EXPERIMENTAL TESTBEDDING INSTITUTIONS FOR TRADABLE FISHING ALLOWANCES*

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ABSTRACT

The objective of this paper is to illustrate that economic institutions matter, i.e., that different rules of trade present different incentives for bidding, asking and trading in new markets, and that these different incentives lead to different price discovery patterns which yield materially different outcomes. In a laboratory tradable fishing allowance system, when trade takes place through a double auction, which parallels an institution common in extant tradable allowance systems, markets are characterized by high volatility, and equilibrium does not obtain. However, when only leases, and not permanent trades, are permitted in the early periods, volatility is significantly reduced and equilibrium obtains. This dependence of equilibration and outcomes on institutions implies that policy-oriented economists must consider institutions in designing new market-based management systems.

Keywords: fishery management; transferable allowance; ITQs; experiment; tradable fishing rights

INTRODUCTION

Policymakers are making increasing use of tradable allowance systems to address environmental and natural resource management problems, including water use, pollution, and overfishing (Tietenberg 2002). A management authority that applies a tradable allowance system typically sets an allowable level of activity, allocates the allowance among users, and gives users the right to trade their allocations to others.[i] In doing so, the management authority effectively establishes a market for an entirely new asset, which can be of great value, and represent a significant portion of the wealth or assets of the resource users, particularly in water and fishing applications where the users are often small or family businesses. However, because the asset is new, there is little basis on which the market participants can draw to determine the prices that are likely to emerge.

Participants in this new market know only their private values, and have little idea of the market-wide marginal value of allowance which the competitive model predicts will emerge as the equilibrium price. As a result, each participant must rely on the information she can glean from the market—the bids, asks and trades of others, as well as the market reaction to her own bids and asks—to determine whether or not a prospective trade constitutes a good deal. It is not surprising, then, that different institutions, which provide different amounts and different types of information, and possess different incentives for revealing information through bids and asks, yield systematically different sequences of bids, asks and contracts, and therefore equilibrate differently.

The objective of this paper is to illustrate that economic institutions matter, i.e., that these different patterns of equilibration yield materially different outcomes. Specifically, in a laboratory evaluation of a significant tradable fishing allowance system, one commonly-used institution performs poorly while a simple modification leads to reliable equilibration. While the research being discussed is ongoing, there is sufficient evidence to argue that policymakers and economists must consider the equilibration process, and the institutions which affect it, in developing new market-based management systems. The wrong

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institution can lead to so much volatility during initial trading that effective price discovery cannot occur, and equilibrium is never reached. Alternatively, bad outcomes can arise during price discovery, and although the market eventually stabilizes, perhaps even at competitive equilibrium prices, trades made during equilibration lead to gross inequities among similar participants based solely on when they traded.

The implication of outcomes' dependence on institutions is that policy-oriented economists must begin asking a question which has historically not been asked: *How should the rules of trade be designed to best achieve policy objectives?* This question is new because there is nothing in competitive microeconomic theory which suggests equilibrium outcomes depend on institutions; there is no mention of institutions in popular graduate microeconomic theory texts such as Varian (1992), Silberberg (1994) or Mas-Colell, Whinston and Green (1995). As a result, there is a common perception among economists, politicians and the public that if regulators establish property rights for natural resource use or environmental harms and allow trade, markets will emerge and efficient allocations or least-cost abatements will arise (e.g., Gwartney *et al*. 2002). Unfortunately, it is not that simple.

In this paper, the role of institutions in determining outcomes will be illustrated with a series of experiments designed to assess tradable fishing allowance management. The study is motivated by a 2001 industry proposal to implement a tradable trap certificate system in the Rhode Island inshore lobster fishery. This is one of many US fisheries considering adoption of tradable allowance management, following recommendations of national panels convened to study fishery management issues (NRC 1999; Pew Oceans Commission 2003; National Commission on Ocean Policy 2004), and the expiration in the Fall of 2003 of a six-year moratorium on new tradable allowance systems. The plan was recently approved by the Atlantic States Marine Fisheries Commission, which manages American lobster in the northeastern US. However, the details of the trading arrangements, which inspired this research, have not yet been determined.

The next section of the paper discusses why the price discovery and equilibration process of the tradable allowance market is important to the functioning of the regulated industry. The following section discusses previous cases in which experiments have contributed to designing markets for managing environmental harm, natural resource use, and other high-value policy applications. The experimental evidence for the dependence of outcomes on institutions in tradable fishing allowance markets is then presented. It is shown that when trade takes place through a double auction market, which shares many features with the institution most commonly used to trade fishing allowances in extant programs, prices are volatile, based on speculation rather than fundamental values, and do not converge to equilibrium. However, by prohibiting permanent allowance trades in the first few years of the program, a market for temporary lease trades can establish a price signal which carries over to the permanent allowance market, facilitating equilibration. Although this process is not yet sufficiently well-understood to ensure initial lease markets will work in the field, the final section discusses the broad policy implications of institutions' important role in determining outcomes.

THE POLICY SIGNIFICANCE OF PRICE DISCOVERY AND EQUILIBRIUM

The equilibration process of allowance markets carries policy importance because many of the commonly-cited advantages of allowing markets to determine effort allocation or production rely on being in equilibrium, whereas many of the outcomes feared by managers and resource users are the result of disequilibrium. When prices are based on fundamental values, as they are in equilibrium, price changes are predictable based on changes in market fundamentals. In fisheries, this means prices change based on beliefs about changes in the fishery, including new technology, stock fluctuations and product market demand. In equilibrium, prices are indicators of future profitability, and therefore serve as signals for capital investment. In addition, the value of held allowances values the right to fish, and provides security for retirement. From a normative standpoint, when trades are based on private fundamental values, allowances will trade from those who can earn less profit by fishing them to those who can earn more, maximizing the profitability of the fishery.

However, when the allowance market is not in equilibrium, outcomes that are feared by resource users and managers arise. When prices are not based on fundamental values, they can fluctuate unpredictably. Even for those who do not participate in speculative trading, and who trade only when it is in their private interest to do so, there are reasons to fear volatility. The inability to predict future prices complicates long-term business and capitalization decisions. This includes the decision whether to participate at all, since arbitrary fluctuations can significantly affect the value of a participant's wealth or retirement savings. Volatility can also shift regulated industries away from family businesses, as the risk associated with investment in volatile allowances also provides an opportunity for consolidation as diversified large operators may take on allowance market risk that smaller operators are unwilling to accept. In farming towns and fishing villages, such consolidation can threaten a local culture and way of life. In dynamic resource use applications, equilibrium prices aggregate and convey information about stock health (Arnason 1990; Batstone and Sharp 2003), but inferences drawn from disequilibrium prices may be incorrect, leading to improper capitalization levels and incorrect management decisions.

While there have been relatively few studies of individual contract price time series from tradable fishing allowance markets, those there are suggest there is considerable market volatility in the first four to six years of a new tradable allowance program. Newell, Sanchirico and Kerr (2003) identify price dispersion as a prominent feature of the first four years of the New Zealand 30-species quota management system. During this period, dispersion levels were close to 30% of the average price level; the level of dispersion over the last five years is closer to 10%.[ii] In the Florida spiny lobster fishery, Larkin and Milon (2000) find price ranges spanning from one to four times the average price in each of the first five years of the tradable trap certificate program.[iii] During these periods, anecdotal evidence suggests people grew unhappy with the system as they learned they sold their allowance at far below its long-term value, or purchased far above it; saw others reap windfall profits from buying allowance far below its long-term value, or selling far above it; or made investment decisions based on incorrect price signals.

The stories of the effects of the volatility in these and other programs often enter the policy debates surrounding the possible adoption of tradable allowance management. However, for fisheries, or communities within community-based management systems, to select the best management alternative for their fishery requires understanding the potential of all alternatives. This requires comparing the likely outcome under a well-designed tradable allowance system to those under other management systems. If equilibration can be accelerated, or the associated volatility reduced, by changing the institution through which trade occurs, then policymakers and managed stakeholder groups could have a better idea of the potential of tradable allowance systems on which to base their decisions.[iv] Even if they do not select tradable allowances, they can do so with a better idea of the strengths and weaknesses of a well-designed system.

THE USE OF EXPERIMENTAL METHODS IN POLICY ANALYSIS

Since equilibration plays an important role in determining whether the promises or the fears associated with tradable allowance systems are realized, selecting an institution which rapidly and reliably equilibrates is an important factor in achieving a successful policy outcome. Without a theory of how the incentives of different institutions affect the information revealed through bids, asks and trades which ultimately guides price discovery, a different tool is need to understand how alternative institutions affect outcomes.

In economic experiments, human subjects play the role of market participants in a controlled setting designed to reflect the key incentives in the naturally-occurring environment being studied. In a fishery management experiment, for example, subjects would be given a profit schedule from which their earnings would be determined based on their chosen fishing effort and other variables of interest. The profit schedule and available actions would be selected to reflect the fishery and management measures being studied. Participants who better respond to these induced preferences are paid more, in cash, at the end of the experiment, for their participation (Smith 1976, 1994; Davis and Holt 1993). It is axiomatic in economics that people make decisions that maximize their utility, and since money earned in the laboratory can be used to increase utility outside the lab, participants will make decisions during the experiment that earn them the most money. Therefore, if the incentives of the economic environment being simulated have been properly represented in the experiment, then participants acting to maximize their laboratory earnings will make the same decisions as agents trying to maximize their utilities in the natural environment.[v]

Experimental economics can contribute to the analysis of market-based policies in two ways. First, it can provide a carefully-controlled test of a theoretical model. Second, it can be used to analyze market-based policies by comparing different ways of structuring the market and complementary institutions (Plott 1994; 1997). While we might accept an equilibrium theory as true if predicted outcomes eventually obtain, the convergence process—about which very little is known theoretically—has important policy consequences (Banks et al. 2003). When theory offers little guidance, experiments can be used to testbed trading institutions or evaluate the merits of alternative trading policy proposals to determine those that appear best-suited for a particular application. Flaws in proposed designs can be uncovered and corrected before implementation in the field, where such adjustments may be impossible or require much greater expense.

Experimental testbedding has been successful in a number of high-profile, high-value applications, including the auction NASA uses to determine space shuttle payload priorities (Ledyard, Porter and Wessen 2000) and the auction the FCC has used raise more than nine billion dollars selling licenses to bandwidth used by cellular telephones (Banks *et al*. 2003; Salant 2000; Plott 1997). Most closely-related to tradable fishing allowances are a number of applications in water rights trading (e.g., Murphy *et al.* 2000; Murphy *et al.* 2003; Cummings, Holt and Laury 2002), and tradable pollution rights (Franciosi *et al.* 1993) (see Shogren and Hurley 1999 for a survey). Specific cases include the market mechanism for trading sulfur dioxide and nitrous oxide in southern California (Ishikida et al. 2000; Carlson et. al. 1993) and that are used by the Environmental Protection Agency to trade pollution permits for sulfur dioxide under the Clean Air Act (Cason 1995; Cason and Plott 1996). In the latter case, the EPA implemented a discriminative auction for trading permits in which buyers and sellers each submit sealed bids and low-asking sellers were matched with high-bidding buyers; buyers paid their bid price to their matched sellers. Experiments demonstrated that this institution's incentives led sellers to underreport the true costs of emissions control in hopes of being matched with lower-bidding buyers, resulting in inefficient trades. These experimental results subsequently led to a change in the auction design for pollution permits. This is an example of how investing in laboratory testbed research before implementation can improve the outcomes of tradable allowance markets.

EXPERIMENTS ON TRADABLE FISHING ALLOWANCE MARKETS

Figures 1 and 2 show the prices which emerged from two experiments, each replicated in five letter-labeled sessions with different subjects, assessing the same tradable allowance system with trade taking place through two different institutions. In each experiment, 12 to 14 human subjects, each playing the role of a fisherman managed by tradable allowances, interact through a computerized market to exchange allowance units which can be used to earn profit from fishing. Each of the 12 periods begins with a trading stage during which the market is open and trades can be executed. When the market closes, each subject earns profit from fishing based on the quantity of allowance units she holds.

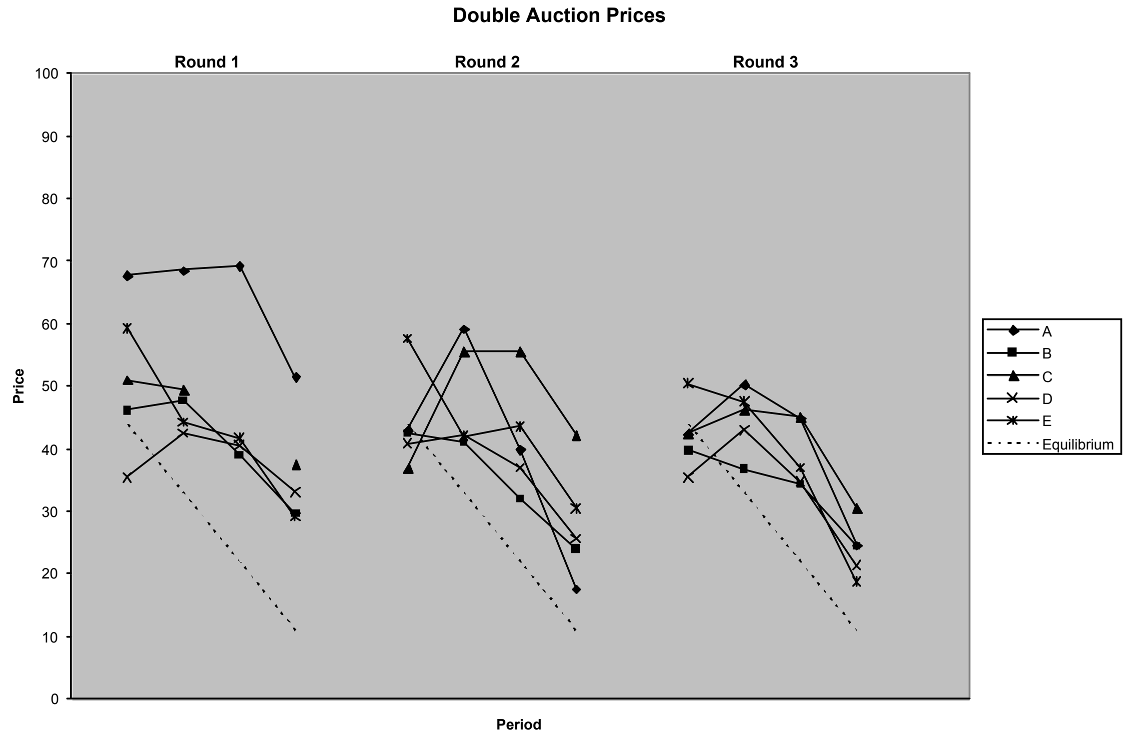

Figure 1: Period average prices in the double auction

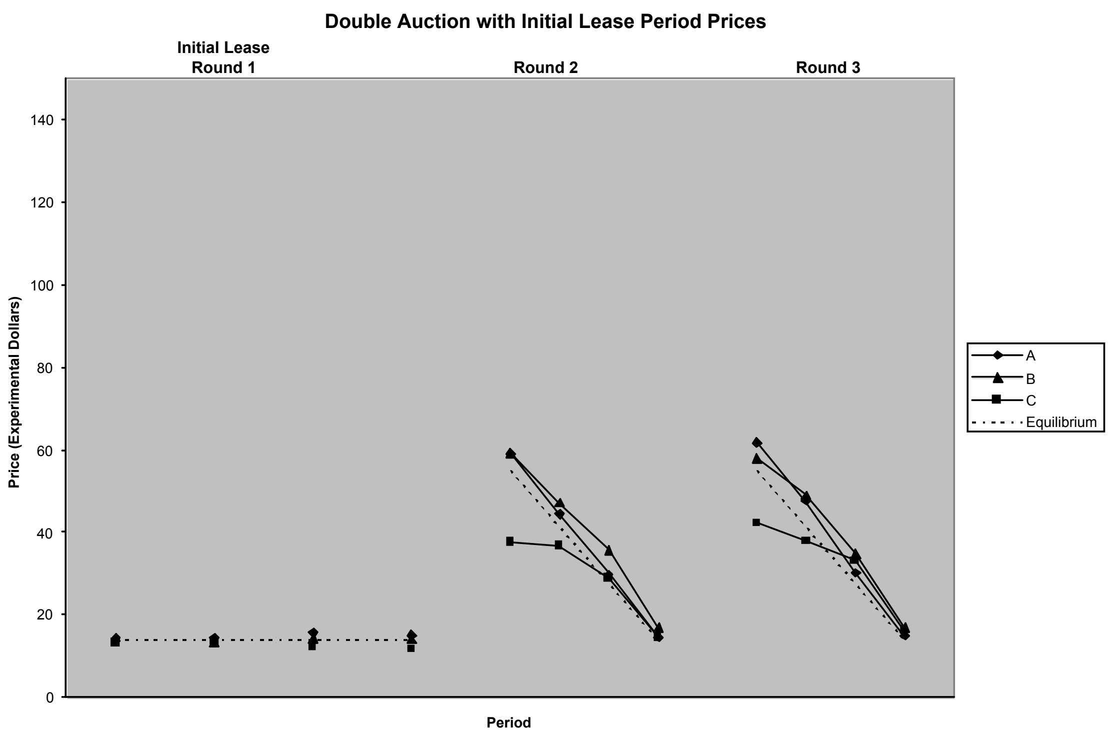

Figure 2: Period average prices in a double auction with initial lease period

Subjects read the amount of profit from fishing they earn for any number of allowance units from a table on their computer screen. Within each experiment, all subjects had identical profit functions estimated from 2001 logbook data on medium-large lobster operations in Area 2, which encompasses the Rhode Island inshore fishing grounds. At the end of the experiment, subjects are paid, in cash, their total earnings from fishing and net trading profits.

In both figures, the 12 periods are grouped into three rounds of four periods each. In all three rounds in Figure 1, and in rounds 2 and 3 in Figure 2, there is a downward-sloping dashed line that indicates the upper bound of the competitive equilibrium price prediction, 11.5 times the number of periods remaining in Figure 1 and 13.8 times the number of periods remaining in Figure 2.[vi] Allowances are assets, which in the experiment are given a life of four periods. In the first period of each round, subjects are given an endowment of allowance units and cash. An allowance unit purchased entitles the buyer to the stream of profits associated with it in each period, so buying in the first period of a round allows the purchaser to earn profit fishing it in all four periods, while an allowance unit purchased in the fourth period provides profit in only one period. If allowance units are traded based on fundamental values, the additional profit that can be earned by fishing them, the equilibrium model predicts prices will decline as periods elapse because there are fewer periods remaining in which to earn profit from fishing with purchased allowance units. Between rounds, endowments are restored to initial levels and the four-period exercise is repeated to assess the effect of experience.

In both experiments, trade took place through a market called a double auction, because both buyers and sellers can make and accept offers (Davis and Holt 1993). At any time during trading, buyers and sellers may advertise a trading price on a central market board, or accept a trading price advertised by someone else. This institution possesses prominent features of many field fishing allowance markets because trading is bilateral, can take place at any time, and different trades can occur at different prices.

The difference between the two experiments shown is the rules under which trade took place in the first round.[vii] In Figure 1, the allowance market was created and participants were allowed to make permanent trades immediately. The market in Figure 2 differs from this in that permanent allowance trades were not permitted in round 1. Instead, a lease-only market was established by returning to the seller at the beginning of each period all the allowances sold during the previous period.[viii]

The major result of this paper is that although the market fundamentals and equilibrium predictions are comparable in these two experiments, the outcomes are consistently and systematically different. Consider the average price observations in Figure 1's double auction (DA) with those in the similarly structured rounds 2 and 3 of Figure 2's double auction with an initial lease period (DAILP). The most important difference is that every single price observation after the first period of a round is considerably above the equilibrium prediction in the DA, whereas the equilibrium model describes well the average behavior of prices in the DAILP, as observations are both closer to and distributed both above and below the equilibrium prediction. Although the data in both figures begin each round with some spread around the equilibrium price, there is a consistent difference in how prices change in consecutive periods. In the DA, prices often change little, or even increase, in the second and third periods to result in higher than equilibrium prices, as equilibrium predicts prices should fall. In contrast, the price changes between the first and second periods in the DAILP move in the direction of equilibrium, and changes between the second and third periods decrease at about the same rate as equilibrium predicts. Based on this initial examination, trade prices in the DA do not appear to reflect the fundamental value of allowance and do not appear to be equilibrating. In contrast, the prices in the DAILP do appear to be responding to changes in fundamental value, consistent with the competitive equilibrium model.[ix] As a result, the efficiency of the allocations in Figure 2 rises and stabilizes above that of the initial allocation, but that in Figure 1 falls consistently below the efficiency of the initial allocation in the third and fourth periods. This difference can only be attributed to the different market structures used to facilitate exchange.

The effective difference between these sets of trading rules is that in the DA in Figure 1, allowing trades to take place at different prices when little information was available led to a great deal of volatility, which in turn reinforced beliefs about the prices that others would be willing to pay in the future. This fueled speculation which led people to bid up the price based on beliefs about what others would pay in future periods, rather than to trade based on the marginal profit from fishing provided by allowances. As a result, average allocative efficiency fell below the level at the initial endowment; the outcome would have been more efficient if trade had been prohibited. In contrast, the DAILP in Figure 2 both provided a high-quality initial price signal from the lease market. The net effect is that when the asset market is introduced in round 2 of the DAILP experiment, subjects have information on which to evaluate prospective trades, and thus facilitates equilibration. As a result, efficiency quickly stabilizes above that of the initial endowment.

The pattern of higher-than-equilibrium prices which do not fall with changes in the fundamental value, but then crash at the end of the round, seen in the DA experiment is consistent with bubble and crash cycles seen in other experimental asset markets (Smith, Suchanek and Williams 1988; Fisher and Kelley 2000; Noussair, Robin and Roffieux 2001; Lei, Noussair and Plott 2001; see Sunder 1995 for a survey). This is a symptom of some underlying difficulty with asset price discovery presented by the double auction institution, which is addressed by the initial lease period.

A comparison of the price discovery process in a double auction market for tradable fishing allowances with and without an initial lease period can be made by examining Figures 3 and 4. They show the time series of individual trade prices from one session in the double auction without and with an initial lease period, respectively. The heavy vertical lines indicate points where the endowment was reset, and the thinner lines indicate changes of period when endowments were not reset. Within each figure, the width of the area between the lines is proportional to the number of trades which occurred during that period. The thin horizontal lines indicate the upper bound of the predicted equilibrium price tunnel.
In comparing the graphs, two differences stand out: in the asset market following the initial lease period in Figure 4, there are far fewer trades and the range and fluctuation in prices is far smaller. Together, this suggests that information gathered in the initial lease period leads to a less volatile market.

While there is undoubtedly volatility in both markets, it has greater range and is more persistent in Figure 3. In the DA, volatility spans several times the range of the inter-period change in equilibrium price, swamping any change in fundamental value. As a result, volume in the DA is very high, over 5 times the minimum number of trades necessary to achieve equilibrium; total volume is much lower in the DAILP. This further indicates that trades in the DA are motivated by factors other than mutual gains in trade based on fundamental values. If reducing volatility and facilitating price discovery are prerequisites for meeting policy objectives, these pictures suggest the initial periods of the market are better spent with a lease market than with permanent allowance trading. Even after three rounds of experience with a double auction asset market, volatility is still higher than in either the initial lease period or the first asset market round of the DAILP following the initial lease period; there is so much dispersion in the double auction market that it is having difficulty converging. Since in a naturally occurring tradable allowance market there is no opportunity to restart as we do in the lab at the beginning of each round, identifying rules of trade which rapidly reduce volatility and facilitate price discovery is particularly important.

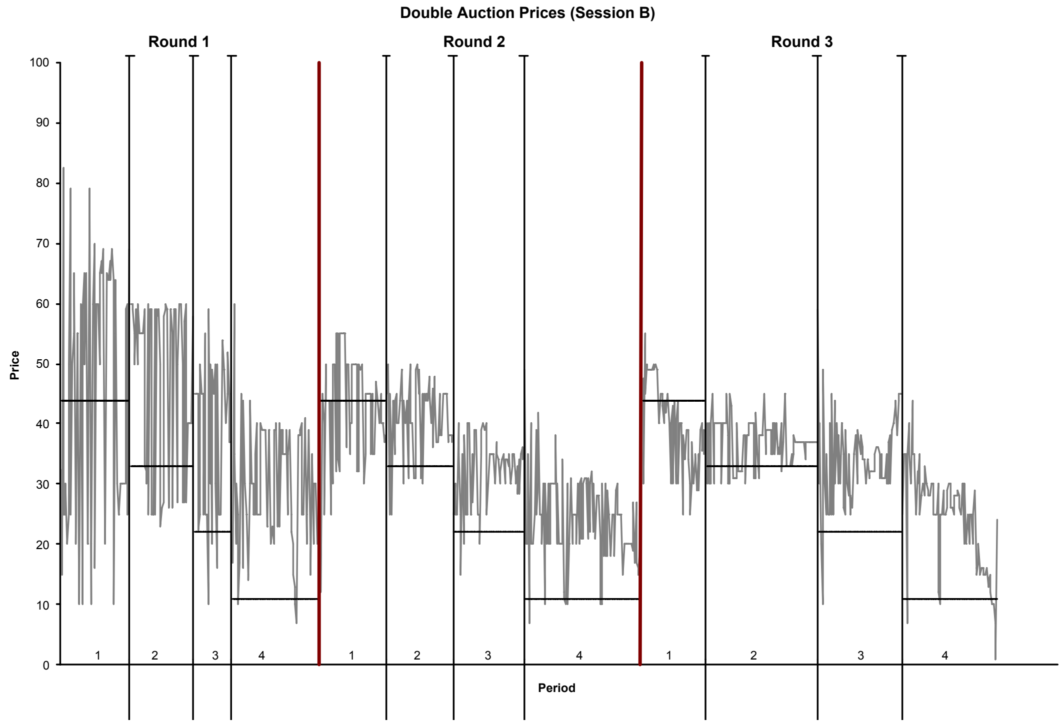

Figure 3: Time series of contracts in a double auction session

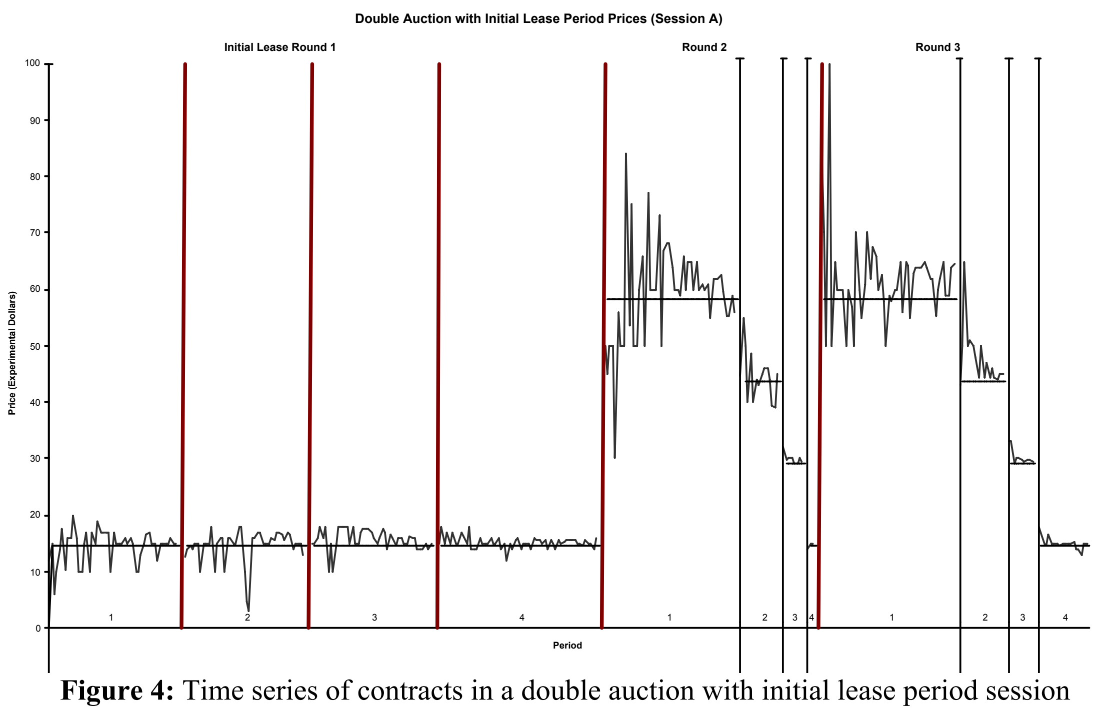

Figure 4: Time series of contracts in a double auction with initial lease period session

DISCUSSION

Tradable rights systems have gained popularity in recent years for managing a variety of natural resource problems. With the expiration in Fall 2003 of a six-year moratorium on new tradable fishing allowance programs in the United States, stakeholders and managers unsatisfied with the outcomes of other management systems are considering this newly available option. However, stakeholders and managers wish to avoid some of the aspects of the outcomes of previous experiences with tradable allowance management which could have resulted from high levels of market volatility. These experiments suggest that, while some volatility during price discovery is inevitable, the persistent, large price swings which have been observed in the field are associated with the particular rules that are most frequently used to facilitate trade. In the laboratory, a higher-quality price signal derived from a single-period lease market—which equilibrates reliably—significantly reduces volatility and facilitates price discovery, leading to efficient, stable equilibrium outcomes.

The general lesson to be taken from this research is that the rules of trade matter: *efficient market outcomes are not an automatic result of establishing a property right and permitting its trade*. For policymakers, this implies that attention must be paid to the rules of trade, as well as to traditional factors such as the definition of the allowance, who is eligible to receive it and the quantity to be allocated. For resource users and policymakers assessing whether or not a tradable allowance system is appropriate for their fishery, the effect of institutions on outcomes also means that what can be inferred from other experiences depends on features specific to the fishery *and* to the institution that was used. Since the presented experiments suggest features of commonly used trading rules may not effectively facilitate convergence, the potential of tradable allowance management may differ significantly from past experiences.

A common reaction of policymakers and stakeholders to adverse experiences with tradable allowance programs is to implement new programs with substantially similar institutions, but with restrictions on trade designed to address previously identified problems. Examples include restrictions on resale to discourage speculation, or on the maximum amount of allowance any participant can hold to limit consolidation. However, these experiments suggest bad outcomes may be symptoms of a deeper problem with the chosen rules of trade. The best way to prevent volatility, consolidation and other feared outcomes may be to identify an institution that works well, rather than imposing limitations on trade within one which does not.

While addressing institutions is challenging for economists because there is no received theory, no model, with which to understand which institutions will be well-suited to a particular application, it also provides a powerful new degree of freedom for achieving policy objectives. Experimental economics can be an important tool in efforts to understand the effect of institutions in a particular policy application. In addition to testing hypotheses about economic theories, experiments can be used to evaluate institutions in a controlled setting, and with knowledge of the necessary market variables such as profit functions which are difficult to know the field, and to compare alternative institutions to determine those that best achieve policy goals. Despite being a relatively new tool, an increasing literature of successful applications to the design of real institutions suggests that experimentation can inform and improve field implementations of market-based policies; experiments may be the best available science for assessing features of market-based institutions, and perhaps others as well.

However, like any science, foundational knowledge must be built slowly and carefully before it can be reliably applied. Because so little is known about how and why different institutions yield the consistently different outcomes that they do, care must be taken in each application to ensure the reason for any regularity in the laboratory transfers to the field; even in the absence of a formal theory, it is necessary to test a story about the interplay of information and incentives to expect external validity.

Although it is tempting to conclude from the data presented here that initial lease periods would enhance equilibration in new tradable allowance markets, it is important to understand exactly why they work prior to field implementation. Future work can focus on what exactly market participants learn in the initial lease period: do they learn only that the per-period price is $11.50, do they actually learn about the relationship between assets and fundamental values as represented by their profit functions, or is it something different altogether? This carries policy importance because it allows prediction of the sorts of market variations to which initial lease market results might be robust.

Although it has not been widely acknowledged by economists, the rules of trade play a significant role in determining market outcomes. This is particularly true when a market is created for an entirely new commodity or asset, and traders have little market information on which evaluate prospective contracts. Tradable allowance systems are an increasingly popular tool for managing environmental and natural resources, but establish new assets, about which little value information exists. This creates a policy need for designing trading institutions which equilibrate quickly, and with a minimum of volatility which can produce irreversible extreme outcomes. Lacking a theory on which to base such development, the laboratory serves as a convenient and flexible environment in which to evaluate alternative institutions in a controlled way, comparing them on the basis of efficiency, volatility, equilibration speed and other application-specific criteria. By identifying the institution which best achieves the bio- and socioeconomic goals of each application, the full potential of tradable allowance management be realized. Only then can tradable allowances be compared to other management alternatives, and the best management system for each community, fishery and resource be selected.

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ENDNOTES

[i] The term "allowance" is used to refer to the privilege to access a resource at a certain level. This term encompasses both transferable production allocations (ITQs and IFQs) and transferable effort allocations (e.g., days-at-sea or trap certificates). In the US, these allocations are not true property rights, in the sense that they may be revoked by the government without compensation, hence we avoid use of the term "right."
[ii] Newell, Sanchrico and Kerr (2003) measure dispersion as the ratio of the absolute value of the difference between a trade's price and the month's mean price, and the month's mean price.
[iii] Even in small fisheries, where everyone knows how much effort everyone else is applying to earn what money, price discovery is necessary because knowing everyone's average value of an effort or production unit at current production levels is little help in determining the fishery-wide marginal profitability—which determines the

allowance price—at the often much lower production levels which are often imposed with new tradable allowance systems.

[iv] Of course, non-market-based management systems can also be better and worse-designed, and the comparison should also consider the best-designed version of those alternative systems. The contribution here is that decision-makers and stakeholders need to be sensitive to the idea that there are better and less-well-designed markets.

[v] See Anderson and Sutinen (forthcoming), Smith (1976, 1994), Plott (1994), Davis and Holt (1993), *inter alia*, for more detailed discussions of experimental methods.

[vi] With discrete-unit supply and demand curves, we must select between a price tunnel (an interval of equilibrium prices) and a quantity tunnel (an interval of equilibrium quantities). In experiments with quantity tunnels, trading commissions are often offered to provide incentive to make the inframarginal trade at the equilibrium price. In environments where resale is allowed, commissions cannot be offered, so a price tunnel was used, where the market provides the incentive to trade the inframarginal unit. In Figure 1, the competitive equilibrium model predicts the price will be between 10.25 and 11.5 (12.6 and 13.8 in Figure 2) experimental dollars times the number of periods remaining in the round.

[vii] The difference in institutions is the material difference between the two experiments, but there were small procedural differences which our debriefing indicates did not affect subjects' understanding of the problem. The instructions for the DAILP experiment differed from those for the DA in that they were abbreviated, and broken into two sections, the first explaining the market software and lease market for the first round, and the second explaining the asset structure administered before the second round. There were two noteworthy software revisions between the DA and DAILP experiments. First, the subjects' software screen had a graph of the profit function in the DA experiment in addition to the table; the graph was not used in the DAILP experiment. Second, the DAILP software had a feature which alerted subjects when they were about to make a bid or ask that would not increase their joint profits from trading and fishing. Debriefing suggests this feature more reduced some subjects' confusion more quickly, but did not inhibit subjects for whom trading at a loss was strategic. Based on others' asset market experiments in which similar loss warnings were implemented, and data reported in Anderson and Sutinen (2004) in which a call market with loss warnings but without an initial lease period shows high volatility and above equilibrium prices, I do not believe these changes caused the differences between the figures. Ideally, the DA experiment could be replicated with these features and with instructions which more closely mirrored those used in the DAILP experiment. However, appropriate scientific skepticism aside, it is instructive to look at these experiments side-by-side and learn from the differences between them.

[viii] This rule parallels the phase-in of quota trading in the BC halibut fishery. In that case, individual vessel quota began in 1991 and, during the first two years, no quota transfers (temporary or permanent) were allowed separate from fishing licenses. After two years, temporary (annual) transfers were permitted, which remained in effect until about three years ago (Casey, *et al.* 1995). Both permanent and temporary transfers are now allowed in the fishery (Turris, 2004).

[ix] Anderson and Sutinen (forthcoming) statistically reject the hypothesis that the average prices and between-period price changes in the DA are consistent with equilibrium, and Anderson and Sutinen (2004) statistically establish that the price levels and changes in the DAILP are consistent with the equilibrium model. See those papers for an analysis of the respective experiment data, and a detailed discussion of the procedures that generated them.