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Joint Bidding in Conservation Auctions: An Experimental Study of Policy Design and Performance

In designing conservation policies both ecologists and economists have argued that greater spatial coordination of producer land use adoption can improve environmental outcomes for a range of important environmental targets such as wetlands restoration, nutrient pollution reduction, and species conservation. Economists have suggested two types of incentive policies for achieving such spatial coordination: the Agglomeration Bonus (AB) (Parkhurst and Shogren, 2007) and spatially-connected auctions (Banerjee et al., 2015). However, a majority of the analyses to date have focused on incentives aimed at individual land manager participation in such schemes (e.g., Fooks et al., 2016). In contrast, a number of countries such as the UK and the Netherlands have recently introduced policies that encourage joint participation by groups of producers. Thus, in this research, we study whether joint participation can in fact lead to improved environmental and economic outcomes in conservation policies.

For this purpose, we design and analyze behavior in a conservation auction using a laboratory economic experiment. In these experiments, auction participants make a repeated set of bidding decisions based on which they get paid. In keeping with reality where joint bidding auctions are uncommon, we consider an experimental treatment condition in which participants submit both individual and joint bids while participating in the conservation auction and a baseline control condition in which only individual bid submissions are possible. Since bidding in these conservation auctions can be a cognitively complex activity (Banerjee and Conte 2018), we also consider a second treatment dimension where in some sessions bidders can revise and resubmit their bids and others in which they cannot. Additionally, given the need for greater coordination and the fact that in reality producers routinely exchange information about various aspects of their operation with their peers, during the experiment participants are permitted to communicate with their neighbors. The focus on neighbors is key as it imparts a spatial dimension to the economic decision environment of the experiment. Specifically, individuals in the experiment are arranged on a circular landscape with every participant having two neighbors with whom they communicate about all aspects of the bidding exercise prior to submitting bids.

In keeping with the conservation policy literature where spatial coordination is incentivized and rewarded with bonus payments if neighboring producers are able to coordinate their land-use decisions, this study considers such bonus payments as well. However, since preparation and submission of joint bids is a time-consuming activity involving deliberation with neighbors much more so than for individual bids, the bonuses rewarded for the successful joint bids are greater than those for individual bids. Specifically, we consider two conditions where the joint bid bonus is 2.5 and 1.5 times the bonus for individual neighboring bids and a third condition where the joint bonus is still at 1.5 the individual bonus value and there is no bonus for selected neighboring individual bids. Given this setup, Table 1 represents the different experimental treatments considered for this study and the data collected.

During the experiments, participants in groups of 8 people submitted bids for their items, in 9 auctions. Each auction varied in terms of the cost of land use practice and environmental benefits generated for the items. At all times during the bidding

Table 1: Experimental Treatments and Groups of Data Collected

Auction-Structure Treatment	Bidding Protocol/Bonus Treatment			
	Individual Bidding Only	Individual & Joint Bidding with γ=2.5 Joint Bonus	Individual & Joint Bidding with γ=1.5 Joint Bonus	Individual & Joint Bidding with γ=1.5 Joint Bonus and 0 Individual Bonus
No Revision Opportunities	SINGLE-INDIVIDUAL (6 groups)	SINGLE-Joint-2.5 (6 groups)	SINGLE-Joint-1.5 (6 groups)	SINGLE-Joint-1.5-Ind0 (6 groups)
Revision & Resubmission Permitted	MULTI-INDIVIDUAL (6 groups)	MULTI-Joint-2.5 (6 groups)	MULTI-Joint-1.5 (6 groups)	MULTI-Joint-1.5-Ind0 (6 groups)

exercise, participants had access to this cost and quality information about their own item, but not for others.[1] By referring to land-use practices as items and thus introducing no environmental context into our experiments, we ensure that all behavioral findings obtained from the experimental analysis are owing to pure economic incentives. [2] During an auction, neighboring bidders communicated with each other and submitted bids which were then evaluated by the computer to obtain the winners. This winner information was provided to participants after which the next auction began. Such information feedback in real-time is valuable in generating learning opportunities for experimental participants which are again a reflection of what happens in practice with producers learning and adjusting their bid submissions over the repeated implementation of conservation policies such as the Conservation Reserve Program.

Results

The goal of this research is to evaluate the impact of joint bidding on auction outcomes in terms of environmental benefits produced and economic cost-effectiveness achieved. For this purpose, we look at the (i) cost-effectiveness of the auction defined by a composite metric termed POCER developed by Cason et al. (2003) (ii) the total level of agglomeration measured as the number of shared borders between selected items and (iii) total benefits generated in the auction from selected items (noting that if items are selected from neighbors, spatial benefits are generated),. Figures 1, 2, and 3 present some key results in terms of the average values for these performance metrics for each treatment for auctions organized by if bid revision is allowed and when it is not.

[1]Bidders could always get to know about others' cost and quality values via communication.
[2]Context loaded economic experiments are common and could be a subject matter for future research.

Figure 1 : Average Cost-Effectiveness

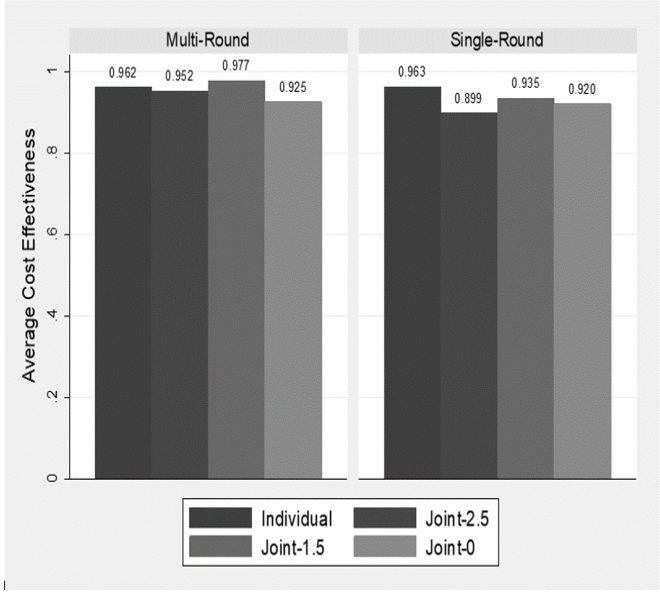


Figure 2: Average Agglomeration

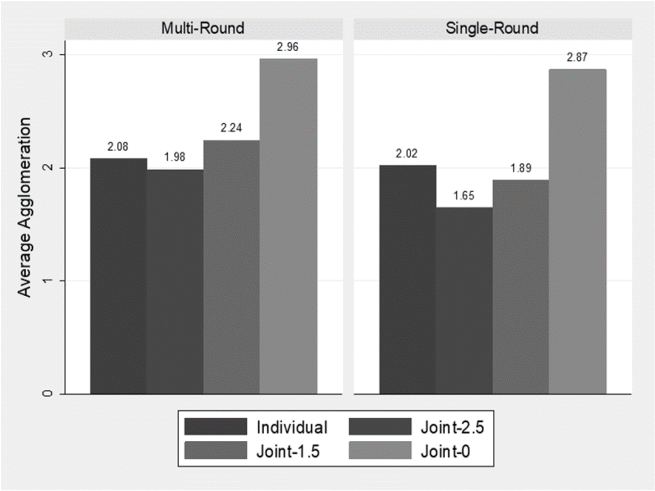
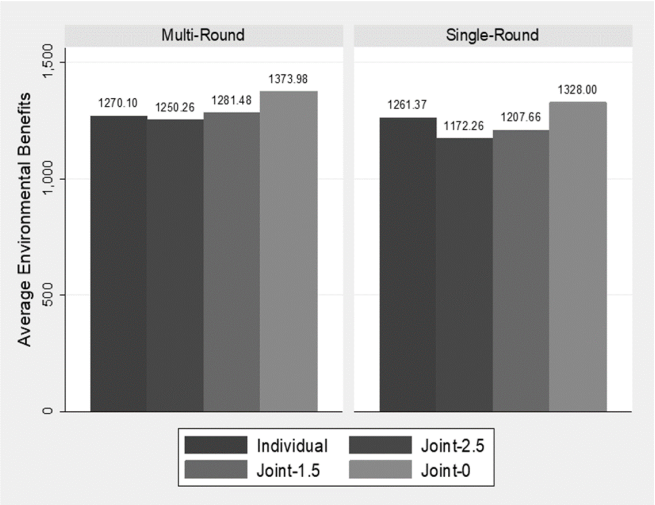


Figure 3: Average Environmental Benefit



The figures indicate that across most treatments, the auction generates a high level of cost-effectiveness (Figure 1) regardless of treatment indicating that conservation auctions can be an economically efficient way to generate environmental benefits. We see higher levels of agglomeration (Figure 2) when only joint bidding is rewarded with a bonus payment as opposed to other treatments where bonuses are available for individual adjacent bids as well. Such high levels of agglomeration also generate higher benefits under this condition (Figure 3).

Statistical testing with non-parametric Wilcoxon tests suggests that relative to individual bidding auctions, joint bidding auctions that pay bonuses for both individual and joint bids either leave environmental benefits and agglomeration rates unchanged or lower them. Realized performance depends upon the size of the bonus for joint bids and bid revision opportunities. In the auction treatments where revision and resubmission are not possible, environmental benefits and cost-effectiveness are significantly lower for the generous (γ=2.5) joint-bidding bonus condition than for individual-only bidding. However, this is the case where both individual and joint bids can generate bonus payments for adjacent winning bidders. When only bonuses for joint bids are possible, benefits generated are significantly higher – since joint bids are more difficult to prepare, bidders are willing to take on this extra effort only if it is rewarded with a bonus while individual bidding is not.

However, transaction costs are rarely (if ever) low and conservation budgets are usually tight. In this case, an auction that does not allow for bid revision with a less generous bonus payment for joint bids may be more suitable.

Finally, if the agency were to eliminate the bonus for adjacent individual bids, the results suggest that economic and environmental performance moves in opposite directions. Cost-effectiveness is significantly lower with joint bidding, but environmental performance improves. Herein is again a situation where broader policy goals beyond those directly associated with auction implementation may guide auction design choices.

Conclusion

This study is one of the few studies to focus on studying the impact of joint bidding on conservation auction performance. Our results indicate that the nature of incentives associated with rewarding spatial coordination in the first place will influence the environmental effectiveness and economic efficiency of conservation auction-based policies with joint bidding. A few caveats are in order. This study is a context-neutral laboratory experiment with university students and provides evidence regarding the internal theoretical validity of the mechanism being studied. However, the findings will require further testing both in controlled and context-rich settings with producer participants before any policy recommendations with the fullest degree of confidence can be made. But in the meantime, the results of the study provide some valuable insights which can guide further experimentation and policy recommendations.

This study is forthcoming in the *Journal of the Association of Environmental and Resource Economists*.

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