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I. INTRODUCTION

In recent years, there has been a growing interest in policy applications of different auction systems. Contemporary examples in the United States include Treasury bill, SO_2 and FCC bandwidth auctions. In Europe, Australia, and New Zealand, auctions have been used in markets for mobile telephone spectrum, television franchises, and in deregulated electricity markets (Cramton, 2000, 2002; Kagel and Levine, 2001; Banks et al., 2003; Klemperer, 2002, and Rassenti et al., 2002). In addition, there has been increasing interest in using auctions to allocate water resources in areas subject to drought conditions. In Victoria, Australia, for example, auctions have been used to award new irrigation permits (Simon and Anderson, 1990). The U.S. federal government, however, has not yet used auctions to obtain water. Instead, they typically rely on using bilateral bargaining or posted-price markets to restrict water use voluntarily in drought-prone areas (see Simon, 1998).

In April 2000, the Georgia legislature passed a unique law, The Flint River Drought Protection Act,[1] which mandated the state hold an auction in drought years in order to pay some farmers to suspend irrigation. The state was entering a third year of drought and Georgia's primary water manager, the Environmental Protection Division (EPD), was concerned that the exercise of existing water use permits could reduce flows in the Flint River to levels that might cause serious harm to the Basin's ecological systems in general, and to endangered species in particular. The Drought Protection Act

[1] O.C.G.A. 12-5-540 through 12-5-550.

was designed to reduce irrigated acreage (which accounts for more than 70% of consumptive water use in the Basin) during drought years. On March 1 of each year, the Director of the EPD is required to announce whether or not the upcoming summer will be characterized by severe drought conditions. If a drought is declared, the Director is then required to determine the number of acres that must be taken out of irrigation to maintain acceptable river flows. He then implements an “auction-like” process wherein farmers may offer to voluntarily forego irrigation of *all*[2] lands covered by a specific water use permit for the remainder of the calendar year, in exchange for a one-time lump sum payment (determined by the auction). The Georgia Legislature set aside $10 million of funds derived from the multi-state Tobacco industry settlement for use in compensating these farmers.

After learning of the Act’s auction provisions, we immediately initiated a program of research aimed at assisting the EPD in their efforts to define the substance of the “auction-like process” that they might be (and ultimately were) required to implement. An appropriate design for such an auction was not immediately obvious. The value of irrigation to farmers in this region contains both private value and common value components. Since most farmers use irrigation for one or more of three major crops, (corn, cotton, and peanuts), we concluded that sellers have relatively good common information about the value of irrigation to other sellers, subject to some uncertainty about price and weather. In contrast, differences in permit size, soil quality, and location produced variations in per-acre productivities of irrigated land, which we modeled as “private value” differences. Finally, any effort to design an auction mechanism for this application would have to reflect obvious incentives for sellers (farmers who know one another) to attempt to collude.

The next section provides an overview of the existing theoretical and empirical auction literature. In Section III we discuss the institutional considerations that determined the basic experimental design and treatments. Section IV presents results

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[2] Reflecting issues related to enforcement, farmers were not allowed to offer partial reductions in acreage covered by a specific water use permit. Offers could be made only to take all lands covered by the permit out of irrigation for the balance of the year. If, as was often the case, a farmer held more than one permit, he/she could offer to take all lands covered by one permit out of irrigation, but continue to irrigate all lands covered by permits with offers not accepted in the auction.

from laboratory experiments of various scales (from 9 to 42 participants), focusing on several key design features: the tie-breaking rule used, the pricing rule, and information-provision rules. The result of two field experiments are reported in Section V, one with subjects that were primarily farmers and one that was a multi-site auctions with 50 people drawn from the local population at two sites in southwest Georgia, just two months prior to the actual auction. Section VI describes how our recommendations were implemented, and summarizes the results of the EPD auction, which involved 194 farmers at 8 Flint River basin locations. The final section concludes.

II. Review of Theoretical and Empirical Studies

While there is a growing body of theoretical and empirical research on auction design, this is a very different implementation environment than that previously studied. Consider, as examples, the SO_2 and bandwidth auctions. These were complex auctions for commodities worth large sums of money. Many participants could afford to hire auction consultants, therefore allowing policy-makers to utilize potentially complex auction mechanisms. In the SO_2 auctions there may be many buyers and sellers, while in the bandwidth auctions there is a single seller (the U.S. government) and many potential buyers competing for licenses. This stands in stark contrast to the situation in Georgia. Under the Flint River Drought Protection Act, there is a single buyer (the state) with a fixed budget and multiple, heterogeneous sellers (irrigation permit holders, typically farmers). Many sellers have multiple, possibly heterogeneous, units (suspended use of water permits) available for sale. Successful offers involve small amounts of money compared to the auctions described above. Therefore it is unlikely that participants will find it profitable to hire experts for advice on bidding strategies.

Despite these differences, it is useful to review the existing literature on auction design, and how it has been applied in a variety of policy settings. In auctions where buyers can purchase a single unit of a commodity, a uniform-price is typically preferred because it is incentive compatible to bid one’s own value (at least when one’s bid cannot determine the market-clearing price). However, in many field environments, buyers can purchase several units of a good. This has proven to be a challenge to auction designers because of the incentive to bid below value on some units of the good, at least when the individual demand for multiple-units is constant or decreasing. Such "demand reduction" occurs in uniform price multi-unit auctions when one's bid can affect the price that one receives for an accepted bid.[3] For example, consider a bidder who can make offers on two units of a good. If one offer is accepted, it is possible that his offer on the second (rejected) unit could determine the market-clearing price. In this environment, bidding one's value is incentive compatible only if the price is determined by the highest rejected offer that is not one's own.

Kagel and Levine (2001) study the performance properties of several auction mechanisms in such a multi-unit, independent-private-value environment. Specifically, they compare two uniform-price mechanisms that have been used in the field: a sealed bid auction and an English clock auction.[4] In the sealed bid auction, bids are submitted simultaneously, with no information given about others' bids. In contrast, in the clock auction, the price is progressively raised, and auction participants can observe the price at which other bidders drop out of the market. While both auctions result in demand-reduction (as predicted by auction theory), outcomes are closer to the equilibrium prediction in the English clock auction. Follow-up experiments (using modifications of these two auctions) indicate that performance differences can be attributed both to the greater information provided in the clock auction and the way in which this information is provided to participants.

A second thread of research has addressed the design and implementation of computer-assisted markets for multiple units of a good (see Banks et al., 2003, for detailed discussion of many of these auction institutions). This is especially relevant to environments where complementarities exist between units of a good (therefore resulting in *increasing* demand for multiple units of a commodity). One might imagine a situation in which an organization values two spectrum licenses, A and B. However, if complementarities exist between the two licenses, the value associated with obtaining both licenses would exceed the sum of the value of the two licenses. Initial FCC

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[3] List and Lucking-Reiley (2000) and Kagel and Levine (2001) document such demand withholding behavior in both laboratory and field experiments.

[4] They also present theoretical and experimental results from several other auctions that have not been used in the field.

spectrum auctions did not allow for so-called "combinatorial" bids for packages of licenses. The FCC has a stated interest in the efficiency of these spectrum auctions (awarding licenses to those with the highest value). Given this, and the possible complementarities associated with obtaining such packages of licenses, current research has explored the feasibility of modifying auction procedures to allow for combinatorial bids for combinations of licenses. Banks et al. (2003) provide a thorough overview of this research.

An additional complication for auction research involves commodities that have both private and common-value components. One might imagine a resource (for example a natural gas reserve) that has a significant common-value component for all bidders. However, bidders may differ in their technology or ability to extract and market the resource (the private value component). In this case, there is no equilibrium bidding strategy (see Banks et al, 2003, and Klemperer, 1998).

Even in cases where theory is not silent, out-of-equilibrium behavior by some participants may create strategic incentives for other participants to modify their behavior. As Banks et al. (2003, p. 311) note, "You begin with a nice, theoretically 'optimal' auction procedure. In implementation, you encounter behavioral incentives or 'strategic' problems not considered as part of the original theory and likely intractable from a theoretical point of view. You come up with a rule 'fix,' to provide a countervailing incentive. You create a new problem requiring a new rule adjustment and so on, in a process that need not converge."

Given that this received literature (theoretical and empirical) does not directly apply to the Georgia auction environment, we turned to experiments for guidance in the auction design. The purpose of this paper is to describe our efforts to evaluate alternative auction mechanisms to implement the Flint River Drought Protection Act's requirements. Our goal was to design an auction that provides farmers with an incentive to reveal their true costs of foregoing irrigation, under the constraints imposed upon the auction by the law and available budget. The subjects were mostly students in laboratory settings designed to mimic likely characteristics of the actual auction, such as easy communication between sellers and large numbers of sellers. We also made use of adult subjects and farmers in field conditions. These field experiments were held at local facilities in the affected farming communities.

The next section describes our basic experimental design.

III. Implementing the Irrigation Auction in Laboratory Experiments

Because our work was motivated by a specific policy question, the experiments that we conducted included more context and fewer controls than is typical for laboratory experiments. The first part of this section provides details on the institutional context for the irrigation auction. The second part outlines our experimental implementation.

Institutional Considerations

There were many institutional details that we considered and mimicked in our experiments. First, there are many potential "sellers" (farmers) and only one "buyer" (the EPD). We use the terms buyer and seller to correspond to traditional auction theory and design, however nothing is being "bought" or "sold" in this auction. To be more precise (and legally accurate) farmers make offers to suspend irrigation for the remainder of the calendar year. These offers may be accepted or rejected by the EPD. Farmers, however, retain their land and their irrigation permit regardless of the outcome of the auction.

Some farmers have more than one irrigation permit, and the value of the land is not homogenous across farmers. In fact, one farmer may hold irrigation permits for land that is used to grow different crops, and therefore has different values, depending on which crop he plants that year. The auction must be implemented and finalized quickly (within 25 days) after a drought declaration is made. Moreover, it must be able to accommodate a potentially large number of farmers, who are located over a broad area of southwest Georgia. Not all of these farmers have internet access, and some are not comfortable with computers. While the EPD will have a target number of acres that they wish to take out of irrigation, they also have a fixed budget constraint that is likely to be binding. The maximum budget is public knowledge, but the target acreage need not be. Finally, the institution should be "collusion-proof" given that many of those participating in the auction know one another and will have ample opportunity prior to (or during) the auction to discuss bidding strategies.

Irrigation systems in this region are not metered. Therefore it was not possible to implement a system in which a given farmer reduces irrigation to a target amount. In order to have more manageable enforcement, regulators decided that any offer to suspend irrigation required no irrigation take place on *any* of the land covered by the permit. For example, if a single irrigation permit covered three distinct fields, an offer to suspend irrigation means that no irrigation will occur on any of the three fields. However, if a farmer had more than one irrigation permit, the farmer could offer to suspend irrigation under one and still irrigate land covered by another.

An offer to suspend irrigation merely states that the farmer is willing to forego irrigating for the remainder of the calendar year in exchange for the specified (per-acre) payment. The farmer can still use the land, and in fact can still plant crops on the land. While dry-cropping (planting without irrigating) is possible, we believe it is unlikely that the land will be used for agricultural purposes. Beginning January 1 of the following year the farmer is free to irrigate once again.

There were political considerations as well. The outcome of the auction should not be considered to be either "wasteful" or "unfair." There is a large variance in the quality of land (and the crops grown), both within and across regions. Many therefore perceived that a fair pricing system would entail paying different amounts to farmers with different values. In addition, in a uniform price auction there was the potential of negative publicity if a farmer offered to suspend irrigation for a very low amount but was paid a much higher amount determined by the uniform market clearing price. While we compared uniform and discriminative pricing in our initial experiments, described below, EPD officials were concerned that farmers would be dissatisfied with the auction outcome if those with low land values (who submitted low offer prices) received the same per-acre payment as those with higher land values. In response, we narrowed our focus to discriminative-price auctions in subsequent experiments.

Typically one considers an auction successful if the outcome is efficient. In this context, this entails not only the "right" price resulting from the auction, but also that those farmers with the lowest land values have their offers accepted. However, the EPD's primary goal was simply to take the maximum number of acres out of irrigation within the fixed budget constraint.[5] This was particularly important given that most thought it was unlikely that they would be able to meet their target acreage within their budget. Efficiency was a secondary concern to them.

Finally, because an auction like this had never been conducted in this region (and is expected to happen only infrequently), it is important that the rules and procedures be clear, easily understood, and also easy to implement. In particular, it was of utmost importance that all farmers understand precisely how their payment would be determined by their offer prices.

Laboratory Implementation

In the typical laboratory experiment, neutral terminology is used for goods of an unspecified nature, in order to preclude the possibility that valuations may be biased by experiment context. Moreover, subjects are often visually isolated from one another, and are not allowed to communicate (unless this communication is a treatment variable). The complexity of the auction procedures being discussed convinced us that a fair amount of context would be useful to reduce confusion, and we did not think vague beliefs about land rental rates would affect induced values that were several orders of magnitude lower. Therefore, subjects in these experiments were told:

> In this auction, each of you will be in the position of a farmer who has three "permits" to irrigate acres of land. These irrigation permits allow you to irrigate the land and earn money on crops that you grow. We (the experimenters) are in the position of a government agency charged with controlling water use. We will use an auction-like process to buy some of these permits back from you in order to reduce the amount of water being taken from river and ground water reserves in this area.

This context-specific terminology proved to be useful when we wrote instructions for the actual auction that followed a year later.

We used induced values to determine the supply function for irrigation permits. The subject was told the (per-acre) value for each permit that was held. If the permit was not sold, the subject would definitely earn this amount of money, multiplied by the number of acres covered by the permit. If the permit was sold, the subject would not earn

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[5] Ideally, the EPD would suspend irrigation on land with the most intensive water use; however without meters on irrigation systems, they have no information that makes this possible.

this money, and would instead earn the negotiated per-acre price multiplied by the number of acres covered by the permit. The certain value of a held permit is a simplification of the actual situation facing farmers, since crop price is not known with certainty in advance. Roughly 75 percent of the acreage in this region is in corn and cotton, and this is also the acreage with the lowest profit margins. Farmers in this area are clearly price-takers in these crops (reducing acreage would have no effect on market prices), and therefore have a good idea of the costs and prices that they face. Farmers are subject to additional uncertainty about crop yields due to unpredictable growing conditions (such as the weather). This tradeoff between the uncertain return from planting (based on crop prices and yield at the end of the growing season) and a certain return from the EPD if an offer is accepted in the auction was not captured in our experiments. However, our focus was on comparing the performance of alternative auction rules. While implementing this uncertainty into our experiments could have changed the *absolute* performance of any given set of rules, we had no *a priori* reason to expect this to change the *relative* performance of one set of rules compared with another. Therefore, to reduce subject confusion, we chose to use permit values that were known with certainty.

In pilot experiments, we tested some one-shot sealed offer auction institutions. After discussions with EPD officials we jointly concluded that allowing farmers to revise offers during the auction would be preferable. We needed a strong justification for the additional time and expense of conducting an auction with revisions (which by necessity involved taking workers into the field). One reason is simply to insure against a bad outcome. Given that this type of auction had never been conducted before, policy-makers wanted some assurance that prices would be at a "reasonable" level. If, for example, a simple sealed offer auction is conducted and the submitted offers are extremely high, very few offers would be accepted. Allowing for revisions gives farmers a chance to think about the situation and to respond to policy-makers' decisions and the bidding behavior of others. Allowing for these revisions could minimize the chance that farmers will come out of the auction wishing that they could do something differently. Given the potential political repercussions of a poor outcome, or unhappy farmers, EPD officials considered this is a big advantage of implementing an auction with revisions. Moreover, holding other factors constant, an institution that results in more efficient outcomes (and therefore, presumably, participants who are more satisfied with the outcome) is preferable. This is a strong argument in favor using an auction mechanism that includes the opportunity to revise offers. In the next section we describe the specific procedures used.

Even before draft rules of the auction were released by the EPD, farmers in the affected area of the state were discussing the auction. We expected them to come to the auction having discussed the auction and bidding strategies amongst themselves prior to the auction. In order to better simulate this level of experience, some subjects participated in several auction experiments. About 40 percent of our subjects participated in more than one session. Therefore our auctions involved a mix of experienced and inexperienced subjects. We did, however, shift the land values (and budget constraint) by a constant between sessions in order to change the competitive price between sessions.

We were concerned that the laboratory environment might inhibit the communication that would certainly occur among farmers in an actual irrigation auction. Therefore, we conducted the majority of our sessions in an open lobby area outside of the laboratory, or in a large meeting room, depending on the number of participants. Refreshments were provided, and subjects were encouraged to talk with one another. The experimenters were available to answer questions, but typically kept their distance (sometimes standing in another nearby room) so that they did not inhibit any conversation. Also, because we expected many of the farmers to know one another, we placed no restrictions on friends or family members participating together in these experiments (this is typically avoided whenever possible in economics experiments). For example, we know of several cases where spouses, siblings, and parents participated together. For the majority of experiments, subjects were students at Georgia State University.

Subjects did, in fact, talk with one another during the sessions. Because communication was not a treatment *per se* (instead we were trying to parallel the naturally occurring environment) we did not monitor the conversations or keep transcripts. We did observe that subjects sometimes engaged in small talk, and at other times talked about the auction itself. Because we wanted to ensure that any auction mechanism that we recommended would be relatively collusion-proof, we were happy that bidding strategies were discussed and attempts at collusion occurred in most sessions.

Overall, 76 subjects participated in 8 laboratory auctions held in May 2000 (some subjects participated in as many as three auctions). Most sessions lasted for two hours (the 42-person session was scheduled to last 4 hours), and earnings ranged from $36.62 to $99.88, with an average of $63.74.

IV. LABORATORY EXPERIMENTS

This section describes the treatments that we tested in the lab, and the results from auctions using each of these treatments. We were interested in how the average price paid, number of acres obtained in the auction, and efficiency were affected by the choice of institution and the opportunity to revise offers based on market information. While the EPD's primary interest was in minimizing the average cost of taking acreage out of irrigation, we also focused on the efficiency of each auction mechanism. Our measure of inefficiency is the amount by which the opportunity cost (the value of a permit that is kept) of the accepted offers exceeds the minimum opportunity cost of the number of acres accepted in the auction.

Each auction tested was a variation of the sealed offer auction with revisions, described below. However, there were specific features of each auction institution that we believed could impact its performance. Table 1 lists each of our sessions, along with the relevant design-features for each. The following sub-sections describe each of these features in turn: the use of tie-breaking rules to inhibit collusion, the pricing rule (uniform or discriminative), and how much information to provide to participants about provisionally accepted offers.

<Table 1 about here>

The Sealed Offer Auction with Revisions

The basic procedures for these auctions were similar to a one-shot sealed offer auction: each participant independently filled out and submitted an offer-submission card that specified the per-acre price required to forego irrigation. After all offers were submitted, they were ranked from low to high. The lowest priced offers were then "provisionally" accepted. After the provisional winners were announced, all subjects (regardless of the status of their offer) were given the opportunity to turn in a revised offer. The new offers were then ranked, and new provisional winners were announced. This process continued until either no one wished to submit a revised offer or the experimenters chose to end the auction.[6] In this case, the provisional acceptances from the most recently completed round became final acceptances. Subjects did not know in advance which would be the final offer round.

We placed no restrictions on the revisions. Therefore a subject who initially submitted a high offer price could lower their offer (provided another revision round was held). Similarly, a subject who submitted a very low offer could increase it, even if the offer was provisionally accepted. Of course, doing so involved the risk that the subject would be excluded from the market at the new offer price.

Participants knew their own land values, the range of values, the number of participants, and the fixed budget. They were told that we had a target number of acres that we wanted to take out of irrigation, and that we would accept as many offers as possible until we either reached this target or expended our budget. However, they were not told the target number of acres.

A key issue here is how to announce the provisional winners. In particular we considered whether we should simply announce which offers were accepted (identified in an anonymous manner, for example by permit ID number) or announce the cut-off offer price that determined which offers were accepted. We thought that it would be cumbersome to announce each ID number, especially in the actual auction with potentially hundreds of permits offered. Therefore, we chose to announce only the cutoff price ("All offers at or below $1.20 were provisionally accepted"), however, this is a treatment that we consider below.

We were concerned that participants might be confused about how their earnings were determined in the auction. There were two potential sources of confusion: how much they earned if they retained a permit, and how their earnings were determined in

[6] In these experiments, we typically conducted as many offer-submission rounds as possible in the time-allotted for each session. However, we typically ended the experiment prior to the scheduled end-time so that subjects could not anticipate the final offer-submission round.

the event that an offer was accepted. If a subject was confused about how earnings were calculated, they received no information during the experiment that would eliminate this confusion. In order to alleviate confusion, we used extensive instructions (available online at http://www.gsu.edu/~eocskl/research.htm), which contained numerous examples of how earnings would be calculated. In addition, participants worked through two practice auctions using real goods (for example, pens or post-it notes).

Tie-Breaking Rules

Given a fixed budget constraint, the possibility exists that a tie could occur at the highest accepted price. For example, suppose the budget was $10 and the ranked offers in a discriminative auction were: $0.50, $1.00, $2.00, $3.00, $3.00, $3.00, $5.00, and $10.50. In this case, we could accept all offers below $3.00, but only 2 of the 3 offers at $3.00.

In the lab, offers are often made in discrete increments, and so tied-offers were likely. Whether this would be the case in the field was an open question. Offers would be allowed in increments of pennies, and with no limit on the range of offers it was not immediately apparent that ties would be an issue in the Flint River Drought Protection Act Auction (hereafter, Irrigation Auction). However, there were early indications that ties might arise at focal prices. For example, shortly after the legislation was passed, one widely circulated estimate of the acreage reduction required was 100,000 acres. Given the $10 million budget, many expected that the EPD had a target price of $100 per acre. EPD officials in the field heard farmers discuss bidding strategies, with bids of $150 or $200 per acre frequently mentioned. Discussions about these issues with EPD officials convinced us that alternative tie-breaking rules should be explored.[7]

In one (uniform-price) session we told participants that, in the event of a tie such as the one described above, we would accept all offers at this price, "even if we have to go a little above our budget." Figure 1 shows the results from this session (and a paired

[7] In the Irrigation Auction, over 99 percent of all offers were whole-dollar amounts and there were many tied offers. Over 70 percent of all offers were made at levels where at least 5 permits were offered at that offer-price. For example, in the last offer-submission round, 15 percent of all offers were at a price of $125.

session, described below). The induced supply and demand arrays are shown on the left side of the graph. The supply curve (labeled “values”) is simply the permit values, ranked from low to high. The demand side of the market comes from the experimenters, and is determined by the fixed budget constraint. For example, in this market the budget constraint was $160. Therefore we could afford to buy one acre at a price of $160 per acre, 4 acres at a price of $40 per acre, or 160 acres at a price of $1 per acre. The demand curve (labeled “budget locus”) traces out the locus of these points where the price multiplied by the number of acres exactly matches the budget constraint. In this session, the uniform competitive price was $1.10 (prices on the graph are shown in pennies). We define this price as the one at which the number of acres that would be offered in the market if all bid value (144 acres) is just what we could afford to purchase at a uniform price within our fixed ($160) budget.[8]

The right side of Figure 1 shows the time series (across revision rounds) of average accepted prices obtained in this market (shown in the "inclusive tie-breaking rule" line).[9] In the first offer round, if we had observed our $160 budget constraint, we would have accepted two of these offers (plus six offers at lower prices), for a total of 112 acres at a cost of $134.40. However, because of our announced procedure of accepting all offers at the tied level, we provisionally accepted offers for 160 acres at a total cost of $192. In the second round the highest accepted offer price fell to $1.15, and there was once again a tie. As additional revision rounds continued, almost all permits with a value below $1.15 were submitted at this level – even those with very low values in this uniform price auction. By round 6, there were 18 accepted offers. All but five of these were submitted at $1.15. We retired a total of 288 acres (double the competitive level), and spent $331.20: over double our budget. Extrapolating to the actual problem faced by the EPD, this translates into spending over $20 million when the available budget is $10 million.

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8 If we assume that all will bid 1-cent above value in order to avoid indifference, the price would be $1.11, and 144 acres could still be retired while staying within the fixed budget.

9 Because the highest accepted offer is the one (uniform) price paid for all accepted offers, this is also the average price paid. For consistency with subsequent figures that show data from discriminative auctions, we label this as the average price.

<Figure 1 about here>

Later on the same day we conducted a second session (with a different group of participants). This session was identical (number of participants, parameter values, and procedures), except for an announcement that, in the event of a tie, we would randomly choose among offers at the tied level in order to stay within our budget constraint. The initial offers were quite similar to those in the first session (and are shown as the "random tie-breaking rule" line in Figure 1). In round 1, the highest accepted offer was at $1.15. There was a tie, and we accepted 2 of 3 offers at this level. In each subsequent round the maximum accepted offer fell. In the end, the price was 2-cents below the competitive level, and we were able to retire 144 acres.[10]

These experiments demonstrated the advantages of the random tie-breaking rule to the EPD. All remaining experiments used this rule, as did the auction rules passed by the EPD.

Uniform versus Discriminative Pricing

A second technical consideration is the pricing rule used in the auction. A uniform price auction is typically preferred over a discriminative auction because it is incentive compatible to bid one's own value (at least when one's bid cannot determine the market-clearing uniform price). However, because subjects in our experiments (like farmers who were to be participants in the auction) had multiple permits, neither pricing rule we tested is theoretically incentive compatible (Smith et al., 1982; Ausubel and Cramton, 1998). As described in the introduction, in this (multi-unit) environment bidding one's value is incentive compatible only if the price is determined by the lowest rejected offer that is not one's own. We did not consider such a pricing rule, however, because of the complexity of explaining and implementing it. Moreover, it wasn't clear to us that farmers would understand the incentive to bid value in such a complicated environment. It certainly would have been possible for us to explain the mechanism and the incentive to submit offers equal to one’s opportunity cost. However, the farmers

[10] The price was below the competitive level of $1.10 because one subject offered a permit at a price below value, and in fact the final price was below the value for this permit. While this sometimes occurred in these sessions, this was not typical of bidding behavior.

knew we advised the EPD in their choice of auction institution, therefore they may not have trusted our advice. In addition, we were hesitant to offer advice to farmers about bidding strategies because of the potential legal liability in the event a farmer was unhappy with the outcome of the auction.

Because of these considerations we restricted our attention to uniform and discriminative pricing rules. In the uniform price auction, the single price at which permits were sold was equal to the highest accepted offer price. In the discriminative auction, each participant with an accepted offer received his own offer price.

Figure 2 shows the results of several auctions run with the same budget, value arrays, and random tie-breaking rule. We observed a clear tendency for the range of offers to lie above values in both uniform and discriminative auctions, especially in early offer rounds (see the top panel of Figure 2). There was little difference in the median offer-to-value ratio among accepted offers in the two types of auctions. Using either pricing rule, the offer-to-value ratio *increased* across revision rounds. In the uniform-price auction, the median ratio increased from 1.02 in Round 1 to 1.04 in Round 6. Combining the two discriminative auctions, the median ratio increased slightly: from 1.02 in Round 1 to 1.03 in Round 5.

<Figure 2 about here>

In each of these experiments, the maximum accepted price decreased across revision rounds. In the uniform-price auction, this maximum accepted price is the one price that is paid for all accepted offers. Therefore, we can say that the average (uniform) price fell across revision rounds in the uniform-price auction. In contrast, the average price in the discriminative auction typically *increased* over revision rounds. Many subjects whose offers were provisionally accepted in early rounds raised their offer price, resulting in this increase in the average price paid as more rounds were held. By the final rounds of the discriminative auction, most accepted offers were at or near the market-clearing price, effectively removing any advantage of a discriminative pricing rule (see the bottom panel of Figure 2). So, while average prices are initially lower in the discriminative auction, this difference tends to diminish or disappear as bidders are allowed to revise their offers. This revenue equivalence between uniform and discriminative auction rules is not predicted. The fact that we announced the highest-accepted offer price in each of these sessions certainly could have contributed to this result in our experiments. Those subjects who submitted low offers observed the price that some others were receiving, inducing many of them to increase their offer price in subsequent offer rounds. The effect of these announcements is considered in the following section.

At this point in our research it became clear to us that the uniform price auction wouldn't be seriously considered by policymakers. Given the political advantages of the discriminative-price auction, and no substantial difference in performance between these two pricing mechanisms, the uniform price auction was ruled out in subsequent experiments.

Information About Cutoff Offers

In all of our discriminative price auction experiments, we consistently observed an increase in average accepted price across revision rounds. This result was robust even as we increased the scale of the experiment, from 8 to 20 to 42 participants.[11] In retrospect, the increase in average accepted price over revision rounds in our discriminative auctions made sense. Because provisionally accepted offers were announced by posting the highest accepted price, all participants had clear information about the price others would receive in the auction. The incentive for low-valued participants to increase their offer was apparent, and they responded to this incentive. After receiving a provisional acceptance, bidders frequently raised their offer price. Sometimes this increase was gradual; others increased their offer by a large amount. After being excluded in a subsequent revision round the subject then tended to decrease the offer again in order to get back into the market. Given that the maximum accepted offer typically fell across revision rounds, some subjects never again received a provisional acceptance.

[11] However, average prices remained near competitive levels despite attempts to collude. Attempts at collusion in these experiments were quite explicit, but unsuccessful. Some subjects stood up to address the group, encouraging all to submit high offers. People worked together in groups, and at times a single person would turn in offer submission cards for all of those in the group.

Because the announcement of the highest accepted offer had this effect, we conducted several (small-group) sessions in which we announced accepted offers identified by permit ID number, but did not announce the highest accepted offer price. Figure 3 shows the average price paid in one of these sessions. As anticipated, we observed an initial decline in the average accepted offer price, however this was followed by a very gradual increase after several rounds. Looking at the individual data, however, helps to explain this. Subjects were quite sophisticated in how they used information. Recall that each subject had three permits with heterogeneous values. Typically, a participant offered each permit at a different price. Therefore, if two offers were accepted, this gave an upper-bound on the amount by which the lower offer could be revised upwards with little risk of being left out of the market. If only one offer was accepted, the participant often experimented with the offer price on one or both permits to ascertain the highest accepted price. Still, given the initial decline in offer prices and the fact that some risk averse subjects did not revise provisionally accepted offers, we concluded that this may be a more effective way to release information about which offers were accepted.[12]

<Figure 3 about here>

V. FIELD EXPERIMENTS

Two experiments were conducted in southwest Georgia, using somewhat different subject pools. The first was conducted before EPD officials made a final decision about the institution to be used to implement the Irrigation Auction. They circulated descriptions of two auctions for public feedback: a one-shot discriminative sealed-offer auction and a discriminative auction with revisions. After holding meetings with EPD representatives, they requested that we conduct an experiment in the affected area, using farmers as participants, to demonstrate the two auction processes under consideration. In order to simplify procedures and expedite instructions, each of the 22 subjects (mostly farmers) were given two "vouchers." Each voucher had a redemption value printed on the face of it. If the voucher was retained the subject received this redemption value in cash.

[12] See Goeree, Holt, and Palfrey (2002) for references and evidence relating to risk aversion in private value auctions.

If it was sold, the participant earned his or her offer price. This is equivalent to a permit that covers a single acre.

These subjects first participated in a sealed bid (no revision) discriminative auction. After turning in an offer, and before any results were announced, they next participated in a discriminative auction with revisions. No information on the highest accepted offer was released: only those permits whose offers were provisionally accepted. A fixed budget constraint was not used in this session: the lowest 15 offers were accepted without consideration of the amount of money it took to purchase these vouchers.[13] The distribution of voucher values (which was approximately uniform in this auction, as shown on the left side of Figure 4) was also different from previous auctions.

<Figure 4 about here>

Results from these auctions are shown on the right side of Figure 4. The average accepted offer was higher in the first round of the auction with revisions than in the one-shot sealed offer auction ($21.05 compared with $19.80). Moreover, the opportunity cost of obtaining 15 vouchers was only 7.5 percent higher than the minimum opportunity cost in the one-shot auction compared with 12.5 percent higher in the first offer submission round of the auction with revisions. However, after round 1 the average accepted price was lower in each revision round than in the one-shot auction. With one exception (round 6) the opportunity cost of obtaining these vouchers was lower in the auction with revisions. The average accepted price dropped dramatically between the first and second offer rounds (from $21.05 to $19.25). The average accepted offer was at its minimum in Round 3 ($18.71), but only increased slightly after this, remaining fairly steady just under $19.00 through the remaining five rounds. This pattern is quite like that observed in our other auctions in which the maximum accepted offer was not announced (see Figure 3, above).

By late January the EPD had approved our recommended auction rules (described in Section VI below), and it appeared likely that a drought would, in fact, be declared. We therefore conducted a multi-site experiment that field-tested the auction preparations.

[13] Although the primary goal of this experiment was to educate farmers on the proposed rules, we also wanted to obtain data that compared the two institutions. The farmers were paid for participation.

This field experiment was conducted at two sites in southwest Georgia, all located within the Flint basin. Most of the participants were high school and college students. However, some farmers (who wanted to participate in a live demonstration of the auction procedures) also participated in the auction. A total of 50 subjects participated in the field test, with bid collection and processing done via a web-based program that enabled the EPD officials in Atlanta to follow the bidding. EPD representatives were sent to the two offer-collection sites, and the EPD director and several others from his office were present in Atlanta to watch this trial auction.

The parameters and procedures were identical to the Albany field experiment, except that a budget constraint was enforced and only a single (iterative) auction was conducted. All subjects were given two vouchers at the start of the auction. Each voucher represented a single acre, and the values were approximately uniformly distributed from \$15.00 to \$22.50. We utilized a target of 55 vouchers, and a budget of \$975 to purchase these vouchers. As in our laboratory experiments, the budget was common information among all participants, however the voucher target was not announced. At the competitive (uniform) equilibrium, 50 vouchers could be purchased at a price between \$18.50 (the value of the last four vouchers) and \$19. This is just short of the target number of vouchers (55). Of course, because we were using a discriminative auction it is possible that more offers could be accepted if the average accepted offer was less than \$19. After all offers were submitted at both sites, they were combined and ranked in order from lowest to highest offer price. Starting with the lowest prices, offers were provisionally accepted until either 55 vouchers were obtained or the cost of obtaining another voucher put the total cost above \$975. In the case of a tie at the cutoff value, offers at this level were randomly chosen for provisional acceptance. Provisional winners were posted using the permit ID number associated with accepted offers. No information about the cutoff value was announced.

On average, offers in this treatment started very low. In the first round, 55 offers were accepted at an average price of \$17.58. However, there appeared to be some confusion among the subjects: almost 20 percent of all offers were below value. Over time, however, the subjects appeared to learn about the incentives, quite possibly through conversations with other auction participants. In the final three rounds 50 offers were accepted – the competitive prediction – at an average price between $19.30 and $19.35 in each of these three rounds. The opportunity cost of these 50 vouchers was 7 percent above the minimum possible to obtain 50 vouchers. Individual behavior was very similar to that observed in our lab experiments. Across revision rounds, those subjects who submitted initial low offers increased them, while those who submitted high offers reduced them. By the final offer submission round, the distribution of offers was close to uniform.

VI. The Flint River Drought Protection Act Auction

After attending one 42-person laboratory experiment and studying results from our other sessions, the EPD implemented our recommended procedures: a discriminative price auction with revisions, with no maximum accepted price announcement, and a random tie-breaking rule.

The EPD's Flint River Drought Protection Act Auction was conducted on Saturday, March 17, 2001 at eight sites in the Flint River Basin.[14] Given the high stakes involved for individual farmers, a key focus of our (frequent) discussions with EPD officials was how to ensure that farmers understood the auction rules. As an upshot of these discussions, several decisions were made. First, we conducted the trial auction, described above, about six weeks before the Irrigation Auction. Farmers were encouraged to attend (or participate) in order to better understand the procedures. As a second step, about two weeks prior to the auction, all eligible participants were sent instructions that detailed the auction procedures and directed them to the eight sites.[15] These instructions included contact information for EPD representatives who were on-call to answer questions about the auction procedures.[16] Finally, in anticipation of

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[14] There was one site supervisor and two EPD representatives at each of the eight auction sites. In addition we hired a total of 58 people to work at the eight locations. These workers collected bids from farmers, entered bids on the computer, and worked with farmers as they verified that offers were entered correctly. We gratefully acknowledge the help of Maribeth Coller, who helped lead auction preparations, trained these workers, and supervised an auction site. We also thank the other site supervisors: Lisa Anderson, Paul Ferraro, Ann Gillette, Laura Taylor, and Mark Van Boening (two of the authors supervised the remaining two auction locations).

[15] These instructions are available at http://www.gsu.edu/~ecoskl/research.htm.

[16] While numerous calls for clarification were made, no record was kept as to the exact number of calls.

potential questions and delays in the auction-registration process, EPD officials asked us to accompany them to the auction sites a day early to conduct on-site auction registration. While some time was left on the morning of the auction to register, nearly all participants registered on the day before the auction. This proved an invaluable opportunity to answer questions and address farmers' concerns about the auction procedures.

A total of 576 permits (covering 98,170 acres) were certified as eligible for the auction. Of these, about two-thirds were registered to participate in the auction. A total of 194 farmers registered to make offers for 347 permits, totaling 61,806 acres. The acreage associated with these permits ranged from 4 to 1442 acres. Although we have some information about the crops (and associated prices) in this part of the state, we can not directly observe the values that the farmers associate with each irrigation permit. Instead, we can only observe the offers that they make on each permit.[17] In all rounds, the per-acre offer prices ranged from $0.01 to $8,000. Arguably, the offers at these extremes weren't serious offers. In fact, the person who made the 1-cent per acre offer (for a permit that covered 20 acres) stated that he was doing so as a protest.[18] About 85 percent of the acreage in the auction was offered at prices from $100 through $500.

<Figure 5 about here>

Figure 5 shows a close-up view of these offers; the three panes divide offers into low (less than $130), medium ($130 - $210), and high ($220 - $500) offers.[19] Across revision rounds offers typically declined (though there were some small increases at the low-end of the offer arrays, especially in the third and fourth rounds). Although the maximum accepted offer was not announced (only the permit ID numbers of those offers that were provisionally accepted), some farmers communicated both within and between

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[17] Observed offer-prices are limited in their use as a proxy for a farmer's true reservation value. Retaining a permit in order to plant and irrigate has an associated risk, given that yields and crop prices are not assured, while selling the permit results in a certain payoff. We do not have measures of risk preference for farmers, nor was the uncertainty associated with retaining a permit implemented in our lab experiments.

[18] This person never cashed the resulting 20-cent check that he received. Instead, he had it framed and has been pictured with it in several news stories, while criticizing the auction.

[19] This comprises over 90 percent of all offers. Very high offers (those greater than $500) changed very little across revision rounds.

the eight auction locations. They asked others whether their offers had been accepted, and at what price. Therefore, we can conclude that they had at least some information (though not perfect) about the range of accepted offers.

During the auction, the EPD director made all decisions regarding the conduct of the auction. In particular, he chose the rule used to determine which offers were accepted, and how many offer submission rounds to hold. Unlike the laboratory experiments that we conducted (and over our strenuous objections), he did not use a fixed budget, acreage target, average price, or maximum accepted price during the auction. This is shown in Table 2, which lists the maximum and average accepted price, the cumulative number of acres, and the cumulative cost of all provisionally accepted offers during each round of the EPD auction. There was little change in the maximum accepted offer price in the first four offer rounds. However, the EPD director increased the average accepted offer price from $105 in the first round to $113 in Round 4, increasing the total number of acres that were provisionally accepted.

<Table 2 about here>

We were concerned that the round-by-round increase in the average accepted offer price would reduce competitive pressures in the market. In fact, the number of acres covered under provisionally accepted offers *decreased* between rounds 3 and 4, while the average price was essentially held constant (at $112.36 in round 3, and $113 in round 4). Anticipating the end of the auction, we encouraged the EPD Director to remain firm in the maximum accepted offer price in round 4, hoping this would encourage farmers to reduce their offers in the subsequent offer submission round.[20] In fact, this happened. The fifth line of Table 2 shows the result that would have been obtained had the maximum average price of $113 been enforced in round 5. Over 3,500 more acres would have been taken out of irrigation than in round 4, and the maximum accepted price would have been unchanged at $125 per acre. In reality, the EPD director chose to accept all offers through $200 an acre in the fifth (final) offer submission round (see the last line

[20] A total of 55 permits were offered at $125, the maximum accepted price in round 4, and only 42 of these offers were provisionally accepted. This was the first time during the auction that the "tie-breaking rule" was implemented.

of Table 2). In the end, a total of 33,006 acres were taken out of irrigation at a total cost of almost $4.5 million (an average price of. $135.70 per acre).

Because a consistent rule was not used during the auction it is difficult to directly compare the outcome of the auction across revision rounds (or compare it to the results from our experiments). However, by fixing a rule and observing what the outcome *would have been* in each round using the fixed rule, we can approximate this analysis. Table 3 shows this for several different rules that might be used in an auction of this type.

<Table 3 about here>

The top section of the table compares results that would have been attained if an acreage target had been used. For example, in the first line the target number of acres is 8,000 (just over the actual number obtained in the first round of the auction). If this had been the EPD director's goal, he could have obtained 8,000 acres at an average price of $107.67 per acre in round 1, and $99.18 per acre in round 5. The number in bold (in this case, $98.90 in round 3) shows the best outcome that would have been attained in any offer submission round. The next two lines show the same comparison for higher acreage targets. The middle section of the table assumes an average price constraint was used, while the last section of the table assumes a fixed budget constraint was in effect. For all three sets of comparisons, constraints were chosen that were consistent with the actual targets used in the first, middle, and last rounds of the auction.

With one exception (8,000 target acreage) the best outcome that would have been attained using any of the three rules would have been achieved in Round 5. This demonstrates the benefit of allowing farmers to revise their offers. Even though the distribution of offers did not change substantially (Figure 5), those changes that did occur generally allowed the EPD to obtain a greater number of acres at a lower price. Holding the average accepted price essentially constant between Rounds 3 and 4 was helpful in lowering Round 5 offer prices. By most measures, the Round 4 outcome was worse than that observed in Round 3. However, as we note above, offer prices decreased in Round 5, which led to the improved final-round outcome (relative to any previous offer submission round).

VII. Conclusion

Auctions are commonly used for perishable commodities like fish and flowers. They are also used in public settings where fair access is important. Auctions can be desirable relative to administrative proceedings, since the bids convey important private information about value. As a result, in recent years there has been an increasing interest in policy applications of different auction systems. Developing an efficient, incentive-compatible auction institution is not a "one size fits all" proposition. The optimal auction procedure (from the standpoint of those implementing the auction) depends on the number of bidders, whether participants may trade one or more units of a good, whether complementarities exist between units of a good, and whether the good in question is characterized by private and/or common value components.

Given these complications, policy makers have turned to experimental economics methods for guidance in the design of auction mechanisms. Auction participants have also hired experimental economists to advise them on bidding strategies to use during an auction. The use of economics experiments is particularly helpful when the theoretical outcome of a particular mechanism is difficult to determine, or when out-of-equilibrium behavior by some participants may alter the incentives of other participants.

The use of an auction for irrigation reduction in Georgia was attractive for these reasons, and in particular because of the narrow time window between the state-mandated drought declaration date (March 1) and the March 25 deadline to finalize the auction outcome. The auction also let farmers' bids reveal (at least indirectly) their willingness to forego irrigation on designated tracts of land for the current growing season. This avoided the anguish, inefficiency, and administrative problems of involuntary usage shutdowns using non-economic (geographic and precedence) criteria.

This experience in Georgia offers a glimpse of how economists and policy-makers can interact and impact one another's work. The Flint River Drought Protection Act, passed by the Georgia legislature in Spring 2000, mandated that the state's Environmental Protection Division develop an auction mechanism that could be used to determine payments to farmers who suspended irrigation. There is no evidence that the legislators envisioned the complexities of implementing such an "auction-like process," nor the vast array of auction mechanisms that could be used. Certainly our economics experiments were instrumental as policy-makers settled on an auction design. At the same time, however, our experiments were guided by institutional details (e.g., a single buyer and multiple sellers) and political considerations, such as those that ruled out a uniform-priced auction. Auction participants (farmers) also had influence on the final choice of auction mechanism via their participation in field experiments. Their behavior and feedback we received after their participation were used as we fine-tuned the auction procedures.

There are many ways to set up the “auction-like process” called for in the legislation, and we used laboratory experiments to sharpen our thinking on a number of issues: the pricing rule (uniform or discriminatory), the closing rule (with or without bid revision rounds), and how provisional results would be reported after each bid revision round. The laboratory experiments enabled us to make recommendations about rules (on tie breaking and information provision) that augmented competition, even in laboratory situations where socializing and collusion were facilitated. The auctions being envisioned were relatively complex environments for the bidders (student subjects and farmers), and we devoted considerable effort to coming up with procedures and instructions that were relatively easy to understand.

The implementation environment and participants were distinct from those used by the Federal government to allocate other scarce resources, such as spectrum and bandwidth. The Georgia legislation was intended to implement an irrigation auction only on those occasions when severe drought conditions exist; therefore one does not expect to hold such an auction frequently. Participants were relatively unsophisticated from the standpoint of participating in a complex auction, and yet the stakes were very high for these individuals: for many, an accepted offer would determine annual earnings.

These experiments are instructive for others who might want to use an auction in a similar situation. Farmers were not likely to devote scarce resources to hire consultants, nor were they likely to trust those working with the EPD. Therefore complicated optimal bid strategies were of limited usefulness as a predictor of auction outcomes. Instead, working with student subjects and farmers, we observed behavioral regularities as we tested alternative bidding rules. Moreover, our efforts to develop easily understood instructions for student subjects laid the framework for the instructions sent to farmers just prior to the auction.

Because the farmers eligible for the auction lived in such a large area of the state, it was not feasible to hold information sessions that were accessible to all farmers. We also anticipated that we would have little time to answer questions about the auction procedures during the registration process. Therefore, we worked hard to develop instructions for the farmers that would be clear about both the auction procedures and how payment would be determined for farmers who had accepted offers in the auction. These instructions included step-by-step instructions and examples of how payments would be determined. We also included a section of "frequently asked questions" that were motivated by questions that came up during our laboratory experiments. Our lab experiments also helped us to design instructions for the farmers that clearly outlined the procedures, without the perception that we were advising farmers about the "correct" or optimal bidding strategy.

The EPD auction held on March 17, 2001 resembled the laboratory and field experiments in some (but not all) respects, and it was considered a success. While we did not take into account the possibility that the EPD would fail to enforce a single fixed constraint, this auction mechanism induced farmers to decrease offers over time. By most measures the best outcome was attained in the final round.

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Table 1. Experiment Sessions

Session	Pricing Rule	Tie-Rule	How Accepted Offers Are Announced	Number of Subjects
Lab Sessions				
1	uniform	inclusive	highest accepted price	9
2	uniform	random	highest accepted price	9
3	discriminative	random	highest accepted price	9
4	discriminative	random	highest accepted price	9
5	discriminative	random	highest accepted price	20
6	discriminative	random	highest accepted price	42
7	discriminative	random	permit ID	8
Field Sessions				
8	discriminative	random	permit ID	22
9	discriminative	random	permit ID	50

Table 2. Results from the March 17, 2001 Irrigation Auction

Offer Round	Maximum Price	Cumulative Acres	Cumulative Cost	Average Price
1	$130	7,311	$766,771	$104.88
2	$127	12,755	$1,401,843	$109.91
3	$127	17,061	$1,917,036	$112.36
4	$125	15,854	$1,791,449	$113.00
5	$125	19,406	$2,192,789	$113.00
	$200	33,006	$4,478,842	$135.70

Table 3. Results from the March 17, 2001 Irrigation Auction
Results Under Alternative Cutoff Rules
Key: Bold figure is the best outcome from any offer round

Acreage Target	Average Cost of Acquiring Target Number of Acres				
	Round 1	Round 2	Round 3	Round 4	Round 5
8,000	107.67	101.90	**98.90**	102.08	99.18
16,000	132.53	115.14	111.61	113.14	**110.59**
32,000	177.78	152.43	140.35	137.57	**113.94**

Average Price Constraint	Number of Acres That Would Be Obtained				
	Round 1	Round 2	Round 3	Round 4	Round 5
$105	7,311	9,604	10,677	9,436	**11,386**
$113	8,977	14,886	17,061	15,740	**19,406**
$136	17,110	25,130	29,912	31,081	**33,006**

Fixed Budget	Average Cost of Acquiring Acres Obtained Within Fixed Budget				
	Round 1	Round 2	Round 3	Round 4	Round 5
$1 million	111.31	104.64	102.81	104.91	**102.42**
$2 million	130.01	116.79	112.36	114.01	**111.89**
$5 million	170.26	152.43	145.22	143.58	**141.74**

Figure 1. The Effect of Tie-Breaking Rules in a Uniform-Price Auction
Average Price Paid in Two Auctions

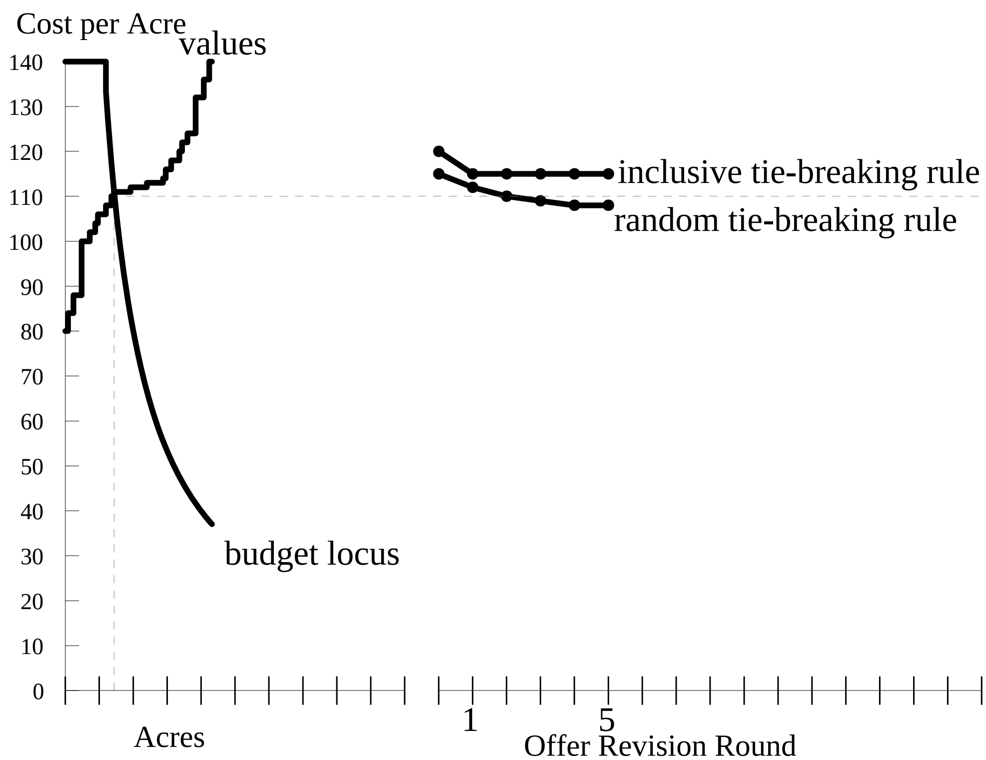
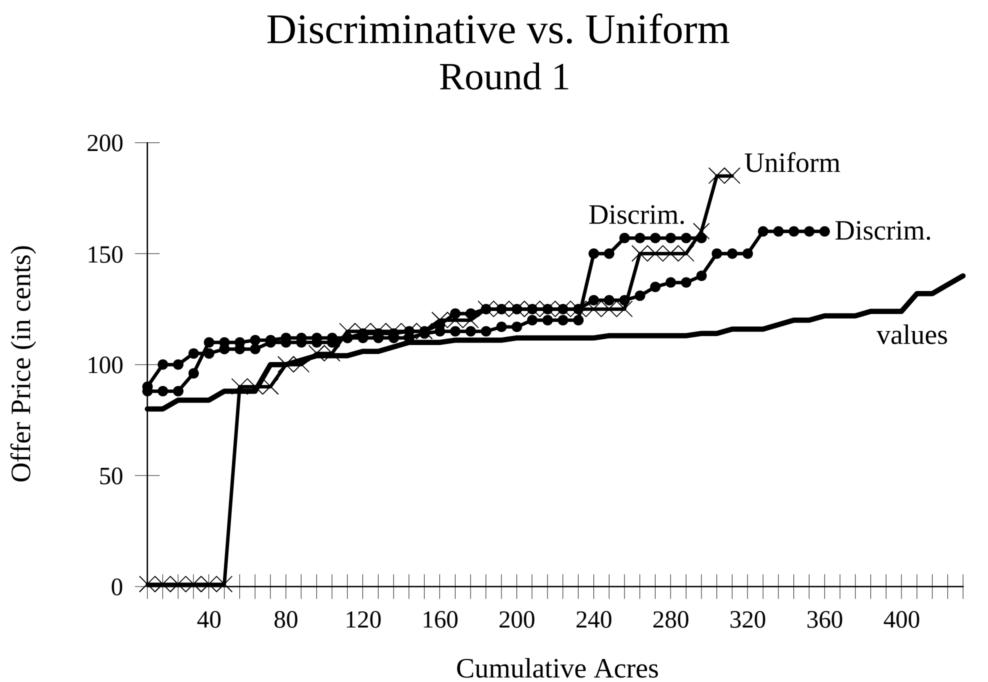


Figure 2. Distribution of Offers: Uniform and Discriminative Auctions
key: uniform (crosses); discriminative (dots)



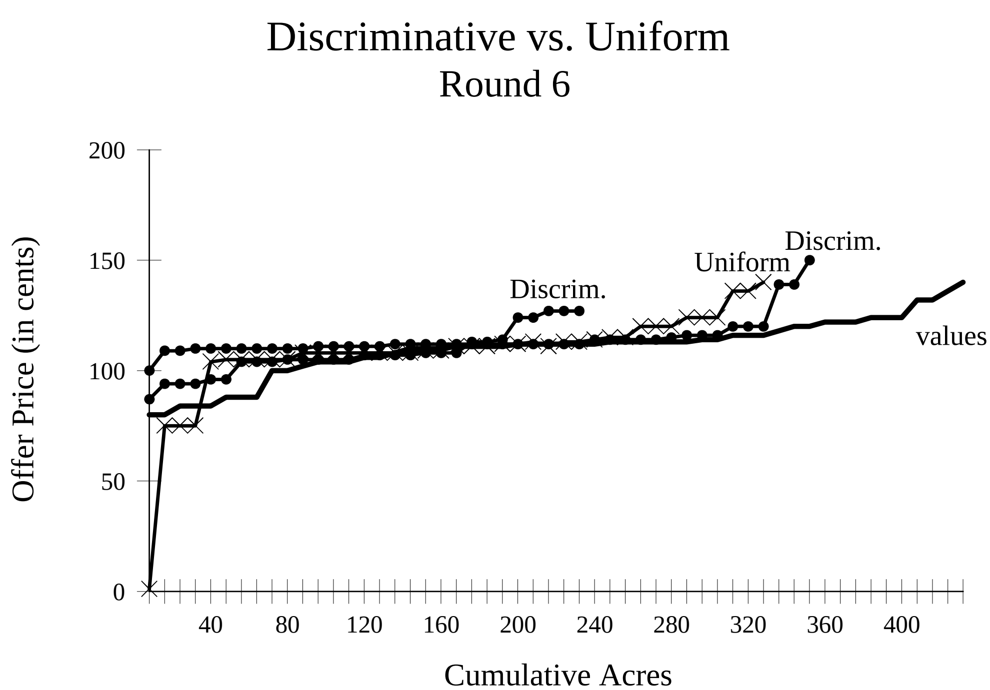


Figure 3. Average Price Paid in a Discriminative Auction: Highest Accepted Price is Not Announced

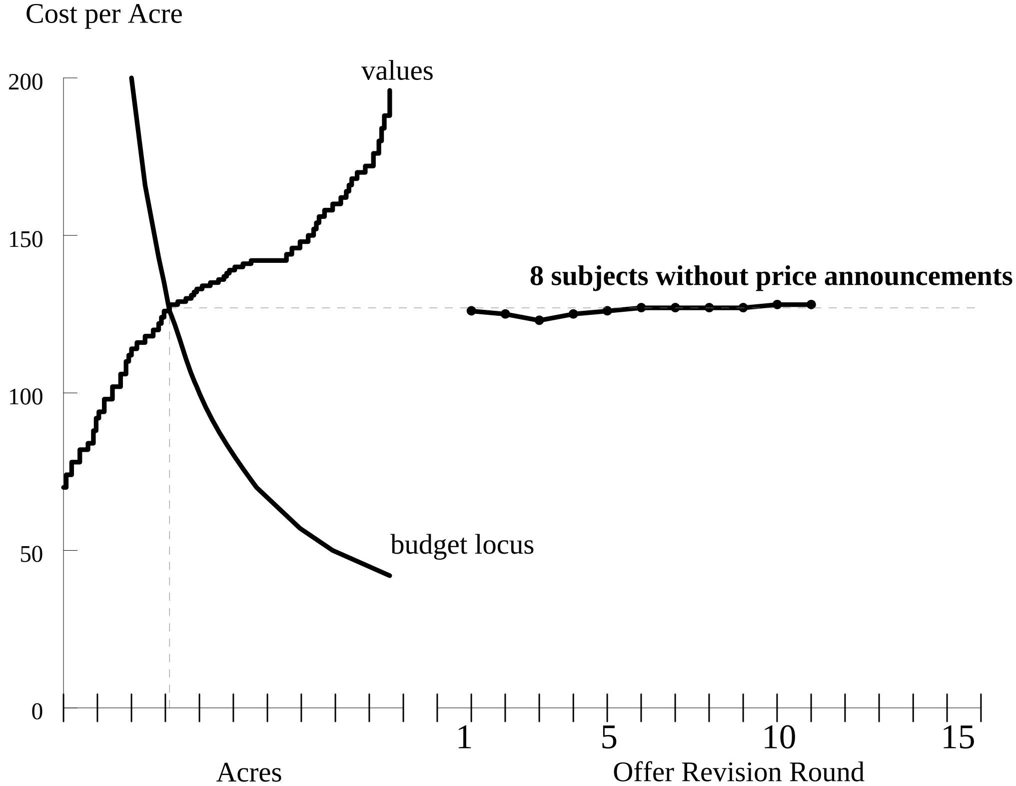


Figure 4. Comparing a One-Shot Discriminative Auction with a Discriminative Auction with Revisions

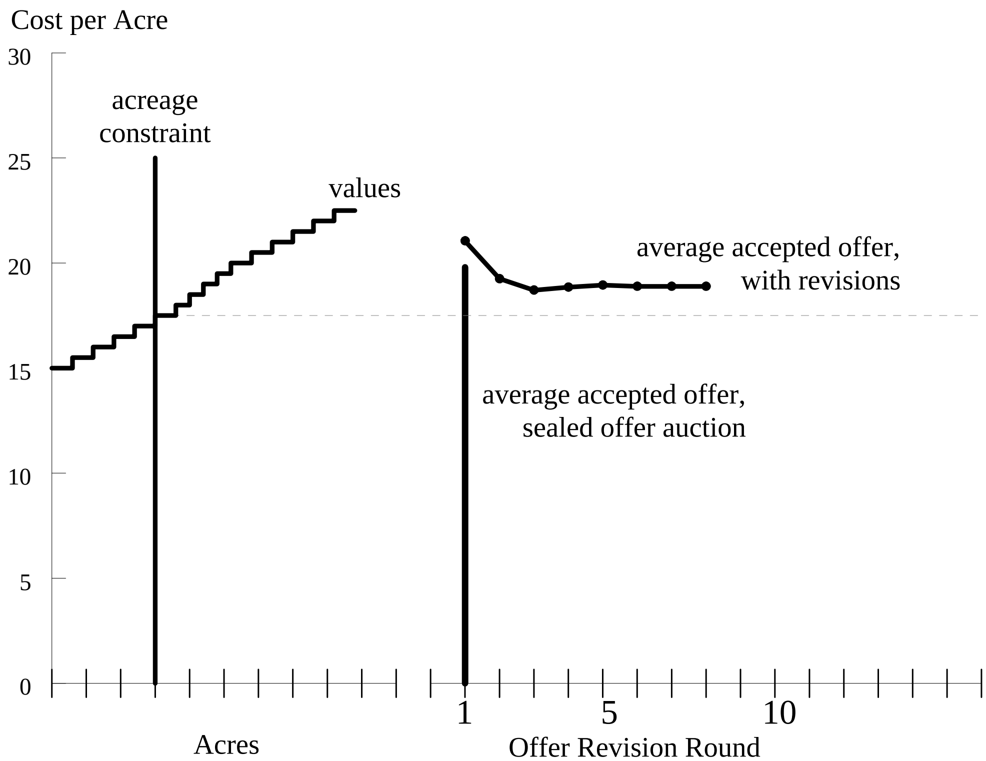
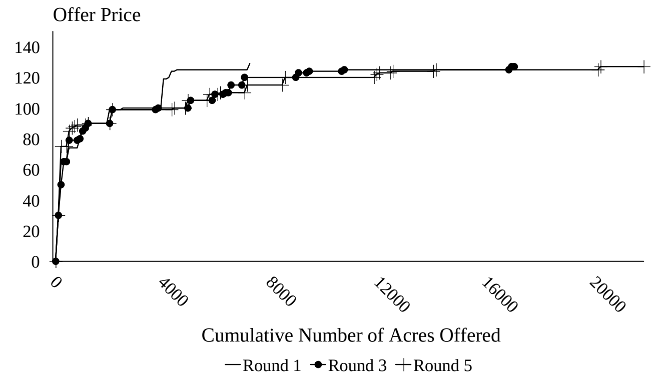
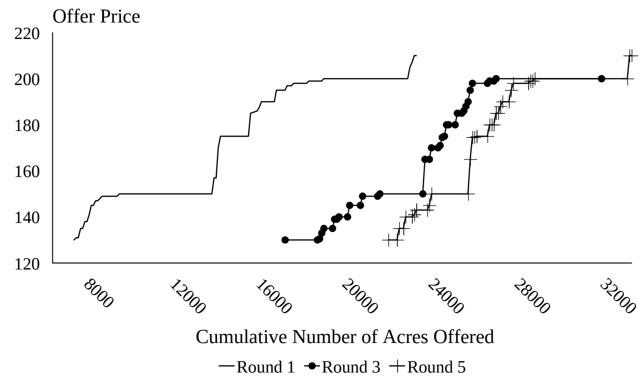


Figure 5. Offer Arrays from the EPD Irrigation Auction
Low, Medium, and High Offers

Offers Less Than $130



Offers from $130 - $210



Offers from $220 - $500