

MW24.2 Experimental Economics (SS2023)

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:

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

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:

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

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 settings¹

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

¹Common 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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