stated position*. Table 4 shows a strong correlation between *stated position* and *position*. For ocean quahogs, the relationship between mean *position* and *stated position* is strongly monotonic. A test of the null hypothesis of common position indices for firms advocating a larger and smaller ocean quahog total allowable catch is rejected at the 99% confidence level. For surf clams, the relationship between the average position index and *stated position* is as expected, with one exception. The average value of the position index for the nine instances when a firm called for a smaller surf clam total allowable catch exceeds the average position of the remaining groups. Closer analysis reveals that this unexpected result is due to one outlying firm. If this firm is removed, resulting mean position is 0.152, and the relationship between *position* and *stated position* is again monotonic. With the outlying firm removed, a test of the null hypothesis of common position indices for firms advocating a larger and smaller surf clam total allowable catch is rejected at the 96% confidence level.

In all, the relationship between a firm's actual position in policy space and our position indices is consistent with a theoretical model based on unrestrictive assumptions, with statements made by firms' representatives, and with an observed relationship between firms' stated positions and the calculated position indices.

6. Descriptive statistics

Table 5 summarizes firm characteristics for the whole sample of 87 firms, and for the subsets of firms that do and do not attend at least one meeting. The table reports the means of four measures of mean firm size: number of vessels owned, number of processing plants owned, and, quota holdings for each clam species. The table also reports; mean travel distance between the center of the zip code containing a firm's mailing address and the center of the zip code containing the meeting site, the number of firms that only own quota, and finally, the number of firms with advisor status.

	Full Sample	**Participants**	**Non-participants**
Firms	87	27	60
Pure Quota Firms	49	7	42
Vessels	.79 (1.50)	2.09 (2.10)	0.20 (0.44)
Plants	.27 (0.52)	0.44 (0.69)	0.20 (0.40)
Surf Clam Quota (‘000 bushels)	35.19 (78.19)	80.33 (124.57)	14.88 (26.84)
Ocean Quahog Quota (‘000 bushels)	65.95 (159.69)	150.07 (243.22)	28.09 (80.05)
Distance (miles)	202.07 (144.84)	138.62 (71.13)	230.62 (160.25)
Advisors	12	12	0

Table 5: Firm characteristics. The unit of observation is a 'firm-year', and averages are taken over this set of observations. Firms are classified as participants if they attended at least one of the nineteen meetings in our sample. Standard deviations are in parentheses.

On average, participating firms have more capital than non-participating firms. This is true for every measure of capital that we use, vessels per firm, processing plants per firm, and quota per firm.[16] Table 5 also shows that participating firms are located 92 miles closer to the meeting site than non-participating firms, on average. All firms with advisor status attended at least one meeting.

Table 5 also shows that pure quota owners are much less likely to attend meetings than other firms. We believe that there are two reasons for this. First, as noted earlier, pure quota owners are much smaller, on average, than other firms. They own no physical capital and typically own small amounts of quota. Second, the animosity of fishermen towards absentee quota owners is strong and well documented (Committee to Review Individual Fishing Quotas (1999)). As such, the social interaction required at meetings is probably more costly for them than for other firms. Given this, we expect that the behavior of these firms may be different from their more diversified counterparts.

We now turn our attention to the relationship between a firm's position and its attendance behavior. Figure 2 presents histograms showing participation rates conditional on surf clam and ocean quahog *position*. In each of the six figures, the dashed line plots the OLS regression of attendance on *position* and *position*^{2}, while the solid line plots the results of a kernel regression of attendance on *position*.[17] The top row presents results where the *position* index is calculated for ocean quahogs, while the bottom row presents the corresponding results for surf clams.

The figures in the left column of Figure 2 are based on the full sample of firms and meetings. Figures in the middle column report results when pure quota owning firms are excluded, i.e., those with position -1 are dropped. Finally, the figures in the right column exclude pure quota owning firms and meetings conducted in years where the relevant total allowable catch was not binding (see Table 2). Thus, Figure 2c (2f) is based on meetings conducted in 1996-8 (1990-6).

In every case we see that the kernel regressions are bimodal. Excluding pure quota owners from the sample in Figures 2b and 2e shows that other firms with positions on the extreme left have high attendance rates. If we consider only years where the total allowable catch is binding, we see in Figure 2c that extremism becomes much more important for ocean quahogs. On the other hand, in Figure 2f, the relationship between attendance and surf clam position changes little when we drop years when the surf clam total allowable catch was not binding. It is not clear what inference we should make from this, however, since the surf clam total allowable catch failed to bind in only two years.

[16] In subsequent regression analysis processing plant size is adjusted for capacity. For each year and plant, we observe the volume of clams processed. Our measure of the plant capacity is the maximum observed annual volume of clams processed by a plant, normalized so that the sample average plant has size unity. Hereafter, references to the plants variable are understood to refer to this index.

[17] Specifically, we present kernel estimates using the Epanechnikov kernel with a window width of 0.4.

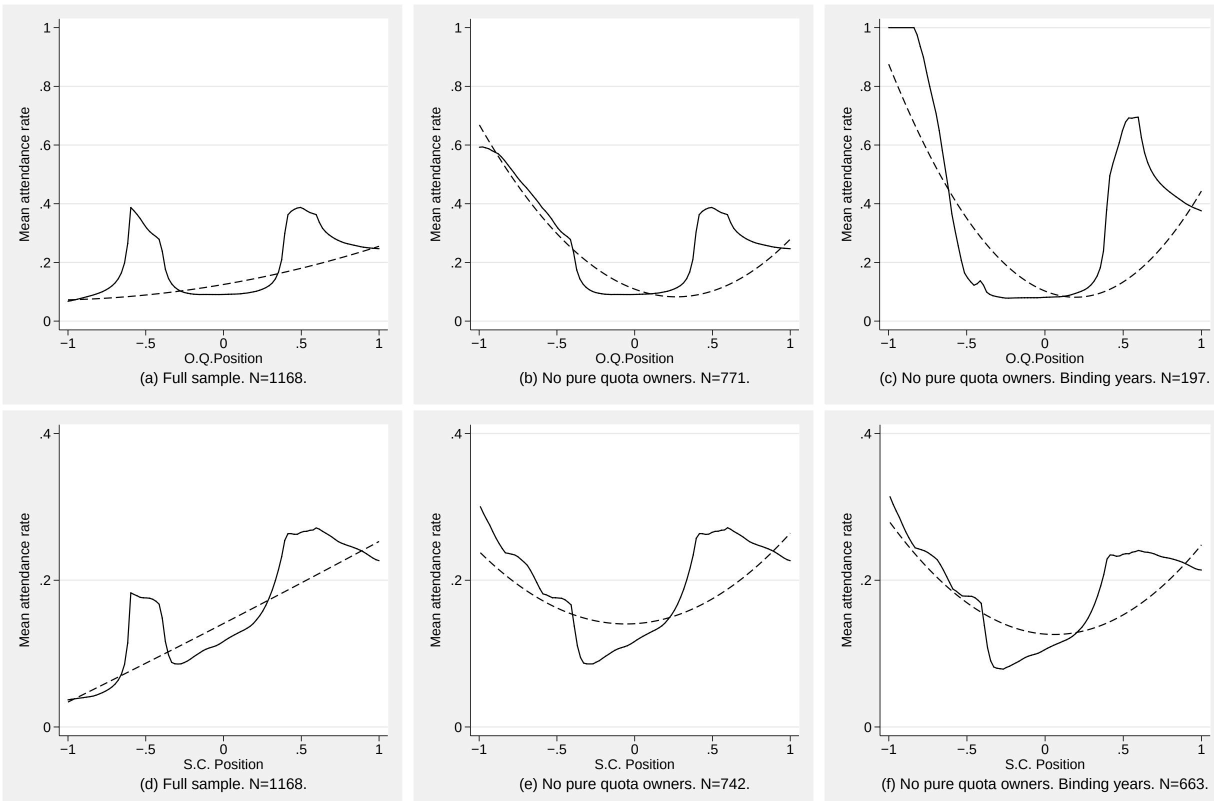

Figure 2: Attendance rates conditional on position. In each figure the dashed line plots the OLS regression of attendance on *position* and *position*^{2}, while the solid line plots the results of a kernel regression of attendance on *position*. Figures (a)-(c) ((d)-(f)) are based on ocean quahog (surf clam) *position*. Figures (a) and (d) are based on the full sample of firms, (b) and (e) exclude pure quota owners, (c) and (f) exclude pure quota owners and meetings that occur in years where the relevant total allowable catch is not binding. Note that the vertical scale is different for the surf clam and ocean quahog figures.

7. Econometric Model

The descriptive statistics suggest that firm characteristics matter in the expected ways, and that firms with more extreme tastes for the total allowable catch are more likely to attend regulatory meetings. We now assess the robustness of these conclusions controlling for observed and unobserved firm characteristics, and for the possibility that regulatory decisions are not equally important in all years.

Our unit of observation is a firm's decision to participate in a particular meeting. Let A_{im} denote a meeting indicator variable that is one if firm i attends meeting m, and zero otherwise. The attendance probability is $\Pr(A_{im} = 1) = F(\beta' z_{im} + \lambda_t + \alpha_i)$ where F is the logistic cumulative distribution function, z_{im} is a vector of firm and meeting characteristics, β is a common parameter vector, λ_t is an unobserved time-specific effect, and α_i is an unobserved firm-specific effect. Firm-specific effects represent firms' unobserved preferences for participating in meetings. Time-specific effects control for unobserved year to year differences in the economic environment, or, for year to year differences in the average firm's interest in the year's choice of total allowable catch. A firm that is active throughout the nine year study period would account for 19 observations. Our panel is incomplete because some firms exit or enter the fishery during the study period. Data are available for 87 firms which account for a total of 1,168 observations.

The parameter of interest, β, can be estimated under the assumption that firm-specific effects are random or fixed components of preferences. Despite the similar error structure, the two corresponding estimation procedures exploit different characteristics of the sample. The random effects estimation uses within firm variation, and also cross-sectional variation between firms that attend at least one meeting and firms that never attend. The fixed effects estimation, however, makes exclusive use of within firm variation for firms that attend at least one meeting. Given the merits of each specification we estimate β under both the random and fixed effects assumptions. The exact specifications of these likelihood functions are given in the appendix.

8. Regression results

To test whether extremists are more likely to attend than moderates, all else equal, we conduct regressions which predict attendance as a function of *position* and *position*^{2}, along with different combinations of control variables. If extremists have higher attendance rates then we should see that the coefficient of the second order term is positive while the first order term is zero or small enough that the minimum of the position quadratic lies near the center of the $[-1,1]$ range of *position*.

To ease exposition, in most regressions we aggregate *position* across species. Thus, in Table 6, the variable 'Position' is the sum of a firm's position index for surf clams and ocean quahogs, and 'Position^2' is the sum of the corresponding squared indices. Similarly, the variable 'Quota' is the sum of the firm's surf clam and ocean quahog individual tradable quota holdings.

Model 1 of Table 6 predicts attendance as a function of linear and quadratic position terms, and an indicator that is one for pure quota owning firms. In Model 1 the coefficient of the quadratic position term is significant and positive, while the coefficient of the linear term requires that the minimum of the position quadratic fall near the center of the range of the position variable, at -0.26. These results are consistent with higher attendance rates by extremists than moderates.

Model 2 of Table 6 duplicates Model 1, but controls for firm size and travel distance.[18] Aside from individual tradable quota holdings, all of the control variables have the expected effect on attendance; larger, closer firms are more likely to attend. Contradicting our findings in Table 5, Model 2 suggests that larger quota holdings are not associated with higher attendance rates. This finding is persistent and seems to be driven by correlated measures of firm size for a small number of firms holding large amounts of quota and other physical capital. In an unreported regression we drop all firm characteristics except for individual tradable quota and the pure quota firm indicator from Model 2. We find that the individual tradable quota term is positive and significant at the 1% level, with other coefficients qualitatively unchanged.

As in Model 1, in Model 2, the coefficient of the quadratic position term is positive, but is different from zero only at the 87% confidence level. Controlling for other firm factors has a more dramatic effect on the coefficient of the linear position term. In Model 2, and in all subsequent models, this linear term is small in magnitude and is not statistically different from zero at standard levels of confidence. Thus, as the hypothesis that extremists are more likely to attend requires, the data suggest that the minimum of the position

[18]It is at least possible that the choice of meeting site is endogenous. This would occur if, for example, the council tried to hold meetings near firms that it thought were likely to participate or if firms that wanted to participate lobbied for meetings close to home. There is no evidence to support these stories. The Mid-Atlantic Council has a policy of rotating meeting sites through the different states in its jurisdiction, and of holding meetings in hotels that offer special rates to government and a free shuttle to the nearest airport. In addition, meetings of the Mid-Atlantic Council discuss policy for many fisheries, spread over several states. In all, it seems unlikely that the Council meetings are moved for the convenience of the firms in our sample, and hence unlikely that these meeting sites are endogenous. The meetings of the Surf-Clam and Ocean Quahog Committee and Science and Statistical Committee meetings discuss only issues that are relevant to the firms in our sample, and so their locations may depend upon firm characteristics. Our data indicate that an average advisor is located 156.31 miles from meetings where advisors are invited to participate and 156.97 miles from meetings where advisors are not invited to participate. This suggests that, firm locations do not have an important impact on meeting locations, even for subcommittee meetings. In sum, the council meeting locations almost certainly do not depend upon firm characteristics, while the subcommittee meeting locations do not appear to depend upon firms characteristics in any important way.

	1	2	3	4	5
Position	0.423**	0.408	0.252	0.211	
	(0.214)	(0.291)	(0.362)	(0.355)	
Position^2	0.615**	0.473	1.193***	1.096***	
	(0.275)	(0.314)	(0.438)	(0.435)	
Position (non-binding years)			0.092	0.122	
			(0.386)	(0.387)	
Position^2 (non-binding years)			-1.390***	-1.401***	
			(0.560)	(0.558)	
S. C. Position (binding years)					-0.419
					(0.462)
S. C. Position^2 (binding years)					1.598***
					(0.593)
O.Q. Position (binding years)					0.701
					(0.463)
O. Q. Position^2 (binding years)					1.258**
					(0.644)
Pure quota firm	-2.387***	-2.150***	-2.573***	-2.348***	-3.518***
	(0.734)	(0.800)	(0.884)	(0.892)	(0.971)
Vessels		0.417***	0.452***	0.440***	0.450***
		(0.116)	(0.117)	(0.116)	(0.117)
Plants		0.722***	0.743***	0.660**	0.828***
		(0.280)	(0.284)	(0.267)	(0.269)
Quota		-0.049	-0.070	-0.074	-0.098
		(0.064)	(0.066)	(0.066)	(0.062)
Distance		-0.729***	-0.726***	-0.628***	-0.699***
		(0.238)	(0.234)	(0.229)	(0.226)
Advisor Meeting				1.546***	
				(0.411)	
Year Effects	No	Yes	Yes	Yes	Yes
Sigma	2.337***	2.173***	2.155***	1.954***	2.179***
	(0.377)	(0.377)	(0.366)	(0.396)	(0.340)
Log Likelihood	-290.431	-245.213	-241.874	-234.559	-240.800

Table 6: Random effects regressions. Models 1-3 and 5 present the results of random effects Logit regressions explaining attendance. Model 4 presents a similar regression but incorporates a two-stage correction for the probable endogeneity of advisor status. Standard errors in this model are biased downward. Asterisks denote parameter is statistically different from zero: *** indicates 1%, ** indicates 5%, and * indicates 10% level of significance.

	1	2	3	4	5
Position	0.387	0.475	0.436	0.474	
	(0.249)	(0.367)	(0.456)	(0.461)	
Position^2	0.737***	0.548	1.308***	1.324***	
	(0.288)	(0.340)	(0.490)	(0.494)	
Position (non-binding years)			0.003	-0.052	
			(0.421)	(0.423)	
Position^2 (non-binding years)			-1.401**	-1.388**	
			(0.608)	(0.609)	
S. C. Position (binding years)					-0.520
					(0.646)
S. C. Position^2 (binding years)					1.720**
					(0.751)
O.Q. Position (binding years)					0.758
					(0.510)
O. Q. Position^2 (binding years)					1.305*
					(0.688)
Pure quota firm	-1.344***	-2.872***	-3.471***	-3.446***	-4.034***
	(0.843)	(1.067)	(1.230)	(1.227)	(1.402)
Vessels		0.412***	0.458***	0.434***	0.433***
		(0.125)	(0.129)	(0.131)	(0.126)
Plants		0.803**	0.815**	0.768**	0.931***
		(0.359)	(0.361)	(0.374)	(0.353)
Quota		-0.091	-0.110	-0.136*	-0.142**
		(0.072)	(0.073)	(0.077)	(0.068)
Distance		-0.613**	-0.605**	-0.589**	-0.611**
		(0.278)	(0.274)	(0.287)	(0.273)
Advisor Meeting				1.817***	
				(0.689)	
Year Effects	No	Yes	Yes	Yes	Yes
Cond. Log Likelihood	-181.137	-147.179	-144.340	-140.447	-143.455

Table 7: Fixed effects regressions. Models 1-3 and 5 present the results of random effects Logit regressions explaining attendance. Model 4 presents a similar regression but incorporates a two-stage correction for the probable endogeneity of advisor status. Asterisks denote parameter is statistically different from zero: *** indicates 1%, ** indicates 5%, and * indicates 10% level of significance.

quadratic lies in a neighborhood of zero.

We now examine the possibility that the effect of position on attendance differs as the total allowable catch is, or is not binding. Model 3 of Table 6 duplicates Model 2, but includes the variables 'Position (not binding)' and 'Position^2 (not binding)'. To calculate the variable 'Position (not binding)', for each species we multiply a firm's position index by an indicator that is one when the species total allowable catch is not binding. We then sum the two resulting species-specific position indices. The corresponding calculation generates 'Position^2 (not binding)'. The results of these estimations are striking. We see that the quadratic position term is positive and significant at the 1% level, while the quadratic non-binding position term is also highly significant, and is of nearly equal magnitude, but opposite sign. Indeed, a likelihood ratio test fails to reject the null hypothesis that the sum of the two coefficients is zero (the Chi-square statistic is 0.632 with 90% critical value 2.70). Therefore, consistent with the intuition derived from Figure 1, the data suggest that extremism only influences participation in years when the total allowable catch is binding.

Model 4 of Table 6 duplicates Model 3, but also includes a variable to indicate whether a firm is able to exercise industry advisor status at the meeting in question. Since advisor status is endogenously determined, we obtain unbiased and consistent estimates of the advisor effects by using a two-stage estimation procedure (Greene 2000; Murphy and Topel, 1985).[19] Model 4 confirms the results of Model 3, and gives the expected result that advisor status, all else equal, increases the likelihood of meeting attendance. Firms are more likely to participate when they are provided an opportunity to speak during the debate over the total allowable catch.

Model 5 includes all control variables used in Model 3, but uses species-specific position variables for total allowable catch-binding years. That is, for each species, the position variable is interacted with an indicator variable that is one if the total allowable catch for the relevant species is binding in the year the meeting occurred. These results are broadly consistent with results of other models. Moreover, we see that the magnitude of coefficients on the linear position variables are statistically indistinguishable, similarly for the coefficients on the second order term. A likelihood ratio test of the null hypothesis that the parameters on the linear and quadratic position terms are the same across clam

[19]The first stage estimation models the decision to become an advisor. The dependent variable (1 if a firm is an industry advisor and 0 otherwise) is estimated with standard Logit regression. 'Advisor Meeting' is equal to the fitted probability of being an advisor if the meeting in question is one where advisors are asked to participate, and 0 otherwise. The explanatory variables for the first stage model are the firm average of vessels, plants, and individual tradable quotas, and distance to meetings. Alternative first stage explanatory variables, including pre-1990 firm characteristics, had little effect on the second-stage results. It is not clear how to implement the Murphy and Topel (1985) error correction for the random effects model. Thus we present uncorrected, downward biased, standard errors for the two stage random effects models in columns 4 of Table 6. The fixed effect results report corrected standard errors. Since the standard error correction for the fixed effects model was slight, we expect that the bias in Table 6 is slight. Additional details for the two-stage estimation procedure are presented in an appendix.

species could not be rejected at conventional levels. Thus aggregating the position indices across species is reasonable.

We also estimate each of the models in Table 6 under the fixed effects specification and report results in Table 7. Note that parameters and standard errors in model 4 of Table 7 are corrected for the probable endogeneity of advisor status (see Appendix). In all, fixed effects results are difficult to distinguish from the random effects results. Thus, the effects of extremism are present in both cross-sectional and time series variation in our data.

In summary, the regression results confirm and refine the patterns observed in the raw data. We see that larger, nearer, and more extreme firms are more likely to attend. However, the regression results also indicate that the effects of extremism operate only when the total allowable catch is binding, a finding that was less clear in Figure 2.

Economic importance

The regression analysis finds that firm size, attendance costs, advisor status and firm *position* all have statistically significant effects on the likelihood of participation in the regulatory process. To get a sense for the magnitude of these effects, we calculate the impact of a one standard deviation increase in explanatory variables on attendance probability, all else equal. The fitted parameters from Model 4 of Table 6 are used for this purpose.[20] A one standard deviation increase in vessels and plants causes a 0.011 and 0.008 increase, respectively in the probability of attending a meeting. Granting advisor status increases the probability of attending an advisor meeting by 0.021. An increase in travel distance to meeting sites reduces attendance probability by 0.012. Lastly, a one standard deviation increase (decrease) in *position* increases the probability of attendance by 0.011 (0.005). Since the average attendance probability at the mean of the data is 0.012, these calculations suggest that relatively small changes in physical capital, distance, and position have quite important impacts on attendance rates.

9. Competing models

We have treated meetings as if their sole purpose is to aggregate preferences. However, it may also be that an important function of meetings is to aggregate private information about clam stock abundance and demand conditions. In this case, we expect that firms with better information are more likely to attend (Feddersen and Pesendorfer (1996)). At first glance, this explanation appears consistent with our findings. A firm which owns

[20]Except for the effect of *position*, economic effects are calculated as the change in attendance probability for a one standard deviation change in the variable of interest around its sample mean value, holding other variables constant at their respective mean values. The 1994 value for λ is used. Because *position* enters quadratically, we report a one standard deviation increase above and below the sample mean.

more fishing vessels is likely to have better information about the state of the clam stock, while a firm that sells more clams is likely to have better information about demand conditions. Thus, our finding that larger firms are more likely to participate is consistent with better informed firms participating.

Unfortunately, the data does not allow us to disentangle the effects of size from the effects of information quality. Having said this, the theoretical literature on meetings as a device for the aggregation of information, as opposed to preferences, suggests that information aggregation is unlikely to be an important function of meetings.

The ability of meetings to aggregate information will be hampered by two problems. First, information about the state of the world is a public good. In an environment where it is costly to report one's signal to the regulator we expect agents to free ride on the reports of others.[21] Second, if agents have different preferences over outcomes and they have private information, then they will have an incentive to not reveal their private information in order to skew the decision toward their preferred outcome. Analysis of this problem suggests that in equilibrium, agents 'garble' their signals by reporting the intervals in which their signals lie (Li *et al.* (2001)), or that uniformed agents will submit signals which favor their own preferred position (Banerjee and Somanathan (2001)). This too works against the use of meetings to aggregate information.

It may also be the case that firms attend public meetings to trade quota rather than to participate in the meeting. Under this hypothesis, we expect that larger nearer firms attend more often since they will, on average, have more need to trade and will face lower transactions costs. By definition, more extreme firms will have a greater need to trade quota, and hence will also attend more often. While the predictions of this model match nicely with our findings, industry representatives report that quota trading is not organized around meetings. Buyers outnumber sellers, and arranging a transaction involves courting a seller and organizing the details of a highly regulated transaction denominated in the millions of dollars.

Finally, it may be that meetings function as a way for firms to become informed about regulators' plans. Under this model, larger and more nearby firms should attend more often, since, on average information will be more valuable to them and their transactions costs are lower. We might also expect to see more extreme firms attend as these firms may value information about future total allowable catches more highly. The predictions of this model, too, match nicely with our findings. However, while it is surely true that firms sometimes go to meetings solely to find out what regulators are doing, this is at best a partial explanation. First of all, this model cannot explain the fact that attendees do, in fact, make partisan statements: This is not an action which serves to elicit information, but one

[21]The importance of this public goods problem is illustrated by the 'Kitty Genovese' game.

that serves to change regulation. Second, the council maintains an extensive mailing list of firms to whom it mails out information about the total allowable catch setting process, so that the information advantage obtained by going to a meeting is marginal. Third, it is contrary to what meeting participants report. Meeting participants do not say that they go to meetings to learn what regulators are doing. They say they are going to change the outcome of the regulatory process.

10. Conclusion

Meetings with costly participation are a very common regulatory institution, not least because they play an important part in the formulation of US regulation. Using data from the Mid-Atlantic surf clam and ocean quahog fishery, we analyze participation in public meetings which determine regulation for this fishery.

The details of how meetings are conducted in the Mid-Atlantic Clam fishery and the space from which a regulatory policy is selected both conform closely to recently analyzed models of participation in meetings and elections. Data on firm assets allows us to construct position indices which measure a firms' most preferred total allowable catches. A simple and unrestrictive model of rent division in a quota-managed industry, comments by firms, and a comparison of the position indices with stated policy preferences made at meetings, all validate the indices.

Our analysis shows that attendance responds in the expected ways to firm characteristics and proximity to meeting locations. Larger, closer, and more influential firms are more likely to attend. These findings are observed in the raw data and in fixed and random effects regression results. Most importantly, the analysis finds that firms with more extreme tastes are more likely to attend. High attendance by extremists is suggested by anecdotal reports of fishing firms' behavior, is observed in our non-parametric analysis (Figure 2), and is strongly evident in fixed and random effects regression results. Overall, the analysis supports the conclusion that extremists are more likely to attend meetings with costly participation than their more moderate counterparts.

These findings confirm the predictions of polarization and bipartisanship that arise in a recent theoretical literature analyzing participation in meetings and elections. Our findings also suggest a refinement to the well established idea that regulators will be captured by the industry they regulate. At least when regulation is formed at meetings with costly attendance, regulators will come under disproportionate pressure from firms whose preferred policies are extreme relative to the population.

We note that, unless we regard 'representativeness' as intrinsically good, the welfare implications of these findings for the design of meeting protocols are at present ambiguous. On the basis of the theory developed in Osborne *et al.* (2000) we would conclude that meetings which are more representative are probably desirable since such meetings are less likely to exhibit the randomness of outcome that may occur at highly polarized meetings. The anecdotes described earlier suggest that such vacillation by regulators is a real phenomena, and it is difficult to imagine that these policy swings do not impose large costs on the regulated population. On the basis of the analysis in Campbell (1999) we would also conclude that the extent to which voluntary participation allows extremists to dominate elections is undesirable. On the other hand, Borgers (2001) argues that meetings with purely voluntary participation welfare dominate a variety of other meeting formats, in particular those where attendance is compulsory and the meetings are perfectly representative. Since Borgers' analysis does not allow for the sort of randomness that is possible in Osborne *et al.* (2000), and since Osborne *et al.* (2000) do not attempt welfare analysis, it remains unclear whether compulsory or voluntary attendance should be preferred.

A tentative conclusion is that voluntary attendance ought to be preferred for decisions which are not expected to be contentious, but at least for decisions where the regulated population is highly polarized, some modification of the meeting protocol should be made to encourage participation by moderates. One such protocol would require a small subset of randomly selected firms to attend meetings in order to increase the likelihood of moderate voices in the debate. This conclusion is of immediate relevance to the current crisis in US fisheries management. Recent proposals to streamline the public comment process in fisheries regulation appear to involve marginal changes in participation costs, rather than qualitative changes in the attendance decision. Thus these reforms should not be expected to reduce influence of extremists over fisheries management councils.

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Appendix: Logistic estimation with panel data

The estimate of β is obtained by maximizing the likelihood of observing the M_i vector of attendance events is $A_{i1},A_{i2},...,A_{iM_i}$, for all firms $i = 1,...,N$, where M_i is the number of meeting periods in which firm i was active in the clam fishery. From Chamberlain (1980), the fixed effects conditional Logit log likelihood function is

$$\ln L = \sum_i \ln\left[\exp(\beta' \textstyle\sum_{M_i} z_{im} A_{im}) / \sum_{d\in B_i} \exp(\beta' \sum_{M_i} z_{im} d_m)\right], \tag{A1}$$

where,

$$B_i = \{d = (d_1,...,d_{M_i}) | d_m = 0 \text{ or } 1 \text{ and } \textstyle\sum_{M_i} d_m = \sum_{M_i} A_{im}\}, \tag{A2}$$

(time effects parameters and year dummy variables have been subsumed into β and z_{im}, respectively). The random effects log likelihood function for the Logit probability F is

$$\ln L = \sum_i \ln\left(\int \Pi_{M_i} F(\beta' z_{im} + \lambda_t + \alpha)^{A_{im}} \left(1 - F(\beta' z_{im} + \lambda_t + \alpha)\right)^{1-A_{im}} dG(\alpha|\overline{\alpha},\sigma^2)\right), \tag{A3}$$

where G is the normal univariate distribution function with mean $\overline{\alpha}$ and variance σ^2.

Two-stage estimation procedure

A firm's decision to become an advisor and attend meetings can be characterized by a system of $M_i + 1$ discrete decisions. Let V_i take the value of one if firm i chooses to become an advisor and zero otherwise. We wish to maximize the likelihood of observing $(V_i,A_{i1},A_{i2},...,A_{iM_i})$ for all i.

In the first-stage, the probability that firm i chooses to become an advisor is $\Pr(V_i = 1) = F(\gamma' x_i)$ where x_i is a vector of explanatory variables, and γ is a parameter vector. The first-stage log likelihood function is

$$\ln L_1 = \sum_i \left[V_i \ln F(\gamma' x_i) + (1 - V_i) \ln(1 - F(\gamma' x_i))\right], \tag{A4}$$

Let $\widehat{\gamma}$ denote the value of γ that maximizes $\ln L_1$. The fitted probability of becoming an advisor, $F(\widehat{\gamma}' x_i)$, is used to construct the regressor, Advisor Meeting. This variable is included in the set of regressors for the second stage model. If standard regularity conditions are met for both log-likelihood functions, the two-stage procedure yields consistent and asymptotically normally distributed estimates of β.

The second stage likelihood contains the predicted advisor meeting variable. We follow Murphy and Topel (1985) to obtain asymptotically correct standard errors for β under the fixed effects specification. Denote the second stage conditional log likelihood in equation (A1) as $\ln L_2$. Let $\mathbf{H}_1$ and $\mathbf{H}_2$ denote the inverse information matrices for the maximized likelihood functions $\ln L_1$ and $\ln L_2$ respectively. The asymptotically correct variance-covariance matrix for β is

$$\mathbf{H}_2^* = \mathbf{H}_2 + \mathbf{H}_2 \left[C\mathbf{H}_1' C' - R\mathbf{H}_1' C' - C\mathbf{H}_1' R' \right] \mathbf{H}_2, \tag{A5}$$

where

$$C = E(\frac{\partial \ln L_2}{\partial \beta} \frac{\partial \ln L_2}{\partial \gamma}), \tag{A6}$$

$$R = E(\frac{\partial \ln L_2}{\partial \beta} \frac{\partial \ln L_1}{\partial \gamma}). \tag{A7}$$

Estimates of C and R are obtained as

$$\widehat{C} = \frac{1}{N} \sum_i (\frac{\partial \ln L_{i,2}}{\partial \widehat{\beta}} \frac{\partial \ln L_{i,2}}{\partial \widehat{\gamma}}), \tag{A8}$$

$$\widehat{R} = \frac{1}{N} \sum_i (\frac{\partial \ln L_{i,2}}{\partial \widehat{\beta}} \frac{\partial \ln L_{i,1}}{\partial \widehat{\gamma}}). \tag{A9}$$

The first stage regression yielded reasonable results. The simple correlation between the fitted probability of becoming an advisor, $F(\widehat{\gamma} x_i)$, and the actual indicator for advisors was 0.533. The reported standard errors in model 4 of Table 7 are derived following equation (A5) with $\mathbf{H}_1$ and $\mathbf{H}_2$ replaced by their estimated counterparts.