

Private Benefits of Conservation and Procurement Auction Performance

Marc N. Conte
Department of Economics
Fordham University

Robert M. Griffin
Woods Institute
Stanford University

2017 CBEAR-MAAP Conference
October 15, 2017

Environmental Benefits Index - Conservation Reserve Program

Factor Name	Factor Description	Factor Points
Wildlife	Wildlife habitat benefits resulting from covers on contract acreage	10-100
Water Quality	Water quality benefits from reduced erosion, runoff and leaching	0-100
Erosion	On-farm benefits from reduced erosion	0-100
Enduring Benefits	Benefits that will likely endure beyond the contract period	0-50
Air Quality	Air quality benefits from reduced wind erosion	0-25
Cost		Based on offers

Conservation action submission

- Landowners have significant latitude regarding the environmental quality of their offers (Claassen et al. 2008)
 - Choice of conservation action
 - Choice of land enrolled
- If eligible, expect landowners to prefer conservation actions that generate private benefits
- The level of competition will determine how inclusion of these benefits impacts auction performance

Advantages of private-benefit action eligibility

- Actions with private benefits could increase the environmental benefits generated with a fixed budget due to their reduced opportunity costs (Hellerstein 2017)
- Inclusion of such items may be beneficial from the perspective of budget-constrained procuring agencies
- Evidence from the CRP shows a preference by bidders for conservation actions that generate private benefits (Miranda 1992; Vukina et al. 2008)

Challenges of private-benefit action eligibility

- Inclusion of such actions favors enactment of high-quality conservation action with private benefits on marginally productive land, a condition that may not exist on parcels across the landscape
- Differences across parcels in productive value due to soil type and in environmental benefits due to landscape configuration increase the variance in net conservation cost
- Auction performance suffers with this increased variance (Latacz-Lohmann and Schilizzi 2005; Messer et al. 2017)

Research question

- How does eligibility of conservation actions with private benefits affect auction performance and bidder behavior?
- We explore this issue in the context of conservation procurement auctions in which conservation action choice is endogenous to bid formation (Conte and Griffin 2017)
- We allow the private benefits of conservation to accrue heterogeneously across bidders, to reflect landscape variability (Kirwan et al. 2005)

Experimental results

- The inclusion of conservation actions with private benefits leads to selection of more cost-effective actions
- We see greater environmental quality provided with similar expenditures when actions with private benefits are included
- We also find that bidders with substantial private benefits from conservation engage in magnified rent-seeking
- Rent-seeking behavior by low-cost sellers erodes the potential cost-effectiveness gains of inclusion

Experiment design

- Participants are asked to select one of three available conservation actions for submission at a chosen offer price
- Actions have both a quality (Q) and a cost (C), which are independent
 - $Q_i \in [50, 100]$
 - $C_i \in [500, 1000]$
- Bids are evaluated for acceptance based on their score ($Score = \frac{Quality}{Price}$), with the highest-score items accepted until the budget is exhausted

Auction design

- Single-round auction, with 12 periods per treatment and 12 sellers per period
- Fixed budget that is unknown to participants
- Discriminatory price auction (receive offered price if the bid is accepted, nothing otherwise)
- Counterbalanced, within-subject design
- Single-item bid submission
- *Private* treatment: One of three actions selected to receive a cost discount that varies across bidder types

Private treatment

- We established three types of bidders in the *Private* treatment
 - *Large private* types received a cost discount of 250
 - *Small private* types received a cost discount of 125
 - *Public* types did not receive a cost discount
- Participants were not explicitly informed about the cost discount

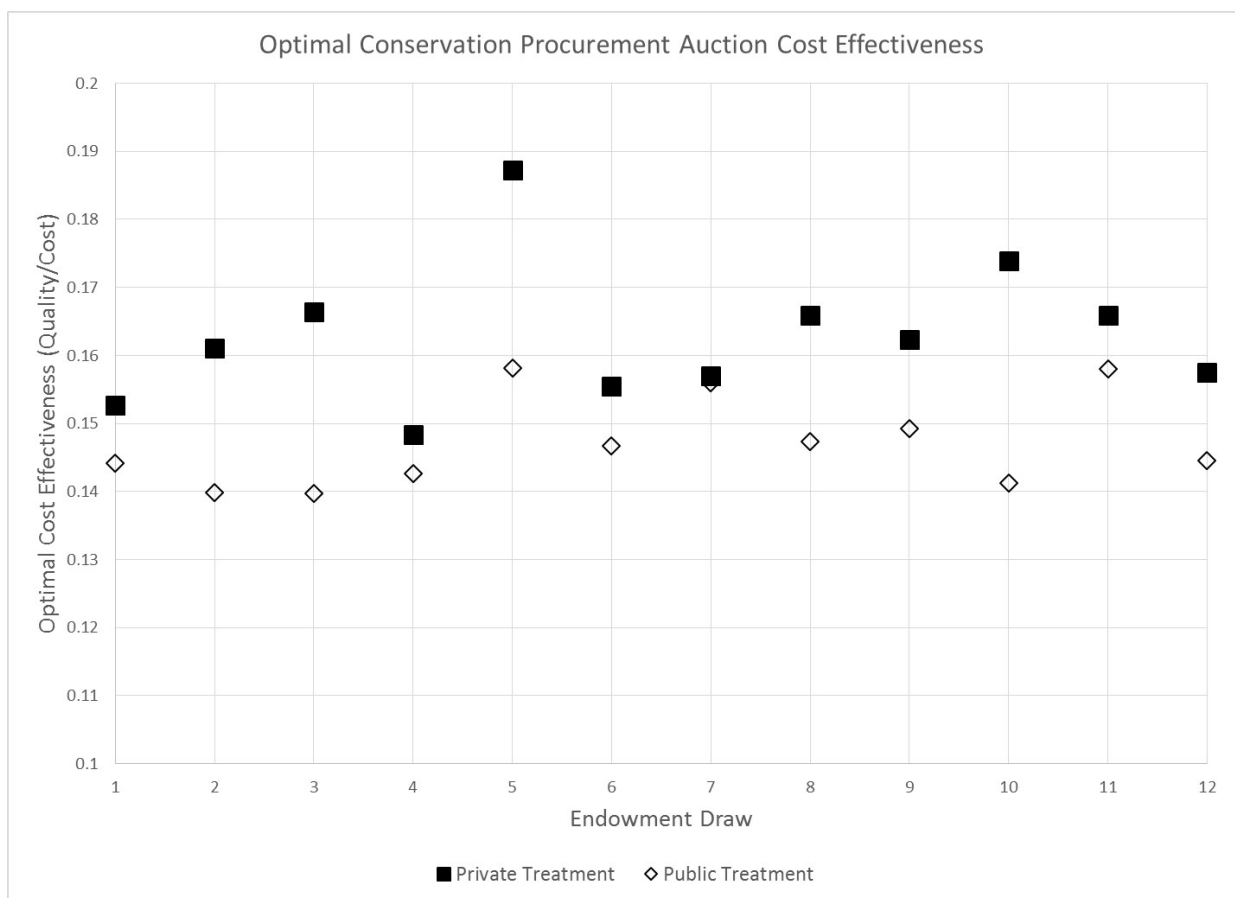
Metric of auction performance

- With multi-dimensional bids, we cannot rely on cost to describe auction performance
- We employ the percentage of optimal cost-effectiveness ratio (POCER; used by Cason et al. 2003) to evaluate auction efficiency:

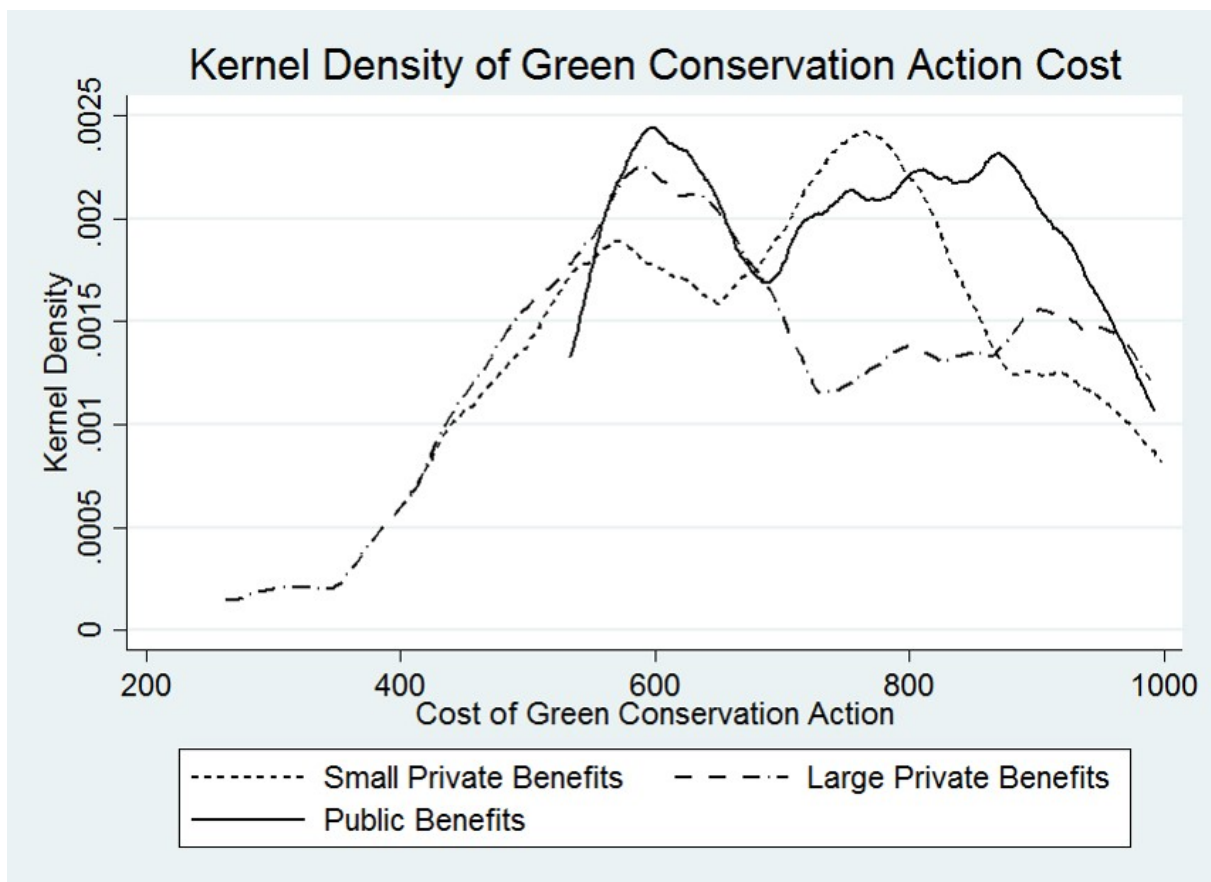
$$\frac{\sum Q_i^a / \sum price_i}{\sum Q_i^o / \sum cost_i^o}$$

- The optimal quality per dollar is calculated by assuming that each item has an offer price equal to the item's cost

Optimal cost-effectiveness by treatment



Conservation action cost distribution



Auction Performance - comparison of means

	Public Treatment	Private Treatment	Difference
Total quality provided	539.45 (42.27)	588.875 (45.98)	-49.425 0.0000
Total expenditures	4102.87 (17.66)	4149.33 (17.08)	-46.46 0.0584
Mean quality/optimal quality	0.8823 (0.005)	0.8892 (0.006)	-0.007 0.0873
Mean quality/expenditures	0.1315 (0.001)	0.1419 (0.001)	-0.010 0.0000
Optimal quality/expenditures	0.1473 (0.001)	0.1628 (0.001)	-0.0155 0.0000
POCER	0.8929 (0.003)	0.8728 (0.004)	0.0201 0.0005
Accepted Offers	6.12 (0.011)	6.77 (0.014)	-0.65 0.0000
Observations	144	144	

Auction Performance - POCER models

	Model 1	Model 2	Model 3
Private Treatment	-0.0201*** (0.0022)	-0.0201*** (0.0022)	-0.0139 (0.0079)
Treatment Experience		0.0011 (0.0008)	0.0016 (0.0011)
Private x Experience			-0.0010 (0.0012)
Constant	0.8929*** (0.0011)	0.8856*** (0.0055)	0.8827*** (0.0073)
Session Fixed Effects	Yes	Yes	Yes
Observations	288	288	288

Evaluating bidder behavior

- We turn to the percentage of optimal score (POScore) to explore bidder behavior in this context
- POScore compares a participant's bid to her highest-endowed-score submission, with POScore defined as:

$$POScore = \frac{Q_i^s / P_i}{Q_i^* / C_i^*}$$

- We see that if bidder i submits her highest-endowed-score conservation action, then $POScore = \frac{C_i^*}{P_i}$

Bidder behavior - POScore models

	Public Treatment	Private Treatment		Both Treatments	
Selected Item Cost	0.0001** (0.0000)	0.0001** (0.0000)	-0.0000 (0.0000)	0.0001*** (0.0000)	0.0000 (0.0000)
Selected Item Quality	0.0006 (0.0004)	-0.0001 (0.0004)	-0.0003 (0.0004)	0.0002 (0.0002)	0.0001 (0.0002)
Minimum Cost	0.0382*** (0.0095)	0.0506*** (0.0070)	0.0455*** (0.0069)	0.0469*** (0.0060)	0.0437*** (0.0058)
Maximum Quality	0.0213*** (0.0071)	0.0421*** (0.0095)	0.0402*** (0.0089)	0.0328*** (0.0059)	0.0323*** (0.0058)
Small Private Benefits Type		-0.0061 (0.0042)	-0.0036 (0.0044)	-0.0002 (0.0045)	0.0053 (0.0051)
Large Private Benefits Type		-0.0530*** (0.0083)	-0.0438*** (0.0080)	-0.0459*** (0.0065)	-0.0309*** (0.0063)
Selected Item Cost Below 500			-0.0863*** (0.0098)		-0.0708*** (0.0112)
Treatment Experience	0.0014* (0.0007)	0.0017** (0.0008)	0.0019** (0.0008)	0.0016*** (0.0005)	0.0015*** (0.0005)
Constant	0.7317*** (0.0335)	0.7964*** (0.0358)	0.9122*** (0.0387)	0.7548*** (0.0208)	0.8096*** (0.0196)
Participant Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	1,720	1,724	1,724	3,444	3,444

Experimental results

- The inclusion of conservation actions with private benefits leads to selection of more cost-effective actions
- We see greater environmental quality provided with similar expenditures when actions with private benefits are included
- We also find that bidders with substantial private benefits from conservation engage in magnified rent-seeking
- Rent-seeking behavior by low-cost sellers erodes the potential cost-effectiveness gains of inclusion

Environmental Benefits Index - Conservation Reserve Program

Factor Name	Factor Description	Factor Points
Wildlife	Wildlife habitat benefits resulting from covers on contract acreage	10-100
Water Quality	Water quality benefits from reduced erosion, runoff and leaching	0-100
Erosion	On-farm benefits from reduced erosion	0-100
Enduring Benefits	Benefits that will likely endure beyond the contract period	0-50
Air Quality	Air quality benefits from reduced wind erosion	0-25
Cost		Based on offers

Auction competitiveness and private benefits

- In our parameterization, increased rent-seeking by low-cost types did not overcome improvements in environmental quality purchased associated with the eligibility of conservation actions with private benefits
- In these auctions, between 51% and 56% of offers were accepted
- At present levels of competition in the CRP, it is quite possible that rent-seeking could entirely offset gains from more environmental quality per dollar spent (a recent signup for the CRP resulted in a 90% acceptance rate)
- Procuring agencies could combat this behavior through the use of bid caps

Valuation of Environmental Benefits

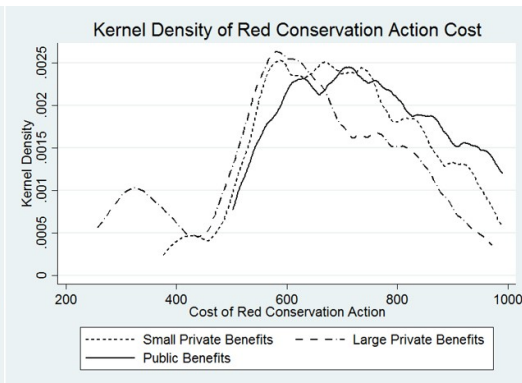
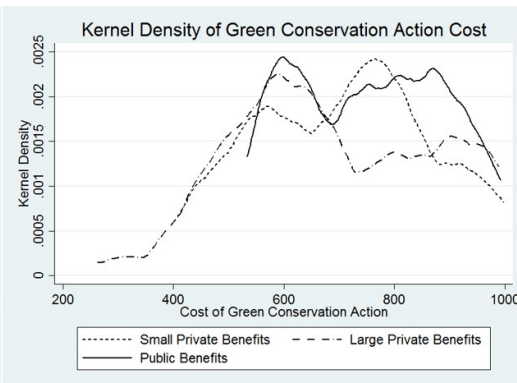
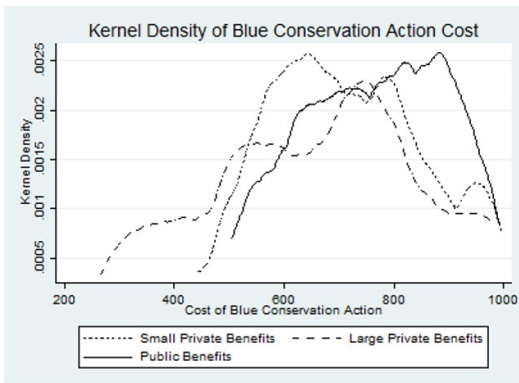
- Measuring environmental outcomes in biophysical units will not lead to efficient land-use outcomes (Vincent 2016)
- Duke et al. (2013) raises several points about the importance of valuing the benefits and costs of conservation procurement, with the bonus of preventing cost discounts from being interpreted as benefits in auction scoring
- With endogenous action choice, valuation could prevent undesirable outcome of over-supply of actions with private benefits at the expense of those with only public benefits

Thank you for your time

Marc Conte
mconte7@fordham.edu

Additional Slides

Conservation action cost distribution



	Public			Private		
	Bottom Third	Middle Third	Top Third	Bottom Third	Middle Third	Top Third
Score	0.092 (0.002)	0.116 (0.0004)	0.140 (0.002)	0.096*** (0.001)	0.125*** (0.001)	0.160*** (0.002)
Percentage of Optimal Score	0.898 (0.021)	0.898 (0.003)	0.878 (0.010)	0.866 (0.006)	0.890 (0.003)	0.839*** (0.009)
Rent	47.18 (3.19)	63.25 (2.08)	90.16 (3.46)	47.11 (2.18)	63.94 (2.20)	100.73** (3.71)
Profit	-2.53 (2.24)	26.32 (1.50)	71.37 (3.04)	0.84*** (0.66)	31.97*** (1.68)	86.09*** (3.30)
Profit for Accepted Offers	-65.18 (57.40)	45.56 (2.05)	78.55 (3.18)	11.57 (9.00)	46.99 (2.09)	91.09*** (3.36)
Acceptance	0.039 (0.008)	0.578 (0.02)	0.909 (0.012)	0.073*** (0.011)	0.680*** (0.019)	0.945** (0.01)
Observations	576	576	576	576	576	576

Item selection

	Public	Private	Both Treatments
Endowed Score	1.4700*** (0.1701)	1.0068*** (0.0872)	0.9449*** (0.0851)
Minimum Cost	0.1795*** (0.0104)	0.1129*** (0.0138)	0.1517*** (0.0100)
Maximum Quality	0.2082*** (0.0124)	0.2601*** (0.0107)	0.2356*** (0.0084)
Small Private Benefits		0.1289*** (0.0204)	0.0964*** (0.0174)
Large Private Benefits		0.2110*** (0.0197)	0.1798*** (0.0179)
Constant	0.0843*** (0.0171)	0.0083 (0.0128)	0.0785*** (0.0111)
Participant Fixed Effects	Yes	Yes	Yes
Observations	5,184	5,184	10,368

