Land Use Policy 63 (2017) 572–583

Contents lists available at ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol

An overview of laboratory research on conservation auctions

Steven G.M. Schilizzi *

School of Agricultural & Resource Economics, The University of Western Australia, Australia

ARTICLE INFO

Article history:
Received 5 September 2014
Received in revised form 2 June 2015
Accepted 18 June 2015

Keywords:
Conservation auctions
Experimental economics
Literature review
Analytical framework
Current research
Unresolved problems

ABSTRACT

This paper reviews the laboratory research on conservation auctions by first suggesting a framework for organizing the literature; then by highlighting the key insights and contributions achieved to date; and thirdly by taking stock of pending questions and unresolved problems. The review framework focuses on the performance of conservation auctions and distinguishes between causal factors and resulting effects. Causal factors include auction format, implementation rules and bidder characteristics, as well as some other aspects. Resulting effects distinguish between intermediate effects, mainly in terms of bidder behaviour, and final auction performance. Rather than a standard literature review, this 'overview' also tries to capture the work that is currently going on and that has not yet been published.

1. Introduction

The study of conservation auctions is fairly recent. Their experimental study is even more recent. Compared to areas that are decades or centuries old, this makes the task of providing an overview of the work done in this field much easier.

Conservation auctions are mechanisms used typically by government agencies to buy conservation services from private landholders. Non-governmental organizations are also beginning to enter the fray, a good example being "Ducks Unlimited Canada": they tender land management contracts that have both environmental and duck-shooting goals in the Prairie Provinces of Canada (Hill et al., 2009; Brown et al., 2011). Much of the land in free market economies is privately owned, and existing markets do not typically push private landowners to carry out conservation works, as these mostly produce public goods that are not paid for by market forces. Such cases of market failure can be mitigated through "payments for environmental services" (PES), where conservation auctions are used as one of the ways in which such payments are allocated amongst landholders. Conservation auctions work as competitive tenders, where a number of eligible landholders (or other types of resource owners) compete to obtain a limited number of contracts that will pay them to carry out conservation works on their land. This is not restricted to land-based operations: conservation auctions have also been used to buy out fishing vessels with owners giving up their boats, in policies aiming to reduce pressure on fish stocks (Schilizzi and Latacz-Lohmann, 2012).

The problem faced by whoever wishes to use conservation auctions is that there are a large number of possible formats, and it is not obvious which one is to be preferred, nor if any of them is preferable to something other than an auction. Most of the research done on conservation auctions has aimed to help government agencies make such choices, and economic experiments have played an important role, alongside theoretical analyses and computer simulations.

The first conservation auction was implemented in 1985 before any clear understanding of its workings had been achieved: the American Conservation Reserve program in the US, which has been running ever since. Its format and rules have changed over time, however, to accommodate early difficulties such as price discovery and collusion, which undermined its initial effectiveness. It was largely to understand why this was happening that Latacz-Lohmann and van der Hamsvoort published in 1997 the first paper that tried to understand bidding behavior in conservation auctions. That was a theoretical paper, illustrated by a simple numerical simulation. Its main contribution was to lay the foundations for rationally understanding the properties of the conservation auction. The next step was not experimental but a field application: the 2001 Victorian 'BushTender' auctions in Australia were directly inspired by this seminal paper, and shortly thereafter, in 2003, the first experimental study was published by Cason & Gangadharan. The 1997 and 2003 papers together established the study of conservation auctions in the two top journals of agricultural and

Abbreviations: wip, work in progress (not yet published at the time of writing); BPP, Boxall, Perger & Packman; BPW, Boxall, Perger & Weber; CG, Cason & Gangadharan; KAB, Kits, Adamowicz & Boxall (wip1 wip2); LLS, Latacz-Lohmann & Schilizzi; SBL, Schilizzi, Breustedt & Latacz-Lohmann; SLB, Schilizzi, Latacz-Lohmann & Breustedt; SLL, Schilizzi & Latacz-Lohmann; PBW, Perger, Boxall & Weber; BWWP, Boxall, Wilson, Wichman & Perger.

* Corresponding author.
E-mail address: Steven.Schilizzi@uwa.edu.au

http://dx.doi.org/10.1016/j.landusepol.2015.06.035
0264-8377/

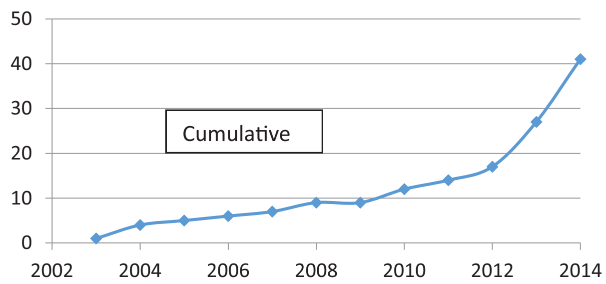

Fig. 1. Laboratory studies of conservation auctions in the last decade, cumulative (including as yet unpublished work). Source: The author.

environmental economics, the first in the American Journal of Agricultural Economics and the second in the Journal of Environmental Economics and Management.

Since 2003, the number of experimental studies has been growing, though until very recently at a rather slow pace. Fig. 1 shows the rate of growth over the last decade. Most of the recent acceleration is still in the form of "work in progress", hereafter abbreviated as "wip".

Table A1 in Appendix A shows, in chronological order, in which journals this experimental literature tends to be published. First on the list comes Land Economics, second is the AJAE. Other journals include JEEM, EARE (Environmental and Resource Economics), Ecological Economics and AJARE (the Australian Journal of Agricultural and Resource Economics).

One can measure the amount of work done in the last decade on conservation auctions by referring to a previous, much cited review on this topic produced by Latacz-Lohmann and Schilizzi, 2005. In it the experimental section was, to say the least, in its very infancy and covered barely more than one page (pp. 60–61).

The relative youth of the experimental literature in this area allows us to provide an almost exhaustive overview. Because this is an active and rapidly developing field, we have included as yet unpublished material (at the time of writing), which currently exists in the form of workshop and seminar presentations.[1] We have also included a number of field experiments, insofar as they are complementary to, and provide interesting insights for, future lab experiments (see Table A2 in Appendix B).

2. A framework for the analysis of conservation auctions[2]

Theissues addressed by the experimental literature of the last decade on conservation auctions (2003–2014) can be conveniently organized by examining how well auctions perform in terms of 'causal factors' and 'outcome effects', with the latter split between intermediate and final. Causal factors include auction format, implementation rules, bidder characteristics and some other auction features. Intermediate outcome effects focus on bidder behaviour, while final outcome effects focus on auction performance. By performance is meant the criteria by which a conservation auction is evaluated; typically, budgetary cost-effectiveness—though other criteria are also used. We briefly outline the content of each of these categories before reviewing, in the next section, the key insights and contributions from the experimental literature.

2.1. Causal factor 1: auction format

Auction format involves several aspects. First, one needs to decide between a budget-constrained (BC) and a target-constrained (TC) format. In a BC format, the available budget for purchasing environmental services is fixed, but the amount of conservation that will be achieved is open to uncertainty, as it will depend on bidders' choices. In a TC format, the amount of conservation—for example, the number of hectares to come under a specific program, is fixed in advance, but the amount it will cost to society is unknown because it is subject to auction outcomes.

Secondly, one needs to decide on the payment rule. In an auction, all bidders are ranked according to some criterion, such as dollars asked per hectare taken out of production, an example of a value-for-money ratio. A discriminatory price (DP) auction pays each winning bidder their own bid: it is the "pay-as-you-bid" rule. The uniform price (UP) auction pays all winning bidders an amount equal to the bid asked by the last accepted bidder, or, less frequently, by the first rejected bidder. There exist other, more sophisticated payment rules, but they are seldom used.[3]

A third format feature relates to what is being auctioned: typically, conservation contracts. The type of contract can heavily influence auction performance. This is the case when determining whether payments are made for actions or for outcomes. For example, if payments are to be made for planting trees, the first option may translate into paying for each tree planted; the second option may translate into paying for every tree still alive and in good shape three years later, once it is well established; a third option would combine the two and make part of the payment a function of the number of trees planted, and the remaining part a function of the number of trees still healthy three years later—the relative percentage of each then being the crucial contracting parameter.

Other formatting features include decisions about whether to run a single auction or a sequence of repeated auctions; whether bids must be single and made by separate bidders or whether group bids are allowed; whether a single item is to be auctioned at a time or whether several items can be auctioned simultaneously, possibly in packages (combinatorial auctions). Allowing both joint bids and multiple-unit auctions also allows for the introduction of agglomeration bonuses linked to on-site synergies, due e.g., to contiguity effects leading to superadditive outcomes, as is typically the case with biodiversity-focused projects. As for competition intensity, although it can only partially be controlled for in the field—mainly through eligibility criteria— it can be tightly controlled in the lab, either as a ratio of budget to bidders (in a BC auction) or as a predefined proportion of winners (in a TC auction).

2.2. Causal factor 2: implementation rules

Once the auction format is determined, experimenters (and policy makers) still have much latitude in how to implement the auction in a given context. Thus, the type and amount of information the auctioning agency should share with bidders can have a major impact on auction performance. Should the agency reveal the metric by which they will measure environmental benefits? Should it reveal the budget it has available? Should it reveal exactly how many are eligible to bid? In the lab, when running sequential auctions, the type and amount of information provided after each round can also be manipulated, to investigate its effects on auction performance.

[1] We are grateful to the Economics Science Association network for having provided, from around the world, information on ongoing work in this field at the time of writing. The ESA is focused on the contribution of experiments to the advancement of economics as a science.

[2] I thank Tobias Wünscher for suggestions made to this section.

[3] For example, the Generalized Vickrey or Vickery-Clarke-Groves auction (see Ausubel, 2005, An efficient ascending-bid auction for multiple objects. *American Economic Review*, 94, 1452–475).