WORK IN PROGRESS – PLEASE DO NOT QUOTE

TRIGGERING COOPERATION

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Abstract

State owned forest, especially in developing countries, suffer from lack of funds to efficiently manage the forest. In particular, this results in unsustainable rate of deforestation. As a result, decentralization of ownership to local institutions (devolution), for example forest user groups, has been suggested. We propose and experimentally test for the relevance of voluntary participation in the form of *opt-out option* as a policy tool that could potentially trigger the establishment of cooperative institutions after devolution of forest rights to community members. The basic idea is that community members choose between joining a (devolved) forest user group or an opt-out option. The opt-out option provides some benefits to those who choose it, but potential benefit is higher if one joins a forest user group, provided that there is cooperation among the users. By framing the social dilemma game after devolution as a multiplayer prisoner's dilemma game, we hypothesize that such an opt-out option could serve as a coordination tool in the presence of social preferences and forward induction. We conduct a lab-in-the field experiment in Ethiopia to test this. Our results show that, not only do most people reject opt-out options that provide a significant amount of money, the level of cooperation is higher among those who reject opt-out options than those who were not offered an opt-out option. Opt-out options can therefore serve as a cheap policy tool to trigger cooperation among forest user groups after devolution reforms.

Key Words: forest devolution, cooperation, opt-out options,, social preferences, forward induction, Ethiopia, experiment.

1. Introduction

One of the leading sources of greenhouse gas emissions is deforestation, and a large part of deforestation takes place in developing countries. Approximately 75% of the forested area in developing countries is state owned and the management of the forest has in many cases been poor shown by the high rate of deforestation. There are many potential reasons for this and key explanations are linked to weak institutions with lack of resources to implement and monitor efficient management of forest. One measure to counteract this negative trend has been to implement devolution of forests rights from state to local levels ranging from villages to single individuals. The basic idea is that people living in the local neighborhood would manage the forest more efficiently since they are directly affected by the quality and quantity of trees and bushes in their neighborhood forest rather than if the forest managed as open-access or by a weak state. The success story of efficiently managed resources if decision power is decentralized has been supported by the work conducted by Elinor Ostrom and discussed for example in her book *Governing the Commons* (Ostrom, 1990).

During last decades several millions of hectares of forest have changed hands to local management, but lately this trend seems to be broken (Rights and Resources Initiative, 2014). An important feature of the institutions studied by Ostrom is that they build on existing institution and often developed over longer period of time. One important reason for this might be that the more recently established institutions might in fact build on weak local institutions which then explain poor management and less new institutions being established. An important question is then how forest should be handed over to local institutions to avoid that the ‘tragedy of the

commons' at local level. In fact, this is a larger problem than just being related to forest but it is also applicable to other natural resources most notably fishery.

The main issue for policy-makers when establishing local institutions, for example as forest users groups (FUGs), is to manage to convince the members to use the resources in a sustainable way. One option could of course be to invest in monitoring but such an option is often not possible in most developing countries, even so the institutions are often weak to punish wrong doers. Our policy proposal builds on insights from behavioral economics that social preferences could transform social dilemma problems into coordination problems. Our idea is to use an *opt-out option*, i.e., the option to a member in a village to either join a local institution, e.g., FUG, to manage a resource, e.g., forest, or decide not to do so and receive a compensation for not doing so. The opt-out option provides some benefits to those who choose it, but potential benefit is higher if one joins a FUG, provided that there is cooperation among the users. Our proposal builds on the fact that the opt-out option serves as a coordination tool in the presence of social preferences and forward induction. That is, people reject the opt-out option in order to join a FUG with the intention to cooperate. That is, devolution with opt-out option results in higher cooperation than devolution without opt-out option.

We test our conceptual framework by conducting a lab-in-the-field experiment among rural household heads in the Ethiopian highlands. Ethiopia is one of the countries in the developing part of the world that is suffering from high rate of deforestation and weak state institution for locally managed forest. Four centuries ago, about 40% of Ethiopia was covered by forest and today it is less than 5% due to agricultural expansion and heavy reliance of fuelwood. At the

federal level, Ethiopia does not have the resources for proper forest management and thus forest management has been decentralized to state level. In the early 2000s, Participatory Forest Management (co-managed FUGs) emerged in Ethiopia and in the coming 5 years 2 million ha will be devolved to the groups. The initial evaluation of Participatory Forest Management shows that speed of deforestation has been reduced explained by less illegal tree cutting, more tree planting and members of Participatory Forest Management stopping others from letting their cattle grazing in the area.

2. Conceptual Framework

Consider a state-forest that is planned for devolution to members of a nearby community. Furthermore, assume that the state is interested in forming forest user groups (FUGs) of size *n* users (e.g., households), and handing parts of the state forest to each FUG. Let us also assume that the total number of potential users in the community is strictly larger than *n*, but there is still enough forest to be devolved if all potential users were to be members of FUGs. An important feature of such a devolution process is that it essentially creates a social dilemma problem, where there is a mismatch between individual interest and collective interest in an FUG. We are interested in how the *approach* of FUG formation is related to the capability of FUGs to deal with the ensuing social dilemma problem. Our analysis is based on the underlying assumption that the potential benefit of being a member of an FUG is directly related to the level of cooperation among all members.

A straightforward approach to form FUGs – one that has been applied in varying contexts around the world – is where target users are assembled into FUGs of desired size. We consider the simplest way of doing this: randomly matching potential users into FUGs of size *n*, and handing

them a tract of the forest. The social dilemma problem in such a situation can be represented as a *Multiplayer Prisoner's Dilemma* (MPD) game with *n* players, where each member of an FUG decides to cooperate or defect regarding the contribution of a given endowment *E* in their possession. The endowment can be related to anything that the member can do or cannot do voluntarily, but that has welfare implications to the member as well as matters to the success of the FUG in efficiently managing their forest. Such kind of MPD game would have the following equilibrium properties depending on whether players are purely selfish or not:

- If players are selfish (i.e., only care about their own material payoff), there is a unique Nash equilibrium for the MPD game where everyone decides to defect, resulting in the tragedy of the commons after the devolution.
- If players have social preferences (e.g., inequality averse as in Fehr and Schmidt, 1999), the MPD would become a *coordination game* with Pareto-ranked multiple equilibria.

In either scenario, there is a risk for the tragedy of the commons, where the FUG fails to institute the local institutions that ensure the sustainable management of the forest. In-deed, there is now considerable amount of evidence showing that people harbor social preferences – they care about the payoff of others, not least others for those whom their actions have an impact upon. It can therefore be argued that we are dealing with a coordination problem. That is, in the presence of social preferences, the MPD game is transformed from a pure dilemma problem with a unique equilibrium of full defection to a coordination game where full cooperation and full defection are both Nash equilibria.

We propose a specific way of forming the FUGs that would result in the coordination of members in the cooperative outcome. In our policy proposal**,** potential users are first offered a choice between being members of an FUG and an opt-out option with some benefit. For example, the opt-out option could be a one-time cash transfer or a right to use part of the forest that will continue be state forest. Those who reject the opt-out option are then randomly matched into FUGs of size *n*, and handed a tract of the forest. We argue that, if the benefit of the opt-out option is *higher than what would be achieved by full defection but lower than what we would be achieved by full cooperation* in the MPD game, those who reject the opt-out option will coordinate in full cooperation. That is, the opt-out option provides people with social preferences the opportunity to give a credible signal about their intention to cooperate in the MPD game. The interesting feature of the opt-out option is therefore that it is most useful when it is rejected. This outcome is achieved through a game theoretic concept termed as *forward induction*[1], where past choices tell stories about predicted future choices, which in turn may affect initial choices. Players with social preferences at first prefer the opt-out option since it provides a higher payoff from playing the game and reaching full defection, and they also expect other players to prefer it. This would lead to the realization that one could achieve a higher pay off by rejecting the opt-out option and choosing cooperation.

3. Experimental Design and Procedure

We conduct experiments that replicate the MPD game discussed in the previous section. We have three treatments:

[1] For discussions of forward induction see e.g. Kohlberg and Mertens (1986), Van Damme (1989), Ben-Porath and Dekel(1992), Battigali and Siniscalchi(2002), Asheim and Dufwenberg(2003).

(i) **No opt-out option (benchmark treatment):**experiment participants are randomly matched in groups of 4 players and play an MPD game

(ii) **Low-value opt-out treatment**: experiment participants first choose between an opt-out option, with value closer to per capita payoff from full defection than to that of full cooperation. Those who reject the opt-out option are randomly matched into groups of 4 and play the exact MPD game as in (i).

(iii) **High-value opt-out treatment:** experiment participants first choose between an opt-out option, with value closer to per capita payoff from full cooperation than to that of full defection. Those who reject the opt-out option are randomly matched into groups of 4 and play the exact MPD game as in (i).

Each subject in the group of 4 playing an MPD game is endowed with 50 Ethiopian Birr[2] and then she is asked to decide whether or not to cooperate. If cooperate, then the 50 Birr was invested in the public good, and if defected the 50 Birr was invested in a private account. Note that players made a binary decision whether to contribute or keep their endowment. The marginal per capita return was set to 0.5. Thus, this results in a conflict between the self-interested choice to free-ride and the social optimum to contribute to the public good. Thus, the payoff function for subject *i* expressed in Ethiopian Birr from the prisoner's dilemma game is then

$$\pi_i = 50 - c_i + 0.5\sum_{j=1}^{4} c_j ,$$

[2] 1 USD was about 19 Birr during the time of the experiment (official exchange rate). A full-day hired wage for a farm worker in the area where we conducted our experiment was between 50 and 60 Birr, indicating that the stakes in our experiment were quite high.

where *c* is the amount invested in the public good, which can either be 0 or 50.. The binary nature of the choice means that we had only 5 different outcomes ranging from full cooperation to full defection. The payoffs for a given player are shown in Table 1. Subjects in the baseline treatment were simply randomly matched into groups of 4 and played the above MPD game. The matching was done anonymously, and all that subjects knew was they are playing against three other people in the room. Decisions were made simultaneously. Subjects in the low-value opt-out treatments were first offered to choose between playing the above game or going home with 60 Birr. Those who rejected the opt-out option were then randomly matched into groups of four and played the MPD game. Subjects in the high-value opt-out treatment were offered with the choice of playing the MPD game or going home with 80 Birr instead. In each opt-out treatment, subjects knew they would be playing against players who have rejected the opt-out option, and they knew this before they chose between playing and opting out. A key difference between the two opt-out treatments is that, while only partial cooperation could be enough to achieve higher payoff than the opt-out option in the low-value treatment, only full cooperation can result in higher payoffs than one gets by opting out in the high-value treatment. Loosely speaking, while the signaling power increases with higher-value opt-out, the associated risk of not achieving a higher payoff also increases.

In the experiment we had one baseline experiment, which is the one described above, and then two treatments. It is a between subject design and subjects were randomly selected for one of the three different types of experiments. The two treatments had in common that an opt-out option was introduced, where we varied the amount that would be received for sure if the opt-out option was chosen; (i) 60 Birr or (ii) 80 Birr. In the option with opt-out, subjects first decided if they

would like to be a member of a group with four people and play the public game described above or to earn a fixed amount for opting out (either 60 Birr or 80 Birr depending on treatment). If subject decided to play, they also marked with ticking a box on the very same decision sheet if they decided to cooperate or to defect in the prisoner's dilemma game.

The experiment was conducted in the locality of Azezo, North Shoa Zone, the Amhara Region, Ethiopia. A total of 327 subjects participated in the experiment. All our subjects were household heads whose main form of livelihood was agriculture. The households also depended on local forests for their fuel wood and timber needs, and most of the forests were state owned. Many of our subjects are therefore likely to be the target users if forest devolution programs were to be implemented in the area. The experiment was conducted in three consecutive days in a local school, located in a small town that serves as the market place for a number of *kebele*s[3] in the area. Households from three surrounding kebeles were randomly selected from household rosters, and people were invited to show up for our experiment in a given day. No information about the experiments was given except that there would be a show up fee of 10 Birr, and an opportunity to earn more money. Each day was slotted for each treatment, with two sessions – one in the morning and one in the afternoon. To avoid word-of-mouth effects, participants of the afternoon sessions were made to arrive just before participants of the morning session left, and they were invited to snacks in a waiting room. To deal with the fact that most adults in the area have very limited formal education, the experiment was designed to be conducted orally in the local language (Amharic), with the aid of posters and real-time demonstrations. An English language version of the instructions used for the experiment is included in the Appendix.

[3] Kebele is the lowest administrative unit in Ethiopia. The geographic and population size of kebeles differs from place to place, but most kebeles consist of hundreds of households.

4. Results

In Table 2, we present the descriptive statistics of our experiment. In the first column we present the result from the baseline treatment, where subjects played the MPD game without opt-out option. 40.4% of the subjects in this treatment decided to defect while 59.6% decided to cooperate. In the next 2 columns we present the results from the low-value opt-out option treatment. First, we note that only 10.5% of the subjects in this treatment decided to choose the opt-out option going home with 60 Birr rather than playing the MPD game (with an endowment of 50 Birr). Among those who rejected the low-value opt-out option and played the MPD game, 70.3% cooperated while 29.7% percent defected. A simple proportion test shows that there is a significant increase in cooperation compared to the game when there was not cooperation. The last two columns show results from the high-value opt-out treatment, where the proportion of subjects choosing the opt-out option of going home with 80 Birr is 24.0%. While this is significantly higher compared to the low-value opt-out treatment, it is still remarkable that more than three-fourth of the subjects rejected 80 Birr to play the MPD game with endowment of 50 Birr. The decisions among those who reject the opt-out also reflect the increased signaling power: close to 78.5% of the subjects cooperate, a level of cooperation that is almost 20% higher than the baseline case.

In order to evaluate our policy suggestions, we calculate the welfare gain from our suggested policy of a monetarily valued opt-out option. The benchmark in our calculation of efficiency is the case when all subjects cooperate. We normalize this to 100. In case of defection, there is of course a drop in efficiency. To illustrate, if all subjects cooperate given our chosen parameters, all subjects will gain 100 Birr, which aggregated at group level is

400 Birr. If one subject defects, then three group members gain 75 Birr each, while the defecting subject gains 125 Birr. In total, the group made in that case 350 Birr. If we normalize the benchmark case to 100, then the case with one defecting results in efficiency of 87.5 (350/400) out of 100. In case all subjects defect, they each gain 50 Birr and total group earning is 200 Birr, which is a drop to an efficiency level of 50 (200/400). In case of low-value opt-out, if all 4 group members choose to opt- out, then they gain 60 Birr each and at group level it corresponds to earning of 240. This equals an efficiency of 60 (240/400). In a similar way maximal efficiency if high-value opt-out is chosen by all is 80. In Table 3, we present our calculated efficiency numbers. Note, we use the average numbers as shown in Table 2, and hence we have weighted each type in the experiment (defector, cooperator and opt-outer) according to the proportion reported in Table 2. As can be read from Table 3, and already indicated in Table 2, the degree of efficiency increases by our suggested policy options. Given the choice of our parameters, the efficiency levels are bounded between 50 and 100. Thus, the increase of 7.25 efficiency points when comparing no opt-out option with high-value opt-out option corresponds to an increase of 14.5% (when considering that efficiency measure is bounded).

5. Conclusion

Despite their potential in realizing the sustainable management of forest resources and improving welfare of households who live close to forests, forest devolution programs run the risk of the tragedy of the commons if the necessary local institutions are not established after devolution. Integral to the emergence of such institutions is cooperation among members of forest user groups. In this study, we propose a specific devolution approach that has the potential to improve cooperation within FUGs. Our policy proposal is

based on the insight from behavioral economics that social preferences could transform social dilemma problems into coordination problems. The basic idea is that community members choose between joining a (devolved) FUG or an opt-out option. The opt-out option provides some benefits to those who choose it, but potential benefit is higher if one joins a forest user group, provided that there is cooperation among the users. We hypothesize that the opt-out option serves as a coordination tool in the presence of social preferences and forward induction. That is, people reject it to join a forest user group and cooperate. Put differently, devolution with opt-out option results in higher cooperation than devolution without opt-out option.

We test the efficacy of our policy proposal in a lab-in-the-field experiment among rural household heads in the Ethiopian highlands. We conduct three experiment treatments, a baseline without opt-out option and two treatments with opt-out options that differ on the value of the opt-out option. The results of our experiment can be summarized as follows: (i) the majority of subjects reject the opt-out option, even when it has a very high value; (ii) there is a significant increase in cooperation among those who reject an opt-out option compared to those who were not offered one; and (iii) relatively more people chose the opt-out option when it has high value, but those who reject a high value opt-out option cooperate to a higher extent than those who reject a low value opt-out option. That is, while high-value opt-out options have greater cooperative power (which is desirable), they also attract more people (which is not desirable). The results are in-line with our theoretical prediction regarding the potential coordination value of opt-out options. These results imply that beneficial opt-out options could be a good policy in the implementation of forest devolution reform. Salient features of well-designed opt-out options are that that most

people reject them and cooperate better when they become members of a FUG. That is, despite appearing expensive, opt-out options are actually cheap policy tools since most people are likely to reject them to be involved in the forest devolution program.

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Tables and Figures

Table 1. Payoff structure in the multi-player prisoners' dilemma game:

	Others' decision			
Own decision	All 3 C	2 C and 1 D	1 C and 2 D	All 3 D
C	100	75	50	25
D	125	100	75	50

C=cooperate (i.e., contribute 50); D= Defect (i.e., keep 50)

Table 2. Descriptive statistics of the experiments.

	No opt-out option	Low-value opt-out option		High-value opt-out option	
	All	All	Only not opt-out	All	Only not opt-out
Defection	**40.4%**	26.6%	**29.7%**	16.4%	**21.5%**
Cooperation	**59.6%**	62.9%	**70.3%**	59.6%	**78.5%**
Opt-out	n.a.	10.5%	n.a.	24.0%	n.a.
Number of observations	99	124	111	104	80

Table 3. Efficiency by treatment.

	Efficiency (max=100)
No opt-out option	79.80
Low-value opt-out option	82.50
High-value opt-out option	87.05