Do conservation auctions crowd out voluntary environmentally friendly activity?

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Abstract

Research has shown that introducing external incentives to encourage pro-social behavior, such as monetary rewards or regulation, may crowd out voluntary pro-social activity. This has implications for the appropriate design and use of such incentive-based programs. This study investigates motivational crowding out in the case of conservation auctions, a relatively new tool that provides monetary incentives to encourage landowners to adopt environmentally friendly management practices. Our experimental evidence shows that the introduction and subsequent removal of a conservation auction significantly reduces voluntary provision of environmental quality (via monetary donations to an environmental charity), compared to a control group that does not experience an auction. We also attempt to examine some economic theories of behavior that attempt to explain this effect according to either individual motivations or social interactions, and our initial exploration finds that crowding out occurs regardless of whether or not participants have opportunities to interact with one another during the experiment.

Keywords: conservation auction; crowding out; environmental policy; experimental economics; social behaviour

1 Introduction

Conservation auctions are a relatively new tool for environmental management and a subject of increasing interest in several countries. Auction programs in Australia, the United States, Canada and elsewhere have been used to provide incentives for landowners to improve environmental quality by adopting beneficial management practices (BMPs). They are appropriately used for BMPs that impose a net cost on landowners, such as habitat protection or suspension of irrigation, which would normally be under-provided from a societal perspective (Pannell 2008). In a competitive tender process, landowners submit bids for a limited number of conservation contracts to adopt specific BMPs. The best bids, based on environmental and cost-effectiveness criteria, are selected and the winners enter into contract with the government.

Auctions have the potential to offer a cost-efficiency advantage over another tool to encourage BMP adoption, fixed cost-share grants. BMP adoption costs are often heterogeneous among landowners since they depend on land and farm characteristics, as well as existing management practices. Because these costs are only known to the landowner, it is difficult to tailor payments to real adoption costs and achieve maximum cost-effectiveness. Conservation auctions have the potential to overcome this problem of asymmetric information; since optimal bids are a function of the net costs of adoption, the auction mechanism reveals information about these costs (Latacz-Lohmann and Van der Hamsvoort 1997). While cost revelation is imperfect because landowners have an incentive to extract rent by bidding above costs, careful auction design can reduce such

rent-seeking behavior (Cason et al. 2003; Cason and Gangadharan 2005; Hailu and Thoyer 2006; Rolfe et al. 2009; Vukina et al. 2008).

However, a concern with conservation auctions is that, in some situations, introducing external incentives to undertake pro-social activities may reduce the amount of such activities that individuals are willing to provide voluntarily (Frey 1997).[i] Individuals may voluntarily undertake pro-social activities, including improving environmental quality, for a number of reasons, including altruism or a concern for social norms (Nyborg and Rege 2003). However, a growing body of evidence shows that these motivations can be crowded out by the introduction of external mechanisms, including economic incentives (Deci et al. 1999, Frey and Jegen 2001, Bowles 2008). In environmental contexts, this has been shown for the case of common pool resources (Cardenas et al. 2000; Vollan 2008), weakly enforced sanctions for pollution (Tenbrunsel and Messick 1999), and public good games with specified minimum contributions (Reeson and Tisdell 2008). Monetary incentives, like the ones offered in conservation auctions, have also been found to cause crowding out (Gneezy and Rustichini 2000, Frey and Oberholzer-Gee 1997, Goeschl and Perino 2012). In fact, crowding out has been shown to occur in the context of a competitive tender experiment that is similar to a conservation auction (Reeson and Tisdell 2010).

This study has two aims. The first is to provide further evidence on whether conservation auctions are likely to result in motivational crowding out of pro-social behavior. We follow the general format of Reeson and Tisdell's (2010) public goods experiment, but with some modifications intended to make the experiment more closely

parallel a conservation auction. The second is to begin exploring whether an experimental context can provide us with any evidence to begin distinguishing among the various economic models that have been proposed as potential explanations of crowding out.

2 Why might conservation auctions cause crowding out?

A number of economic theories have been developed to explain why individuals may rationally undertake actions that are privately costly, but socially beneficial (Nyborg and Rege 2003). Each of these provides some explanation for why landowners may voluntarily adopt privately costly BMPs and why this behavior may be crowded out by introducing external incentives.

Some theories suggest that individuals undertake pro-social behavior primarily because of their own internal motivations or beliefs. The theory of altruism holds that improving the well-being of others contributes to an individual's utility (Becker 1974; Schmid and Robison 1995; Schwartz 1970). Warr (1982) shows theoretically that altruistic contributions to a public good are completely crowded out by government contributions. Thus, landowners may stop adopting BMPs voluntarily when others are paid to adopt them instead. Impure altruism, a variant, states that individuals receive utility ("warm glow") simply from the act of contributing to a public good; in this case, crowding out still occurs, but is incomplete (Andreoni 1990).

Theories of commitment argue that individuals contribute to a public good even when it does not increase their utility, because they are willing to place constraints on their own private utility maximization for the sake of the common good (Nyborg 2000;

Sen 1977; Sugden 1984). These theories imply that landowners may adopt BMPs simply because they believe that it is "the right thing to do." However, introducing external monetary incentives may change the frame of reference for a particular decision from an ethical one to a business one, thus crowding out moral motivations (Tenbrunsel and Messick 1999, Bowles 2008). If this happens, landowners may no longer be willing to adopt costly BMPs for ethical reasons without being paid.

A second set of theories suggest that the actions or reactions of others can influence pro-social behavior. One argument holds that individuals gain utility from social approval, which can be obtained by following social norms, or undertaking actions of which society approves (Hollander 1990; Levitt and List 2007; Nøstbakken 2009; Nyborg et al. 2006; Rege 2004). If there is a positive social norm towards BMP adoption, landowners may receive sufficient utility from social approval of their actions to make such a decision worthwhile. However, it is possible that when payments are introduced, observers will assume that those who contribute are motivated not by social norms but by the external financial rewards. This crowds out the social or "reputational" incentive to contribute (Benabou and Tirole 2006).

Theories of fairness or reciprocity argue that individuals contribute to public goods because they gain utility from reciprocating the "kind" actions of others who have also contributed (Falk and Fischbacher 2006; Levine 1998; Rabin 1993; Segal and Sobel 2007). In this case, landowners would adopt BMPs because others are doing so, and the utility of reciprocating, by contributing to environmental quality that is enjoyed by those others, outweighs the cost of adoption. As with social norms, introducing payments may

reduce the perception that people adopt BMPs out of "kindness," and therefore reduce the incentives of others to reciprocate.

3 Experimental Design

To empirically investigate whether conservation auctions, like other external incentives, can cause crowding out, we designed a laboratory experiment to simulate the incentives associated with BMP adoption and conservation auctions. The basic structure of the experiment draws on work by Reeson and Tisdell (2010) who investigated crowding out using public goods experiments that included an auction. However, although conservation auctions are intended to elicit contributions to a public good, a public goods game may not be the best way to represent these programs experimentally because the benefits that are typically sought (such as species preservation via habitat protection) are widely distributed among many members of society, while only a small subset of individuals have the ability to contribute. Instead, we used a modified dictator game where participants were given the opportunity to make voluntary contributions that were costly to them, but provided benefits to society. Specifically, each participant was told that they represented a landowner with a hypothetical farm to manage, and were asked to decide whether to adopt (unspecified) BMPs on their farm. To adopt BMPs, they had to pay a specified amount out of their initial monetary endowment. If a participant chose to adopt BMPs, the experimenters made a real donation to an (unnamed) environmental charity on their behalf.

Each experimental session consisted of 12 rounds. In each round, each participant was endowed with $2 (their "farm profits"). Each participant was told their individual costs for various levels of BMP adoption (0%, 25%, 50%, 75% and 100% of "the practices that will work on your farm"). These costs were drawn from real data on BMP adoption (wetlands restoration) by Canadian farmers in a Manitoba watershed (Boxall et al. 2009), scaled to match the $2 endowment, and ranged from $0.04 to $0.76 in experimental dollars per 25% increment. There were ten different adoption costs (one per participant), which were redistributed among participants each round. This mimics a restart effect in each round (Andreoni 1988). Because experimental procedures changed during the auction treatment (to be discussed shortly), this avoided confounding the potential restart effect of these changes with any treatment effect that may be present. Participants were also told the social benefit associated with these levels of adoption, which was fixed at a $0.50 donation to a Canadian environmental charity for each 25% increment adopted. Based on these costs and benefits, participants were invited to choose their desired level of BMP adoption, subject to the condition that they could only adopt BMPs that they could afford to pay for out of their endowment. The cost of the chosen adoption level was deducted from the $2 endowment for that round, and participants were told their earnings for that round and the monetary donation that would be made on their behalf. Each subsequent round began with a new $2 endowment and a new decision regarding BMP adoption.

The experiment was implemented using Z-Tree (Fischbacher 2007), software designed for conducting economic experiments. Each participant was seated at an

individual computer terminal and made their decisions anonymously, using the computer software. Throughout the experiment, each participant's computer displayed information about their current adoption costs and benefits, decisions in past rounds, and an ongoing tally of earnings. Total earnings were paid in cash at the end of the experiment, and participants were also told the total amount of the donation to be made on their behalf.

To examine whether conservation auctions can cause crowding out, an auctioned sharing subsidy was used during some experimental sessions. In these sessions, the first four rounds followed the procedure described above. However, between the fourth and fifth rounds, the auction mechanism was introduced.[ii] Similarly to real conservation auctions, participants were invited to submit an offer specifying the adoption level they would commit to, and the compensation they would like to receive in return. They were informed that the offers would be ranked according to the per-unit compensation desired, and that the best offers would be accepted up to an (unrevealed) budget cap. The auction was implemented during each of the following four rounds. Participants submitted their bids and were then told whether or not their bid was successful. Successful bidders received their desired compensation, in addition to their $2 "farm profits" endowment. Unsuccessful bidders, or participants who chose not to submit a bid, received only their $2 endowment. Each participant then chose their adoption level for that round and the cost of adoption was deducted from their compensation and/or endowment. Successful bidders were required to choose at least the adoption level specified in their bid, but were also allowed to choose a higher level; however, additional adoption did not result in additional compensation. Unsuccessful bidders could choose any adoption level, as long

as they could pay for it using their endowment. Thus, voluntary adoption behavior was still an option. After round eight, participants were informed that they could no longer receive compensation for BMP adoption, and the procedure then reverted to the original design. This continued for the final four rounds of the auction treatments.

If conservation auctions cause crowding out, voluntary (uncompensated) BMP adoption, *ceteris paribus*, should be lower among individuals who have been exposed to an auction than among those who have not. In the experiment described above, this implies that voluntary adoption in the final four rounds should be lower in the group that experienced an auction than in the group that did not. Behavior in the auction treatment is compared to behavior in the control treatment, rather than simply comparing behavior before and after the auction, because there may be other factors (such as boredom, fatigue, satiation, or wealth effects) that induce changes in behavior over time. Because these factors should be the same for the control and experimental treatments, comparison of the two treatments allowed us to take these factors into account.

As an initial attempt to begin untangling the various theoretical explanations for crowding out, in the context of this experiment, we designed an additional treatment intended to distinguish between theories that rely on individual motivations, and theories that rely on the behavior of others. In theories of altruism and commitment, crowding out is a function of individual motivations (utility or ethics) and the behavior of the agency providing external motivations. In theories of social norms and reciprocity, however, crowding out occurs because of the observed behavior of others in society (in establishing social norms or kindness) and/or their expected responses (social approval or

disapproval) to an individual's decisions. We hypothesized, therefore, that we might be able to distinguish between the "individual" explanations and the "social" explanations by varying participants' abilities to observe the actions of others and to interact with them. If the "social" explanations for crowding out are correct while the "individual" explanations are not, we should only observe crowding out when participants can interact with each other. If crowding out is still observed when no social interaction takes place, this indicates that the "individual" explanations may play a role (but does not rule out the social explanations playing a role as well).

To investigate this, participants were offered opportunities for social interaction in some of the experimental sessions. In these sessions, participants were told the adoption level chosen by each other participant in the past round, but not their adoption costs or compensation amounts. In a real auction, landowners may have some information about the adoption decisions made by others; for example, wetlands restoration is a visible change to the landscape. However, they would normally not know how much it cost the landowner to implement the BMP, or how much they were paid to do so. To protect confidentiality, this information was displayed by participant number, which was unknown to the other participants. This information allowed for the formation of social norms, which in economic theory are typically represented as arising from the "average" behavior of members of a group. It also allowed reciprocity to play a role, where participants respond directly to the behavior of others.

Second, participants in these treatments were allowed to communicate throughout the experiment, both through an electronic chat function in the experimental

software and by simply talking among themselves. This gave participants the opportunity to express social approval or disapproval in response to the behavior of others. The electronic chat allowed participants to relate communications directly to actions of other participants, since individuals were identified in the chat by their participant number. Allowing verbal chatting provided participants with a more natural way to communicate, especially for those who might not have been comfortable using the electronic chat. In fact, we observed that participants did not choose to verbally communicate during the experiments. They did use the electronic chat in some sessions. In either case, however, the *possibility* of communication existed, leaving participants exposed to potential social approval or disapproval.

The overall organization of the experimental sessions is illustrated below. The two separate experimental treatments (auction or no auction, and social interaction or no-social interaction) gave us a two-by-two experimental design. For each of the four possibilities, four experimental sessions were held.

	No social interaction	Social interaction
No auction	*Treatment 1*	*Treatment 3*
Auction	*Treatment 2*	*Treatment 4*

There were 10 participants in each experimental session, making a total of 160 participants in the experiment. Participants were drawn from a database of volunteer experimental participants at the University of ---. The vast majority were students, while a few were non-students (office staff or faculty connected with the university). Whether

an individual was student, staff or faculty was not revealed to any of the other participants.

4 Analysis and results

[Figure 1 and Figure 2 about here]

Figures 1 and 2 summarize the outcome of the experiments. These graphs show the average total costs of the BMP adoption decisions of participants, during the first four rounds of the experiment (before the auction was implemented in the auction treatment group), second four rounds (during the auction in the auction treatment group), and last four rounds (after the auction in the auction treatment group). Figure 1 shows the results for the treatment with no social interaction, while Figure 2 shows the results for the social interaction treatment. The last column in each graph shows the change in total adoption cost between the first four rounds and the final four rounds.

The first observation to be drawn from these results is that the auction mechanism used in this experiment did indeed appear to cause crowding out. Interestingly, this happened regardless of whether or not participants were able to use social mechanisms to observe and respond to the behavior of others. In both graphs, when an auction was used, the amount participants were willing to contribute toward BMP adoption was lower after the auction than it was before the auction (it was also much higher during the auction, which is to be expected, since participants were compensated

for adoption during these rounds). It also appears that participants were willing to contribute more when these social mechanisms were absent - in the initial four rounds only for the auction treatment, but throughout the experiment when the auction was not used.

We examine these patterns more precisely using a difference-in-differences approach (Card and Krueger 1994). This approach allows us to examine differences at various points during the experiment (i.e. before and after the auction) while accounting for any time trends that are common to both groups and not dependent on the experimental treatment. It also accounts for any differences between the experimental groups unrelated to the treatment, although we do not expect there to be any selection bias or consistent unobserved differences between the groups. While participants did self-select into the experimental time-slots, they were given no information in advance as to what would happen during the different sessions.

The dependent variable is the total level of BMP adoption during each round. Because participants chose from discrete levels of adoption (0%, 25%, 50%, 75%, and 100%), with an identical cost for each level, individual adoption is coded as 0, 1, 2, 3, and 4 units. Each round, therefore, the quantity of total adoption units could range from 0 to 40. Although adoption costs were rotated among participants, the same set of costs was used for every round. This allows us to examine aggregate results. While examining individual adoption decisions would allow us to control for more variation given the panel structure of the data, the fact that participants were allowed to communicate during the communication treatment means that the individual observations may not be

independent. To account for the panel structure of the data (12 observations for each session), a random effects model is estimated. Although the data are in theory truncated, in this data no observations at the endpoints were in fact recorded.

The difference-in-differences model requires several dummy variables. AUCTION equals one if the observation comes from a session that included an auction. SECOND is a dummy representing the second four periods during the experiment (during which the auction was implemented in the auction treatments), and THIRD is a dummy representing the third four periods during the experiment (after the auction was removed in the auction treatment). INAUC represents the interaction between AUCTION and SECOND and indicates the periods when an auction was actually taking place. The variable of primary interest is POSTAUC, which represents the interaction between AUCTION and THIRD. This variable captures any difference in adoption behavior, during the last four periods, between the groups that experienced an auction during the previous rounds and those that did not. If negative, POSTAUC would indicate that crowding out did occur; in other words, adoption was lower in these four periods among participants who experienced an auction, than among participants who did not. The data are analyzed separately for the social interaction and no-social interaction sessions, to see whether there were differences in crowding out between these treatments.

[Table 1 about here]

The results of the econometric analysis, presented in Table 1, confirm that crowding out did occur during our experiments. Focusing on the no-social interaction treatment first, we see that the coefficient on POSTAUC is negative and statistically significant (p-value of 0.067). In other words, compared to the control groups that did not experience an auction, participants who experienced an auction displayed less willingness to adopt BMPs after the auction had been introduced and then removed. [iii] The results also suggest that the magnitude of the crowding out effect is large enough to be of concern. In the control groups that did not experience an auction, the mean total adoption level during the last four periods was 16.75 units for the no-social interaction treatment. The crowding out effect reduced this by 3.06 units (18.3%). Were crowding out to cause an 18% reduction in BMP adoption in a real setting, this would likely be an issue of concern for policy-makers.[iv]

The results for the social interaction treatment similarly indicate that crowding out occurred in this experiment. Again, the coefficient on POSTAUC is negative and statistically significant (p-value of 0.044). The magnitude of the effect is also similar; total adoption is reduced by 2.50 units from the mean of 13.62 units in the control sessions, giving an 18.4% reduction. Thus, there is no strong evidence from this particular experiment to suggest that different social environments produce differences in crowding out. These data may indicate that the "individual" explanations for crowding out (related to theories of altruism and commitment) have some validity; crowding out does not appear to be purely a social phenomenon, since it still occurred when participants had no opportunities for social scrutiny or interaction. This does not,

however, rule out social interactions also playing a role. An important next step will be to separate the different components of "social interaction," communication (or the possibility of communication) and information provision, to get a clearer idea of what is happening in this context.

We noted above that the analysis was done with aggregate data because of concerns that communication between participants could cause individual observations to not be independent. It may, nevertheless, be worth noting that when analysis is repeated with individual observations, the results essentially agree with the aggregate results described above. The results of the individual-level analysis are reported in Table 2, with the dependent variable being the individual adoption level chosen by each participant. Again, the analysis is done separately for the social interaction and no-social interaction treatments. The model includes three additional variables beyond those included in the aggregate model. UNITCOST and BIDPAY, which control for each individual's cost of adoption and for any compensation they received during an auction, respectively.[v] LNPREV is the log of the cumulative total of the individual's previous donations. This is included to control for the possibility that any crowding out effects are simply due to satiation or moral licensing (Mazar and Zhong 2010), since individuals who had the opportunity to participate in the auction are likely to have donated more and this, separately from the auction itself, may also have an impact on behavior.

The analysis used a Tobit model to reflect the fact that participants were limited in their choice of adoption levels. The lower limit for each participant was 0, and the upper

limit was calculated separately for each participant based on how many adoption units they could afford given their per-unit cost and compensation.

[Table 2 about here]

The results shown in Table 2 are strikingly similar to the results of the aggregate analysis. Again, we can be confident that the observations in the no-social interaction treatment are independent of each other, and the magnitude of the coefficients and statistical significance are qualitatively very similar to the results from the data where participants were allowed to communicate. In particular, in both treatments the coefficients on the variable of interest, POSTAUC (which indicates the difference in adoption behavior during the last four periods between participants who had experienced an auction and those who had not), have negative signs. Furthermore, they are similar in magnitude and are statistically significant at about the same level (Table 2). This is true even when previous donations are controlled for via LNPREV, suggesting that this result is not due to satiation. In other words, these results seem to indicate that motivational crowding out took place, and that it occurred regardless of whether or not participants were able to socially interact. While we are hesitant to draw strong conclusions from this individual level analysis, because the individual observations from the social interaction treatment are likely to violate the assumption of independence, these results do provide support for conclusions drawn earlier in the aggregate analysis.

5 Conclusions

The results of this experiment provide reason to believe that crowding out may be a problem in conservation auctions. This finding adds to the growing body of evidence that demonstrates that crowding out occurs in other experimental and field situations. The present experiment was designed to provide participants with similar incentives to those that landowners would experience in a conservation auction, including both individual monetary compensation and real environmental benefits to wider society. At the same time, the laboratory context allows us to control for extraneous factors and provide a counterfactual through the control treatment. The results of the experiment show that crowding out did occur.

The next step in research would be to implement a field experiment to test the real-life validity of these findings. Obviously, decisions made by student participants in an experimental context cannot be assumed to generalize to real decisions made by landowners. However, because real conservation auctions are expensive, experiments like this one are often used to testbed experimental hypotheses and determine whether field experiments are worth conducting. To our knowledge, no field experiments of crowding out in conservation auctions have yet been done, although field experiments have demonstrated that external incentives can cause crowding out in other contexts (Frey and Jegen 2001). We suggest that the results of this experiment justify conducting field research to further test the hypothesis that conservation auctions can cause crowding out. Such research is important because if conservation auctions do cause crowding out of voluntary pro-environmental behavior, they may need to be implemented with caution in

some circumstances. For example, they may be more useful in communities where there is little voluntary pro-environmental behavior occurring, rather than in communities where there is more voluntary behavior to be crowded out. It may be especially important for policy-makers to consider this issue when implementing temporary or short-term programs where funding for BMP adoption is discontinued after a few years. Although initial BMP adoption costs have been covered and the landowner has gained knowledge about the new management practices, there may be ongoing costs for maintaining some BMPs. If the auction has crowded out voluntary pro-environmental or pro-social motivations, the landowner may not be willing to bear these ongoing costs and continue with the BMP. Designers of such auction programs should consider this possibility and implement measures to minimize crowding out. For example, information reminding landowners of the social and environmental benefits of their auctions may help restore the motivations that induced the voluntary behavior in the first place.

The experiment also attempted to distinguish between two types of economic theories that seek to explain crowding out, those that rely on social mechanisms (social norms and reciprocity) and those that rely on individual motivations (altruism and commitment). If crowding out had been found to occur only when participants were able to socially interact, this would imply that it is primarily a social phenomenon. In fact, in this experiment, crowding out occurred whether or not participants interacted. While not ruling out social mechanisms, these findings do provide some support for the individual explanations for crowding out. It seems that social norms and reciprocity are not necessary for crowding out to occur, although they may play a contributing role. Instead,

it seems that the provision of external incentives has a direct impact on people's individual motivations. However, it may also be the case that the limited social interactions between participants in the experiment were not sufficient to establish social norms, or that the pro-social behavior of participants was a response to more deep-seated social norms arising from contexts outside of the experiment. In addition, since the social interaction treatment allowed for two different social mechanisms (communication and information provision) to occur at once, it is not possible to distinguish between their separate effects. Further research focusing on these issues may shed more light on whether and how social interaction makes a difference to crowding out. Such research would be beneficial, since better understanding of the reasons behind this phenomenon may lead to ways to minimize its potential negative impacts.

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Footnotes

[i] While our discussion focuses on crowding out as a potential outcome of incentive based policies, it is also possible that "crowding in" may occur as a result of motivational crowding (Frey and Jegen 2001).

[ii] As in Reeson and Tisdell (2010), participants in all treatment groups had been told that the procedures might change during the experiment, but not how or when. This was necessary to prevent strategic behaviour from influencing the experimental results.

[iii] We also estimated a simpler version of the model, which drops the data for periods 5-9 (during which the auction took place in the auction treatment), and omits the corresponding dummy variables. The individual coefficients for the remaining variables (including those reflecting crowding out) as well as their statistical significance levels are nearly identical to those in the full model. These results are available from the authors upon request.

[iv] Note that these calculations are not directly comparable with the figures, since the figures indicate the amount that people were willing to contribute, while these calculations look at the ultimate benefit of such contributions in terms of "BMP adoption."

[v] We also estimated the model with session dummies as a way to partially account for possible interdependence between observations in the communication data. Including

these dummy variables makes very little difference to the estimated coefficients or to their statistical significance, so they are omitted here.