An Experiment Illustrating the Provision of Discrete Public Good under Asymmetric Information

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Motivation

Suppose an Economics department needs to hire a new faculty member and needs to form a search committee. Who will serve on the committee? Suppose that a community needs a new bridge. Who will pay for the bridge if public funds are unavailable?

There are many situations like this where a public good needs a certain number of voluntary contributions for the good to be provided. In many cases the costs of contributing differ across individuals and are not publicly known. This is a static game of incomplete information. To illustrate the game, I conduct a classroom experiment based on the 2-player game from Fudenberg and Tirole (1991) and show students how rational players make decisions consistent with Bayesian equilibrium.

Experiment

To start, the instructor explains the basic structure of the game.

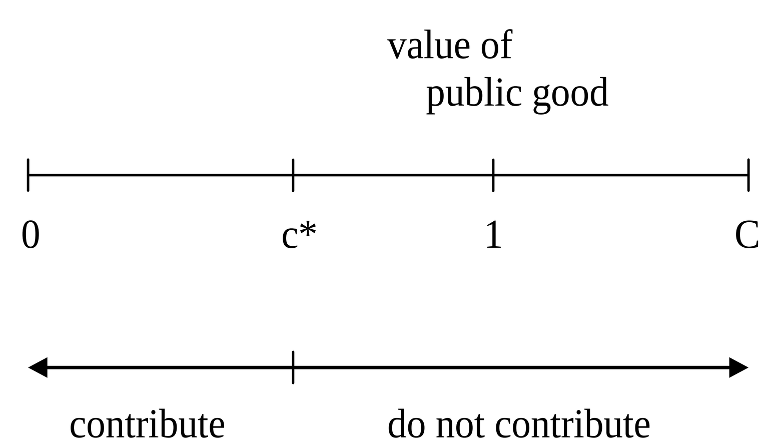
There are N students in the class (N=19). Each student has two actions: "contribute" or "don't contribute". The cost of contributing is assigned to each student before each round of play (the number is independently drawn from a uniform distribution on [0,C] where C>1 (C=2 for this experiment)).

If at least K ($0 \le K \le N$) students contribute, the public good will be provided and everyone receives a benefit of 1. Students who chose to contribute have to pay the previously determined costs if the public good is provided. If fewer than K students contribute, then everyone receives 0.

The instructor chooses K before each round of play. The number of rounds can vary as well as the value of K and the maximum cost, C, depending on the instructor's objectives.

What Theory Suggests

The theory suggests that there exists a unique, symmetric Bayesian equilibrium with a positive cut off cost: players with costs less than c^* choose to contribute, and players with costs more than c^* choose not to contribute (Nishikawa (2007)).
Also, the cut off cost c^* is increasing in K and C.



Results

Round of play	K	The cut off cost c*	# of players with cost under c*	Actual number of contribution	Public good provided? Blue: as predicted Red: not as predicted	# of players who didn't contribute even though the cost was under c*	# of player who contributed even though the cost was above c*
1	19	1	9	9	No	1	1
2	5	0.413	4	5	Yes	1	2
3	10	0.627	9	13	Yes	0	4
4	4	0.364	1	5	Yes	0	4
5	2	0.252	3	5	Yes	0	2
6	18	0.952	9	8	No	3	2
7	9	0.587	3	5	No	1	3
8	11	0.667	8	10	No	0	2
9	14	0.784	4	5	No	0	1
10	0	0	0	0	Yes	0	0
11	7	0.504	4	9	Yes	0	5
12	12	0.706	5	8	No	1	4
13	1	0.181	1	5	Yes	1	5
14	13	0.745	5	7	No	0	2
15	17	0.907	8	7	No	1	0
16	3	0.311	4	5	Yes	2	3
17	6	0.459	5	7	Yes	0	2
18	15	0.824	9	9	No	1	1
19	8	0.546	3	6	No	0	3
20	16	0.865	7	7	No	2	2

Discussion

The results show that students tend to over-contribute to the public good. In 5 out of 20 rounds, the public good was provided although the theory predicted otherwise. Some students chose to contribute if their costs were less than 1, instead of c*. One explanation for over-contributing is the structure of the game: if fewer than K contribute, everyone receives zero. If contributors must pay the cost even if the public good is not provided, students will be more cautious about contributing. Some students played inconsistent strategies in the early rounds but their strategic behavior improved in later rounds.

References

Fudenberg, D., & Tirole, J. (1991). *Game theory*. Cambridge, Mass. and London

Nishikawa, S. (2007). Preliminary Analysis of Dynamic Voluntary Public Good Provision Game with Incomplete Information, working paper

Sample Sheet

Classroom Experiment: Public Good provision under incomplete information

$N=\{1,\ldots,n\}$

A_i={Contribute, Don't Contribute}

$\Theta_i=[0, 2]$ Types for player i = cost of contribution $0 \le c_i \le 2$

The cost is independently drawn from Uniform distribution function on [0, 2].

If at least K ($1 \le K_i \le n$) players contribute, the public good with value 1 will be provided.

If less than K players contribute, everyone receives 0.

Player 1

Round of play	Your cost of contribution	K	Your action	Actual number of contribution	Your payoff
1	0.88	19			
2	0.51	5			
3	0.22	10			
4	0.61	4			
5	0.18	2			
6	0.76	18			
7	0.45	9			
8	1.57	11			
9	0.09	14			
10	1.23	0			
11	1.53	7			
12	1.34	12			
13	0.58	1			
14	0.39	13			
15	0.02	17			
16	1.59	3			
17	1.69	6			
18	1.2	15			
19	1.44	8			
20	1.15	16			
Total payoff					

Post Experiment Survey

Q1: The procedures were easy to follow and thoroughly explained before the experiment.
Q2: I had a clear idea about my own strategy before the experiment.
Q3: The experiment was very helpful in making the connection between the theoretical analysis and the actual decision making process.