MW24.2 Experimental Economics (SS2022)
Public Goods Game

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Public Good Problem

* non-rival (of consumption) $\sim$ property of a commodity s.t. its consumption by one individual does *not* diminish the amount available to others

* non-excludable $\sim$ property of a commodity s.t. no individual can be prevented from consuming it

	Non-excludable	Excludable
Non-rival	(pure) public good[a]	club good[b]
Rival	common-pool resource[c]	private good[d]

Examples:

a) national defense
b) coded broadcast
c) public park
d) food

Private good:

$\Rightarrow$ all costs and benefits are *internalized*; hence free markets provide at the optimal level ($\sim$efficient markets hypothesis)

Public good:

* because of non-excludability, there is a *positive externality* enjoyed by those who did not pay for the production

$\Rightarrow$ not all benefits are internalized; hence the producer(s) will generally underprovide in free markets

$\Rightarrow$ in reality, typically provided by the government (supported by taxes)

(?) can the *voluntary contribution mechanism* (VCM) provide the optimal level of a public good?

VCM / Linear Public Goods Game

* Simultaneous-move, n-person game. Each player i is endowed with a budget of y and must split it between contribution to the public account g_i, s.t. $0 \leq g_i \leq y$, and his private consumption $y - g_i$. Once all the contributions have been made, each player receives the total sum multiplied by a factor of a, s.t. $a \in (\frac{1}{n}, 1)$.

* individual payoff:

$$\pi_i(g_i, ..., g_n) = y - g_i + a \cdot \sum_{j=1}^{n} g_j,$$

where: $a \sim$ marginal per capita return (MPCR)
$\sum_{j=1}^{n} g_j \sim$ total amount of the public good produced

$\Rightarrow$ dominant strategy: contribute *nothing* since $a < 1$ (i.e., free ride)

$\Rightarrow$ social optimum: contribute *everything* since $n \cdot a > 1$

$\Rightarrow$ essentially, it's an n-player continuous space Prisoner's Dilemma

Marwell and Ames [1981]

* telephone/mail public goods game [Table 1]

* predictions from six prominent economists and one sociologist:

  — one economist said, theory had no relevant predictions!

  — the rest said, theory predicts investments under 5%, but themselves predicted $\sim$ 20% on average ("people like taking risks"/altruism)

$\Rightarrow$ 12 various manipulations confirm the weak free riding hypothesis; 40–60% contributed on average [Table 2]

$\Rightarrow$ more than three out of every four subjects stated that "about half" or more should be contributed

$\Rightarrow$ more than one out of every four subjects considered it "fair" to contribute everything

$\Rightarrow$ correlation of only 0.23 between what was considered "fair" and actual investment

Goeree et al. [2002]

* comparative statics of VCM w.r.t. MPCR and group size

* individual payoff:

$$\pi_i(g_i, ..., g_n) = y - g_i + a_i \cdot g_i + a_{-i} \cdot \sum_{j \neq i}^{n} g_j,$$

where: $a_i \sim$ internal return
$a_{-i} \sim$ external return

$\sim$ decompose MPCR: private cost of contribution versus value of own contribution to others

* within-subject design; 10 treatments; random rematching; strategy method [Table 1]

* endowment of 25 tokens; private account pays 5; internal return < 5; social return > 5 [Table 1]

Results: [Fig. 1]

$\Rightarrow$ higher internal return increases contributions

$\Rightarrow$ higher external return increases contributions

$\Rightarrow$ larger group size increases contributions

$\Rightarrow$ contributions respond to the aggregate benefit

$\Rightarrow$ stochastic model fit to the data favors linear altruism as opposed to "warm-glow" altruism or mix between the two; no evidence of pure altruism [Fig. 3]

$\Rightarrow$ men and women appear to have the same average levels of altruism but the latter distribution is more 'compact' [Fig. 2]

Fischbacher et al. [2001]

* one-shot public goods game; strategy method for conditional contributions

(?) are people *conditionally* cooperative?

* 4-person group; 20 tokens; 0.4 MPCR

* conditional stage: *average* contribution known → strategy elicited

Results: [Fig. 1]

⇒ 50% of the subjects are conditionally cooperative

⇒ 30% of the subjects are free riders

⇒ 14% of the subjects exhibit "hump-shaped" contribution patterns

⇒ average behavior is conditionally cooperative

⇒ conditional cooperators exhibit a *self-serving bias*, which may explain the deteriorating contributions in repeated settings[1]

Croson [1996]

* Repeated public goods game; partners versus strangers

* 10 + 10 periods; between-subject design

(?) Do contributions deteriorate over time due to learning (to play the free-riding equilibrium) or strategic reasoning à la Kreps et al. [1982]?

* 4-person group; 25 tokens; 0.5 MPCR; aggregate contribution known

Results: [Fig. 1]

⇒ contributions are dropping over time and appear to converge as far as the treatments

⇒ partners' contributions dominate those of the strangers

⇒ significant restart effect for the partners

⇒ "strategies hypothesis" consistent with the data

⇒ partners exhibit higher variance as far as individual contributions

[1] Common finding in the literature, similar to the repeated Prisoner's Dilemma play.

Suggested Literature

- Charles A Holt. *Markets, games, & strategic behavior*. Boston Pearson Addison Wesley, 2007 [Chapter 26]
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* Ernst Fehr and Simon Gachter. Cooperation and punishment in public goods experiments. *American Economic Review*, 90(4):980–994, September 2000