What do You Choose for Public Good Provision: VCM or Lottery?

(Extended Abstract)

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Abstract

Literature on public good provision suggests that lottery provides a level of public good that are superior to the equilibrium level provided in the VCM. In reality, however, the two mechanisms usually coexist. Why is that? One possible explanation may be that current research assumes that players are eligible to only one mechanism at a time. Remarkably not much has been done considering players' free choice between the two. This has raised many intriguing questions: When two public good provision mechanisms are available for players at the same time, which one will they choose to participate? Can two mechanisms coexist? Under what circumstances will the more efficient mechanism to prevail? This paper develops a two-stage model to address the above questions.

Keywords: Public good provision, VCM, Lottery

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1. Motivation and Research Questions

For many years, literature on public good provision attempts to solve the free-rider problems aroused by collective actions, and to seek for a mechanism that generates the most efficient levels of public good provision. Different mechanisms have been examined and compared, among which the voluntary contribution mechanism (VCM) and lottery are the most frequently discussed.

In typical literature on the VCM (see Ledvard 1995), players decide how to spend their endowment wealth. A player can either keep these wealth for himself or invest them into a public account. The money in the public account will be used to finance a public good. Each player can equally benefit from this public good. Theoretically, the socially efficient outcome require all players to contribute all of their endowment wealth to the public account. However, the dominate strategy for each player is to contribute nothing and free-ride other players' contribution. This leads to under provision of public good in equilibrium. Though one-shot laboratory experiments usually report more contribution than Nash equilibrium predictions, the contributions usually decay over time when the game is played

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repeatedly (see Isaac and Walker 1988, Andreoni 1988 1995, and reviews of literature in Chaudhuri 2011).

Another strand of literature attempts to deal with the free-rider problem using lotteries as a means to finance public goods. The standard settings for this line of work is that each lottery player can contribute to the public good provision by purchasing lottery tickets. Players can also win a lottery prize. The probability of winning depends on this players' contribution level, relative to the total contribution of other players. Theoretical and experimental studies suggest that lotteries lead to higher levels of public good provision than the equilibrium level provided in the VCM, since in lotteries players' contribution in the public account also win them a chance to increase their private wealth (e.g. Morgan 2000; Morgan and Sefton 2000; Lange, List and Price 2007; Corazzini, Faravelli, and Stanca 2010).

In reality, however, charities and non-profit organizations receive their funding for public projects from both sources: voluntary donations from individuals/organizations, and lotteries (e.g. Ruffles and Bingos). If lottery generates higher public contribution than the VCM, why we observe the coexistence of the two mechanisms in reality? Notably, a common assumption for the above two lines of work is that both theoretical and experimental research, is that players are only eligible to one mechanism (either VCM or lottery) at a time. However, in reality, players can freely choose to participate in different charity activities. This has raised a series of intriguing questions, which set the starting point of our paper: Which mechanism will players prefer if they can freely choose between VCM and lottery? Can the two mechanisms coexist? Under what conditions can one expect the more efficient public good provision mechanism to prevail? This paper develops a two-stage game to answer the above questions.

2. Model Set-up

To address the above questions, this paper designs a two-stage game, assuming players can freely choose from two public good games (the VCM and the lottery) at different islands. At stage 1, each player chooses one of the islands in order to play the corresponding public good game. At stage 2, each player observes the number of players on her island, chooses a level of contribution, and plays corresponding public game with other players on the same island. The design of VCM game follows the typical settings in a standard public good game as we introduced at the beginning (see Ledvard 1995), the symmetric Nash equilibrium strategy for each player is to contribute nothing. The design of lottery game follows the settings in Morgan (2000), which is also discussed at the beginning of this abstract.

3. Findings and Discussion.

Using backward induction, we describe three sub-game perfect equilibria (SPEs) for our two stage game: (1) At stage 1, all players choose to participate in VCM; at stage 2, each player adopts the symmetric equilibrium strategy, that is, contribute nothing to the public account. (2) All players choose to participate in the lottery at stage 1; at stage 2,

each player on the lottery island contributes according to the symmetric equilibrium strategy. (3) At stage 1, some players participate in VCM, and others go for lottery; at stage 2, players in both games play according to the corresponding symmetric equilibrium strategies. The third SPE resembles the coexistence of two mechanisms observed in real life. However, in this case, the number of people on the lottery island is not sufficient to generate efficient public good provision. Typically in literature on lottery games, the group size is fixed so that the public good provision is efficient. In this study, we remove this group size restriction and predict a SPE when public good provision is not efficient. For a certain set of parameters, our model also allows multiple SPEs to coexist. Specifically, SPEs (1) and (3) may coexist, and SPEs (2) and (3) may coexist.

4. Multiple SPEs

When we only have unique SPE, the prediction is clear. But when our model predicts more than one SPEs, one is then left to think about the long run equilibrium selection between the two mechanisms. To solve this, we introduce the evolutionary setting, following the approach in Kandori, Mailath and Rob (KMR 1993). In each discrete period, a group of boundedly rational players play this two-stage game. We assume players' actions at stage 2 is independent from time. Players use a myopic best reply rule in each period. That is, each player myopically believe that what happened in the previous period will re-occur in current period, and therefore, he plays a strategy that is the best reply to the strategies of other players in the previous period. Based on this setting, we first find absorbing states in the short run. Following the short run predictions, we analyze the long run equilibrium selection among the absorbing states, assuming players make mistakes with positive probabilities. The long run analysis predicts the stochastic stability of the two mechanisms.

Under evolutionary settings, the short run prediction suggests three absorbing states: 1) all the players go to the VCM island, and VCM prevails; 2) all the players go to the lottery island, and the lottery mechanism prevails; and 3) players end up on both islands, and hence two mechanisms coexist. In addition, our model also allows absorbing states 1) and 2) to coexist, and absorbing states 2) and 3) to coexist in the short run, under certain circumstances. The short run predictions depend on initial conditions. It is revealed that when players can choose between two public good provision mechanisms, lottery does not necessarily prevail in the short run. Under some circumstances, VCM outweighs lottery, and prevails. Coexistence of two mechanisms is possible in short run dynamic settings, but only occurs when lottery is inefficient. Finally, the model predicts two possible long run equilibrium selections between lottery and VCM, under different circumstances. The characteristic of the associated parameters are discussed.

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