Extended Abstract
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Paper Title	Assessing the performance of agglomeration bonus in budget-constrained conservation auctions

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Abstract	***200 words max***
Based on theoretical analyses, the Agglomeration Bonus (AB) has been advocated as a pecuniary incentive mechanism to effectively boost spatially coordinated conservation efforts. However, empirical evidence has remained scant, and the results are inconclusive. Specifically, our understanding of the performance of AB in conservation auction-based programmes across different contextual conditions is still limited. To fill in the gap, this paper employs a controlled lab experiment to investigate the performance of AB in budget-constrained discriminatory-price auctions across different landscape configurations. We set up a stylized agricultural landscape, where the conservation agency aimed to connect fragmented wildlife habitats. Spatial correlations between opportunity costs and environmental benefits are uncorrelated, negatively correlated, or positively correlated. We found that auction performance was sensitive to landscape configuration. The benefits of AB in improving landscape-scale environmental outcomes became apparent in the positive landscape type. However, the AB resulted in worse outcomes in the uncorrelated or negative landscape types. Insights from the budget effect of bonus payment versus conservation procurement payment could partly explain the variation in bonus performance. The results suggest that in the presence of a budget constraint, policy makers should consider adopting AB with great caution.	

Keywords	Conservation auctions; spatial correlation; spatial coordination; agglomeration bonus; wildlife corridors
JEL Code	Q57 see: www.aeaweb.org/jel/guide/jel.php?class=Q)

Introduction	***100 – 250 words***
Effective delivery of many ecosystem services on private farmland, such as water quality improvements and migratory bird conservation is only achievable at the landscape-scale level. This highlights the need for designing agri-environmental schemes targeted at conservation land uses beyond the farm-scale level. The Agglomeration Bonus (AB) is a pecuniary reward for spatial coordination of conservation efforts across different land holdings. Theoretical analysis has flagged the AB as an effective incentive for enhancing spatial coordination. However, empirical evidence about the performance of AB has remained scant and the results are inconclusive. Although auctioning conservation contracts has been shown to offer significant cost savings relative to fixed-price schemes, research on the inclusion of AB in conservation auctions is still in its infancy. Specifically, very little is known about the performance of AB in budget-constrained auctions, relative to fixed payment	

schemes or target-constrained auctions. Moreover, spatial correlations between opportunity costs and environmental benefits could vary across different landscapes. They could be uncorrelated, negatively correlated (i.e., the high-benefit parcels tend to be the low-cost parcels), or positively correlated (i.e., the high-benefit parcels tend to be the high-cost parcels). However, a systematic understanding of how landscape configuration affects the performance of AB is still lacking. Against this background, we examine, for the first time, the performance of AB in budget-constrained auctions across different landscape configurations.

Methodology	***100 – 250 words***

We carried out a series of controlled lab experiments with 180 students at Kiel University, Germany, from November 2021 to March 2022 via Z-tree Unleashed. The experiments followed a three-by-two design with varying spatial configurations of the landscape (uncorrelated, positive, and negative), and the presence or absence of an Agglomeration Bonus (with and without bonus) in a stylized agricultural landscape. The general management goal was to establish corridors and/or stepping stones to link two fragmented habitats, thereby facilitating the migration of wildlife species. The subjects could communicate at a cost with their neighbours to negotiate/coordinate their conservation activities and bidding strategies. We adopted the auction format of a multi-period discriminatory-price auction with a budget constraint and unknown endpoints. The subjects were told that the government buys corridors and stepping stones that can generate the highest environmental value per dollar spent until the budget is exhausted. The degree of correlation between opportunity costs and environmental values was calibrated so that Spearman correlation coefficients equal 0.5 for the positive landscape type and -0.5 for the negative landscape type. The average bonus payment per parcel was exogenously determined by the government and was set at approximately 25% of the average opportunity costs. Auction performance was evaluated using the following performance criteria: participation rate, mark-up rate, degree of spatial coordination, and cost-effectiveness.

Results	***100 – 250 words***

We found that the AB increased the participation rate, thereby inducing more contiguous farmland being enrolled/offered in the programme in the negative and positive landscapes. The effect tends to be more salient in the positive landscape type. By contrast, no significant effect of AB on participation rate was found in the uncorrelated landscape. The AB mitigates rent-seeking behaviour among landholders. Bidders were likely to tender lower bids in expectation of receiving the bonus payment. However, it is worth noting that the mitigation effect on mark-up rates was only statistically significant in the uncorrelated and positive landscape types. With more “high quality” submitted offers in the presence of AB, we hypothesized that given a limited budget, the degree of spatial coordination obtained from the selected offers would also be enhanced. Indeed, in the positive landscape, we found that the AB enhanced spatial coordination and improved auction cost-effectiveness, although the effect was not robust. However, unexpectedly, the degree of spatial coordination was not improved in the negative and uncorrelated landscape types. The AB was also found to worsen auction cost-effectiveness in these landscape types. The paper thus provides important insights into how landscape configuration affects the performance of AB in budget-constrained auctions.

Discussion and Conclusion	***100 – 250 words***

This paper lends experimental support to adopting AB in landscapes where opportunity costs and environmental benefits are positively correlated. However, the results also suggest that the costs incurred by the AB payment was likely to weaken the positive effects of AB on cost-effectiveness. There are two likely causes for these results. First, with a fixed total budget, the increased AB payment also means a shrinking budget for conservation procurement. However, the lower conservation procurement budget was not compensated for by the increased benefits from improved spatial coordination. Second, the reduction in mark-up rate was not sufficient to offset the AB payment. The budget effect of bonus payment was found to be stronger in the uncorrelated landscape than in the positive landscape type. This might partly explain the unexpected effect of AB on cost-effectiveness. Concerning the negative landscape type, bidders were found not to capitalise the bonus in their bids. It might be related to the fact that bidders were uncertain about the bidding strategies of their neighbours, thereby rating the AB as a less attractive incentive. In the negative landscape, we also found no significant difference between the treatments with and without bonus in the mark-up rates on the high-cost parcels. This could in part explain the insignificant reduction in rent premiums. We acknowledge that our findings may be an artefact of the experimental design. However, the paper provides a first proof-of-concept for guiding the choice to use AB for improving landscape-scale environmental management on private farmland.