Actors' strategic anticipation of policy change has led to overstatements of the benefits of ITQs.

A Tale of Two Clams

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In open-access fisheries, individual fishermen give little thought to the effects of their harvest on the total available stock. That results in endemic excessive fishing. To limit such behavior, federal fisheries have historically been regulated through command-and-control policies: limits on the number of hours that fishing is permitted, the type of gear allowed, and other inputs. The effect of command-and-control regulation of fisheries has been serious economic inefficiencies, safety hazards, detriments to the ecosystem, and failure to protect marine resources. Those results have provoked interest in the use of tradable property rights—known in fisheries as individual transferable quotas (ITQs)—to regulate marine resources.

Initial research into the adoption of ITQs suggests the change dramatically boosts productivity. But for reasons that I will explain in this article, a simple comparison of productivity immediately before and after the official adoption of ITQs would yield an exaggerated measure of the actual productivity gains realized.

To accurately characterize the direction and scale of productivity change, I examined the landmark adoptions of ITQs for two species of clam: the mid-Atlantic surf clam and the ocean quahog. I identified the period during which firms responded to the incentives created by the expected policy change and established a baseline prior to that transitional period. The gains from ITQs are real, but they are smaller than what others have claimed because those researchers have not taken into account the incentives created by anticipation of the policy change.

A BRIEF HISTORY

In their history, the mid-Atlantic surf clam and ocean quahog fisheries have been governed by both command-and-control regulations and ITQs. As the first federal marine fisheries to implement tradable property rights, they remain of central interest in assessing the relative merits of both regulatory regimes in fisheries. The two fisheries were subject to command-and-control regulation from 1979 through 1989, but they have been governed by ITQs since 1990.

Since the early 1980s, there has been little annual fluctuation in the total allowable harvest in each species, and the stock can be considered to be in equilibrium—the annual harvest limits equal the annual growth. Although tradable property rights were implemented in both fisheries concurrently, in the years prior to implementation it was generally believed that tradable property rights would affect the surf clam fishery only. Therefore, the two fisheries provide a unique view of two industries with similar inputs and outputs but differing expectations concerning regulatory policy.

With annual production valued at more than $48 million, the mid-Atlantic surf clam and ocean quahog fisheries provide almost the entire supply for domestic, processed clam products including canned clam chowder, canned minced clams, canned sauces and juices, and breaded products. Both clam species grow slowly, live on the ocean floor, and do not move. They are clustered in groups known as beds whose location and density are common knowledge in the industry, and they are harvested using hydraulic dredges. Ocean quahogs are found in deeper waters than surf clams, thus necessitating larger vessels with more horsepower and gear appropriate to harvesting in deeper waters.

By the mid-1980s, rapid growth in harvesting capacity and resulting inefficiencies triggered a debate over establishing tradable property rights. As with other overcapitalized fisheries, command-and-control regulation in the surf clam fishery was progressively restrictive, ratcheting down the permitted fishing time as the season's allowable harvest was gathered in a shorter and shorter time. The time each vessel was allowed to harvest surf clams fell by 28 percent from 1980 to 1982 and another 88 percent from 1983 to 1986. The average annual

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quota and harvests of surf clams and ocean quahogs increased slightly between 1980–84 and 1985–1989, and since 1989 they have remained relatively stable.

Implementation of an ITQ system to regulate fisheries requires an initial property rights allocation system. Although the economic literature prefers auctioning initial property rights, such auctions have not been politically viable. From the beginning of negotiations over a tradable property rights system for surf clams in the mid-1980s, it was clear that allocations would be granted gratis based on some form of historical harvest quantities. A critical aspect of the allocation mechanism was that property rights would be distributed on a vessel basis, not directly to vessel owners. Thus, the property right asset was embedded in the vessel asset. Prior to the negotiation period, there were some vessels that were licensed to harvest surf clams and ocean quahogs but they were not actively utilized; the vessel owners' expectation of a future property right created the incentive to harvest with those vessels in order to establish a historical record of harvests. As a result, while the number of licensed vessels could not change because of a moratorium instituted in 1979, the number of active vessels did increase during the ITQ negotiation period of 1985–1989.

During the negotiation period, there were more vessels active in the surf clam fishery than in the prior period, an increase primarily resulting from the reintroduction of previously inactive large vessels. From 1980 to 1984, the median number of vessels in the fishery was 119; from 1985 to 1989 the median number was 138 with a peak of 144 in 1986. The movement of vessels back into the fishery was a direct consequence of the decision to distribute rights to active vessels and increased pressure on the clam population.

The formula for distributing allocations was finalized in 1989, with initial allocations based on individual vessels' catch history. The new property rights system was implemented in 1990. At that point, the property right was disaggregated from the vessel and could be traded as a separate asset. As predicted by economic models, the number of vessels in the industry decreased; the median number of active vessels fell to 56 in the 1990–1995 period.

TABLE 1

Total Factor Productivity

Tornqvist Index of total factor productivity by policy era

POLICY ERA	SURF CLAMS		OCEAN QUAHOGS	
	Mean	Standard Deviation	Mean	Standard Deviation
Command & Control Period 1980–1984	1.071	0.180	1.022	0.085
Transition Period 1985–1989	1.012	0.066	1.009	0.057
Property Rights Period 1990–1995	1.102	0.076	1.046	0.060

Source: Author's calculations

RESEARCH STRATEGY

In general, when evaluating the productivity impact of regulation, it is necessary to establish a baseline for comparison because changes in environmental policy alter the incentives of economic actors. Firms in the surf clam fishery acted in anticipation of policy change, while firms in the quahog fishery did not. Hence, the baseline must be established in the period prior to policy negotiation—a significant difference from other analyses that simply compare periods immediately before and after policy implementation. As a result, my analysis differs from numerous studies of productivity and regulation by explicitly isolating the effect of firms' policy expectations. The importance of these expectations can be clearly seen by comparing the surf clam and the ocean quahog industries—two industries that had opposite policy expectations.

Available data on the surf clam and ocean quahog fisheries make it possible to calculate productivity in three distinct policy environments: command-and-control regulation, a transition period, and a tradable property rights regime. This three-period analysis demonstrates the crucial importance of firm expectations and their resulting strategic behavior in assessing productivity change—behavior that would be invisible to a simple two-period analysis of the new regulatory regime.

EMPIRICAL RESULTS

I calculated annual productivity over 1980–1995 for the surf clam and ocean quahog fisheries using the Tornqvist index of total factor productivity. The results are summarized by species and policy period in Tables 1 and 2. For both species, the average productivity level decreases during the transition period (negotiation of property rights) and then increases after implementation of tradable property rights.

The indexes reveal strategic behavior by forward-looking firms in the surf clam fishery. Although the two fisheries had similar annual average productivity levels in the early 1980s, their paths diverged during the transition period because a tradable property rights system was being negotiated for surf clams. During the command-and-control period, the average annual total factor productivity was 1.07 for the surf clam fishery and 1.02 for the ocean quahog fishery. During the transition

TABLE 2

Percent Change

Tornqvist Index of total factory productivity over policy periods

POLICY PERIOD	SURF CLAMS	OCEAN QUAHOGS
1980–1984 to 1985–1989	-5.5%	-1.2%
1985–1989 to 1990–1995	8.9%	3.7%
1980–1984 to 1990–1995	2.8%	2.4%

Source: Author's calculations

period when the industry was negotiating property rights for surf clams only, the average productivity in the surf clam industry (characterized by property rights negotiations) decreased by 5.5 percent, while the quahog fishery (with no negotiations) experienced little more than a 1 percent decline. After the implementation of tradable property rights, productivity in the surf clam fishery increased by almost 9 percent while the increase in the quahog fishery was approximately 4 percent.

The depression of total factor productivity in the surf clam fishery during property rights negotiations reflects firms' increased capital holdings as they returned previously inactive vessels to the fleet. The recovery of productivity in the surf clam fishery after the implementation of ITQs reflects the retirement of those vessels once the incentive for their use (establishing catch histories) no longer applied.

The changes in productivity in the two fisheries illustrate how firms adjusted the allocation of capital across the fisheries in response to changes in expected returns. Together, the surf clam and ocean quahog fisheries can be thought of as a "manmade natural" experiment in which the control industry is the quahog fishery and the surf clam fishery is subjected to the "experiment" of new policy expectations. The increase in productivity under the property rights regime (1990–1995) relative to command-and-control regulation (1980–1984) was similar in both fisheries (2.8 percent and 2.4 percent for surf clams and ocean quahog, respectively), reflecting long-term trends, including the shift from command-and-control regulation to ITQs. But in the short term, differing policy expectations caused productivity to follow a markedly different path in each fishery. The implication for economic evaluations is clear: The 8.9 percent increase in productivity greatly overstates the gains from implementing property rights because it is a result of the negotiation prior to the policy change.

TABLE 3

Average Annual Productivity Growth Rates

1981 - 1995

PERIOD	SURF CLAMS	OCEAN QUAHOGS
1981–1984	7.18% (0.17)	2.35% (0.08)
1985–1989	0.97% (0.07)	0.82% (0.06)
1990–1995	9.47% (0.07)	4.40% (0.06)

Source: Author's calculations
Note: Standard deviations of growth rates over policy periods are given in parentheses.

In addition to the production level, we can examine the rate of change in productivity during the alternative policy periods, as shown in Table 3. During the command-and-control period (1980–1984), the surf clam fishery had an average annual growth rate of productivity of 7.2 percent, while the quahog fishery achieved only a 2.4 percent average growth rate. In the transition period (1985–1989), the average growth rate in both fisheries fell to less than 1 percent. However, the change in the growth rate was greater in the surf clam fishery than in the quahog fishery. The steeper decline in surf clam productivity growth can be attributed to the accumulation of capital to maximize property rights allocations. The average productivity growth rate in the surf clam fishery rebounded to 9 percent after the implementation of ITQs as inefficient vessels were withdrawn from use, while the average growth rate in the quahog fishery increased by a more modest 4.4 percent.

Those annual productivity growth rates over the policy periods indicate a significant productivity slowdown in the surf clam fishery induced by policy expectations while the quahog fishery, where there was no expectation of a policy change, did not experience such a slowdown. The results in Table 3 also help us to assess the real productivity impact of ITQs. At first glance, the 9 percent annual growth rate in the 1990–1995 period appears to indicate a rapid increase from ITQs; however, some of that growth is undoubtedly because firms reversed the actions they took in the transition period. As a result, productivity growth after ITQs should more reasonably be compared to productivity growth during the command-and-control period prior to property rights negotiations.

CONCLUSION

Although tradable property rights enjoy a number of theoretical advantages over traditional command-and-control regulation, current policy debates question whether those advantages are achieved in practice. This article addresses the central question of whether tradable property rights increase overall industry productivity as predicted in theory. Rather than simply comparing productivity before and after the moment of official policy change, it looks in depth at the transitional period during which new regulations are negotiated in order to assess the impact of policy expectations and strategic behavior on industry productivity. The mid-Atlantic surf clam and ocean quahog fisheries provide an appropriate "manmade natural" experiment for addressing this question. Participants in the surf clam fishery expected the tradable property rights would be allocated based on vessels' historical harvests, while participants in the ocean quahog fishery had no such expectation.

The results imply that both the public negotiation of a tradable property rights system and the design of the property rights allocation scheme can depress productivity prior to actual implementation of the new system. Because firms knew that surf clam quotas were to be allocated based on vessels' recorded catch and size, the opportunity cost of keeping a vessel inactive increased during the negotiation period; as a result, additional capital flowed into this already overcapitalized fishery. The result was a significant depression of productivity and stagnation of productivity growth. In contrast, in the quahog fishery—where there was no anticipation of property rights—overall productivity trends did not change prior to the actual implementation of property rights.

This analysis has implications for both the economic analysis of environmental regulation and the actual design of regulation. Because productivity in the surf clam fishery was tem-

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porarily depressed during the negotiation period, a simple comparison of productivity immediately before and after the official policy change yields an exaggerated measure of the actual productivity gains realized. Accurate characterization of the direction and scale of productivity change requires us to minimize the "bias" caused by firms' anticipatory behavior. We can do this by identifying the period during which firms may respond to the new incentives created by the expected policy change, and by ensuring that the analysis establishes a baseline prior to the transitional period.

In addition, the results have two important implications for the design of tradable property rights systems for natural resource industries. First, if property rights are allocated to vessels rather than directly to capital owners, capital owners can only ensure their maximum share of property rights by keeping vessels in production, regardless of whether that is economically efficient. Second, the incentive to overinvest in capital is directly affected by the weight given to harvests during the actual negotiation period. At one extreme, if allocations are based solely on harvests during that period, capital owners will have exaggerated incentives to maximize harvests at virtually any cost without regard for efficiency or productivity in the short term. The productivity slowdown observed in the surf clam fishery could be either exacerbated or reduced through careful consideration of those policy levers.

The results of this analysis suggest four policy recommendations that will improve resource management. First, a control date should be established after which harvests will not count toward the allocation of property rights. Preferably, the control date would be set prior to ITQ negotiations. Second, tradable property rights should be allocated to firms, rather than to individual vessels so as to reduce fishers' incentives to increase capital as a means to establishing a claim to future ITQs. Third, the negotiation of ITQs should be transparent and address how fisheries related either by joint harvesting or by shared markets would be affected by any new ITQs. Last, federal guidelines for economic evaluation of fisheries should explicitly address the incentives created during policy negotiations in order to measure correctly the impact of policy on productive efficiency.

In fisheries within which negotiations over tradable property rights are ongoing, such as the New England herring and Gulf snapper fisheries, regulators should pay close attention to the impact of policy expectations on firms' strategic behavior and on industry productivity. In those fisheries in particular, the expiration of the moratorium on expanding the use of ITQs has, in all likelihood, already motivated firms to increase their use of capital, with a consequent reduction in productivity. To counter that inefficient behavior, regulators should seek to design allocation schemes that do not reward such inefficient and productivity-reducing behavior. And when it is time for economists to evaluate the impact of ITQs on those and other fisheries, they should likewise ensure that their analyses incorporate the impact of this strategic behavior rather than accepting the distorted picture drawn by simple before-and-after comparisons. Otherwise, economics may create more confusion than clarity in the ongoing debate over ITQs. R

READINGS

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