5. Public goods experiments

- The problem of voluntary cooperation
- Motives (not) to cooperate
- Measuring conditional cooperation
- Economic Applications: Social interactions
- The importance of social sanctions
- A public goods game with punishment
- Emotions

Cooperation problems

- Hunting and gathering
- Common pool resources
- Environmental protection
- Teamwork
- Organizations
- Politics & Voting
- Collective Action
- Charities
- Public goods
- ...

The voluntary provision of public goods

- Private markets do a very good job supplying an efficient amount of private goods (if contracts are complete and if there is competition).
- However, in general private markets do not supply an efficient amount of public goods.
- Reason: private marginal benefit $\neq$ social marginal benefit (Samuelson 1954).
- Thus: if we have to rely on private provision, there will be an inefficient undersupply of the public good. See also Olson (1965) and Hardin (1968)
- Are the prospects really that bleak?
- Tool: lab experiments

A simple workhorse for studying social dilemmas

- Groups with n members
- Each member has endowment of z "tokens"
- Each group member decides simultaneously about c_i
  - c_i investment in public good
  - private good: $(z - c_i)$
- Payoff function for each group member i:

$$\pi_i = (z - c_i) + \alpha \sum_{j=1}^{n} c_j$$

- Public good: sum of all investments c_j

Example

- $n = 4$; $z = 20$; $\alpha = 0.4$
- Prediction: $c_i = 0$, $\forall$ i , which implies an inefficient level of contribution!

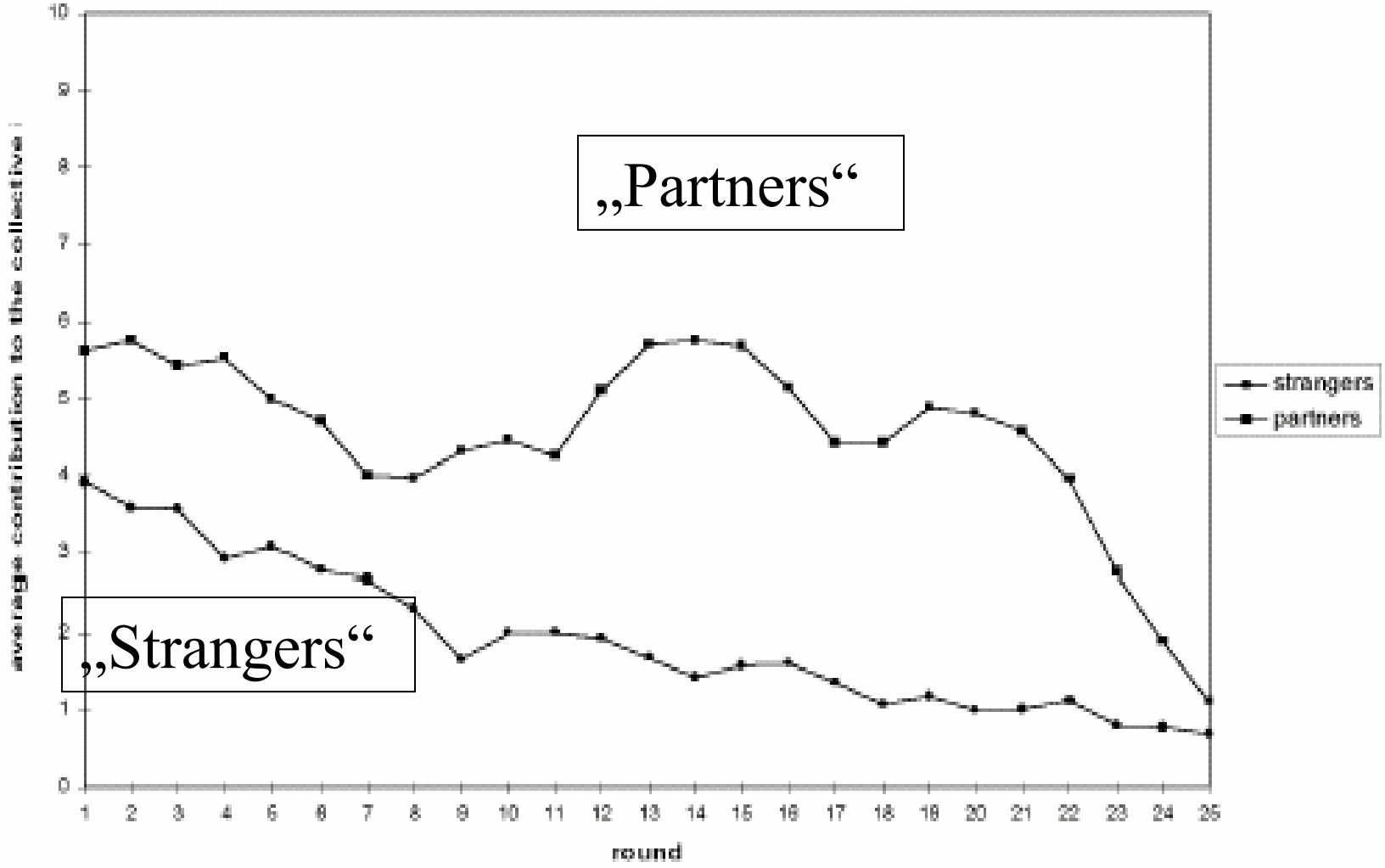
- General problem:
  - If $\alpha < 1$, individual incentive to free ride
  - If $\alpha n > 1$, free riding is inefficient

- α is often called "marginal per capita return" (MPCR)

Two first questions

- Do subjects cooperate at all?
  - Yes, but cooperation rate drops from roughly 40 to 60 percent (of full cooperation) in early periods to virtually zero in later periods
  - In final periods full defection is the most frequent choice
  - This observation has been made very often
- Do "partners" contribute more than "strangers"
  - Yes
  - But also in "Partner" setups cooperation rates drop as play reaches the final period(s)

Do partners contribute more than strangers?
Keser/Van Winden SJE 2000



Comparative statics

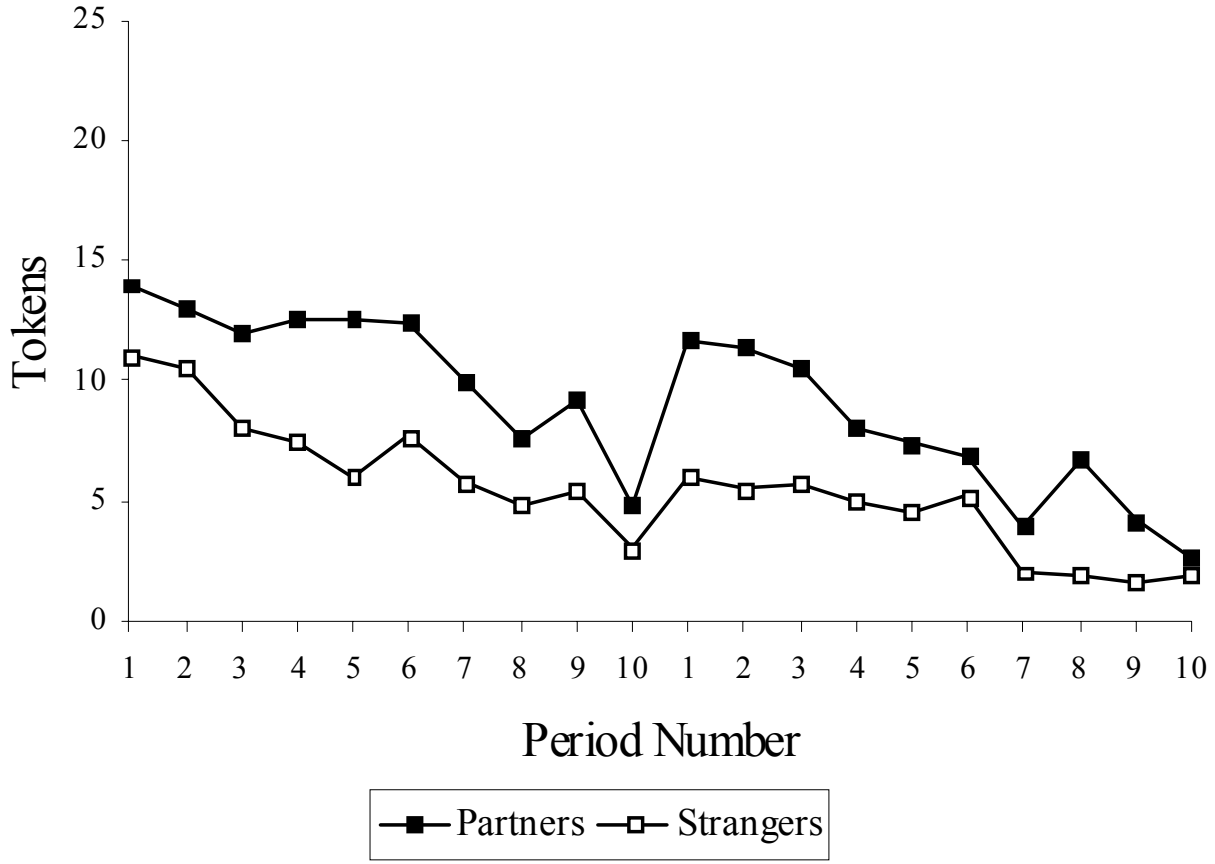
- Group size effect
- Olson (1965) hypothesis: larger groups contribute less
- Impact of marginal per capita return (Isaac, Walker and Thomas, Public Choice 1984)

	MPCR = 0.3	**MPCR = 0.75**
N = 4	19%	57%
N = 10	33%	59%

- Large groups studied in: Isaac, Walker and Williams, *JPubE* 1994.

Learning Hypothesis (Andreoni JPubE 1988)

- Contributions decline as people "learn how to play Nash"
- Test: non-announced "Restart" after 10 periods.



Do people cooperate because they make errors?

- If the Nash prediction is at zero, all errors must be above zero, i.e., they lead inevitably to "cooperation".
- Cooperation and errors are indistinguishable.
- Test: Non-linear public good such that the Nash equilibrium is an interior solution (e.g., convex costs or concave utility).
- True errors should unsystematically fluctuate around this prediction.

Errors (Overcontribution)
Keser (EconLetters 1996)

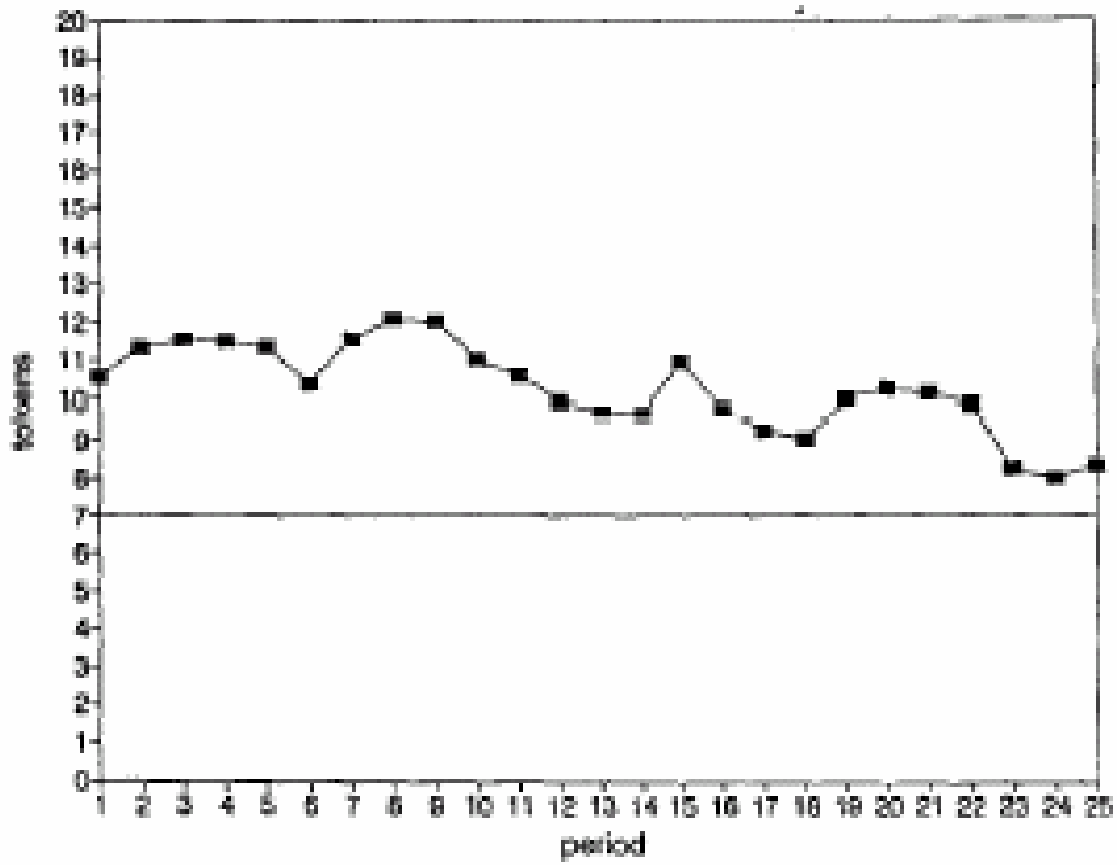


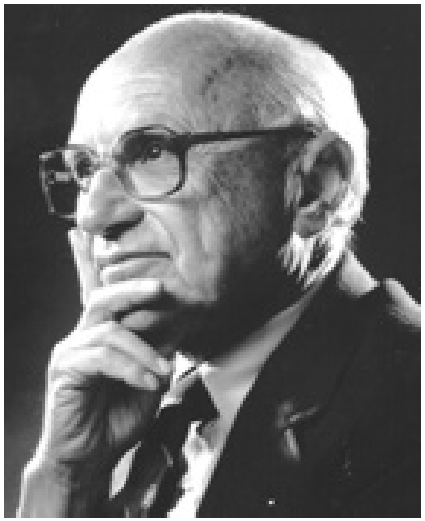
Fig. 1. Time path of the average contribution to activity B.

Conditional and unconditional cooperation

- Palfrey & Prisbrey AER 1997 argue that people cooperate unconditionally, i.e., independent of what the other group members do: “warm glow”
- This used to be the leading explanation why people cooperate
- Today it seems common sense that the true motive is conditional cooperation (reciprocity)

Conditional cooperation is intuitive

- "... we might all of us be willing to contribute to the relief of poverty, provided everyone else did. We might not be willing to contribute the same amount without such assurance.'' Milton Friedman Capitalism and Freedom, 1962, p.191)



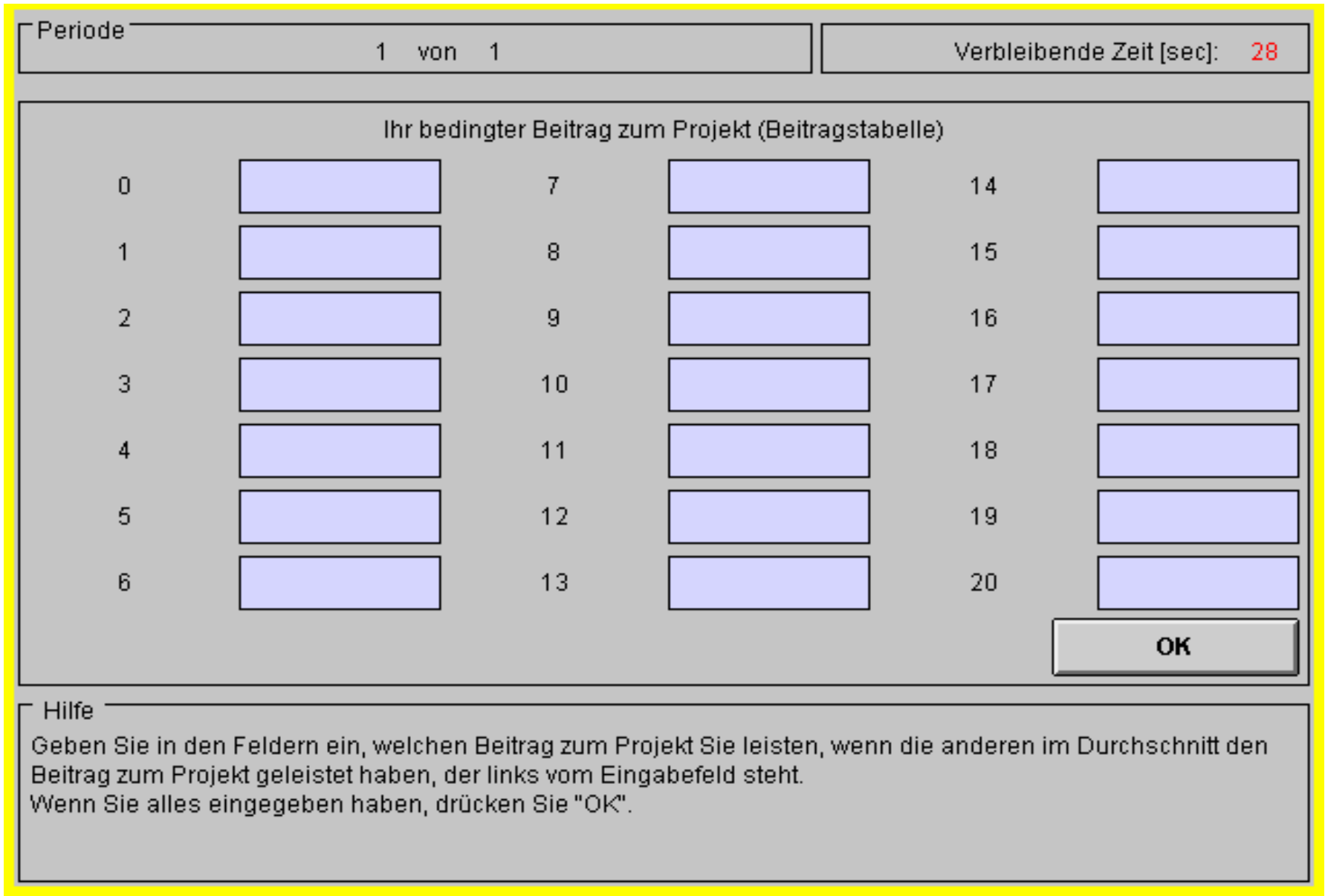
Evidence on Conditional Cooperation

- Psychology
  - Bornstein, Ben-Yossef, J Experimental Soc Psych 1994
  - Dawes, McTavish, Shaklee, J Personality & Soc Psych 1977
  - Kelley, Stahelski, J Personality & Soc Psych 1970
  - Komorita, Parks, Hulbert, J Personality & Soc Psych 1992
  - Messick, Wilke, Brewer, Kramer, Zemke, Lui, J Personality & Soc Psych 1983
  - Wit, Wilke, J Econ Psych 1992
  - Yamagishi, Sato J Personality & SocPsych 1986
- Economics
  - Keser, van Winden Scand J Economics 2000
  - Sonnemans, Schram, Offerman, EconLetters 1999

Using the strategy method to measure conditional cooperation

- This procedure was used in Fischbacher, Gächter, Fehr (Economics Letters 2001) and Falk, Fischbacher (EER 2002)
- Standard public goods situation (n = 4); played only once but with a variant of the strategy method
- Subjects have to make two decisions:
  - An unconditional contribution to the public good between 0 and 20
  - A conditional contribution to the project (conditional on the average contribution of the others – called „contribution table")

The decision screen (contribution table)



Predictions

- Free riders always put in zero because $\alpha < 1$
- This is inefficient because $n\alpha > 1$

- Conditional cooperators' contributions increase in the average contribution of the other group members.

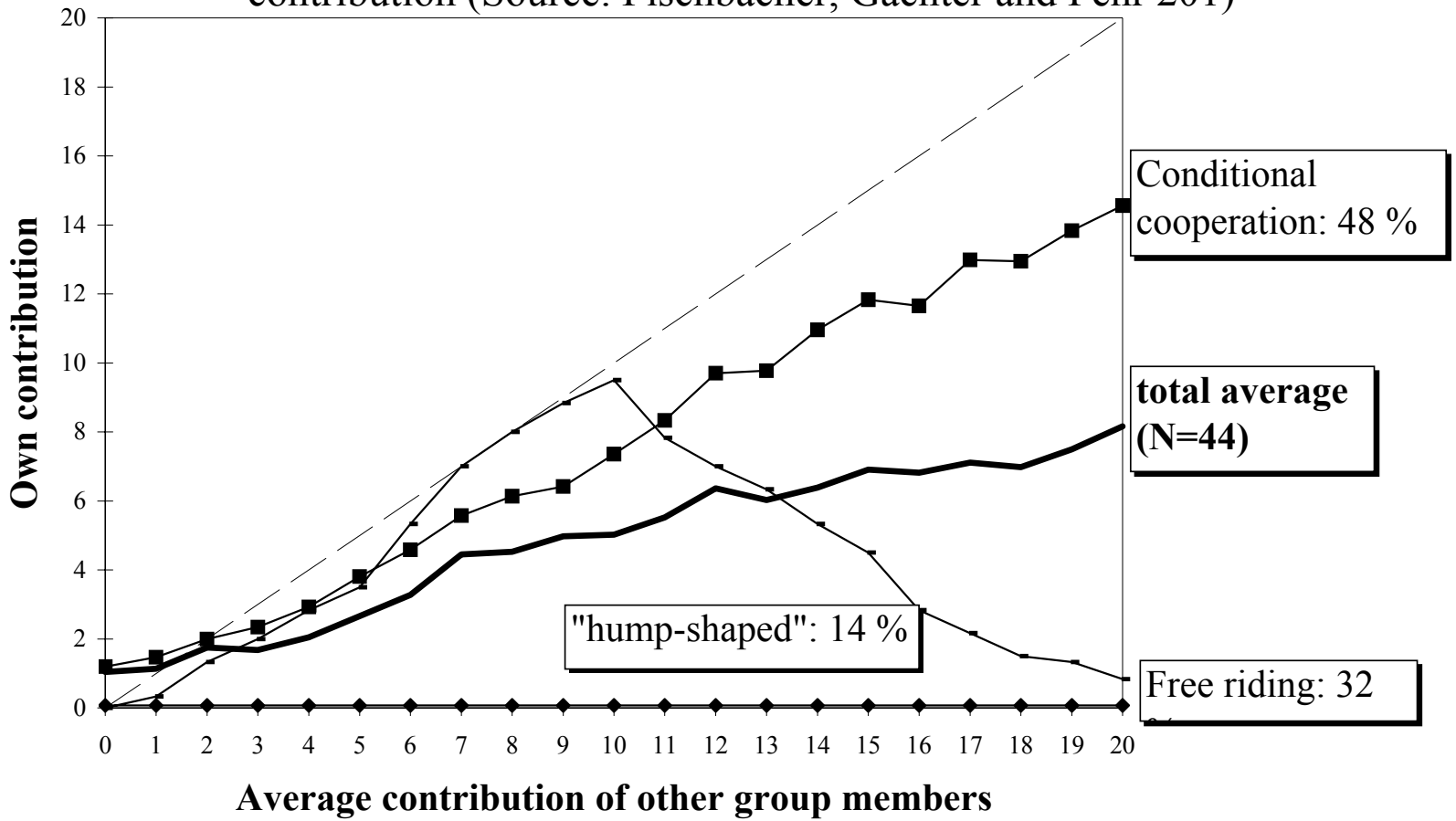
Incentives

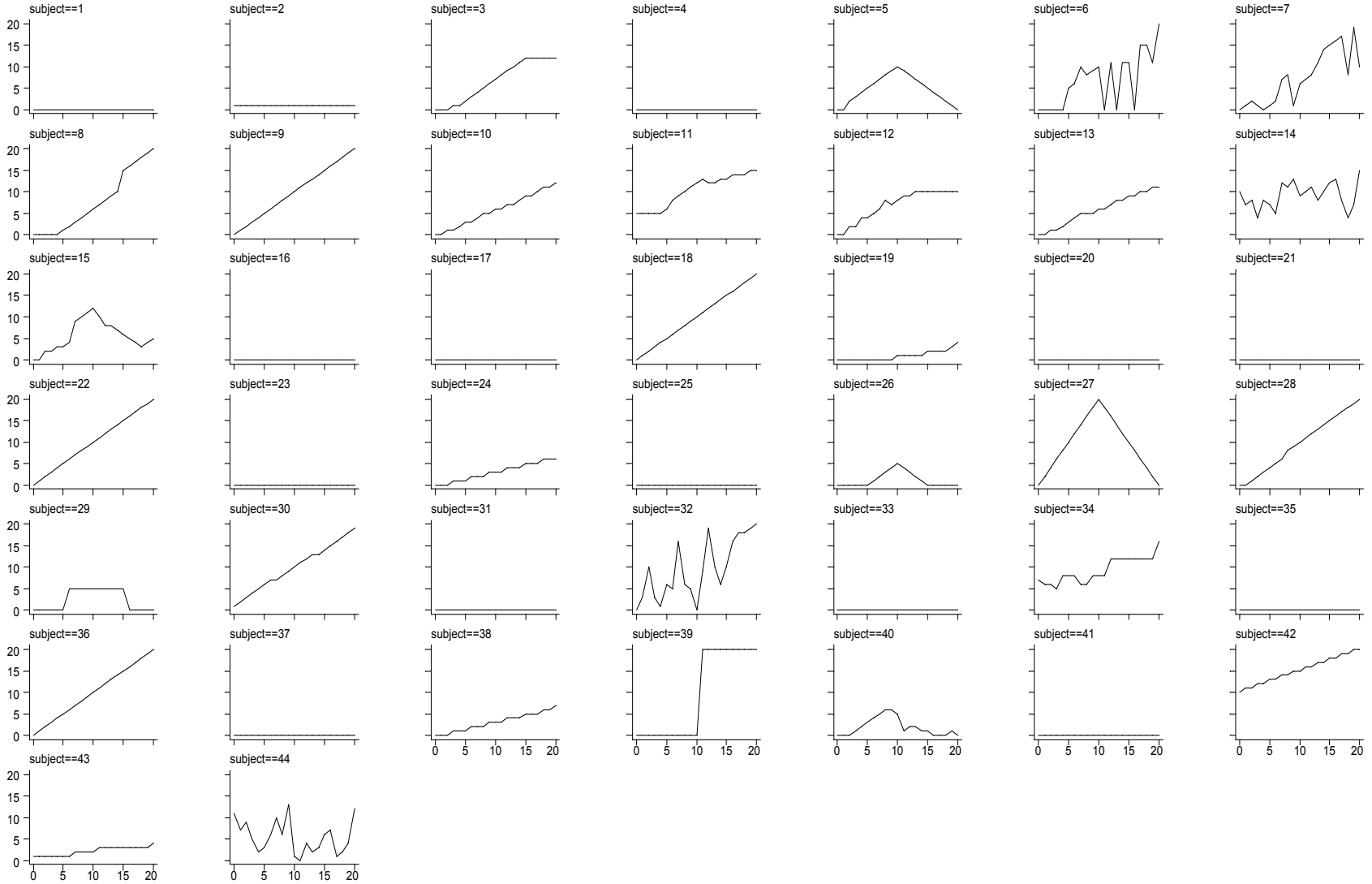
- For a randomly selected group member his/her contribution schedule is relevant for the decision; for the 3 others, their particular unconditional contribution is relevant

- You have to have this because if everybody makes a conditional choice on the others' conditional choices the play of the game is not determined

Conditional cooperation
Fischbacher, Gächter, Fehr (EconLetters 2001)

Own contribution as a function of other members' average contribution (Source: Fischbacher, Gächter and Fehr 201)





Contribution other group members

Contribution schedules per subject

Falk: Experimental and behavioral economics

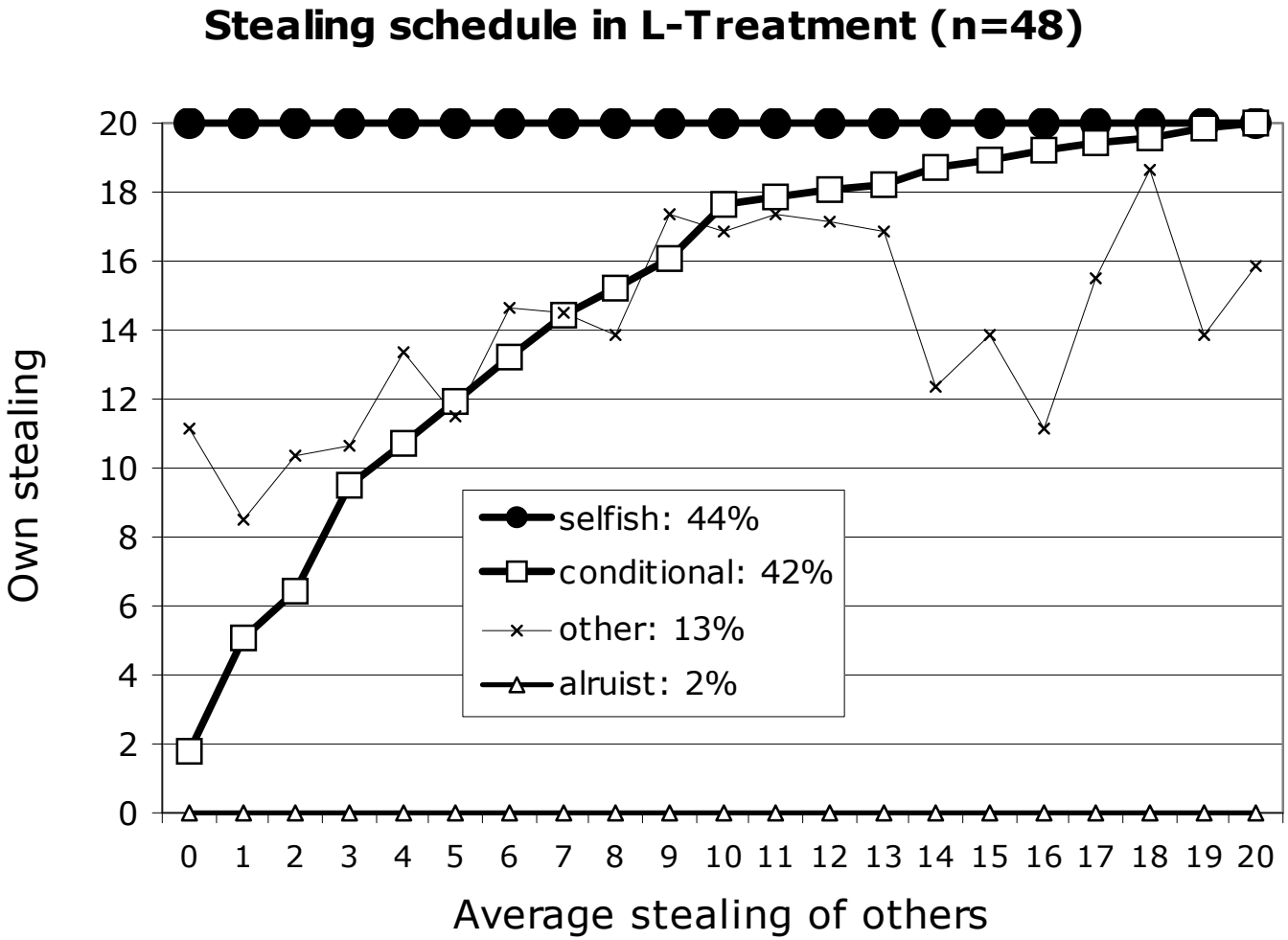
A stealing experiment
(Falk and Fischbacher 2002 EER)

- Part 1: Subjects can earn points in a quiz. (e_i)
  - 40 points at maximum
  - This procedure is useful to stress "moral property rights or entitlements"
- Part 2:
  - Groups of 4
  - Subjects can steal ("take away") up to 20 points from other subjects (same amount from all three group members) (s_i)
  - Payoffs: $\pi_i = e_i + k s_i - \sum_{j \neq i} \frac{s_j}{3}$
  - k = 0.5

- All subjects make unconditional stealing decision
- All subjects decide conditionally on what the other subjects have stolen, i.e., subjects specify strategy: Stealing schedule
- Payoff relevance of the schedule only for one randomly selected subject
- All decisions are potentially payoff relevant!

- Selfishness prediction: $s_i = 20$, which yields a highly inefficient result

Falk and Fischbacher, EER 2002



Once again: Why does cooperation unravel?

- Many people are willing to cooperate conditional on others' cooperation.
- A large minority of the subjects free-rides fully irrespective of what others do.
- The reciprocal types can punish the selfish types only by ceasing to cooperate.
- The selfish types induce the reciprocal types to defect once the reciprocal types realize that there are defectors in the group. Explains the decay in cooperation over time.

- From the fact that people behave selfishly (in final rounds), one cannot conclude that they are selfishly motivated!

An application: Understanding social interactions Falk, Fischbacher & Gächter (2002)

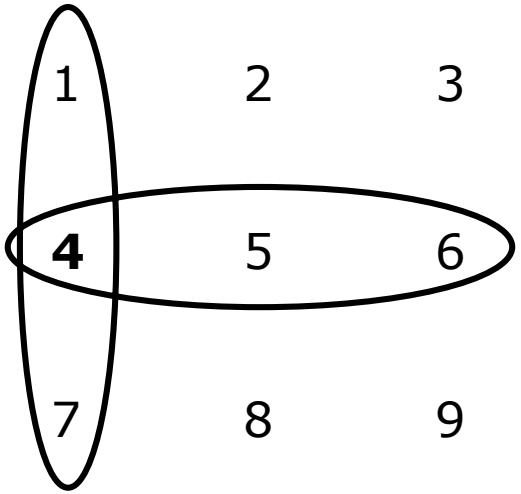
- A lot of (descriptive) evidence suggests that agents belonging to the same group tend to behave similarly ("group or social interaction effects")
- Examples:
  - Case, Katz (NBER WP 3705, 1991): Family and neighborhood affect (criminal) behavior.
  - Glaeser, Scheinkman and Sacerdote (QJE 1996): Variance of crime levels between different regions is too high to be explained by economic conditions and without social interaction.
  - Falk and Ichino: (2003): Work behavior affected by co-workers

Measuring social interactions

- Measurement is very difficult with field data
- Among many other problems:
  - Measurement errors and identifying relevant comparison groups
  - Self-Selection (people with similar attributes, preferences etc. self select into firms, neighborhoods etc.)
- Problems discussed in: Manski RES ‘93; JEP ‘00

"Living in two neighborhoods"

- 9 subjects form a "matching group"
- Each subject can contribute to public goods in two groups of 3 persons each; Group 1 and Group 2



- Payoffs: $\pi_i = (20 - c_i^1) + 0.6\sum_{j=1}^{3} c_j^1 + (20 - c_i^2) + 0.6\sum_{k=1}^{3} c_k^2$
- Public goods economically independent

Period

2 of 2

Group 1		Group 2	
Your contribution in the previous period	3	Your contribution in the previous period	18
Group's average contribution in previous period	1.5	Group's average contribution in previous period	16.5
Your income in the previous period	18.8	Your income in the previous period	21.8
Group's average contribution in ALL previous periods	1.5	Group's average contribution in ALL previous periods	16.5
Your endowment	20	Your endowment	20
Your contribution to the project		Your contribution to the project	

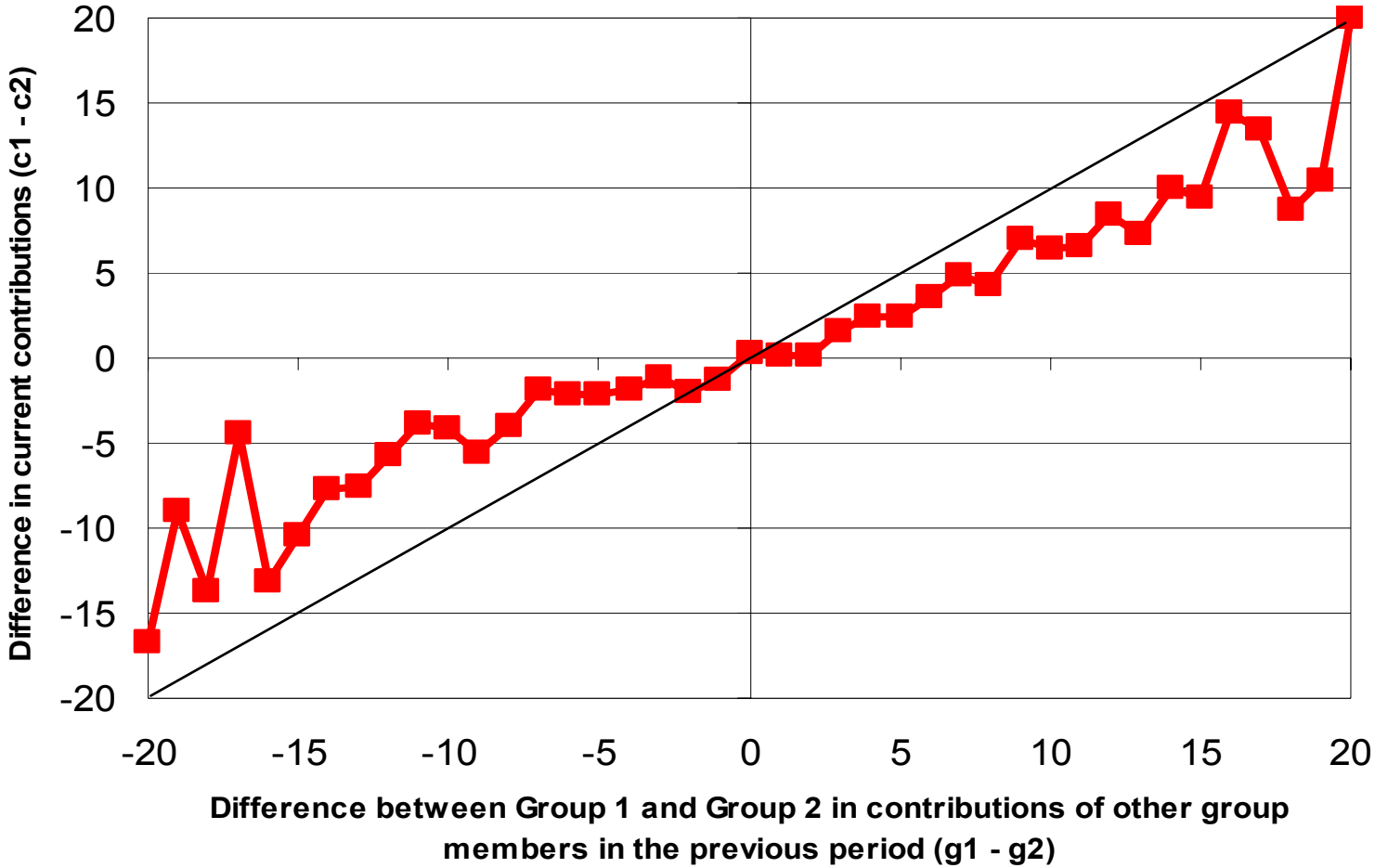
OK

Advantages of this design

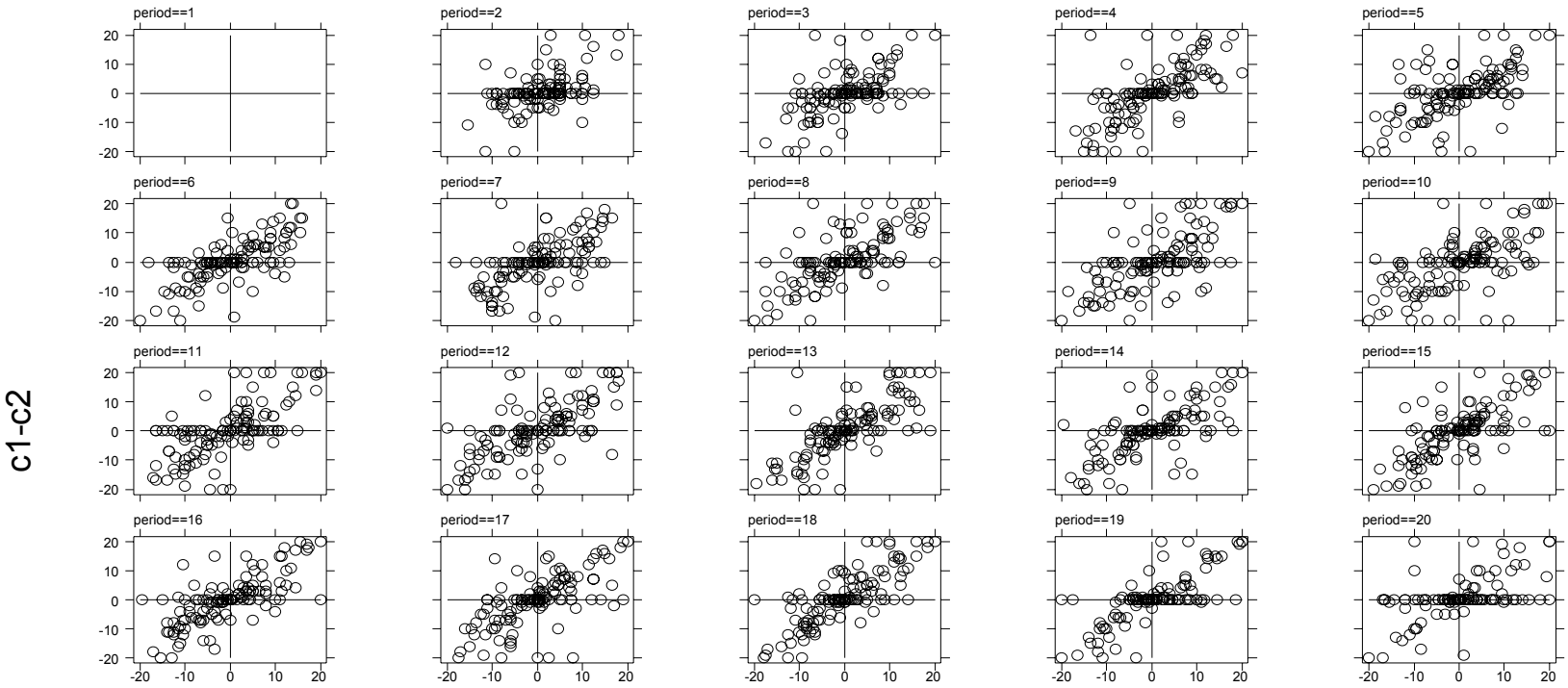
- Standard theory predicts no social interaction effect.

- No measurement error; control of comparison group
- Controls for self-selection.
  - Group assignment is random.
  - The same subject is a member of both groups.

Group interaction effects between Group 1 and Group 2 ("Social interaction effects")



Temporal stability



Interaction of selfish and reciprocal players

- If selfish and reciprocal players interact, one would expect that eventually cooperation breaks down (see argument above)
- Reciprocal players contribute conditional on what others do. Put differently: The only way to punish free riders is to withdraw contributions.

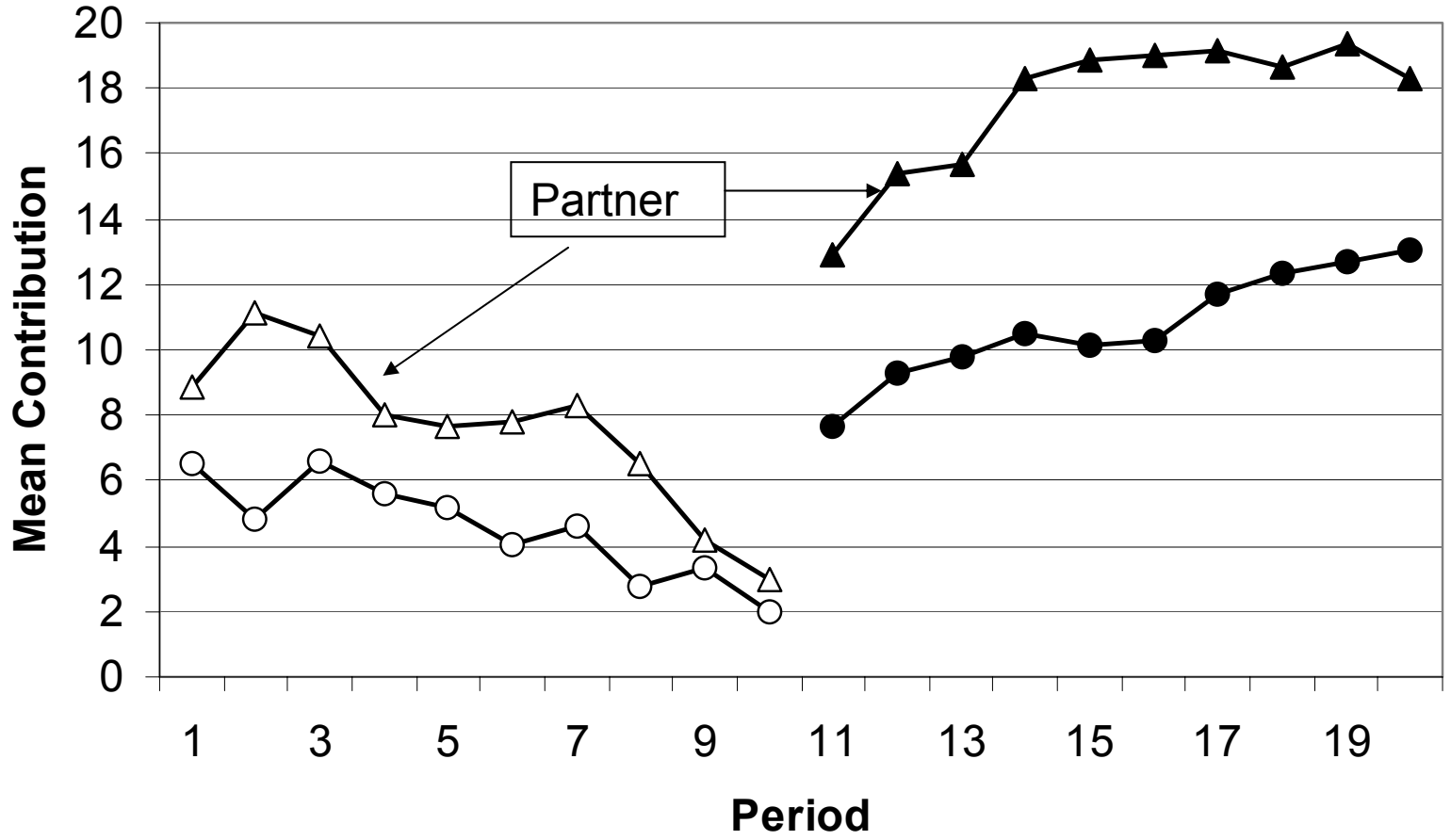
Interaction (ii)

- In a sparse environment, conditional cooperative players cannot achieve high contribution levels.
- What happens if they are given the chance to punish free-riders? (Fehr and Gächter AER 2000, Carpenter 2000, Falk et al. "Informal sanctions", WP 2001)
- Fehr/Gächter 2000: Stage 1: $\pi_i = (20 - c_i) + 0{,}4 \sum_{j=1}^{n} c_j$
- Stage 2: Players decide simultaneously whether to assign punishment points to the other players after they observed (anonymously) how much the others contributed.
- Each punishment point reduces the Stage 1-Payoff of the punished subject by ten percent. Punishment is also costly for the punisher (roughly 1:3 relation)

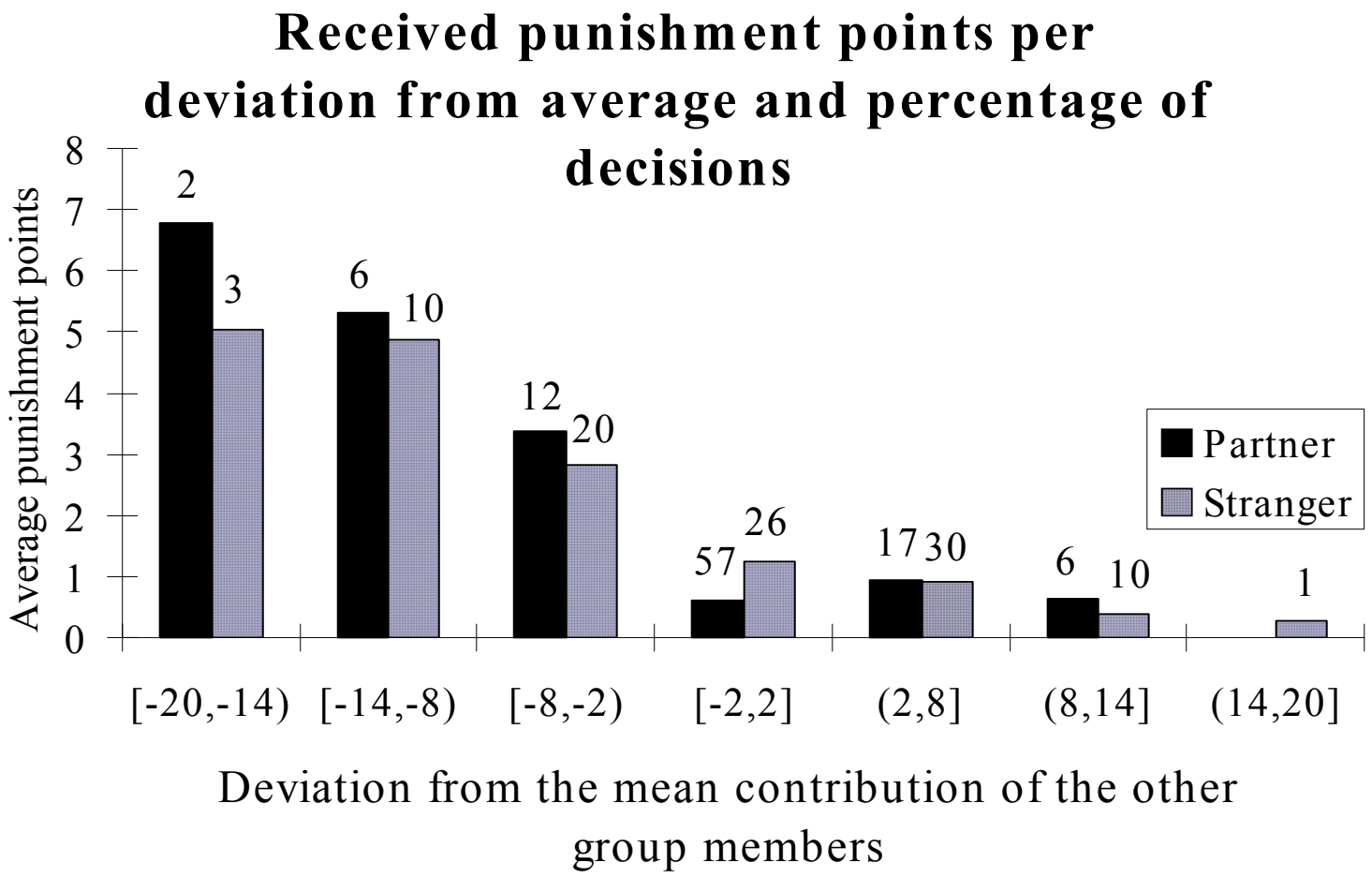
Interaction (iii)

- Punishment is very frequent.
- The less a player contributes the more he is punished.
- While cooperation declines without a punishment opportunity, cooperation is stable or increases with a punishment opportunity. Reciprocal players effectively discipline free-riders.
- 82.5% of the subjects contribute the whole endowment in the final period of the Partner treatment when there is a punishment option while the majority fully defects in the final period when there is no punishment option.

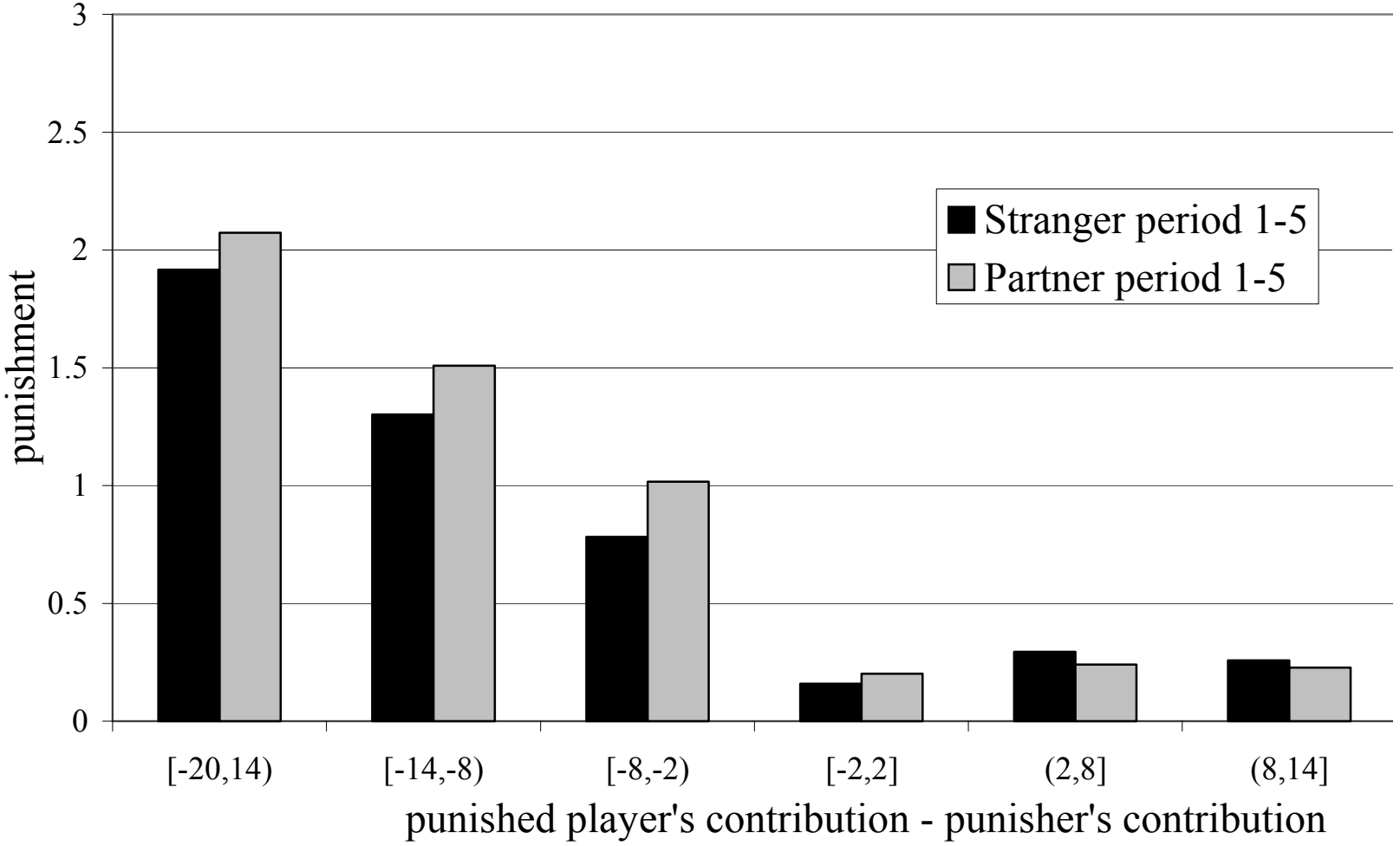
Partners and Strangers - cooperation
Fehr & Gächter (AER 2000)



Partners and Strangers - punishment
Fehr & Gächter (AER 2000)



Punishment pattern in one-shot and repeated public goods gam
(Source: Falk, Fehr, Fischbacher 2001)



Enforcement of norms

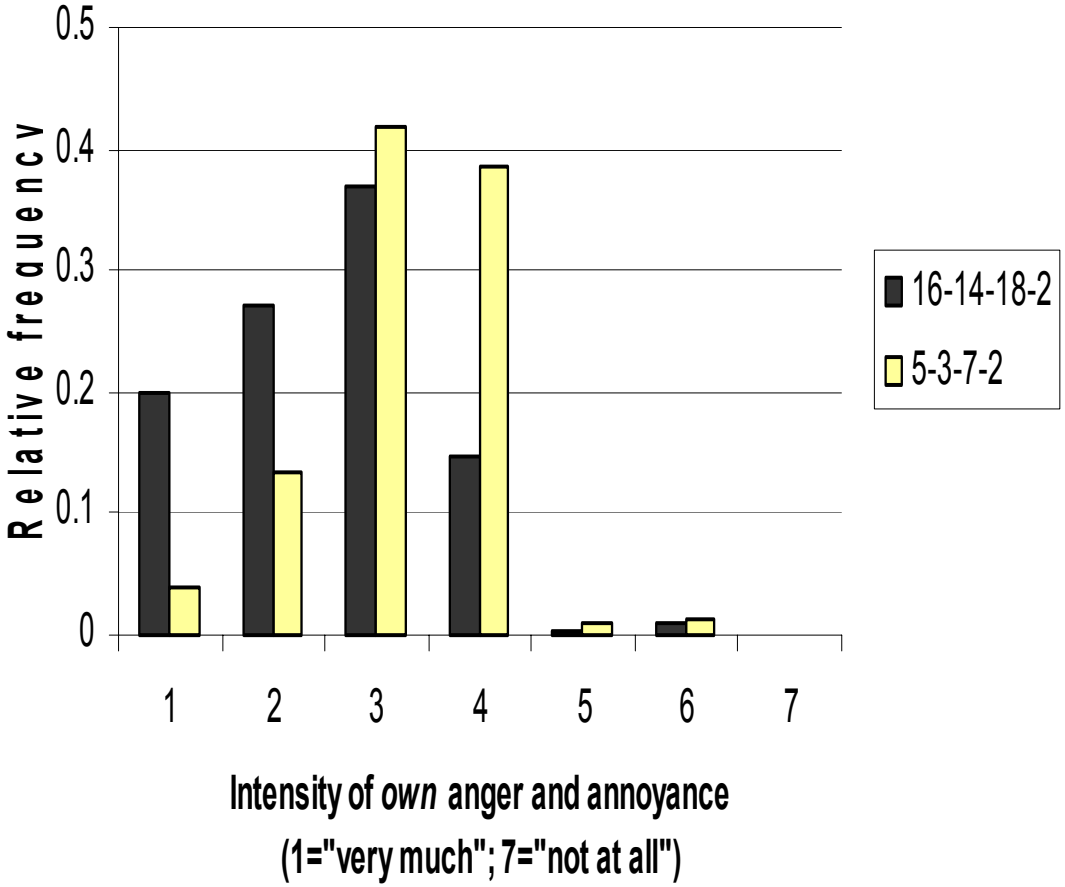
- The fact that subjects are willing to sanction free-riding behavior has important consequences for the enforcement of norms and incomplete contracts
- In some sense, these informal sanctions are part of a society's social capital
- Whether this is beneficial depends not least on the content of a norm
- For example
  - Team incentives work better than according to standard view (norm = work hard)
  - Tournament incentives work less well because cooperation means here to work less
  - Less littering, less crime, less butting into line in a long queue, tougher strikes of workers, more voting etc.

Emotions

- Emotions may be a mechanism that sustains cooperation and punishment.
- Hypothesis: free riding may cause strong negative emotions among the cooperators and these emotions, in turn, may trigger their willingness to punish the free riders.
  - Elster (JEL 1998); Hirshleifer (1986); Frank (1988); Bosman & van Winden (EJ 2002).
- Difficulty: how to measure emotions?
- We test this conjecture with the help of vignettes (Fehr and Gächter).
- Ask for
  - Own emotions towards free rider
  - Expected emotions of others if one free rides.

Own emotions towards a free rider

"You decide to invest 16 [5] francs to the project. The second group member invests 14 [3] and the third 18 [7] francs. Suppose the fourth member invests 2 francs to the project. You now accidentally meet this member. Please indicate your feeling towards this person".



Expected emotions in case of free riding

"Imagine that the other three group members invest 14, 16 and 18 [3, 5 and 7] francs to the project. You invest 2 francs to the projects and the others know this. You now accidentally meet one of the other members. Please indicate the feelings you expect from this member towards you".