

Public Goods

- **Real-world problems of cooperation**
 - Cooperative hunting and warfare
 - Teamwork in firms
 - Charities and gift-giving
 - Environmental protection
 - Economic public goods
 - Paying taxes
 - Fishing
 - Security
 - Political collective action
 - Voting
 - Lobbying
 - Revolutions



Classical literature: Samuelson 1954, Olson 1965, Hardin 1968

Overview of the lecture

- The voluntary contributions mechanism
- Reasons for cooperation
 - Cooperation due to errors
 - Conditional cooperation
 - Identifying types
 - Learning and strategic cooperation
 - Identifying types
- Centralized institutions that promote cooperation
 - Taxation
 - Competition
- Decentralized institutions that promote cooperation
 - Communication
 - Social sanctioning (punishment)
 - Punishment vs. rewards
- Endogenous formation of institutions

The voluntary contribution mechanism

- Group of n members
- Each member gets an endowment: e_i
- Each member has two investment possibilities
 - Keep on private account
 - Contribute to public account: c_i
- Contributions to the public good benefit each member by: α_i
- The profit of each subject is:
 - $\pi_i = e_i - c_i + \alpha_i \sum_j c_j$
 - Note:
 - if no one contributes: $\pi_i = e_i$
 - if everyone contributes: $\pi_i = \alpha_i \bar{e}$
 - if $\alpha_i < 1$ you maximize π_i by contributing zero
 - α_i is commonly called as the MPCR (marginal per capita return)

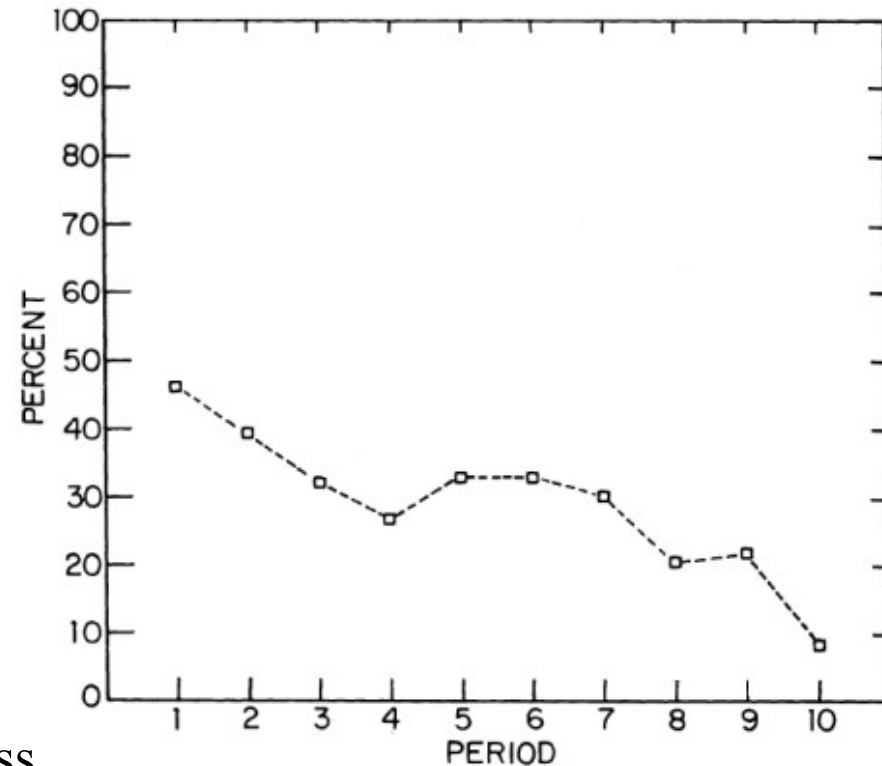
The voluntary contribution mechanism

- 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 contributions or average contribution
 - e_i and α_i are common knowledge or private information

The voluntary contribution mechanism

- **Standard result**
 - Initial cooperation of 40-60%
 - Cooperation declines with repetition
- **Some stylized facts**
 - Positive effect of MPCR
 - Positive effect of partners
 - No effect of group size
 - Negative effect of experience
- **Less robust**
 - Negative effect of heterogeneity
 - No effect of number of periods
 - Women contribute more and men less
 - Positive effect of framing

$n = 10$ MPCR = 0.3



Reasons for cooperation

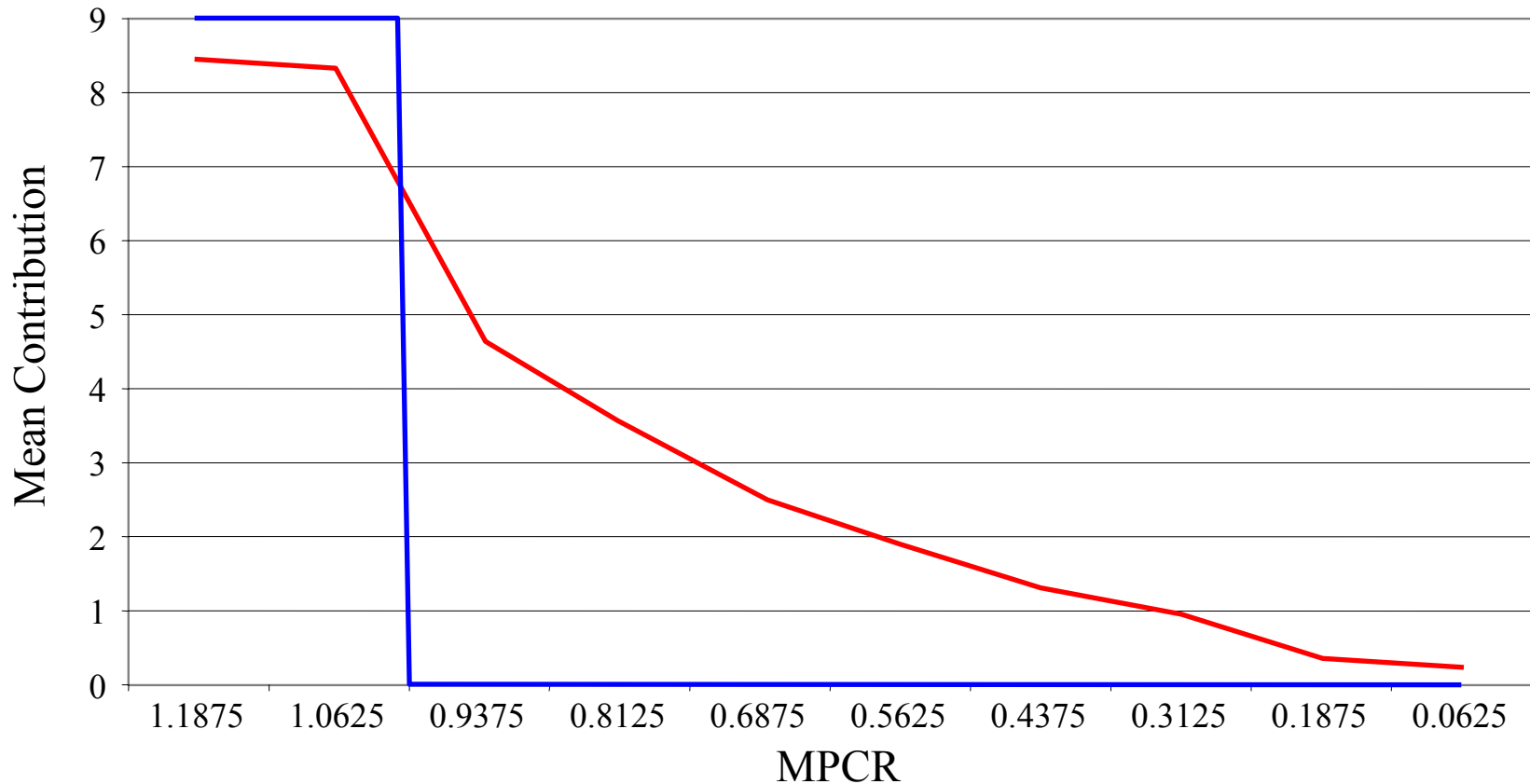
- By mistake
 - Do not understand that $c_i = 0$ is dominant
 - Do understand dominance but make systematic errors
- Social preferences
 - Altruism, warm glow, efficiency-seeking motives
 - Conditional cooperation, reciprocity
- Strategic cooperation
 - Strategies such as Tit-for-Tat can support cooperation among selfish players
 - mostly infinitely repeated games but see also Kreps et al. 1982

Cooperating by Mistake

- **Cooperating by Mistake** Brandts and Schram 2001
- Extend the experiment of Palfrey and Prisbrey 96, 97
- Design
 - VCM: $n = 4$, $e = 9$, repeated for 10 periods
 - 72 subjects, within subjects
 - On every period the MPCR is randomly drawn from 10 values
 - $\text{MPCR} \leq 0.1875$: efficient $\rightarrow c_i = 0$, dominant strategy $\rightarrow c_i = 0$
 - $0.3125 \leq \text{MPCR} \leq 0.9375$: efficient $\rightarrow c_i = 9$, dominant strategy $\rightarrow c_i = 0$
 - $\text{MPCR} \geq 1.0625$: efficient $\rightarrow c_i = 9$, dominant strategy $\rightarrow c_i = 9$
 - Use strategy method to elicit c_i for every MPRC

Cooperating by Mistake

- **Cooperating by Mistake** Brandts and Schram 2001
- Results
 - Minor role for mistakes

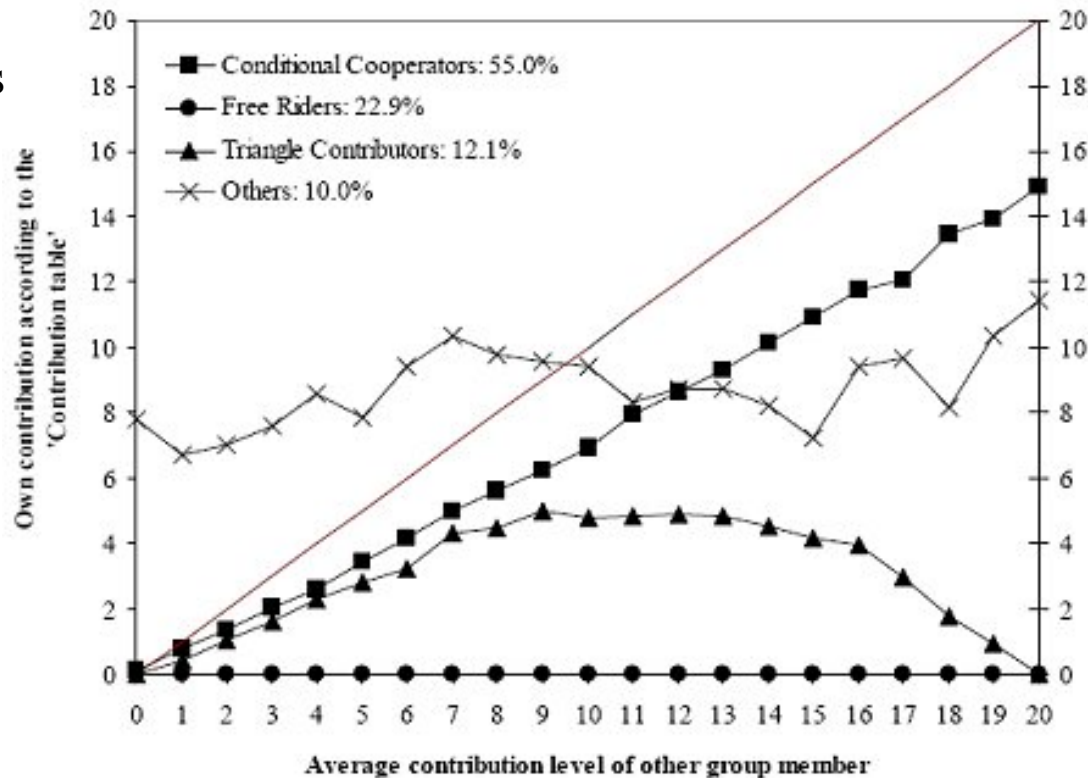


Conditional Cooperation

- **Conditional or unconditional cooperation?** Fischbacher & Gächter 2009
- Design
 - 140 subjects, within subjects
 - VCM: $n = 4$, $e = 20$, $MPCR = 0.4$
 - 2 stages: strategy method and normal
 - Decisions 1: unconditional contribution decision
 - Decision 2: use strategy method to elicit contribution schedule with respect to average contribution of decision 1
 - Pick randomly three decision 1's and one decision 2
- Predictions
 - Altruism or 'warm glow': contribution is positive but independent of others contribution
 - Reciprocity: contribution increases with the average contribution of others
 - Selfish: always contribute zero

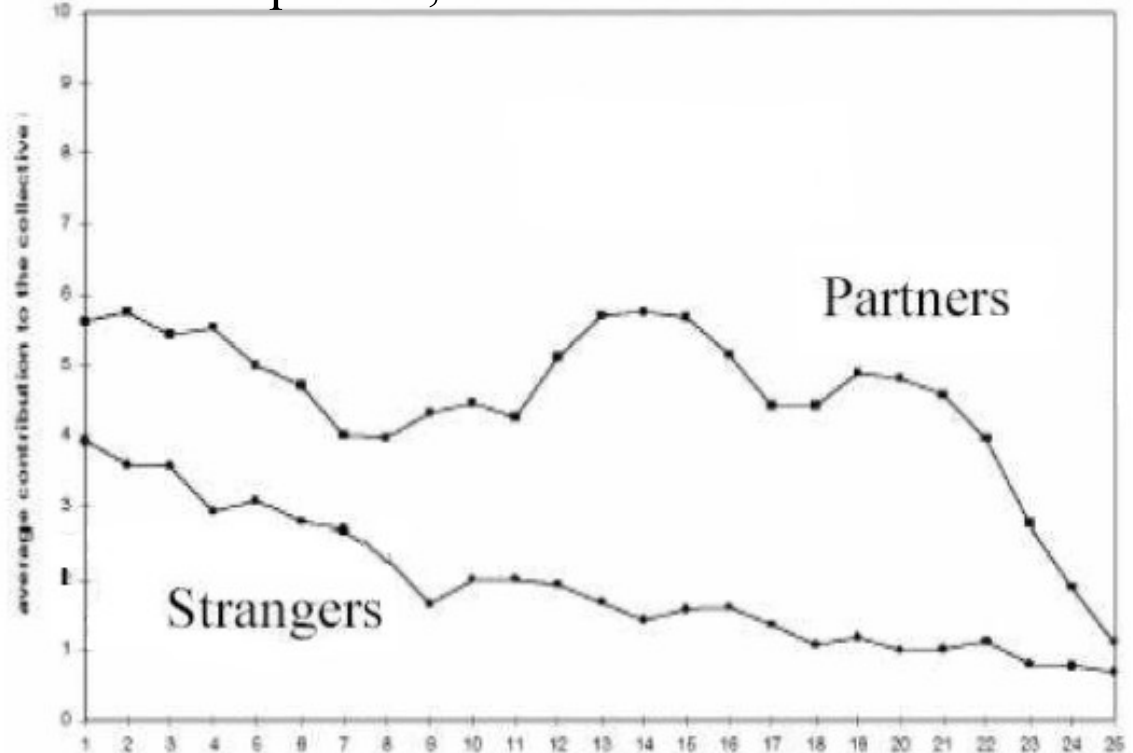
Conditional Cooperation

- **Conditional or unconditional cooperation?** Fischbacher & Gächter 2009
- Results
 - Little unconditional cooperation
 - Heterogeneity in types:
 - 55% conditional cooperators
 - 23% selfish
 - 12% ‘hump-shape’ contributors
 - 10% other
- Can conditional cooperation explain the decline of contributions?



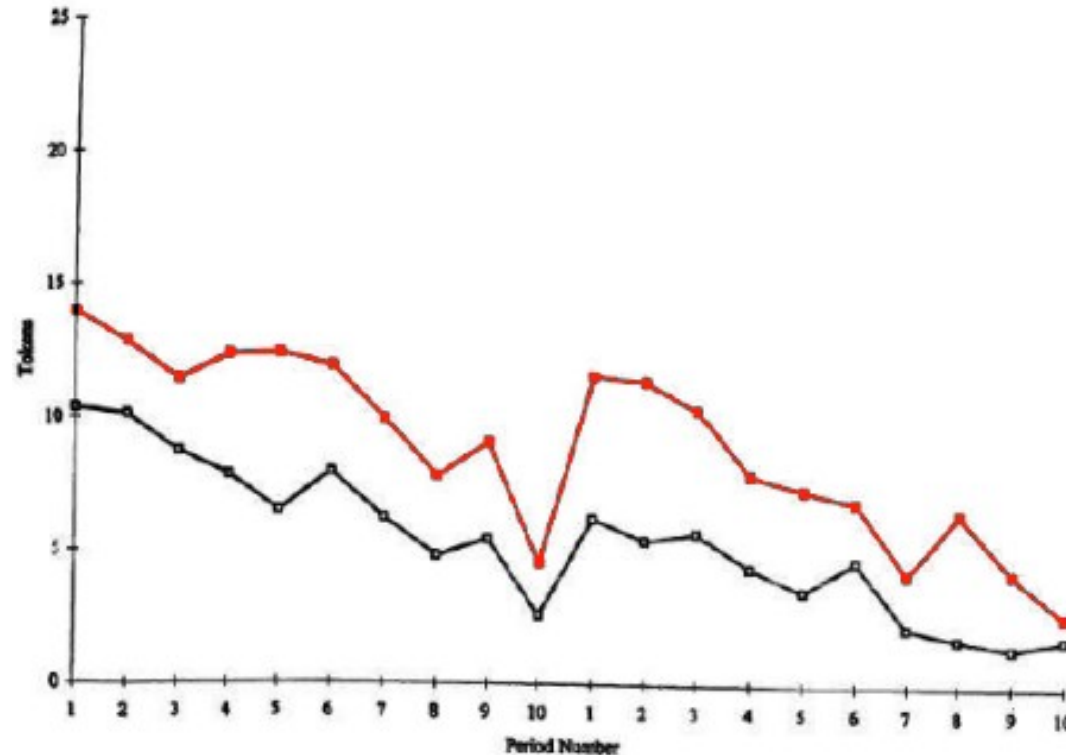
Strategic Cooperation

- **Is there strategic cooperation** Keser & van Winden 2000
- Compare partners vs. strangers
 - If partners cooperate more → supports strategic cooperation?
- Design
 - VCM: $n = 4$, $e = 10$, repeated for 25 periods, MPCR = 0.5
 - 160 subjects between subjects
- Results
 - Strong effect of the partner's treatment



Strategic Cooperation

- **Explaining the decline in cooperation** Croson 1996
- Why does cooperation decline with time
 - Strategic cooperation
 - Learning to play the dominant strategy
- Design: use a surprise restart
 - VCM: $n = 4$, $e = 25$, MPCR = 0.5
 - Repeated 10 + 10 periods
 - 24 subjects
- Results
 - Clear evidence of restart specially for **partners**
 - What about cooperation among strangers?



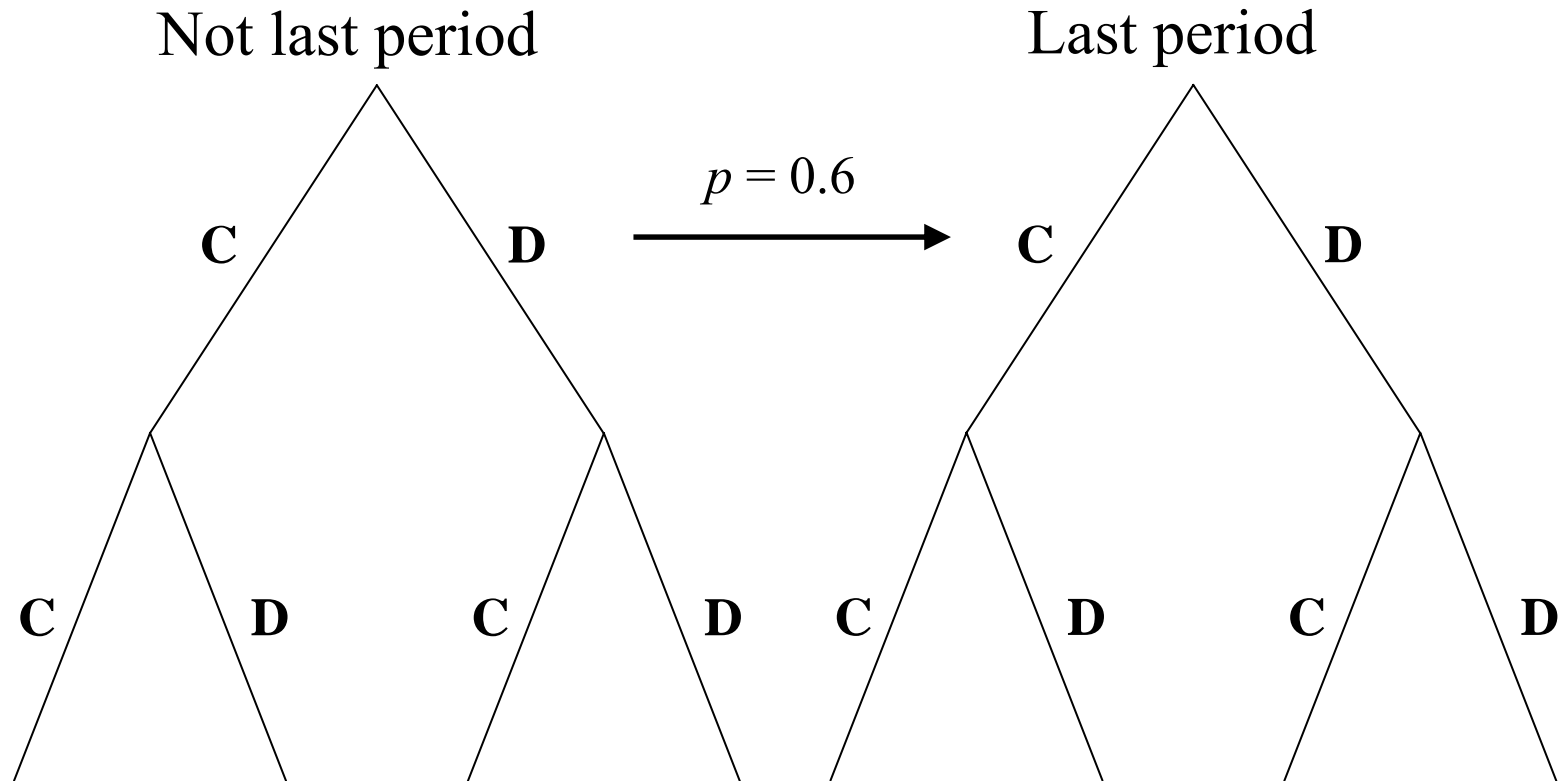
Identifying Strategic Cooperation

- **Measuring strategic cooperation** Reuben & Suetens 2009
 - Identification problem
 - In most cases conditional cooperators and strategic cooperators will have the same behavior and beliefs
 - Examples
 - End-game effects
 - Strategic cooperators defect because there is no future interaction
 - Conditional cooperators defect if they believe strategic cooperators will defect too
 - MPCR effects (individuals cooperate more if cooperation pays more)
 - Conditional cooperators cooperate more because doing so is cheaper (e.g. if they are inequity averse)
 - Strategic cooperators are more likely to cooperate because a lower belief threshold is needed to sustain cooperation

Identifying Strategic Cooperation

- **Measuring strategic cooperation** Reuben & Suetens 2009
 - Solving the identification problem
 - Infinitely repeated sequential prisoners' dilemma
 - Use strategy method
 - First movers
 - Do you cooperate or defect if the current period is not the final period?
 - Do you cooperate or defect if the current period is the final period?
 - Second movers
 - If the first mover cooperates, do you cooperate or defect if the current period is not the final period?
 - If the first mover cooperates, do you cooperate or defect if the current period is the final period?
 - If the first mover defects, do you cooperate or defect if the current period is not the final period?
 - If the first mover defects, do you cooperate or defect if the current period is the final period?

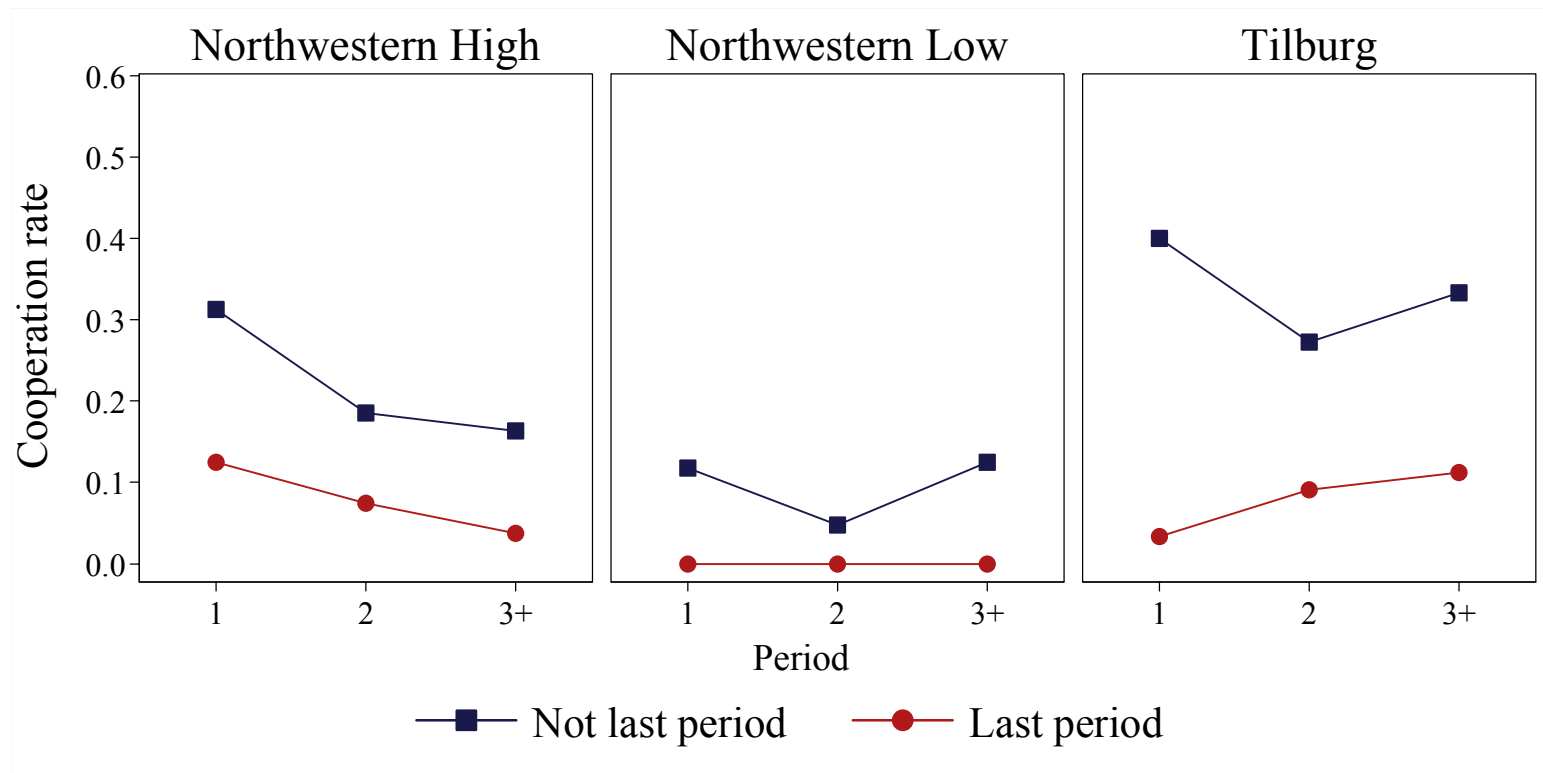
Identifying Strategic Cooperation



<i>Defector</i>	D	D	D	D
<i>Conditional Cooperator</i>	C	D	C	D
<i>Reputation Builder</i>	C	D	D	D

Identifying Strategic Cooperation

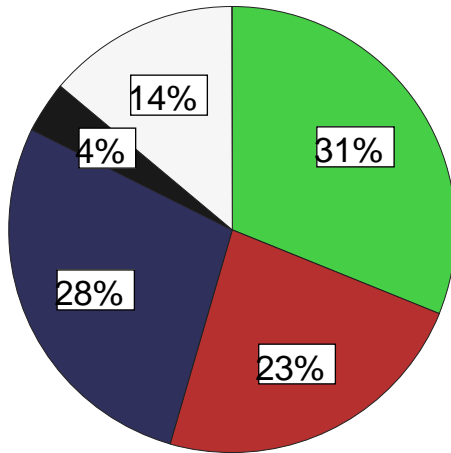
- **Measuring strategic cooperation** Reuben & Suetens 2009
 - Clear difference in cooperation depending whether it is the last period or not.



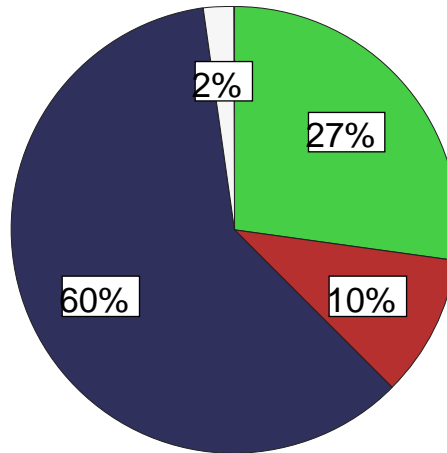
Identifying Strategic Cooperation

- **Measuring strategic cooperation** Reuben & Suetens 2009
 - Most common reason for second-mover cooperation is strategic
 - Frequency of non-strategic cooperation varies considerable with the profitability of cooperation
 - Surprising amount of selfish individuals who do not strategically cooperate.

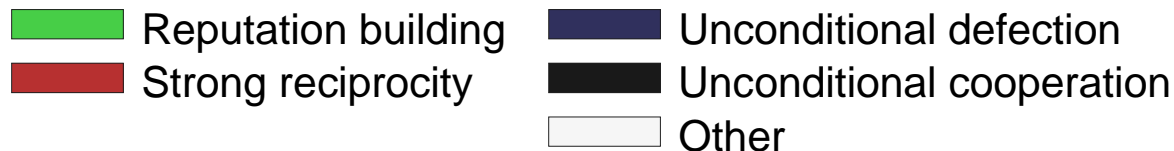
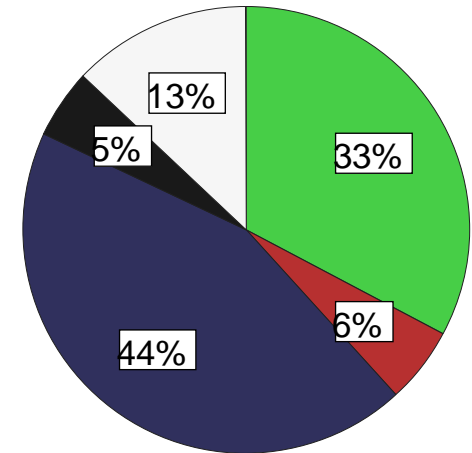
Northwestern High



Northwestern Low



Tilburg

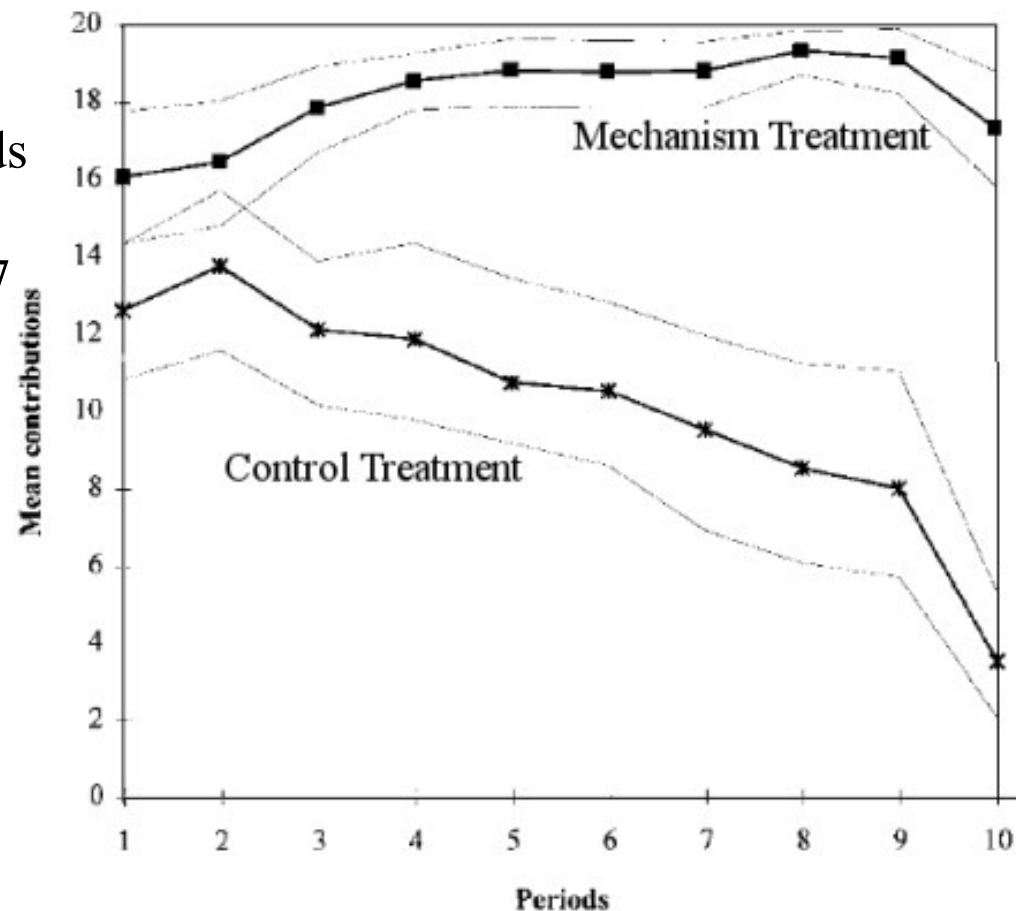


Summary

- Summary so far ...
 - Positive contributions in VCM experiments
 - Contributions are not due to errors
 - Decline in contributions with repetition
 - Some effect of experience but restart effect hints that it is not (only) learning
 - Conditional cooperation
 - Majority of subjects behave reciprocally
 - Partly for social preferences
 - Partly for strategic cooperation
 - Contributions still positive in stranger treatments
 - Strong reciprocity?
 - Miscalculated strategic cooperation?

Centralized Institutions: Taxation

- **A simple mechanism to promote cooperation** Falkinger et al. 2000
- If you contribute more than the average:
 - Get a bonus of $\beta(c_i - C_{-i})$
- If you contribute less than the average:
 - Pay a tax of $\beta(C_{-i} - c_i)$
- Design
 - VCM: $n = 4$, $e = 20$, 10 periods
MPCR = 0.4
 - 2 treatments: $\beta = 0$ and $\beta = 0.7$
 - 240 subjects
- Results
 - The mechanism clearly works
 - Robust to:
 - different group sizes
 - interior equilibria
- But how to enforce?

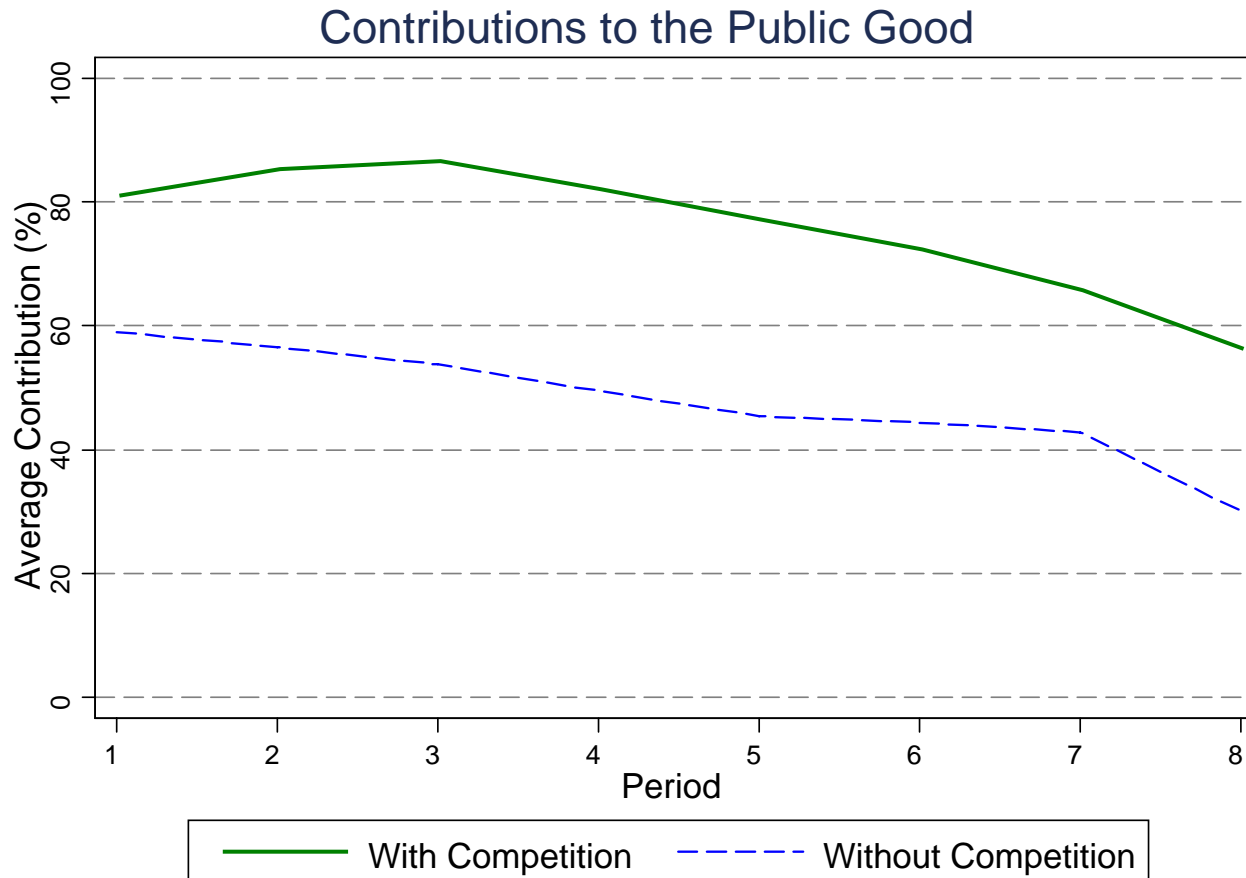


Centralized Institutions: Competition

- **Does competition promote cooperation?** Reuben & Tyran 2009 (approx)
 - Competition between 3 groups of 3 individuals
 - Individuals in the most cooperative group: gain 10 points
 - Individuals in the intermediate group: neither gain nor lose
 - Individuals in the least cooperative group: lose 10 points
 - Ties are resolved with a random draw.
 - Equilibria with positive contributions but none in pure strategies
- Design
 - VCM: $n = 3$, $e = 30$, 24 periods, MPCR = 0.5
 - Look at 2 treatments: competition and no competition
 - 243 subjects

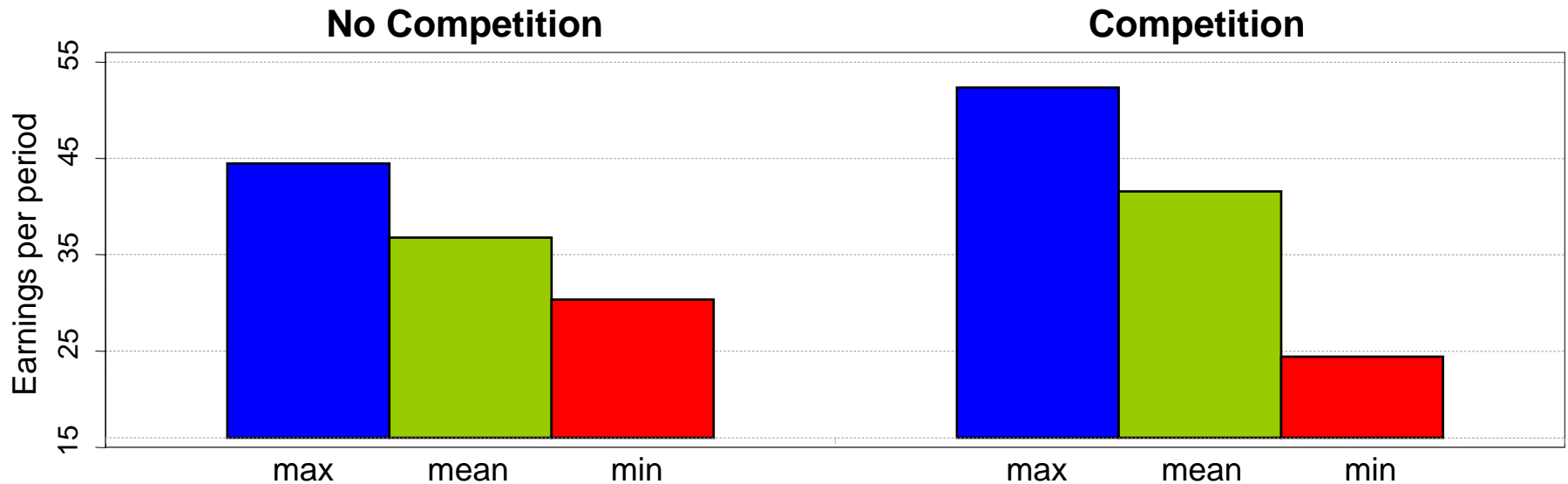
Centralized Institutions: Competition

- **Does competition promote cooperation?** Reuben & Tyran 2009 (approx)
- Results
 - Competition increases cooperation by 20%



Centralized Institutions: Competition

- **Does competition promote cooperation?** Reuben & Tyran 2009 (approx)
- Implementing competition:
 - 71% vote for competition
 - Direct voting (simple majority): 94% implement competition
 - Indirect voting (federation): 48% implement competition



- Competition increases earnings but also inequality

Decentralized Institutions: Communication

- **The power of words** Bochet et al. 2006
 - Allow subjects to communicate but not make any binding contracts
- Design
 - VCM: $n = 4$, $e = 10$, 10 periods, MPCR = 0.4
 - Look at 4 treatments:
 - No communication
 - Face to face communication
 - Chat room communication
 - Numeric cheap talk communication
 - 172 subjects

Decentralized Institutions: Communication

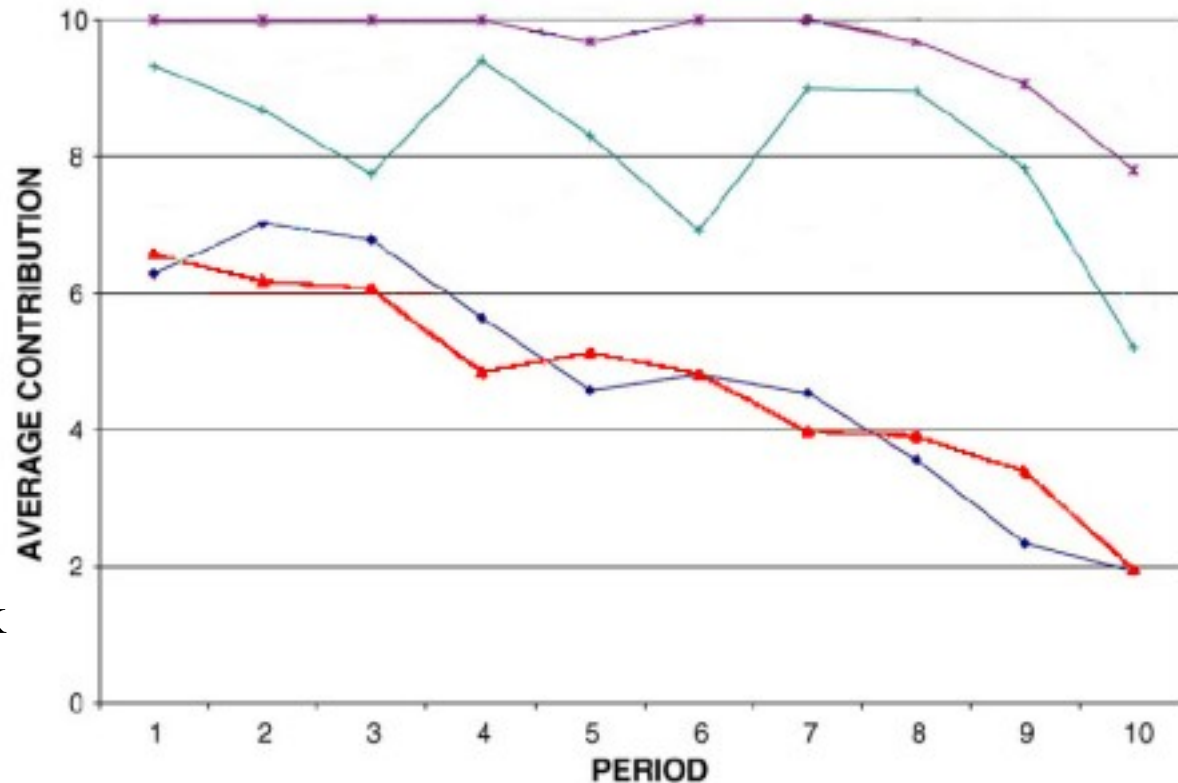
- **The power of words** Bochet et al. 2006

- Results

- Face to face communication dramatically increases cooperation
 - The effect of communication is eroded as it becomes more restricted

- From other studies

- Making promises is very effective
 - Promises are even better than history
 - Calling on others' kindness does not work
 - Video communication is also effective

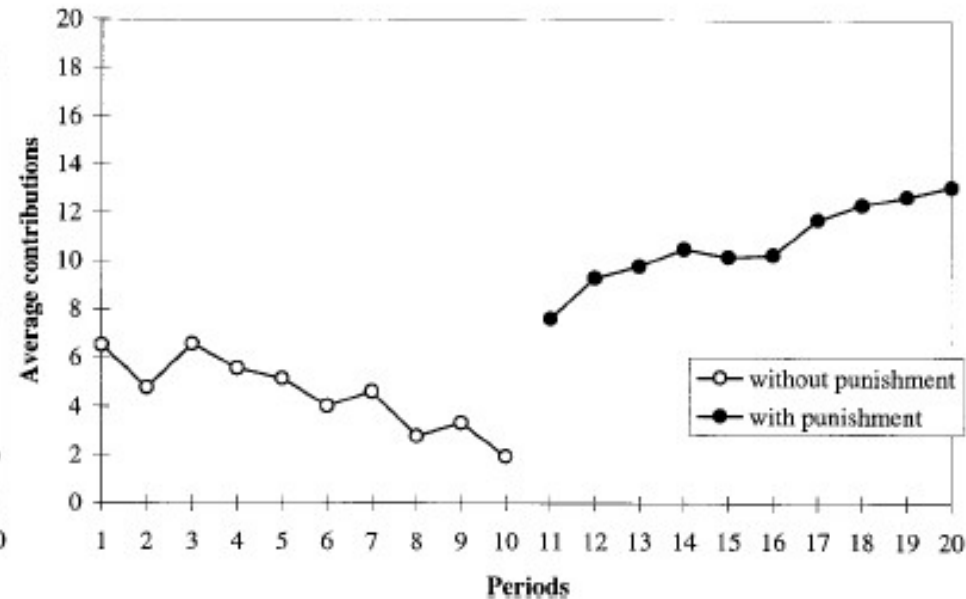
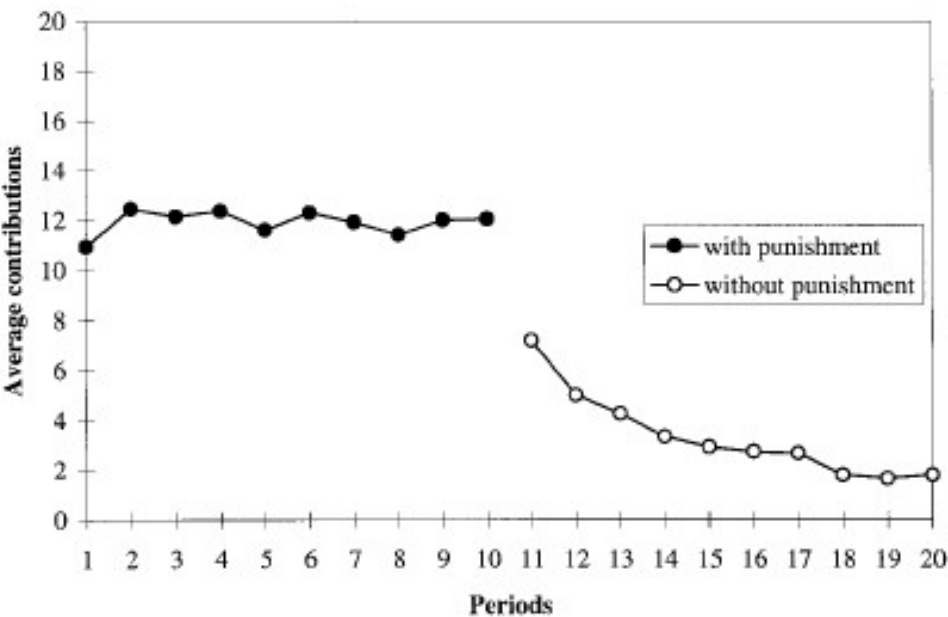


Decentralized Institutions: Punishment

- **The power of informal sanctions** Fehr & Gaechter 2000
- Design
 - VCM: $n = 4$, $e = 20$, 20 periods, MPCR = 0.4, $\frac{1}{2}$ with partners matching and the other $\frac{1}{2}$ with strangers matching
 - Treatment 1: no punishment
 - Treatment 2: punishment
 - Stage 1: standard VCM
 - Subjects are informed of each other's contribution
 - Stage 2: punishment opportunity
 - Subjects can punish other group members at a cost to themselves
 - A punished subject could not lose more than the Stage 1 income
 - The cost of punishment is approximately 1 point for 3 points of damage
 - With standard assumptions
 - Punishment is not credible since the game is finitely repeated
 - Punishment itself is a public good prone to free riding

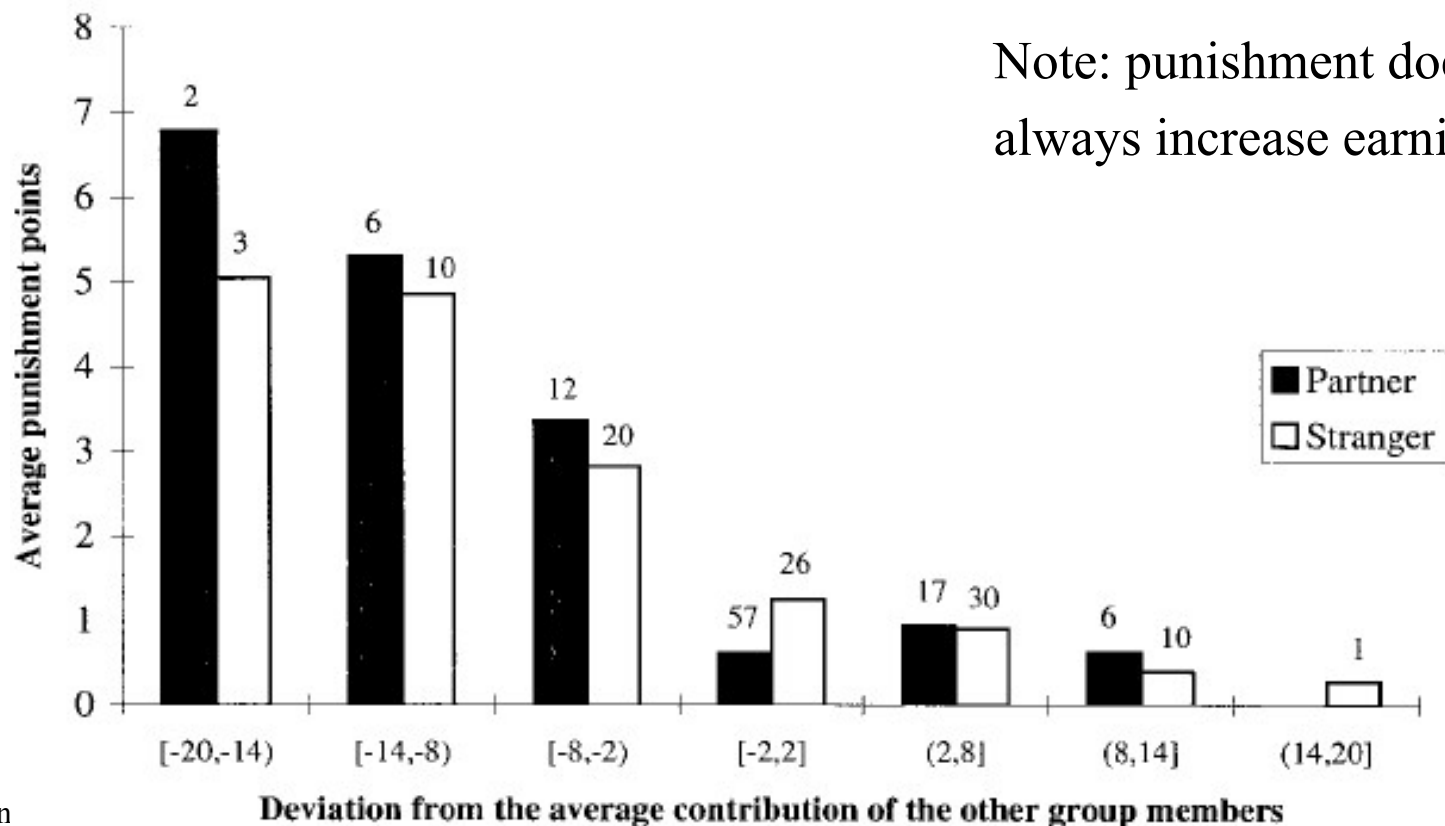
Decentralized Institutions: Punishment

- **The power of informal sanctions** Fehr & Gaechter 2000
- Results
 - Punishment increases contributions (even among strangers)



Decentralized Institutions: Punishment

- **The power of informal sanctions** Fehr & Gächter 2000
- Results
 - Punishment is concentrated on low contributors



Decentralized Institutions: Rewards

- **Rewards vs. punishment** Sutter et al. 2006
- If punishment works so well, why not informal rewarding
- Design
 - VCM: $n = 4$, $e = 20$, 10 periods, MPCR = 0.4, 160 subjects
 - 4 treatments
 - Control: no punishment nor reward
 - Punishment: costs 1 to reduce others' earnings by 3
 - Expensive rewards: costs 1 to increase others' earnings by 1
 - Cheap rewards: costs 1 to increase other's earnings by 3

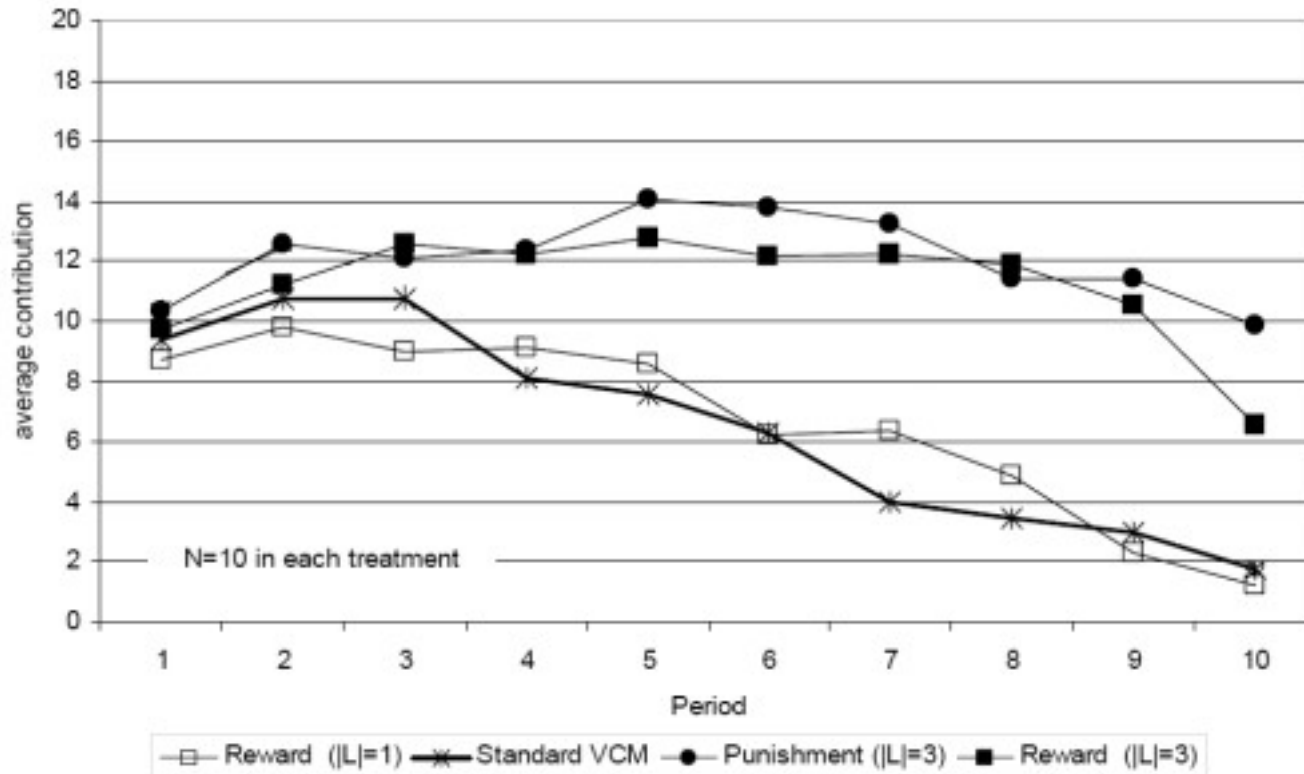
Decentralized Institutions: Rewards

- **Rewards vs. punishment** Sutter et al. 2006

- Results

- Expensive reward does not increase contributions
 - High contributors reward each other → no deterrence of free riding
- Cheap reward works as well as punishment

but is this realistic?

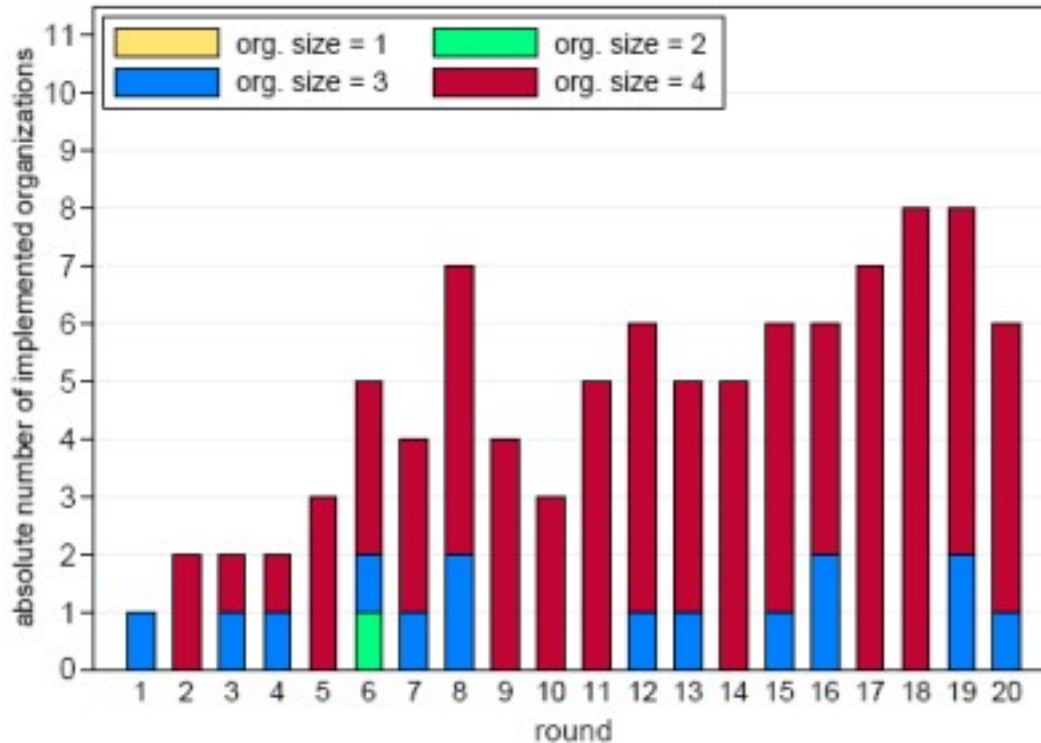


Institution formation

- **Picking by consensus** Kosfeld et al. 2009
 - In many cases it is not possible to exclude individuals from a public good
- Design
 - VCM: $n = 4$, $e = 20$, 20 periods, MPCR = 0.4
 - 3 stages
 - Participation stage: decide whether to be part of an organization
 - Taking part in the organization is costly ($k = 2 / n_o$)
 - Implementation stage: members of the organization decide whether to enforce high cooperation levels among themselves (by unanimity)
 - If enforced every member contributes 20
 - Contribution stage

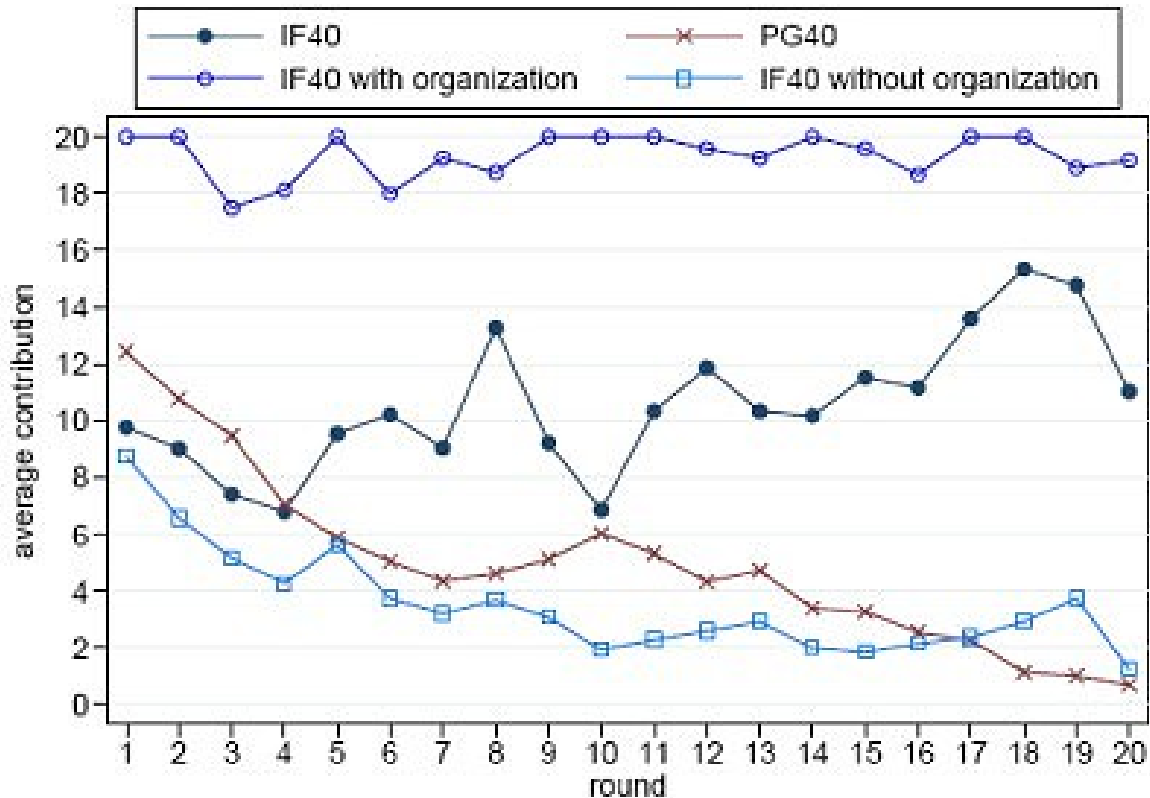
Institution formation

- **Picking by consensus** Kosfeld et al. 2009
- Results
 - Organizations are frequently and increasingly implemented



Institution formation

- **Picking by consensus** Kosfeld et al. 2009
- Results
 - Contributions increase with the use of the organization
 - If one player does not want to join the organization is not implemented and contributions are low



Summary

- Institutions that successfully promote cooperation usually:
 - Facilitate coordination
 - Communication
 - Particularly face-to-face
 - Signaling through institution formation
 - Penalize free-riders
 - Punishment
 - Taxation
 - Competition