Public goods experiments

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Overview

- Public good and free rider problem
- VCM model and equilibrium
- Factors alleviating cooperation
- Selected designs (threshold, lottery, sanctions)
- Applications
  - Tax compliance

Public good

- Non-rivalrous

- Non-excludable

=> „Market failure", i.e. impossibility of voluntary contribution

PG and games

Prisoners dilemma

	Cooperate	Defect
Cooperate	1,1	-1,2
Defect	2,-1	0,0

Game of Chicken

	Straight	Turn
Straight	-10,-10	2,-1
Turn	-1,2	0,0

To defect is dominant strategy

No dominant strategy

Unique Nash equilibrium is

Usually multiple equilibria

Zero contribution

PGG as Coordination problem

Voluntary Contributions to PG: the Model

- the participants decide which part of their disposable income (y) they would contribute to a PG (g_i) and which part they would keep

$$\pi_i = y - g_i + a\sum_{j=1}^{n} g_j$$

- a – Marginal Per Capita Return (MPCR)

- **Corner solution - Invest all if $a>1$, else nothing**

Why people cooperate?

- Social preferences
  - Altruism, warm glow, efficiency-seeking motives
  - Conditional cooperation, reciprocity

- Strategic cooperation
  - Strategies such as Tit-for-Tat can support cooperation among selfish players

- By mistake
  - Do not understand that $c_i = 0$ is dominant
  - Do understand dominance but make systematic errors

Altruism, warm glow

- Becker (1974) Andreoni (1990)

- Motives to donate
  - Pure altruism U=U(G)
  - Social contract that prevent free riding
  - **Warm-glow**

  => Theory of impure altruism U=U (X,g,G)

PG Experiments objective

- Why people cooperate
  - Testing the theory; explaining why people contribute as much or as little as they do;

- How we can alleviate cooperation
  - Manipulating parametres;
  - Designing alternative mechanism so that public goods will be provided at efficient levels.

Possible designs

- One-shot or (infinitely) repeated

- Partners or strangers ⬚

- Equal or unequal endowments ⬚

- Equal or unequal MPCRs ⬚

- Simultaneous or sequential decisions ⬚

- Feedback (on all or average contribution) ⬚

Stylized facts

Three main categories (Ledyard, 1995):

- **Environmental variables** (easy to control - MPCR, number of subjects, repetition, gender)
- **Systemic variables** (control is more difficult - beliefs, economics training, experience, risk attitudes)
- **Design variables** (factors identified by experimentalists, aspects of institutional design - enabling of communication, unanimity rules, or moral suasion.

Standard results

- Initial cooperation of 40-60%, cooperation declines with repetition ⬚

- Some effects:

Positive

(i)   Strong
  - MPCR
  - Partners
  - Communication

(ii) Weak
  - Gender (Women)
  - Group identification (friendship)
  - Threshold

Negative

(i)   Strong
  - Experience
  - Heterogeneity

(ii) Weak
  - Economic training
 - Unanimity
  - Group size (large) ?!

Alternative mechanisms

- Threshold

- Decentralized Punishment (Rewards)
  - Fehr and Gächter (2000, 2002); Nikiforakis (2008), Dunant-Boèmont et al. (2007)

- Lottery (raffle)
  - Morgan (2000), Dale (2004)

- Hundreds of others (voting, Groves-Ledyard,…)

Threshold (provision point)

- PG provision conditioned by some minimal amount of contributions

- Theoretical equilibrium change (PD=>chicken)

- Game of coordination

- Reimbursement of funds if threshold not met

Threshold (provision point) - results

Average Contribution to the Group Account by Different Groups

Source: Authors
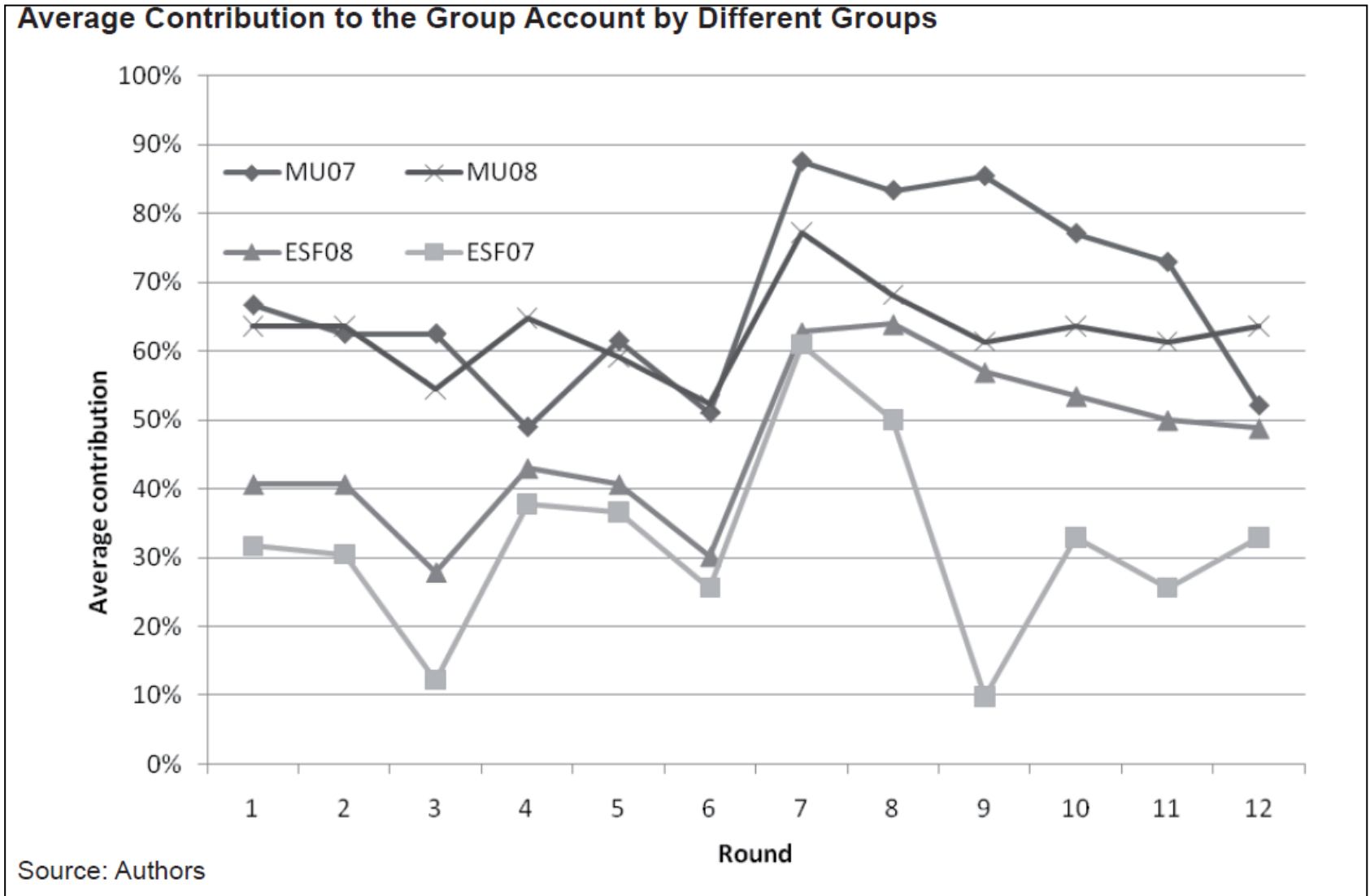
Threshold – results (2)

- Convergence to Nash
- Increase in contributions
- Effect of communication (followed by steep drop)
- Weak effect of experience and economic training

Charitable lottery

- Joint supply of public and private goods
- Prize mechanism
  - Fixed prize
  - Prize as ration of contributions
- Increase in contribution for fixed
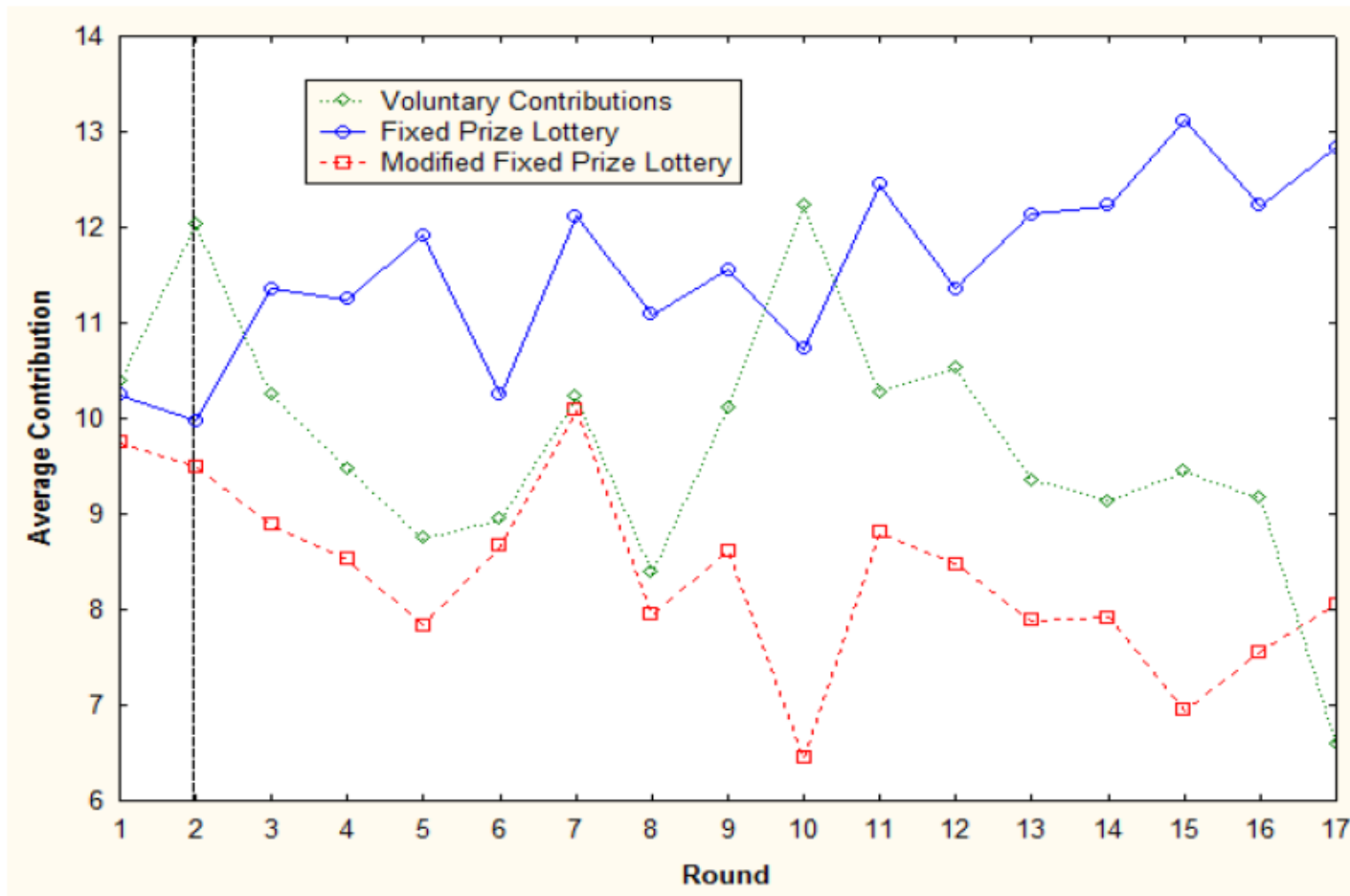
- Prize as a cost of lottery

Charitable lottery – results (1)

- 108 subjects Masaryk University and Lobachevsky University (Russia)
- 15 rounds
- Earnings 205 CZK (8 €) and 95 RUR (4€)
- Three designs
  - VCM
  - Fixed prize with p depend on contribution (FPL)
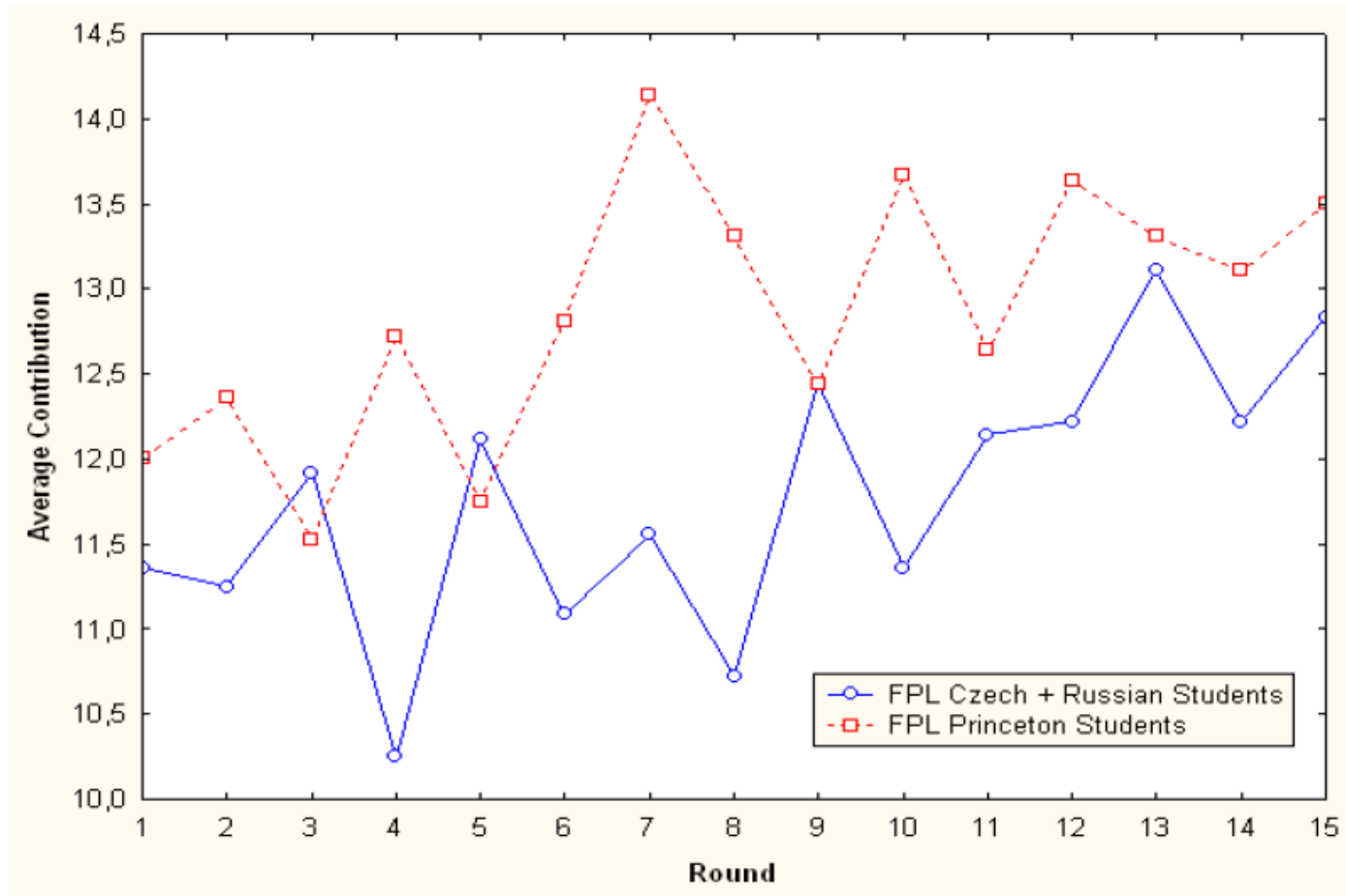 - Fixed prize with equal p (MFPL)

Charitable lottery – results (2)

Average Contributions to the Group Account According to Treatment

Charitable lottery – results (3)

Average Contribution under FPL "by Continent"

Decentralized Punishments

- Subjects informed about individual contributions and given an opportunity to punish their co-players by distributing points reducing the current incomes.

- Punishment is costly

- Change of game equilibria (if credible threat)

- Fehr, Gachter (Nature, 2002), Hermann, Thoni, Gachter (Science, 2008)

Decentralized punishment - results

- 188 subject Masaryk University 2009
- Replication of Denan-Boèmont et al., 2007
- No country effect
- possibility of decentralized punishment had a positive effect on voluntary cooperation
  - Less effective in stranger matching
- Ruined by counter-punishment
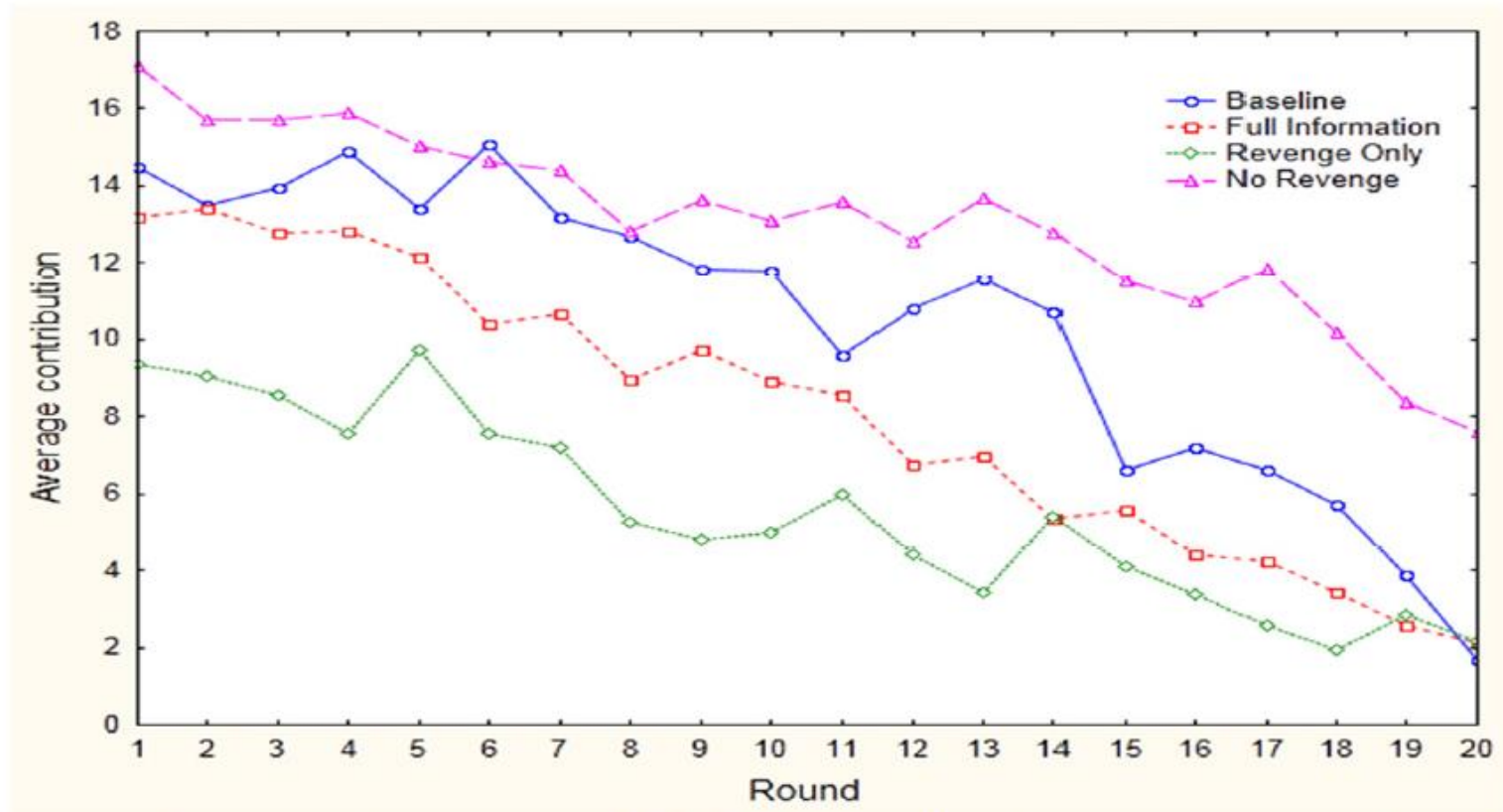
Decentralized punishment – results (2)

Figure 1. Strangers' average individual contributions (*Source: Author*)

Applications – Tax compliance

- Model

$$E[U] = (1-p)U(W-\theta X) + pU\big(W-\theta X-\pi(W-X)\big)$$

- If *p* and π low => dominant strategy to evade

- Variables of interest
  - *Probability of audit p*
  - *Penalty rate π*
  - Tax rate θ

Tax compliance - results