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**Reverse Auctions for
Purchases of Ecosystem
Services: The Effect of
Information on Auction
Structure Performance**

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ABSTRACT

Social Preferences and Communication as Stigma Mitigation Devices – Evidence from Recycled Drinking Water Experiments

Keywords: reverse auctions, auction efficiency, laboratory experiments, land conservation, ecosystem service markets

Differences between private and public decision-making are quantified using willingness-to-accept (WTA) data collected in artefactual field experiments.

Participants first made decisions in a second-price auction (private rounds) followed by majority-rule voting (public rounds) on the median price collected in the private rounds. Results suggest that other-regarding behavior in the public rounds regarding stigma and disgust can significantly reduce WTA. Chat-box communication can further reduce WTA, and social preferences, education, and unrelated communication are the primary drivers that lead participants to accept significantly lower prices for potentially disgusting tasks. The results have application for sustainable, cost-effective recycled water projects.

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Reverse Auctions for Purchases of Ecosystem Services: The Effect of Information on Auction Structure Performance

Introduction

Public agencies increasingly use reverse auctions for purchasing ecosystem services. Payments for ecosystem services such as farmland preservation, conservation practice benefits, biodiversity retention, as well as wildlife habitat are set through reverse auctions (Duke et al. 2013). Governmental entities in hopes of stretching limited budgets perceive auctions as a means of revealing the opportunity costs of potential participants. An important goal of using reverse auctions is to achieve fiscal efficiency, i.e., maximizing purchases of ecosystem services relative to the government budget.

Prior research has suggested that auctions are more efficient than alternative methods for purchasing ecosystem services. For instance, Stoneham et al. (2003) concluded that the biodiversity benefits gained from the first period of bush tender auctions in Victoria, Australia would have cost the government seven times more if a fixed payment had been used. Another example is the reverse auction used in Scotland by the Challenge Fund; a study of this conservation program found that the total cost would have been 33% to 36% greater under fixed payments (CJC Consulting 2004). Latacz-Lohmann and Van der Hamsvoort (1997) show that total emission reductions gained by various auction formats were 16% to 29% greater than those procured under flat-rate offer systems. Horowitz et al. (2009) also found that a reverse auction enrolled more acres than a fixed-price procurement scheme.

Public agency staff, politicians, and advocates apparently assume that discriminatory reverse (also referred to pay-what-you-offer) auctions for ecosystem services are fiscally efficient. For example, at the end of 2015, the U.S. Department of Agriculture's Conservation

Reserve Program (CRP) had enrolled 24.3 million acres and was paying \$1.6 billion in rent annually (U.S. Department of Agriculture 2015). In addition, reverse auctions have been used outside the United States, including Australia's Auction for Landscape Recovery (Gole et al. 2005) and Bush Tender pilot trials (Stoneham et al. 2003). As a result, recent economic literature has studied auction efficiency extensively and considerable attention has been given to discriminatory auctions between conservation agencies and landowners (Hanley et al., 2012; Fooks et al., 2016).

A widely documented problem in reverse auctions is bid shading (rent premium), which refers to the difference between a landowner's ownership-return (opportunity cost) function and the bid function (Schilizzi and Latacz-Lohmann 2013). For example, Kirwan et al. (2005) estimated rents in the CRP are between 10% and 40% of program expenditures. The efficiency of different types of reverse auctions remains an open question, depending on the institution's structure, the budget, and the information environment (Connor et al. 2008; Hellerstein and Higgins, 2010). It has been a robust area of economic research in recent years, and experimental economics has been a leading approach because it allows for systematic testing of different auction mechanisms while also being able to observe the underlying landownership through the use of induced values.

Although there are many types of reverse auctions, discriminatory and uniform-price auctions are used most frequently for purchasing ecosystem services. In a discriminatory price auction, the buyer pays winning sellers the amount of their offer. In uniform-price auctions, a type of Vickrey (1961) auction, the buyer pays each winning seller the same amount—either the highest accepted offer or the lowest rejected offer. Our study extends the existing literature by assessing the relative performance of these two auction formats while controlling for private

valuations and examining potential interactions for three levels of information. The policy implications of this study arise from the ability to test various combinations of auction rules and information availability to identify the most efficient mechanisms.

The remainder of this paper proceeds as follows. In the next section, we review the previous theoretical, empirical, and experimental findings. We then present the experimental design and the model, followed by the results of our experiments and close with conclusions drawn from those results.

Literature Review

Auction Rules, Information, Learning, and Relative Efficiency

Recently, laboratory experiments have been used to investigate reverse auction performance. Experiments allow us to examine relative auction performance because we can control the induced value (opportunity cost) for each participant and subsequently observe which participants decided to participate in the auction and what they selected as their offer (Cason et al. 2003; Banerjee et al. 2011; Haruvy and Katok 2013; Messer et al. 2014; Banerjee et al. 2015).

The related literature focuses on investigating the efficiency of reverse auctions in budget-constrained settings with information-revealing and learning through rounds (Hong and Shum 2002; Parkhurst and Shogren 2003; Rolfe et al. 2011; Arnold et al., 2013; Schilizzi and Latacz-Lohmann 2012, 2013; Fooks et al. 2015). The effects of these factors have been examined in both discriminatory and uniform-price auctions.

Discriminatory auctions are increasingly popular among conservation organizations because they ostensibly sort sellers by willingness-to-accept (WTA) and pay landowners who make the least expensive offers until the budget is exhausted. Theoretically, such auctions will be

efficient if the parcels enrolled are of homogeneous quality or if the auction is able to correctly adjust offers for parcel quality (Glebe, 2013). However, landowners assess their WTA against their probability of winning to determine whether to participate and how much to offer. In a discriminatory auction, landowners may also inflate their offers in response to uncertainty when they are risk-averse or strategically if the probability of winning is large. In other words, they may not have a strong incentive to offer true WTA if a higher offer is still likely to be accepted.

A uniform-price auction pays the same price to all of the landowners whose parcels are chosen regardless of what they offered until the budget is expended. In this case, theoretically landowners have no incentive to offer an amount that is different from their true WTA.

Cason and Gangadharan (2004) compared discriminatory and uniform-price auctions in the context of a regulator assigning management contracts to abate pollution and found that discriminatory auctions generally outperformed uniform-price auctions. However, there are many auction characteristics that potentially interact and can affect the relative performance of different auction mechanisms. In energy markets, for example, auctions often involve multiple periods per day, are information-rich, and are comprised of a relatively limited number of sellers who have some market power that comes from the ability to withhold offers for some units from the market or to reduce supply capacity by taking plants offline for “repairs;” as a result, the efficiency of an auction is often affected by complex interactions (Rassenti et al. 2003; Vossler et al. 2009; Shawhan et al. 2011).

In the context of purchase of ecosystem services, how information revealing affects auction efficiency has not been determined. Some studies have suggested that provision of information can increase auction efficiency (Duffy and Feltovich 2002; Devetag 2003; Ferraro

2008; Krishna 2010), while others have concluded that concealing information increases efficiency (Vukina et al. 2008; Rolfe et al. 2009).

Discriminatory auctions appear to be particularly vulnerable to information rents, because it is optimal for a seller to inflate the offer above the real opportunity cost (Latacz-Lohmann and Schilizzi 2005). Bidders may also inflate their offers in uniform-price auctions. Cason and Gangadharan (2004) found that offers in a uniform-price auction were within 2% of the landowners' costs while most of the offers in a discriminatory auction were at least 8% higher than the landowners' costs. However, the authors determined that the discriminatory auction was more cost-effective overall in enrolling more parcels because it did not pay a single market-clearing price.

Another factor that influences auction efficiency is learning, which usually interacts with information provision. Several studies noted that landowners' bids tended to be the amount of the conservation agencies' maximum bid cap after the first few rounds of the auction (Shoemaker 1989; Khanna and Ando 2009). Therefore, incorporating learning in an experiment captures the ability of reverse auction participants to process information on past auction outcomes and the potential for extra rent in the future. Cason et al. (2003) concluded that sellers' rents increase as they gain experience and that sellers extract greater rents when they know the benefits of their offers from the buyer's perspective. Schilizzi and Latacz-Lohmann (2007) found that auctions generally were more efficient than fixed-price procurement but the advantage dissipated over time as participants gained experience. This result corresponds with conclusions drawn from an agent-based model by Hailu and Schilizzi (2004) that found sellers' experience with auctions led to decreased auction efficiency.

Some studies, nonetheless, have suggested that experience with an auction mechanism

improves efficiency by decreasing uncertainty. For example, Latacz-Lohmann and Van der Hamsvoort (1997) theorized that a high level of uncertainty could lead to an inefficient outcome and strategic behavior by bidders. Cummings et al. (2004) also found that strategic rent-seeking behavior can develop when uncertainty is high. Klemperer (2002) reported that allowing sellers to learn about others' valuations through multiple rounds could make the sellers more comfortable with their own assessments and less cautious in making offers.

Building on the existing literature, in this study we test the following hypotheses. 1) A uniform-price auction will result in higher rent premium than a discriminatory auction. 2) Both a treatment with little public auction information and a setting of a robust set of public information will reduce the auction efficiency relative to partial-information. 3) The treatment effects of information provision will interact with the auction format. 4) Rent premium will increase with learning through auction rounds. 5) Larger budgets will generate greater rent premiums.

Policy Setting

The information treatments adopted in this study are based on policy settings in reality. Although one might expect reverse auctions for ecosystem services to provide as much information about the auction to the public because they are publicly funded, in reality there is considerable variability in information provision. For instance, yearly auctions under the U.S. Environmental Protection Agency's (EPA's) Acid Rain Program list every bid submitted and clearing prices from all preceding auctions (U.S. Environmental Protection Agency 2013). But auctions associated with private land often involve formal rules that restrict the provision of information.

Our approach is influenced by annual auctions over several decades in the mid-Atlantic region of the United States conducted by Delaware Agricultural Lands Preservation Foundation

(DALPF), which buys conservation easements on agricultural land through a discriminatory reverse auction (Messer and Allen, 2010). DALPF provides relatively detailed information:

1. current year budget,
2. amount of program budgets in preceding years,
3. number of offers received in preceding years,
4. number of offers accepted in preceding years,
5. highest accepted offer in preceding years,
6. lowest accepted offer in preceding years, and
7. average accepted offer in preceding years.

Note that this example of “full information” is not complete. Unlike EPA’s Acid Rain Program, DALPF does not provide information on every offer.

The Maryland Agricultural Land Preservation Foundation (MALPF), on the other hand, provides very little detailed public information. Participants in MALPF must place offers for the upcoming annual cycle before the previous year’s results are announced (Horowitz et al. 2009). The bush tender project in Australia provides a different no-information setting that it does not reveal information to landowner-sellers about the environmental benefits (Stoneham et al. 2003).

Methods

Using laboratory experiments, this paper examines how changes in the level of information provision affect the ability of sellers to capture rent premiums in a reverse auction, discriminatory or uniform-priced, over rounds.

Experimental Parameters and Structure

The experimental sessions in this study were conducted in an experimental economics laboratory at a large university in the Northeast of the United States. As shown in Table 1, email recruitment efforts yield 180 participants from undergraduate courses in business and economics. Each experiment lasted approximately 90 minutes and the average earning was \$25. There are 45 periods from each of 18 sessions—9 for each auction format. Thus, each auction format generated 405 observations.

The 180 participants were randomly divided into 18 groups. The framing assigned each participant the role of a landholder who owned one 100-acre parcel, which they could decide to sell to an environmental agency or not. Participants sat at individual laptop computers with privacy screens such that their decisions would remain private. They completed a consent form and then read written instructions provided by the administrator (see the appendix for the instructions used). Following those steps, the administrator described the experiment verbally with the aid of a PowerPoint presentation to ensure consistency. No communication among participants was permitted.

Each period represented a single-period game—the beginning and end of the world. Incentives were described as net present values, meaning that owners' returns and offers reflected the future stream of benefits accruing from retaining or selling the parcel. Consequently, there was no incentive for participants to wait for later periods to sell; the budget was reset and induced values were new in each period.

Like information, experience with an auction's format can interact with auction efficiency (Fooks et al. 2012), complicating our single-shot approach. But there are some advantages to it (Rolfe et al. 2009). Within the context of this particular experiment, the assumption meant that there was no option value of information since each period constituted an

independent observation on choice. However, that does not mean that knowledge of the market was independent in each period. On the contrary, participants learned about the market with each successive period, and the models control for period number.

We develop a model that incorporates true homogeneity of quality from the buyers' perspective with laboratory controls but induce heterogeneity in WTA so we can examine various selection processes. Heterogeneous induced values allow the model to control for what would otherwise be unobservable opportunity costs in a real-world setting. The induced values were conceptualized as an "ownership return." We chose "experimental dollars" (hereafter denominated simply as dollars) to match the incentives actual landowners would have in regional land markets. An exchange rate between experimental dollars and real dollars was provided to participants and the calculations of the cash payment were done by the computer software throughout the experiment. The return to owners was randomly selected from a uniform distribution that ranged from \$2,000 to \$8,000 per acre to approximate agricultural land values in markets in the mid-Atlantic United States. That region includes some of the country's most active land conservation programs, and there is substantial development pressure.

Participants had to choose whether to submit an offer in an auction for their parcel. When no offer was submitted for a parcel, the participant received the ownership return for that parcel. The amount of all offers remained confidential. When an offer was submitted, the participant incurred a nominal nonrefundable transaction cost ("submission fee") of \$20,000 per parcel. The submission fee was designed to capture costs incurred in an actual conservation auction, including the cost of learning about the auction. The fee also deterred participants from automatically submitting an offer, even a very high one, when "no offer" was the weakly dominant strategy. When an offer was accepted, the participant received a payment from the

conservation program administrator. When an offer was rejected, the participant still received the ownership return minus the submission fee. The amount of payment received for accepted offers varied with the auction mechanism as previously described.

The experiment administrator (acting as the conservation program administrator) received offers via the administrative computer and ranked them from lowest to highest by the amount offered. In the discriminatory auction, the administrator sequentially selected the least expensive offers until the budget did not have enough funds left to buy the next parcel. In the uniform-price auction, the administrator examined the lowest ranked offers and selected the largest number of offers possible when all accepted offers would be paid the price of the highest offer in the set.

For each period, prior to deciding whether to submit an offer, participants were advised of the amount of the “ownership return,” an induced value that represented the participants’ opportunity costs and reflected the presumed private knowledge of landholders in an actual auction. All participants were provided with the distribution from which the private valuations (theirs and others) were drawn to represent landowners’ knowledge of regional land market patterns.

All participants also knew the distribution from which the program budget was drawn. In each period, a randomly selected program budget was assigned. Budgets varied independently in each period and funds not spent by the buyer in a period were not carried over into subsequent periods. The conservation budget was drawn from a triangular distribution: a minimum of \$2 million, a maximum of \$6 million, and an average of \$4 million. A random process using a uniform distribution determined the budget prior to each period. We randomized the budgets for each period so the experiments would be consistent with the highly variable budgets typical of

many conservation programs, including MALF (Horowitz et al. 2009), DALPF and USDA's Forest Legacy Program (Messer and Allen 2010). Some conservation programs' budgets are more consistent, but since the research setting treated each period as the beginning and end of the world, a stochastic budget seemed more appropriate. This allowed us to fully control for experience effects related to the budgets and facilitated data analysis.

Although we seek to replicate some real-world auctions in our laboratory experiment, we cannot control for possible program-specific issues. For instance, information may interact with a particular program or with locational characteristics in an unobserved or unobservable manner. In such a case, the most efficient auction structure would have to be determined on a case-by-case basis. Instead, we provide three levels of information and test the performance of generic uniform-price and discriminatory auctions through rounds.

As shown in Table 2, participants in all treatments received private information about their past choices, and the screens displayed historic information about the opportunity costs. The experiment controlled the type and amount of public information available to participants about the future and past auction markets. Full information was represented by provision of a robust set of public information about the buyer budget and previous market behavior of sellers that closely mimicked the seven types of information provided by DALPF. Partial information consisted of a set of public information that included the program's budgets for the current and preceding year (period). A no-information treatment provided only the program budgets for the preceding year (period). Each combination of information and auction mechanism treatment was assigned to three of the 18 sessions. Thus, since each group participated in a single information treatment, there was no need for treatment ordering and statistical comparisons were made between subjects.

Model

We employed panel data regression models with robust standard errors to analyze the experimental data. For all treatments, the unit of analysis was a round (i.e. 1 session as the beginning and end of the world) —one auction’s collective decisions by participants. The dependent variable was aggregate participant rent premium for the group in each of the 45 periods. The rent premium was defined as the auction return received by a successful seller in a period minus that particular parcel’s induced value. This econometric structure allowed for direct policy insights because smaller rents would indicate greater fiscal efficiency.

The independent variables captured the information treatment and auction design characteristics. *Partial Info* and *No Info* reflected the partial-information and no-information treatments while the full-information treatment was the reserve. *Budget* controlled for the impact of variations in the conservation budgets. *Period* controlled for the period number and thus for experience with the auction. While the ownership returns and budgets were re-set in each period, experience allowed participants to make fewer mistakes, try different offer strategies, and ultimately better understand how competition operates in subsequent periods. As a result, we expect participants to have a better understanding of how much they can inflate their offers in later periods regardless of the information they receive. Several interaction variables tested for joint effects with *Period*. The information-treatment interaction terms tested whether learning is magnified or attenuated in the partial-information and no-information settings. The budget-period interaction terms controlled for any synergistic impacts when the value for *Period* and *Budget* are correlated.

Theoretically, sellers in a uniform-price auction have no incentive to inflate their offers because they will receive the amount of the largest accepted offer. Thus, the incentive is to offer

one's opportunity costs to increase the probability one is below the cut-off of the least expensive offers rather than to inflate one's offer to extract the most money from the program in a pay what you bid auction. In this case, we expect that participants would learn through successive periods that offering an amount equal to their opportunity cost plus the submission cost was the optimal strategy. In addition, we expect that they would not abandon that strategy when the budget is larger. Providing less information would constrain landowners' ability to identify their optimal rent seeking strategy and thus the partial-information treatment would have a negative coefficient. Similarly, we expect that no information would impede participants' realization of the optimal strategy, generating a negative coefficient.

Results

Table 3 presents the descriptive statistics. In all information treatments, the average group rent premium is higher in the uniform-price auction compared to the discriminatory auction, and the difference becomes more significant when partial information is provided. It indicates that the discriminatory auction is more efficient than the uniform-price auction in general. Moreover, the efficiency gap is larger when the administrator provides partial information to the bidders, compared to providing no information or full information.

Table 4 presents the results from the panel-data analysis for 405 observations for each auction format (45 periods in each of the 9 sessions). *Period* had a positive impact on rents in both auction mechanisms as sellers gained experience with the auction environment and the behavior of others in their groups. Additionally, larger budgets consistently led to greater rents. On average, one extra dollar of budget delivered \$0.38 in additional rent in the discriminatory auction and \$0.46 in additional rent in the uniform-price auction. Thus, both auctions result in

high efficiency losses that, without some mitigating factor, it raises doubts about the ability of conservation auctions to efficiently purchase ecosystem services. In addition, the magnitudes are similar to estimates by Kirwan et al. (2005) that between 10% and 40% of the CRP's budgets went to rents. We also find that the impact of budget size on rents was attenuated slightly in both auctions as participants gained more experience; that is, the *Budget*Period* interaction term was negative. Over time, then, greater competition drove down rents (although the effect is relatively small).

The information treatments have very different effects within the discriminatory and uniform-price auctions. In the discriminatory auction, the full-information and no-information treatments inflated rents by similar amounts. The partial-information treatment led to the smallest amount of rent, suggesting that partial information may produce the most efficient discriminatory auction for ecosystem services. The magnitude of the group's rent decrease associated with partial information is \$277,051 and the average conservation budget was \$4,000,000, so the partial information effects represented approximately 6.9% of the budget. Thus, compared to partial information, the full and no information treatments would transfer a significant amount of public money to landowners (versus the ideal of using the entire conservation budget to purchase ecological services). In the uniform-price auctions, on the other hand, none of the information treatments significantly affected the groups' rents.

In the discriminatory auction, interactions between *Period* and the information treatments led to slightly different rents in each treatment. In the partial-information treatment, participants' rents increased in successive periods. However, the effect was relatively small (having a coefficient of 4644) so the benefit to the sellers of having full information was not fully offset even at the conclusion of the 45-period experiment. In the no-information treatment and in all of

the uniform-price auction experiments, there was no statistical decline (or increase) in rents over time.

In sum, learning through experience has similar effects on both auction mechanisms. However, market information matters a great deal when assessing the performance of discriminatory auctions while the uniform-price auction seemed to be almost completely immune to it despite being tested under identical, experimentally controlled settings.

Conclusion

Experimental economics techniques have been applied to a variety of land economics questions. The techniques can be useful to conservation researchers because they allow for control of values for both buyers and sellers in the market. They permit researchers to test theories about land markets, analyze particular policies and mechanism structures, identify landowners' willingness to participate in various programs, and examine specific behaviors of interest and can inform effective methods of educating the public and policymakers. Of particular interest has been the efficiency of various auction mechanisms used for obtaining ecosystem services generated by land uses and how various forms of information alter outcomes for sellers and buyers.

This study conducts laboratory experiments to examine the efficiency of two types of reverse auctions under different structures of information. Our results suggest that, for a discriminatory reverse auction, a partial-information setting may lead to greater efficiency than either the no-information or the full-information setting tested in this research. In other words, simply announcing the anticipated program budget before offers are submitted can lead to more parcels being enrolled, which, from the perspective of the conservation program, represents more offers that less inflated and more closely aligned with the landowners' opportunity costs.

While the experiments did not test all of the possible variations of the information set to identify the optimal amount of public information, they do highlight how too much public information allows participants to “game” the auction by raising their offers above their true reservation values. Furthermore, too little public information can lead participants to inflate their offers because market competition is not fully realized and the price is not forced to be close to the true opportunity cost. It suggests that a regulator could employ a strategically appropriate amount of public market information in a discriminatory auction to mitigate inefficiency.

In addition, our results suggest that auction efficiency may decrease (i) as the size of the procurement budget increases and (ii) over time as sellers learn through experience to elevate their offers strategically to secure greater rent premiums. If one assumes that there is no systematic joint impact of experience and endogenous opportunity costs—a question for future experiments—then the evidence supports the theory that these factors lead to conservation programs paying more than they would have to otherwise, which reduces the provision of ecosystem services given the limits of program resources. Our results contribute to ongoing research in the area of ecosystem markets and illustrate how experiments can be applied to address important issues related to land economics.

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Table 1. Experimental Design

Number of participants:	180	(90 in each of the two auction mechanisms) (60 in each of the three information treatments) (30 in each of the six auction and information combinations)
Periods per session	45	
Participants per group:	10	
Length of session:	Approximately 90 minutes	
Average earnings:	\$25 US	
Initial endowment:	3 parcels, 100 acres, homogeneous conservation benefits	
Length of contract:	1 period	
Ownership returns:	\$2,000-\$8,000 (uniform distribution)	
Submission fee:	\$20,000 per parcel	
Buyer's budget:	\$2-6 million (triangular distribution)	

Table 2. Definition of Full-information, Partial-information, and No-information Treatments

Information	Full	Partial	No
<u>Participants' private information</u>			
Own WTA ("ownership return" for each parcel)	●	●	●
Previous history of sale for each own parcels	●	●	●
<u>Public market information</u>			
Distribution of landowners ownership returns	●	●	●
Distribution of program budgets	●	●	●
Budgets from previous periods	●	●	●
Budgets for current period	●	●	
Number of offers received from previous periods	●		
Number of offers accepted from previous periods	●		
Highest accepted offer from previous periods	●		
Lowest accepted offer from previous periods	●		
Average accepted offer from previous periods	●		
Which owners sold parcels from previous periods ¹	●		

¹ Owners were identified only by participants ID number, not by name.

Table 3. Descriptive statistics of group rent premiums (\$) by treatment

Public Information		Uniform-Price Auction	Discriminatory Auction	Difference	p-value
All Treatments (n=405)	Mean	1,115,940	962,377	153,563	0.000
	Std. Deviation	399,624	378,642		
	Max	2,251,106	2,072,406		
	Min	199,707	178,123		
Full (n=135)	Mean	1,098,314	1,002,821	95,493	0.055
	Std. Deviation	402,536	412,332		
	Max	2,125,265	1,954,270		
	Min	252,573	178,123		
Partial (n=135)	Mean	1,126,273	833,267	293,006	0.000
	Std. Deviation	423,833	353,499		
	Max	2,106,691	1,739,183		
	Min	350,778	188,653		
No (n=135)	Mean	1,123,234	1,051,043	72,191	0.095
	Std. Deviation	373,281	333,029		
	Max	2,251,106	2,072,406		
	Min	199,707	264,749		

Notes: Two-tailed t-tests

Table 4. Panel Data Analysis of Group Rents by Auction Type

Variable	Uniform-Price Auction	Discriminatory Auction
<i>Constant</i>	-523,487.3*** (149,949.7)	-395,557.7*** (153,654.6)
<i>No Info</i>	39,556.2 (64,044.5)	2,880.5 (51,191.7)
<i>Partial Info</i>	63,837.0 (67,936.2)	-277,050.9*** (64,430.4)
<i>Budget</i>	0.4590*** (0.0357)	0.3772*** (0.0406)
<i>Period</i>	13,115.6*** (4,958.5)	11,125.6*** (3,303.3)
<i>No Info * Period</i>	-867.9 (2,650.1)	1941.1 (2,029.9)
<i>Partial Info * Period</i>	-1,754.6 (2,942.0)	4,643.5*** (1,566.7)
<i>Budget * Period</i>	-0.0052*** (0.0011)	-0.0037*** (0.0010)
Observations	405	405
Wald chi ²	389.07	47183.98
Prob > chi ²	0.000	0.000

Note: *** indicates statistical significance at the 1% level; ** indicates statistical significance at the 5% level; and * indicates statistical significance at the 10% level.

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