Background on laboratory experiments

Over the past 35 years there has been an increase in the use of laboratory experiments to study behavior in markets. Many of these experiments use the method of induced values, described in Smith (1982), in which participants are given "redemption" values for fictitious items that they "own" at the end of the study session. Oftentimes the experiments involve markets in which these items can be purchased, sold, and traded. In these experiments participants are paid based upon how much they actually earn in the session. The payment is used to align the incentives of the participant in the experiment with those the participant would face if posed with the task in everyday life.

The main reason laboratory experiments are used in economics is because researchers lack quality data on important economic variables. For instance, most models of behavior in auctions rely on knowing an individual's personal value for the auctioned item. While it is possible to infer the individual's value from the bidding process, the researcher (1) still does not have the actual value for the individual and (2) these inferences are based on individuals with a certain value behaving according to a specific model of bidding behavior. In examining land aggregation tasks there is a similar issue in that the landowner's private value of the property is not known to the researcher. While market value of the property provides some indication of its value, individuals may have higher values for the property due to their own personal reasons (they like the schools, it is close to work, they like their neighbors, etc.) Thus, the reason a landowner rejects an offer is unclear – it may be that the offer exceeds the landowner's personal value for the property and the landowner is trying to extract a larger payout from the developer, or it may be that the developer has not made an offer that captures everything the landowner values.

Due to experimenter budget constraints and the need for an acceptable number of observations from which statistical inferences can be made, the payments made to participants are typically in the $15-$50 range for sessions that last between 30 minutes and 2 hours. Due to the small stakes, university students are often used as participants in these studies. The belief is that because they are likely not earning much while enrolled in school the difference between earning say $10 and $22 will lead them to respond more to the incentives provided in the experimental setting than someone making $100,000 a year will. In addition, because most of the students attend classes on campus, it is easier for both the experimenter and the potential participants to coordinate on a meeting time and location.

The use of students has raised some concerns because the tasks they are undertaking in the experiments may not be tasks that they would undertake in everyday life, leading to questions of external validity. Typically this is more of an issue in experiments which focus on measuring some innate characteristic, such as individual risk aversion, than in experiments which focus on behavior in markets. Nonetheless, there may be instances in which the differences in experimental treatments are so subtle that students not familiar with the particular market may not key in on the differences.

Prior land aggregation experiments

There has been a recent interest in using laboratory experiments in land aggregation settings. Cadigan et al. (2009), Swope et al. (2009) and Swope et al. (2011) are all primarily concerned with comparing behavior in the experiments with predictions from their theoretical models. They vary who makes the initial offer (buyer or seller), as well as whether offers to sellers are simultaneous or sequential. In all experiments the fallback position of the sellers is zero, meaning that if they do not accept an offer they

will receive a payment of zero. Also, all parties know that the seller has a zero fallback position, making the seller's private value for the parcel public information. This zero fallback position, and its public nature, likely contribute to the high percentage of successful aggregations (over 90%) that they see in their data.

Collins and Isaac (2012) is another recent paper that examines the holdout problem in a laboratory experiment. They assume that the buyer is capital constrained and cannot use the full value of the aggregated land to make purchases of the N parcels needed for aggregation. This assumption means that if the aggregated value of the land is 5000, the buyer can only use a certain amount, say 3000, to purchase the first N-1 parcels, and can only use the remaining value to purchase the last parcel. The experimental design was structured in this manner because earlier work found few holdouts. Due to this experimental design, they find more holdouts than prior work.

In our prior work, Zillante, Schwarz, and Read (2014), we were able to increase the number of failed aggregations simply by giving the landowner participants a non-zero fallback position. In addition we tested how different payment mechanisms affected aggregation outcomes. The two payment mechanisms were a contingent offer payment and a combination payment that consisted of a contingent offer and a guaranteed offer. The contingent payment was only payable upon successful aggregation of the land, while the guaranteed payment was paid regardless of whether or not aggregation was successful. Developers earned a higher payoff when using the combination payment mechanism, though the contingent payment only mechanism led to faster (as measured in number of negotiating rounds) aggregations.

Current land aggregation experiment

In the current land aggregation experiment we examine how knowledge of a linchpin parcel affects aggregation and payments to the landowners. Two settings are used, one in which it is known that a linchpin parcel exists but the landowners do not know if they own the linchpin and the other in which the landowner knows whether or not he or she owns the linchpin.

In each group there are 4 landowners and 1 developer. The parcels of land are labeled A, B, C, and D, with parcel C being the linchpin. The parcels are set so that three of them represent road frontage (B, C, and D) while the remaining parcel (A) is behind parcel C. Developers need to acquire two connected parcels, so only purchased combinations of BC, CD, or AC will be profitable. In the experiment, the two road frontage combinations (BC and CD) are more valuable than the combination with only one piece of road frontage (AC).

Each landowner is endowed with a parcel of land worth a certain amount to the landowner. The landowner values are distributed randomly between 400 and 1500 according to the uniform distribution. Developers know the distribution of landowner values but not each landowner's individual private value for the land. Should the landowner retain the parcel of land at the end of the experiment then they receive a payment equal to their private value. Figure 1 shows the layout of the parcels as well as the developer values for the aggregated parcels and the individual landowner values.

Developers acquire parcels of land by making simultaneous and private offers to the landowners. The offer is contingent upon the developer needing the parcel of land – in essence the developer and

landowner make a contract giving the developer the option to purchase the parcel at the agreed upon price at the end of the experiment. The experiment is designed to last for ten negotiating rounds.

After receiving an offer for the land, the landowner can either accept or reject the offer. If the landowner accepts the offer no more offers will be forthcoming from the developer. If the landowner rejects the offer then a counteroffer can be submitted. In order for this counteroffer to be accepted the developer needs to submit this as an offer in the next period and the landowner needs to then accept it.

Upon the completion of ten rounds the developer is awarded the combination of parcels that leads to the largest profit, which is simply the difference between the value of the combined parcels and the agreed upon contract prices for the individual parcels.

Results

There are three measures on which comparisons are made. The first measure is the first period offer made to each parcel owner. This measure can be used to gauge how developer participants perceived the importance of each parcel prior to any input from the landowners. The other two measures are based on outcomes. One measure is the accepted offers by each landowner type in the two treatments and the other is the aggregation that occurred, if any.

1st period offers

Figure 2 shows a comparison of first period offers for different experimental treatments and participant groups. The initial offers in the unknown setting tend to be less than those in the known setting, and this is particularly true of the practitioner participants in the unknown setting.

Perhaps the most surprising result occurs when the linchpin landowner knows that he or she is the linchpin. The average first period offers to the linchpin parcel in this setting are less than, or about equal to, offers to landowners B and D, who know they are not linchpin owners. This result is consistent across participant types. When the owner of the linchpin is unaware that he or she owns the linchpin, the offer to the linchpin parcel is greater than the offers to other parcels. Again, this result is consistent across participant types.

Accepted offers

Figure 3 shows the average accepted offers for each landowner type by treatment. Note that these are accepted offers and not necessarily ones that would be used in aggregation. On average there is not much difference across treatments. The biggest differences are in the amount that landowner B was able to extract in the Practitioner-Known treatment and the low amount that landowner A was able to extract in the Practitioner-Unknown treatment. Other than those results, the average accepted offers were fairly stable for other landowners. For instance, the average accepted offer for landowner D ranged between 1134 (students with an unknown linchpin) and 1218 (practitioners with an unknown linchpin).

Aggregation

Given the values in the experiment, parcel combinations AC and CD were more likely to be aggregated than BD. Figure 4 shows aggregation outcomes for student and practitioner groups for the unknown and known linchpin settings. All but two groups were able to successfully aggregate land, which differs from our prior research in which only 2/3 of the groups successfully aggregated land. The difference in the results is likely due to the excess slack in the system in the current design, as a single landowner in the prior research could impede aggregation. The most commonly aggregated set of parcels is CD, with AC the most next common set of parcels.

Discussion

One goal of this study is to examine differences in behavior between student and practitioner participants. The biggest difference in behavior between the two groups appears in the initial offers by the practitioners in the unknown linchpin setting, as practitioners made much lower initial offers to all landowners. However, when examining final outcomes, the average accepted offers by student and practitioner participants were fairly similar despite the difference in starting offers.

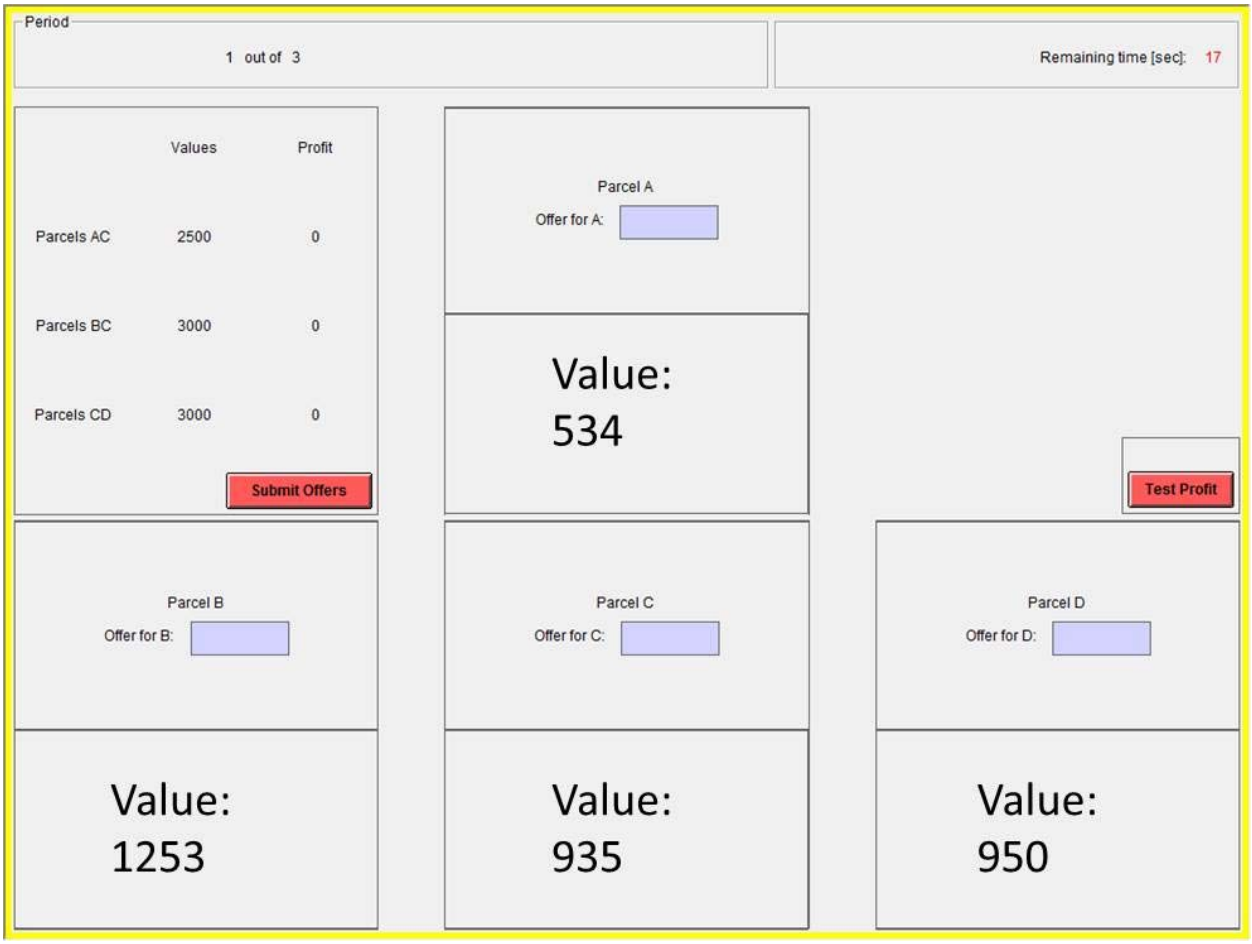

Figure 1 Developer screen with the landowner values included.

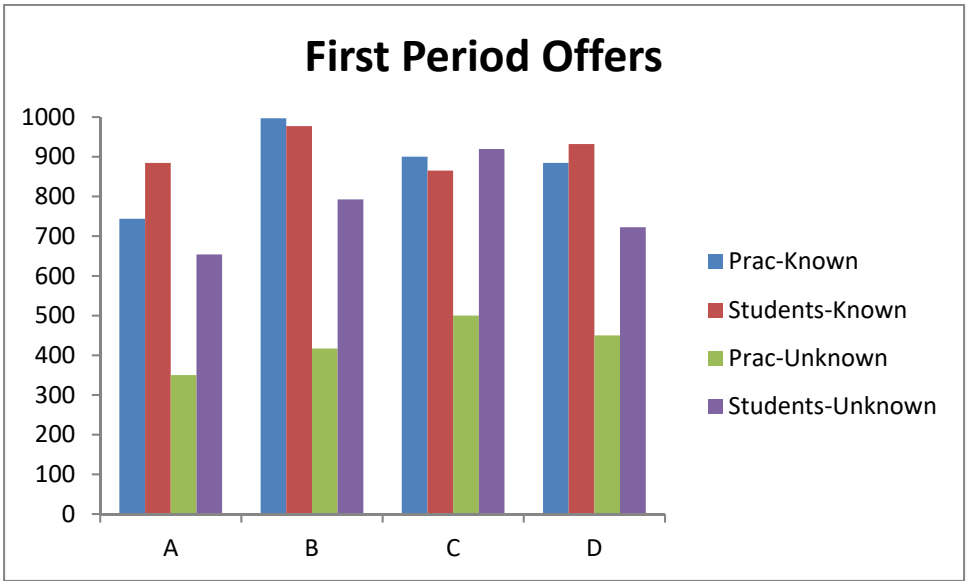

Figure 2 Average first period offers to each landowner type by participant group and treatment.

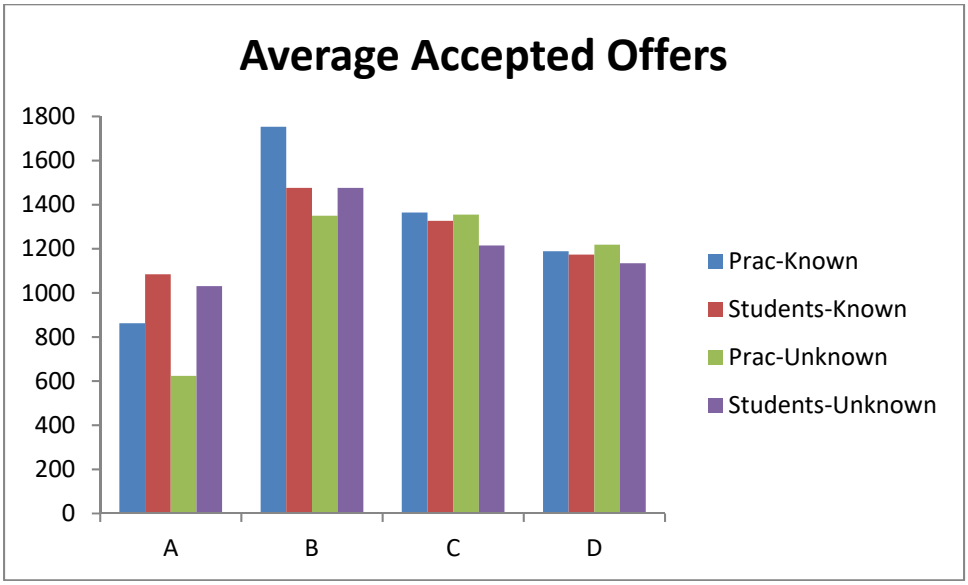

Figure 3 Average accepted offer by each landowner type. Only accepted offers are included in the average, and some accepted offers may not have been used in aggregation.

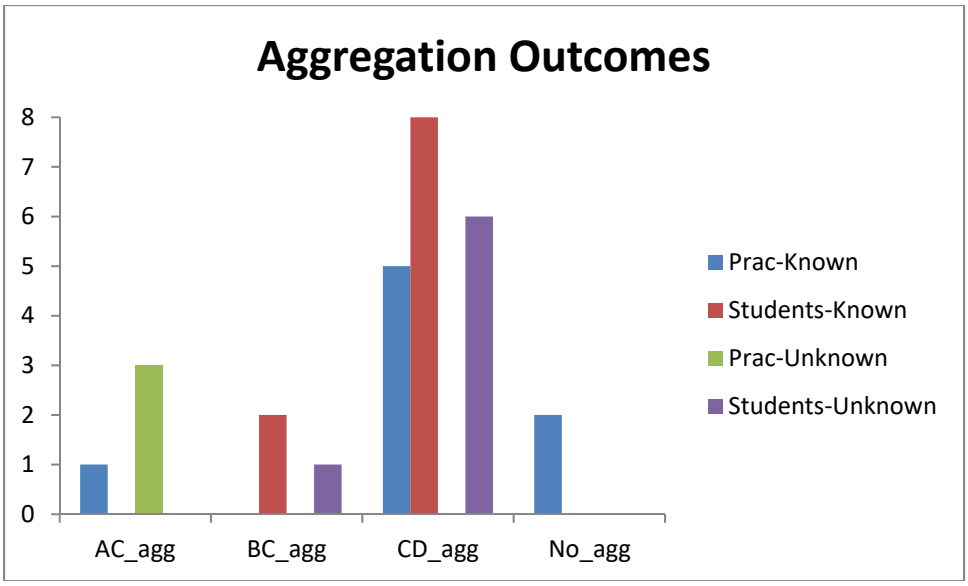

Figure 4 Number of aggregations that occurred by participant type and treatment.