8. Public Goods

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Economics 176

- Individual choice experiments
  - Test assumptions about Homo Economicus
- Strategic interaction experiments
  - Test game theory
- Market experiments
  - Test classical notions of competitive equilibrium

Public Goods

What is a **public good**? Three components:

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Classic prediction?

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Classic prediction?

- Free riding and underprovision!

Multi-agent situation where efficiency and individual rationality are at odds.

Examples

Classic examples

- Military
- Parks
- Environmental quality
- Teamwork / team production

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Historical examples

- Communes (Jamestown)
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Closely related: common pool resources

- Like a public good but rivalrous
- Describes a lot of environmental problems
- Fisheries are the classic example

The Voluntary Contribution Mechanism

Experimentalists use a simple model to describe the central problem with public goods.

Called the **voluntary contribution mechanism (VCM)** it consists of the following rules:

- N players
- Player i has endowment e_i of **tokens** and
- chooses a number x_i to contribute to a public account (choices are simultaneous)
- keeping $e_i - x_i$ to herself and, in total, earning

$$e_i - x_i + m \sum_{j=1}^{N} x_j \tag{1}$$

- where m is the marginal per capital return (or MPCR).

The Voluntary Contribution Mechanism

As long as $1/N < m < 1$ this is a public goods problem.

- Consider an example where there $N = 4$ player and
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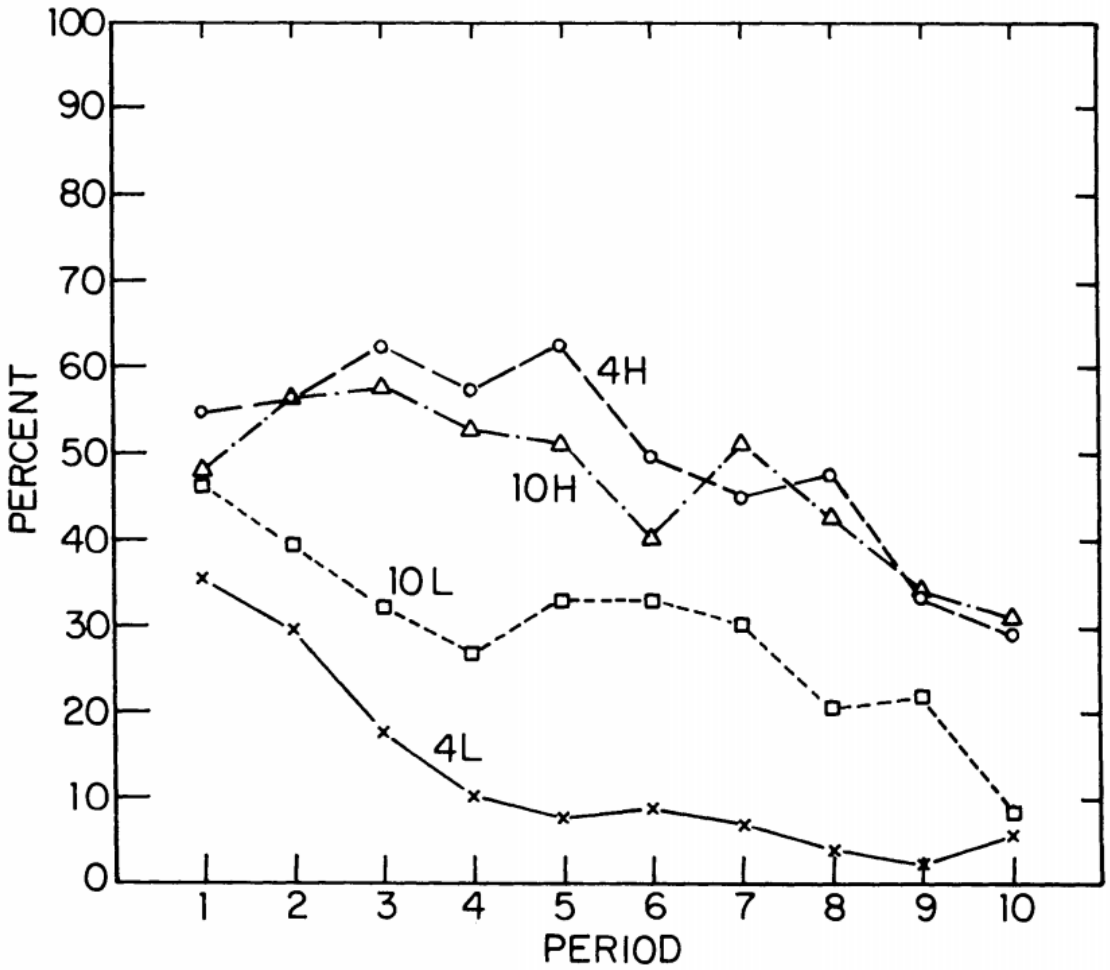
- Suppose everyone else is giving the full amount.
- If you give the full amount you earn 100
- But if you give nothing you earn 250!
- We call doing this **free riding**.

Typical Results

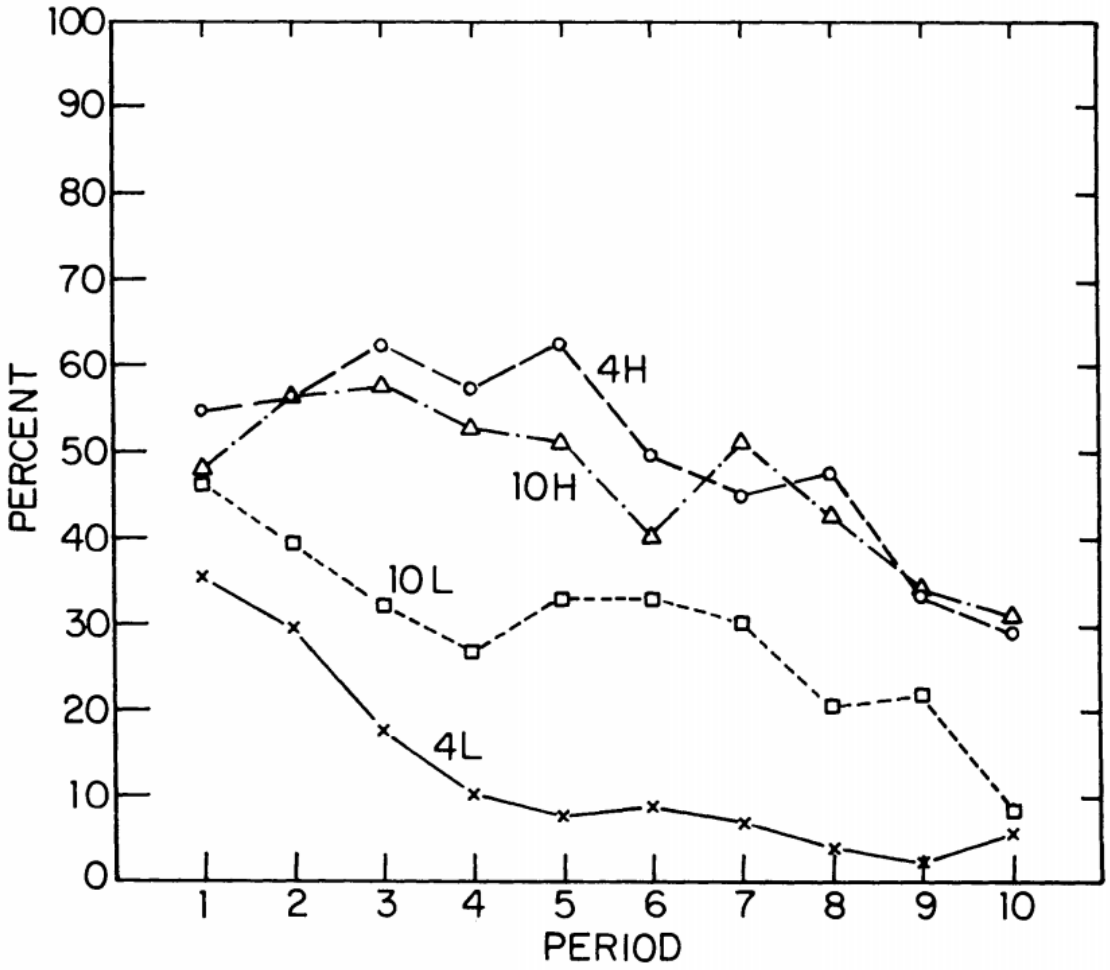
1. In one shot games, give roughly half to the public good.
2. In most economics public goods games, let subjects play a number of times (10 seems focal)



Typical Results

Subjects experience what is sometimes called **cooperative decay**

Cooperation rates drop to under 10% with experience in some parameterizations and less drastically in others.



Group Size and MPCR

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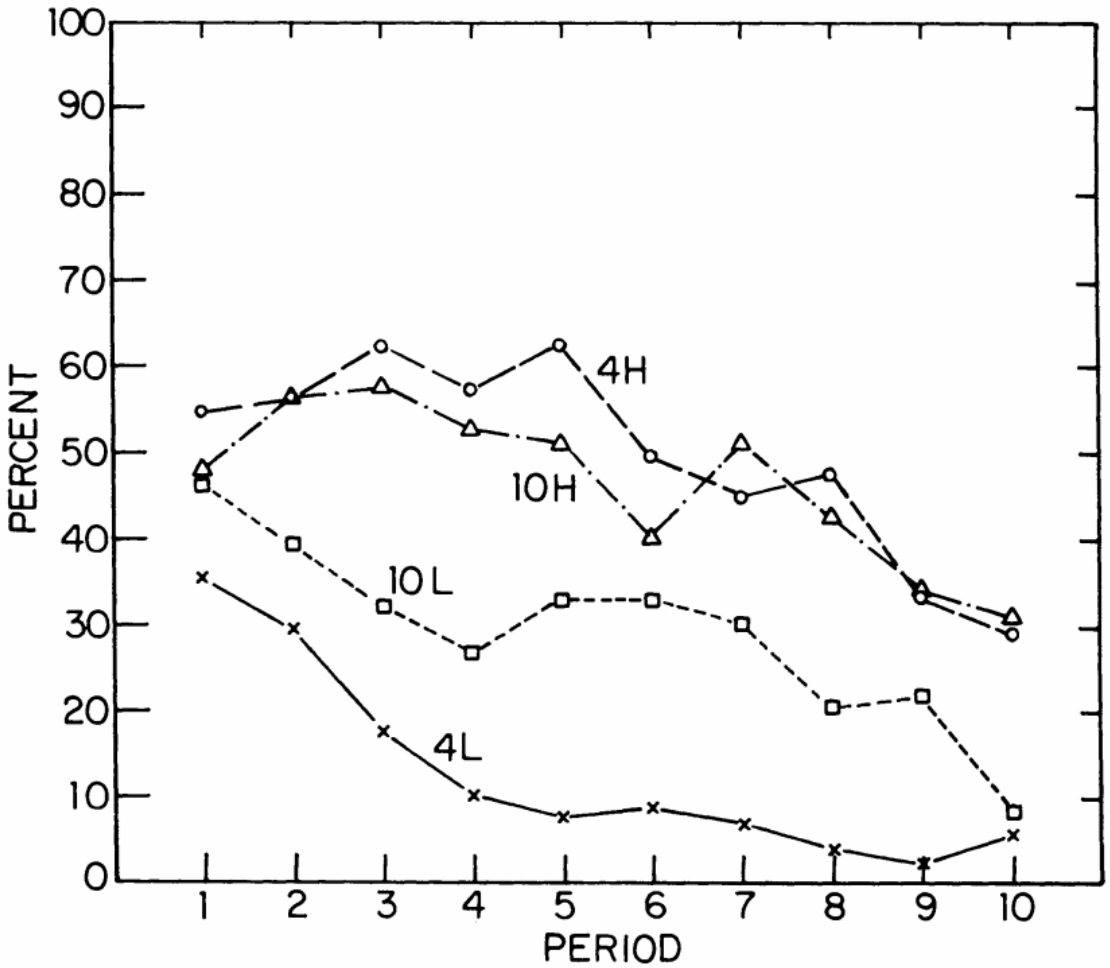
What effect should N have on cooperation rates?

- Increases the efficiency of cooperating as every token helps more people (should **increase** cooperation) but
- usually we think of coordination harder with a larger group and altruistic motives less salient in a less personal setting (should **decrease** cooperation).
- Which force should dominate?

Isaac and Walker (1988)

Varies both of these variables

- MPCR between L (0.3) and H (0.75)
- N between 4 and 10



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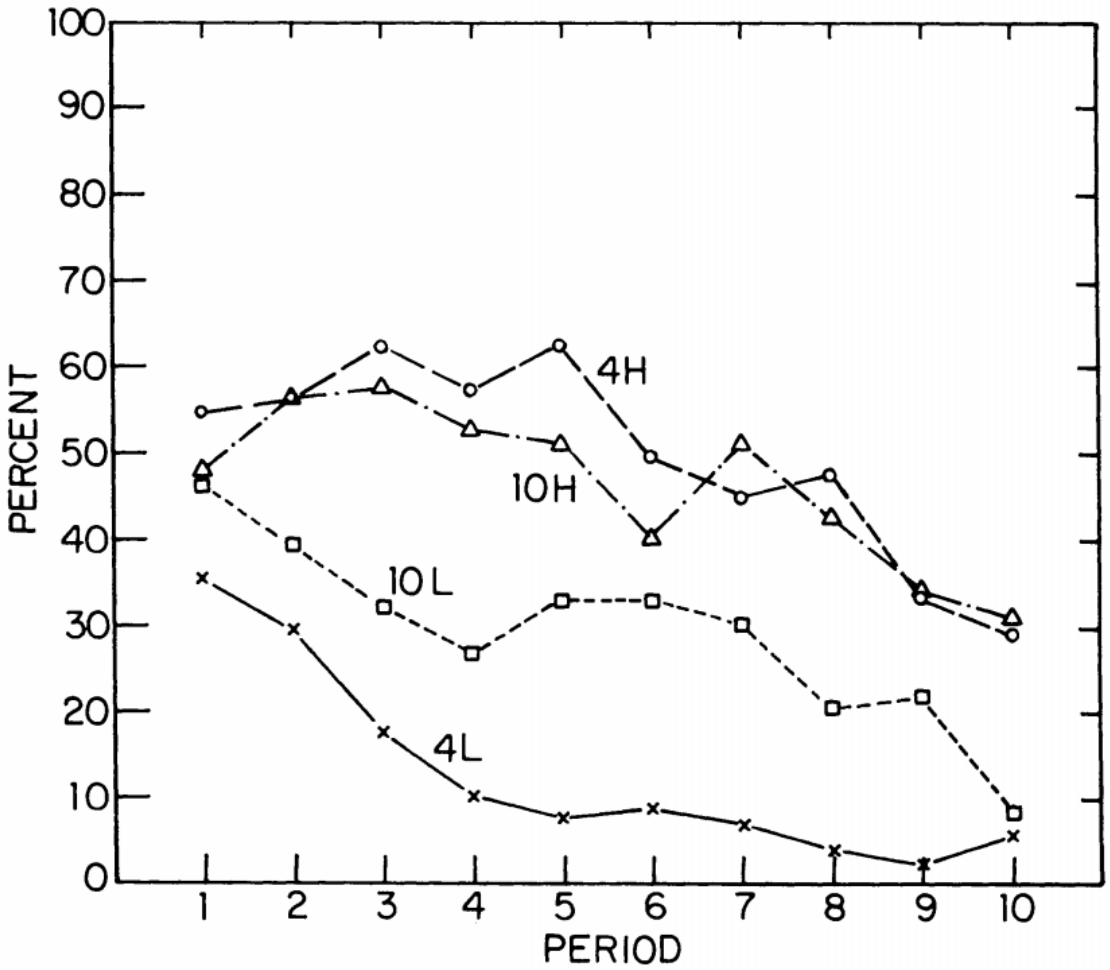
Varies both of these variables

- MPCR has a real effect on behavior.
- N has little clear effect – if anything larger groups cooperate better!



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Returned to this question with even more variation in group sizes.

- Vary MPCR between 0.30 and 0.75
- Vary N between 4 and 10 like before
- but also groups 10 times larger: N of 40 and 100!

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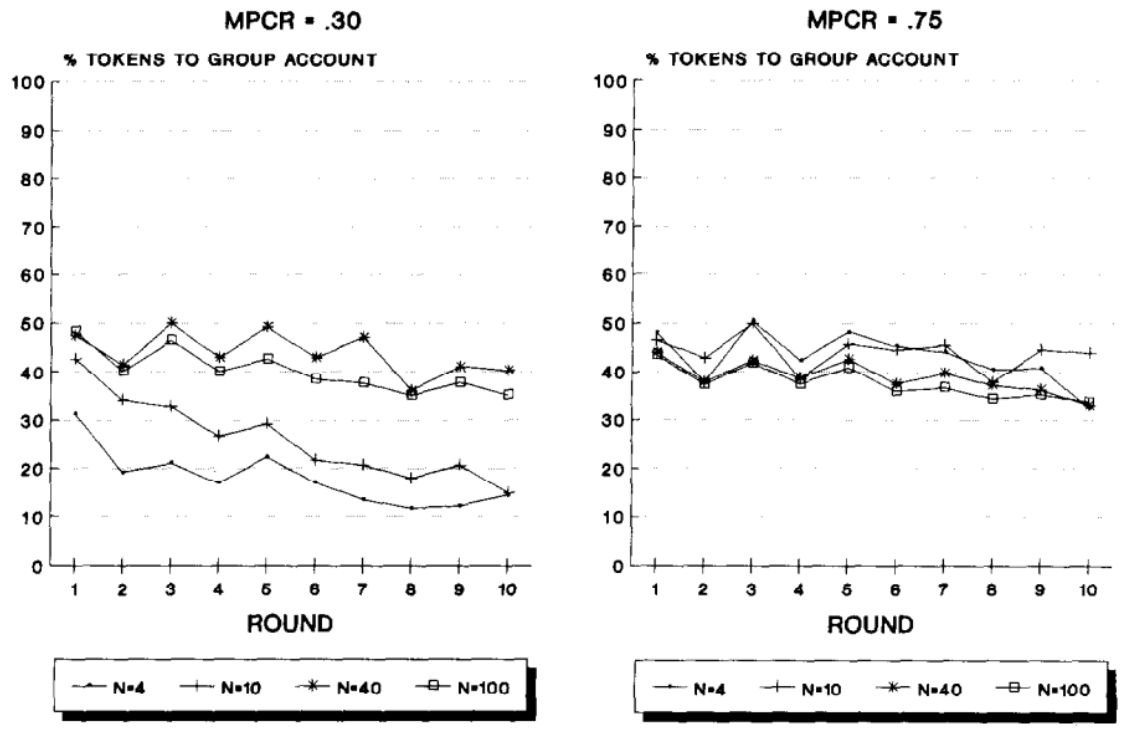

Why Do People Cooperate?

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1. Why do people cooperate *at all*?
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Two popular answers to the questions:

1. **Kindness:** People are conditional cooperators: enjoy the experience of cooperating ("warm glow") but only if others are cooperating too.
   - As in prisoner's dilemmas people might have incentives to pretend to be conditional cooperators!
   - Over time some of these defect, causing a chain reaction.

2. **Confusion:** People do not fully understand their best response and are simply making mistakes.
   - Cooperative decay is just learning.

Andreoni (1995)

Idea: Create a treatment where "kindness" can't be causing the results and compare to a baseline.

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Three treatments:

- **Regular:** Normal VCM
- **Rank:** Earnings are entirely based on rank of your returns relative to others (i.e. if you earn the highest amount you get \$0.95 while if you earn the lowest you get \$0.65.).
- **RegRank:** Normal VCM but you tell people ranks (to make sure knowing about ranks isn't driving results).

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Claim: Rank treatment is zero sum and thus can't be due to cooperative motives – you can't all build up your earnings together.

Andreoni (1995)

TABLE 1—PERCENTAGES OF ENDOWMENT CONTRIBUTED TO THE PUBLIC GOOD PER ROUND

	Round										
Condition	1	2	3	4	5	6	7	8	9	10	All
Regular	56.0	59.8	55.2	49.6	48.1	41.0	36.0	35.1	33.4	26.5	44.07
RegRank	45.8	45.4	32.6	25.0	23.1	17.8	11.3	9.5	8.3	9.0	22.79
Rank	32.7	20.3	17.7	9.9	9.2	6.9	8.1	8.3	7.1	5.4	12.55
RegRank – Rank	13.2	25.1	15.0	15.1	13.9	11.0	3.2	1.3	1.2	3.6	10.24
As percentage of Regular	23.5	42.0	27.1	30.4	28.9	26.7	8.9	3.6	3.6	13.5	20.82

TABLE 2—PERCENTAGE OF SUBJECTS CONTRIBUTING ZERO TO THE PUBLIC GOOD PER ROUND

	Round										
Condition	1	2	3	4	5	6	7	8	9	10	All
Regular	20	12.5	17.5	25	25	30	30	37.5	35	45	27.75
RegRank	10	22.5	27.5	40	35	45	50	67.5	70	65	43.25
Rank	35	52.5	65	72.5	80	85	85	85	92.5	92.5	74.50
Kindness:											
Rank – RegRank	25	30	37.5	32.5	45	40	35	17.5	22.5	27.5	31.25
As percentage of 100 – Regular	31.3	34.3	45.5	43.3	60.0	57.1	50.0	28.0	34.6	50.0	43.41
Confusion:											
100 – Rank	65	47.5	35	27.5	20	15	15	15	7.5	7.5	25.50
As percentage of 100 – Regular	81.3	54.3	42.4	36.7	26.7	21.4	21.4	24.0	11.5	13.6	33.33
Either:											
RegRank – Regular	– 10	10	10	15	10	15	20	30	35	20	15.5
As percentage of 100 – Regular	– 13.0	11.4	12.1	20.0	13.3	21.4	28.6	48.0	53.8	36.4	23.26

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Summary of findings:

- Around half of subjects are confused and half are kind.
- A lot are misclassified so kindness could be as low as 43% or as high as 67%
- Strangely, simply knowing the rankings of earnings has a massive negative impact on cooperation even in the standard VCM!

Houser and Kurzban (2002)

Idea: Use a very different method to disentangle kindness and confusion.

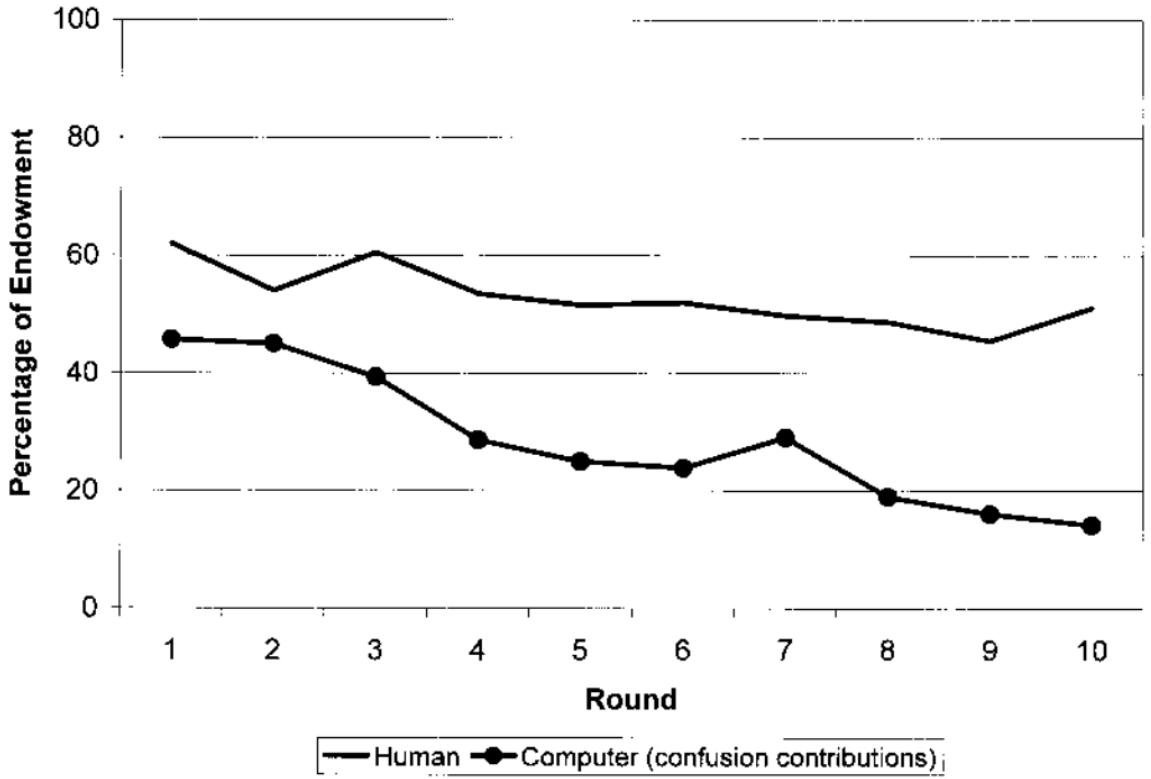
Two treatments:

- **Human:** Normal VCM with 4 players
- **Computer:** Play against three computer players that each play the mean contribution from the Human treatment.

Claim: Computer treatment has to be entirely due to confusion. Difference between two treatments measures contributions due to "kindness."

Houser and Kurzban (2002)

About half of cooperation is due to confusion, especially in early rounds!



Pivot Point Mechanism

Suppose a public good will only be provided if a sufficient amount of money, τ is invested.

- For example, suppose contributions to the public pot generates $msumx_i$ as before but only if $x_i \geq \tau$.

Several variations:

- **No Money Back:** Fail to meet threshold, money disappears.
- **Money Back:** Get contributions back!
- Also several variations that alter what happens to contributions higher than the threshold.

This family of **mechanisms** is sometimes referred to as a **threshold public good** or a **pivot point mechanism**.

Early experiment by Isaac, Schmidt and Walker (1989)

- Run with low, medium and high thresholds
- and Money Back or No Money Back protocols.

Pivot Point Mechanism

Does this actually do anything to Nash equilibrium?

- Yes! In fact it generates **multiple equilibria**. Focus on two:
- Everyone free rides (just as in a standard VCM) or
- everyone coordinates on contributing τ/N!

Will this make things better or worse?

- Provision point could serve as a focal point leading to really high contributions or
- could drive people from making even modest contributions (due to something like risk dominance).

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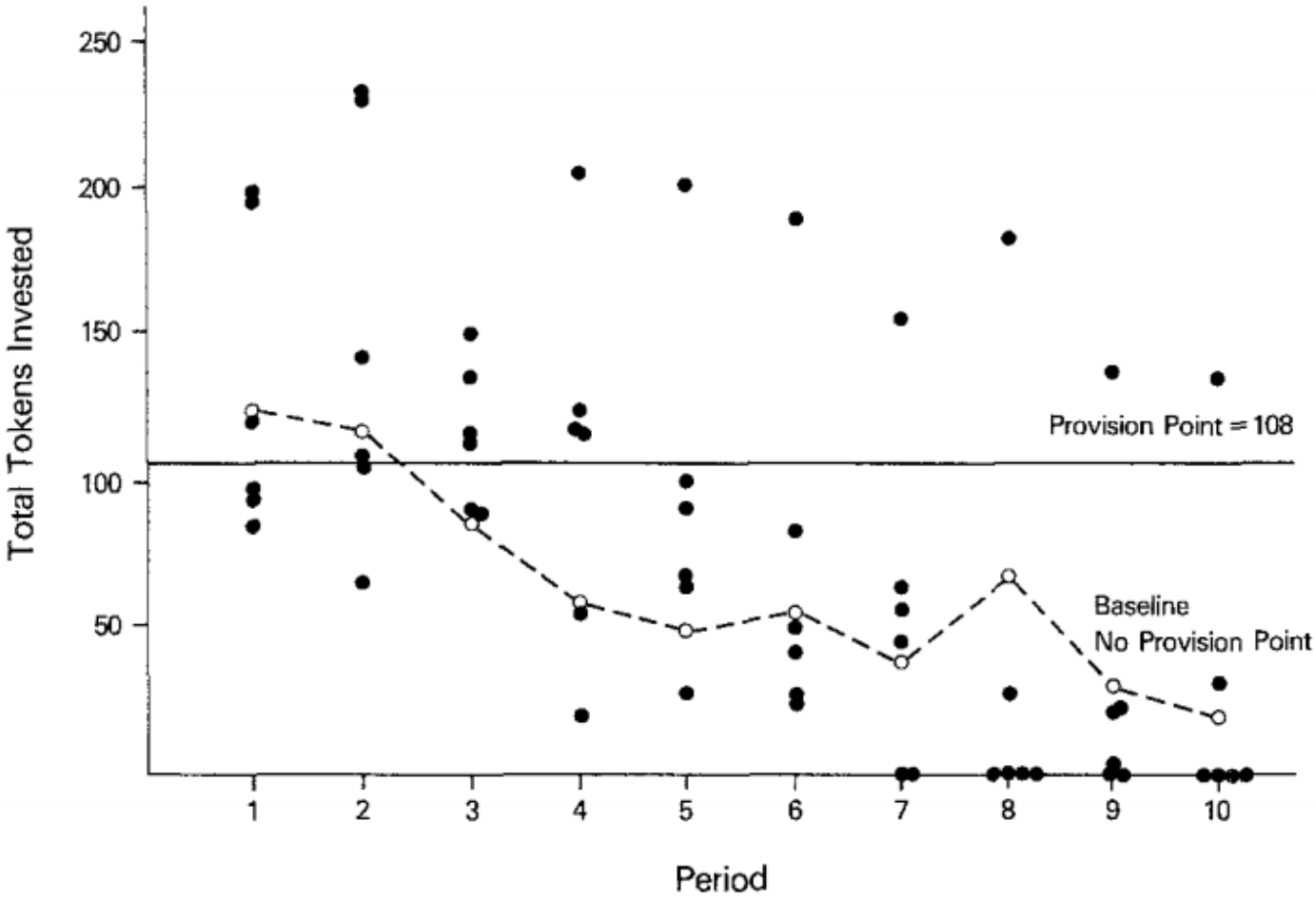

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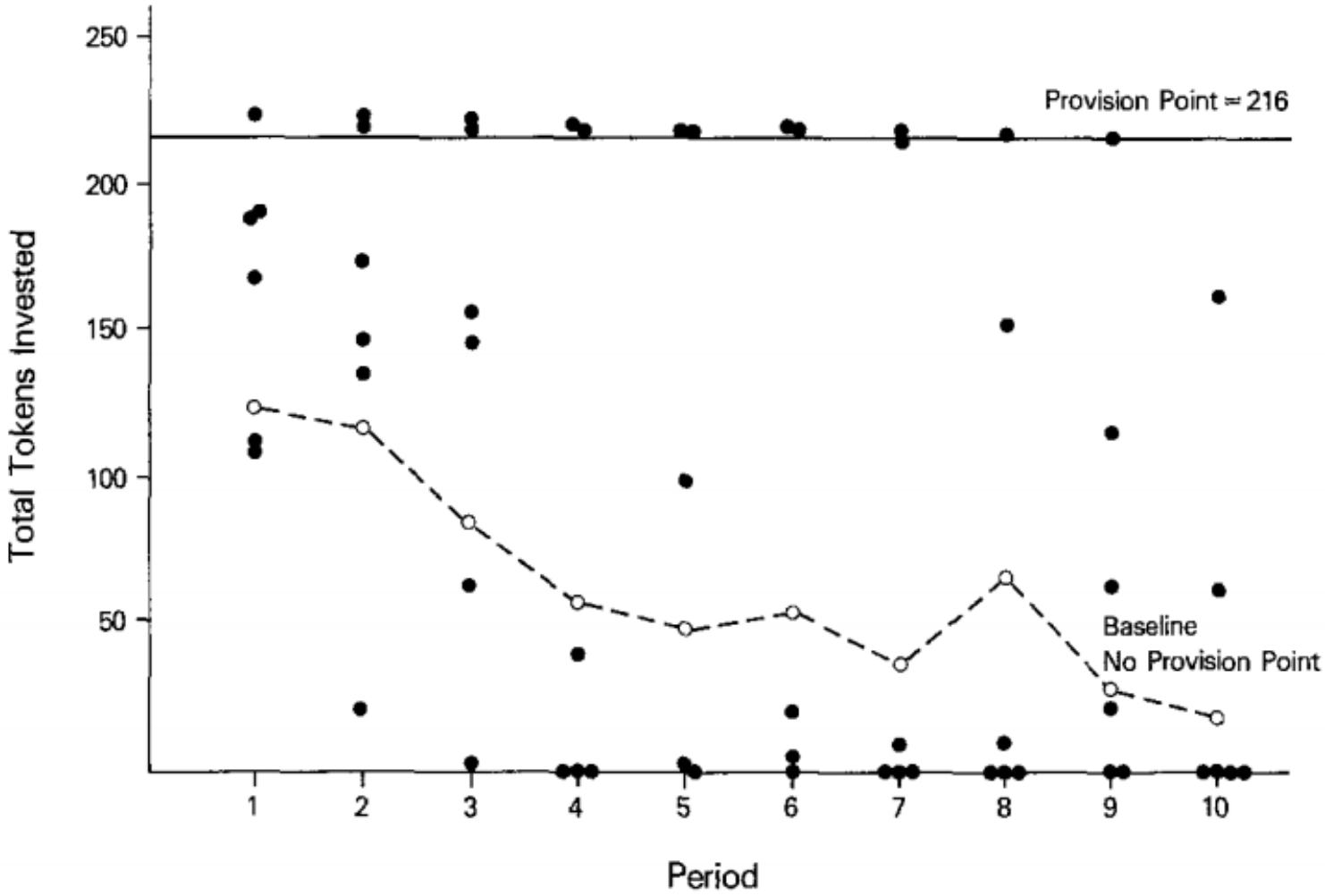

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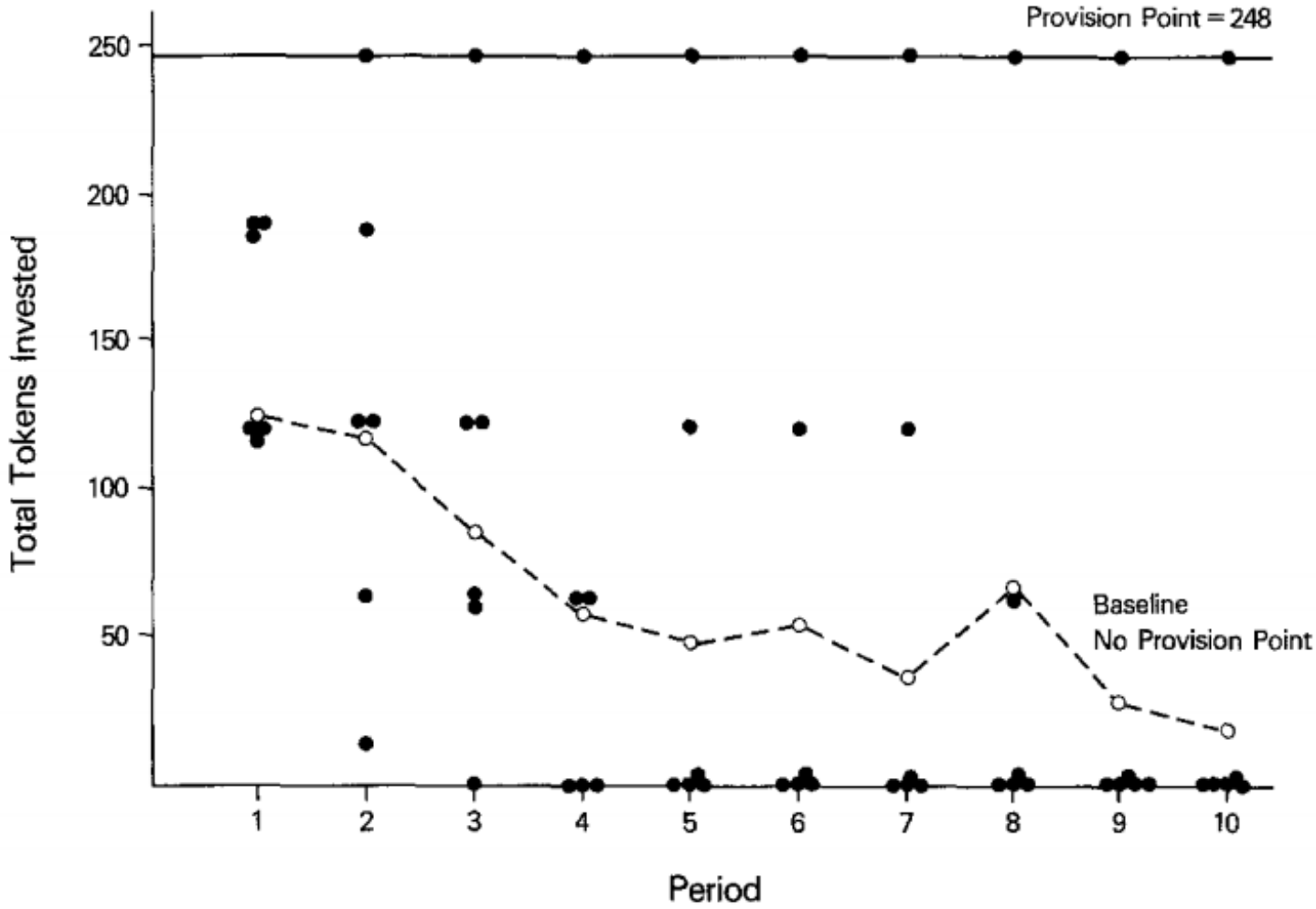

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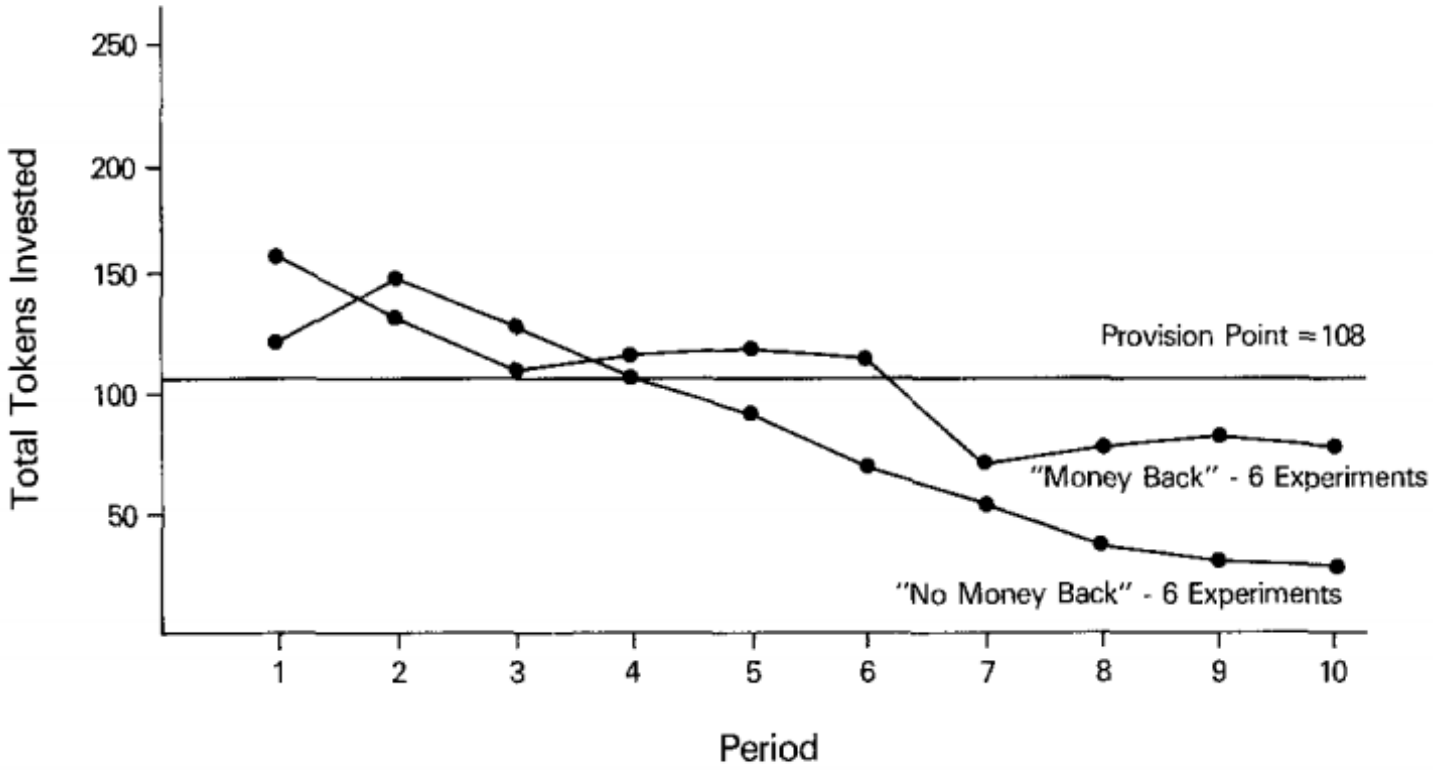

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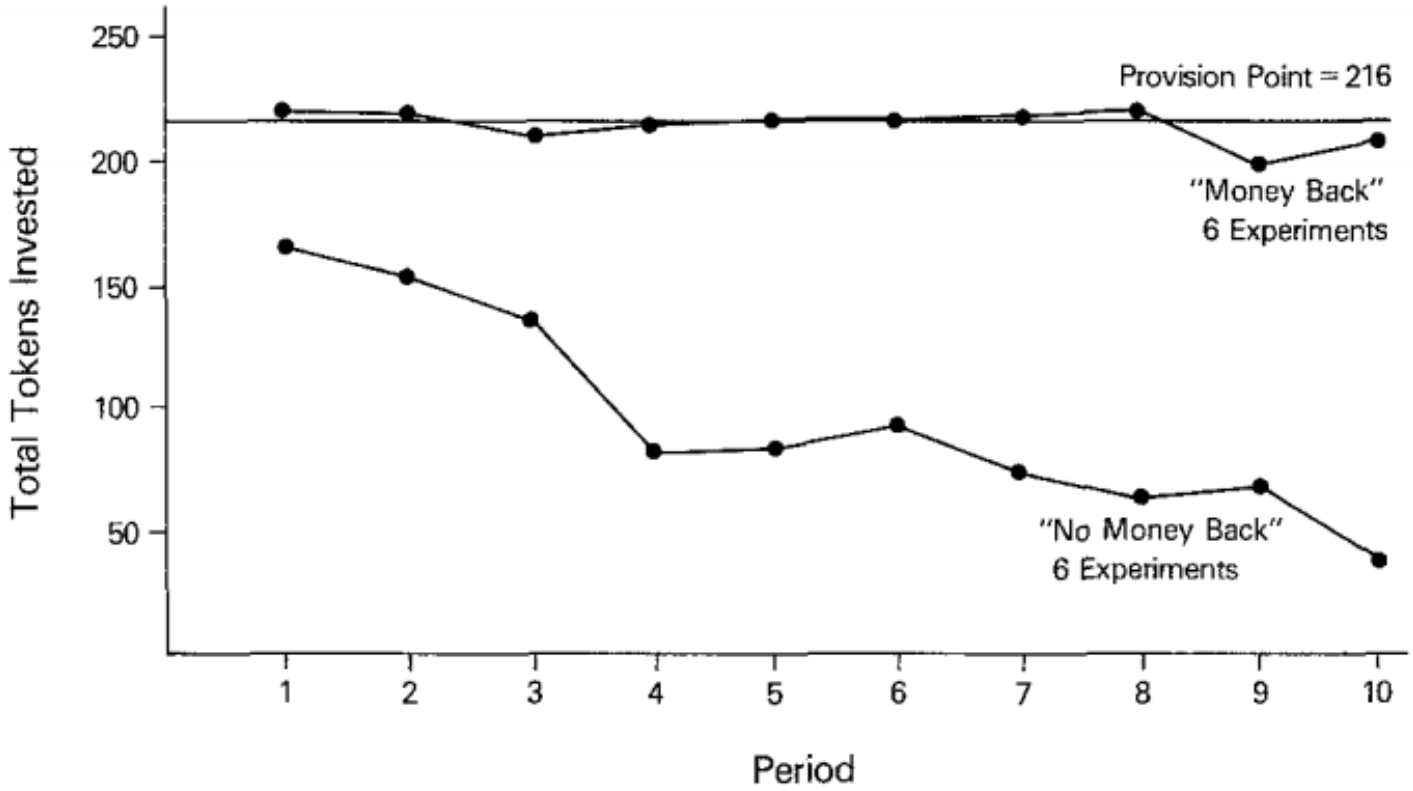

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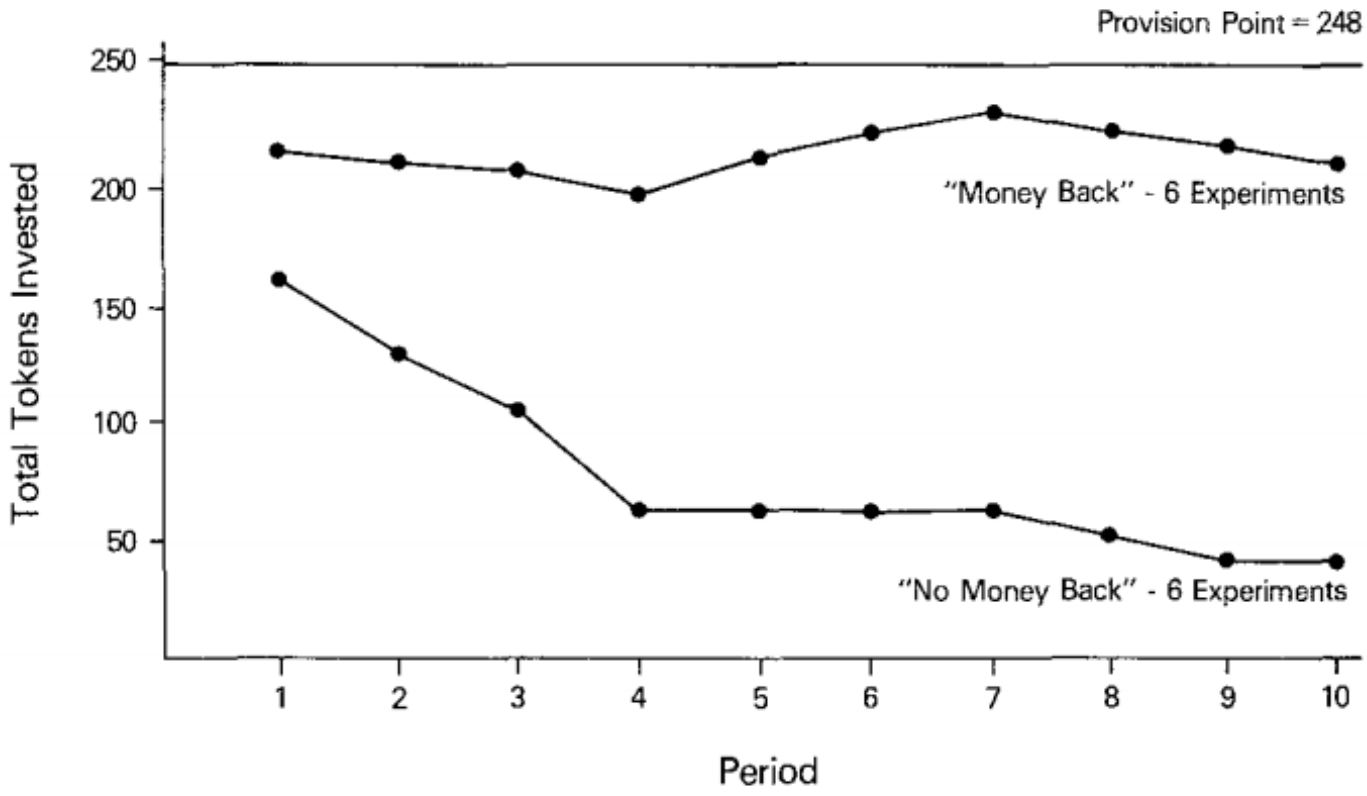

Punishment: Fehr and Gachter (2000)

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- by backwards induction, the ability to punish should have no effect on contributions!

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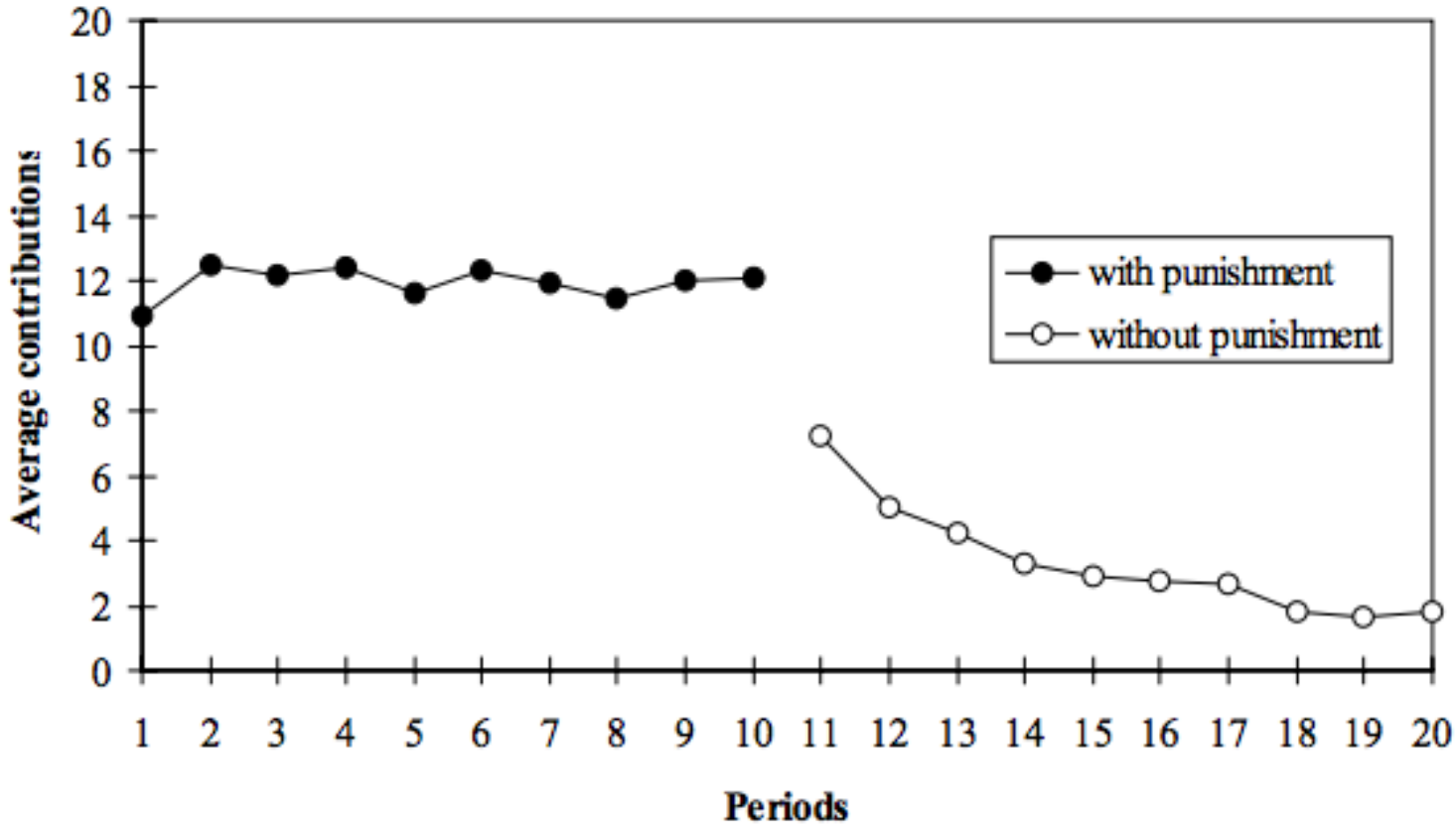

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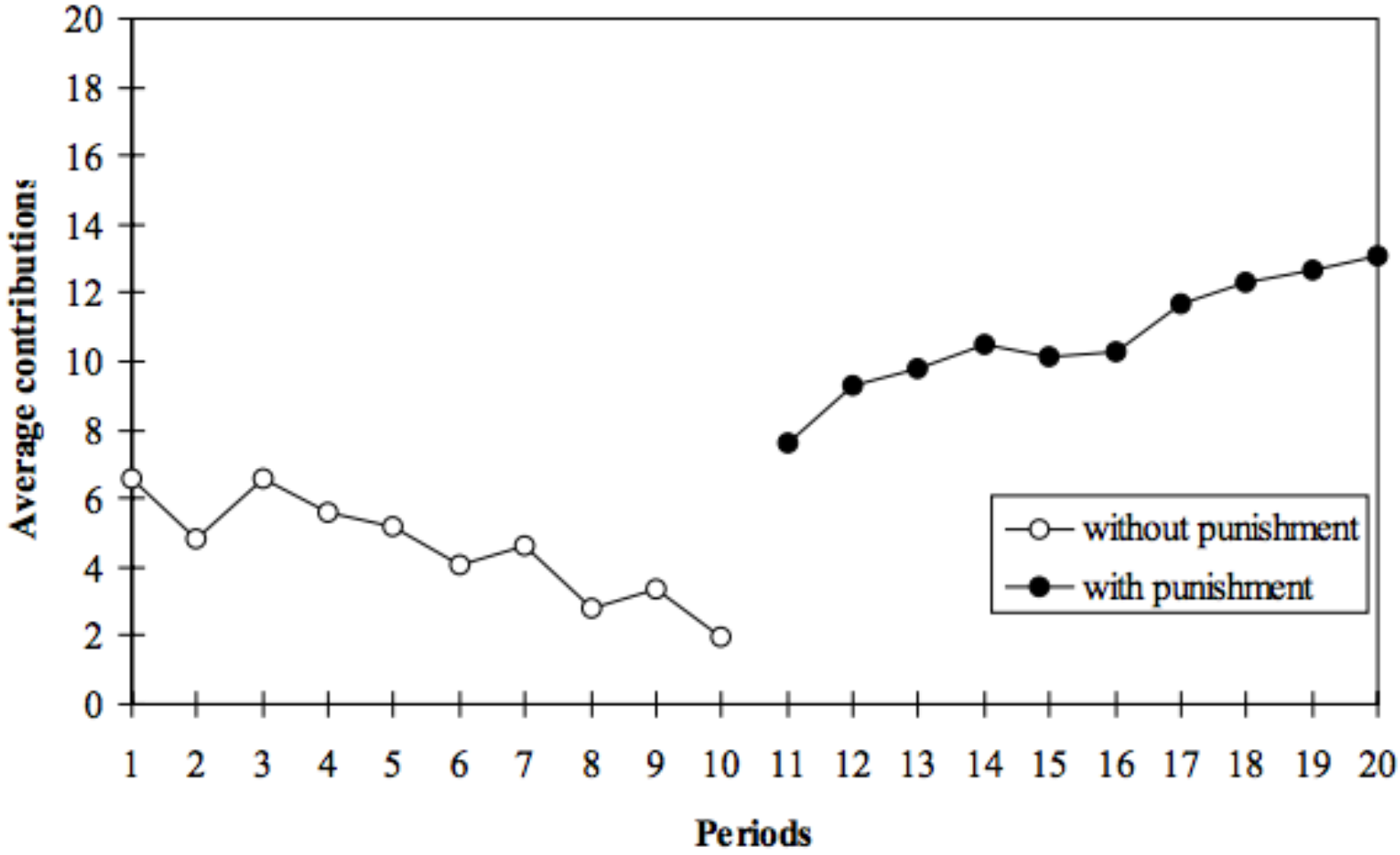

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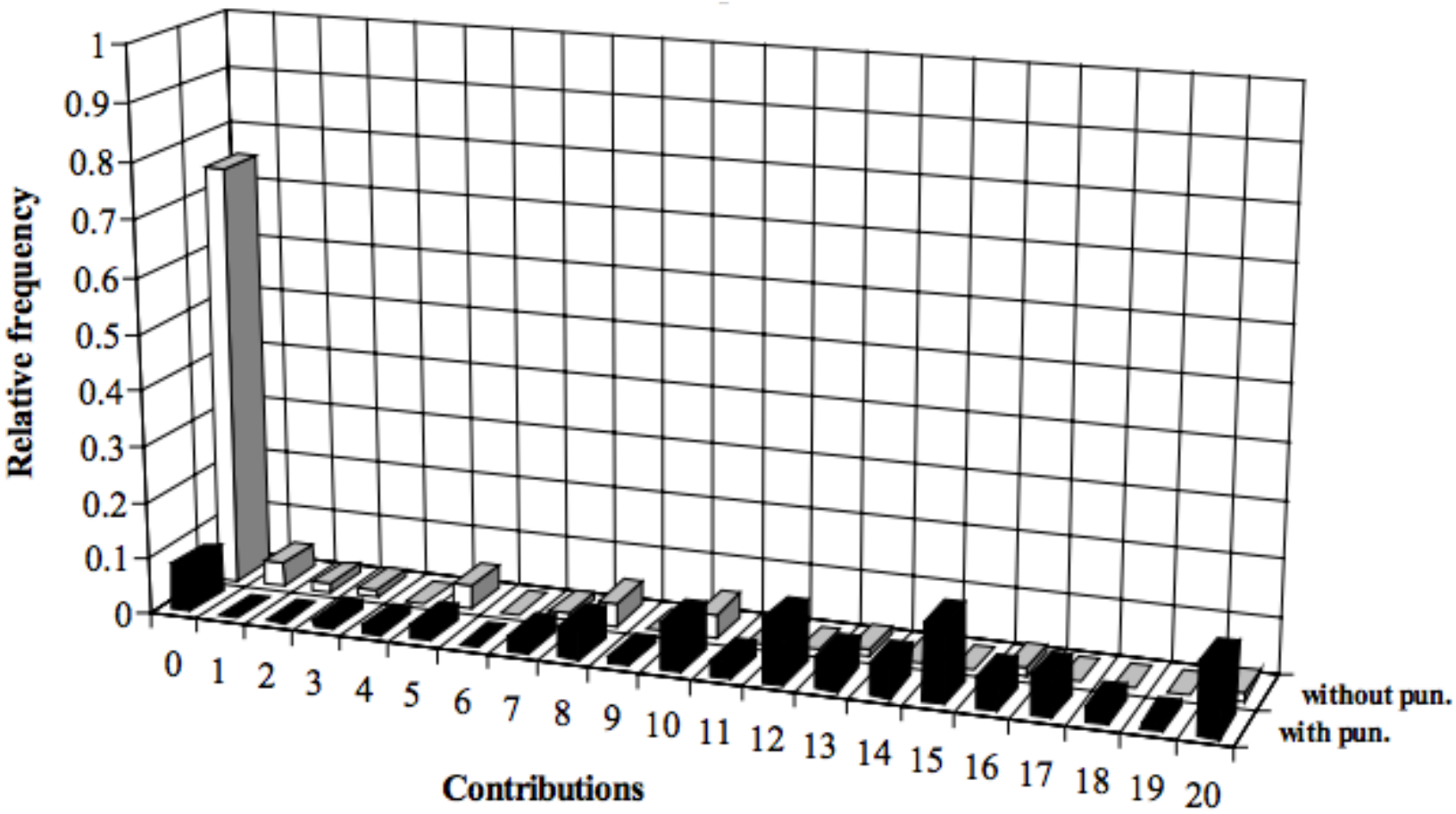

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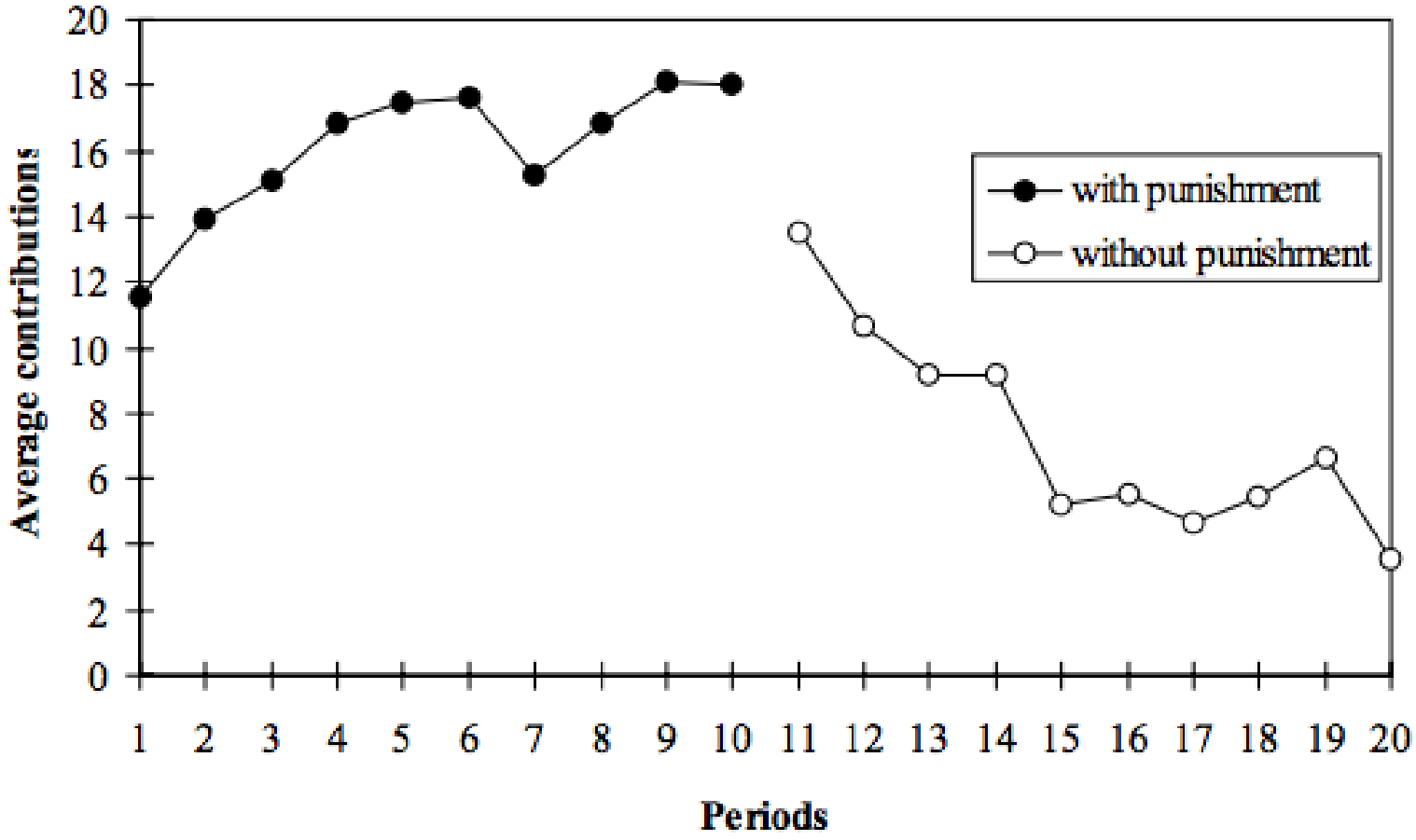

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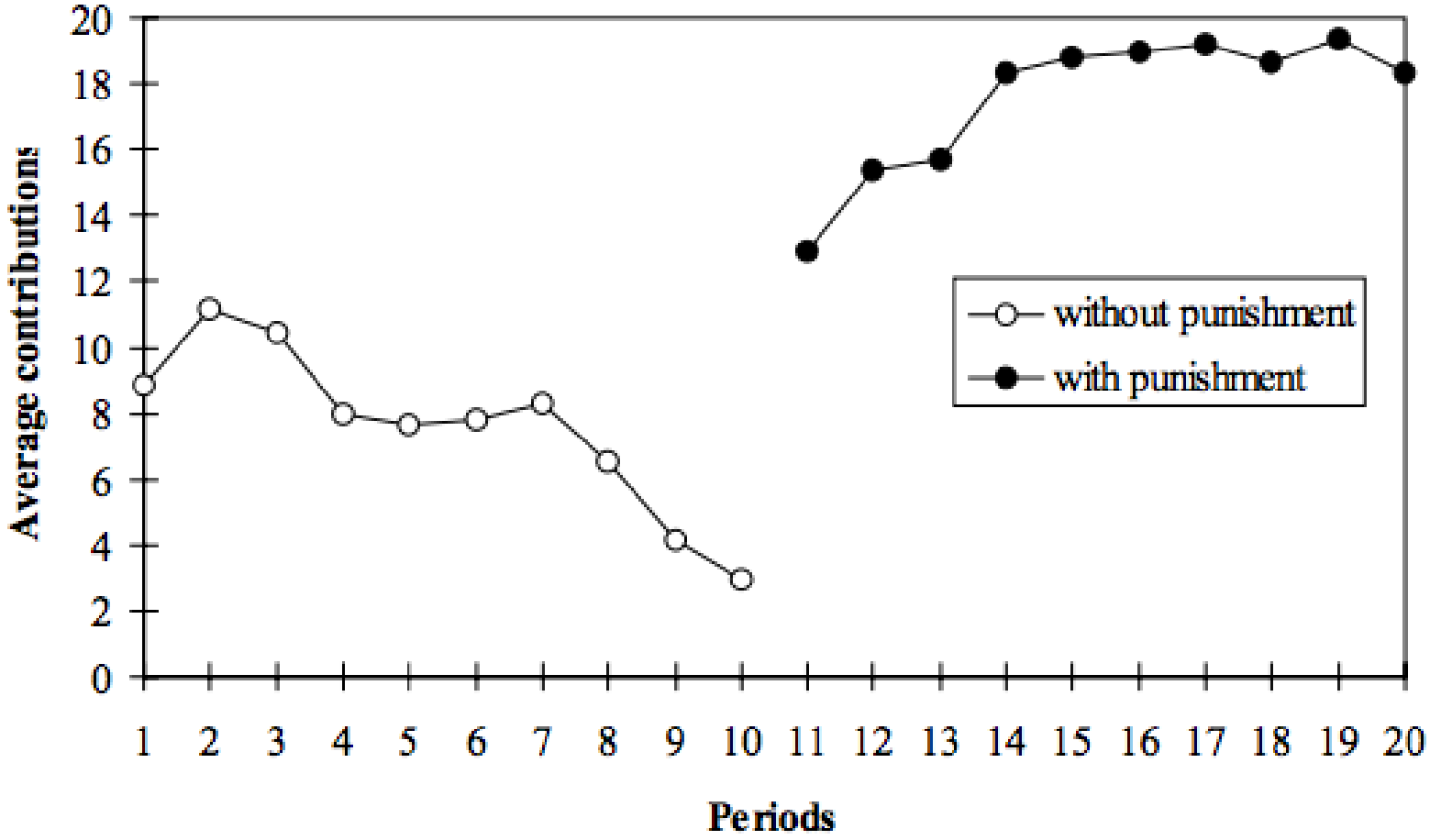

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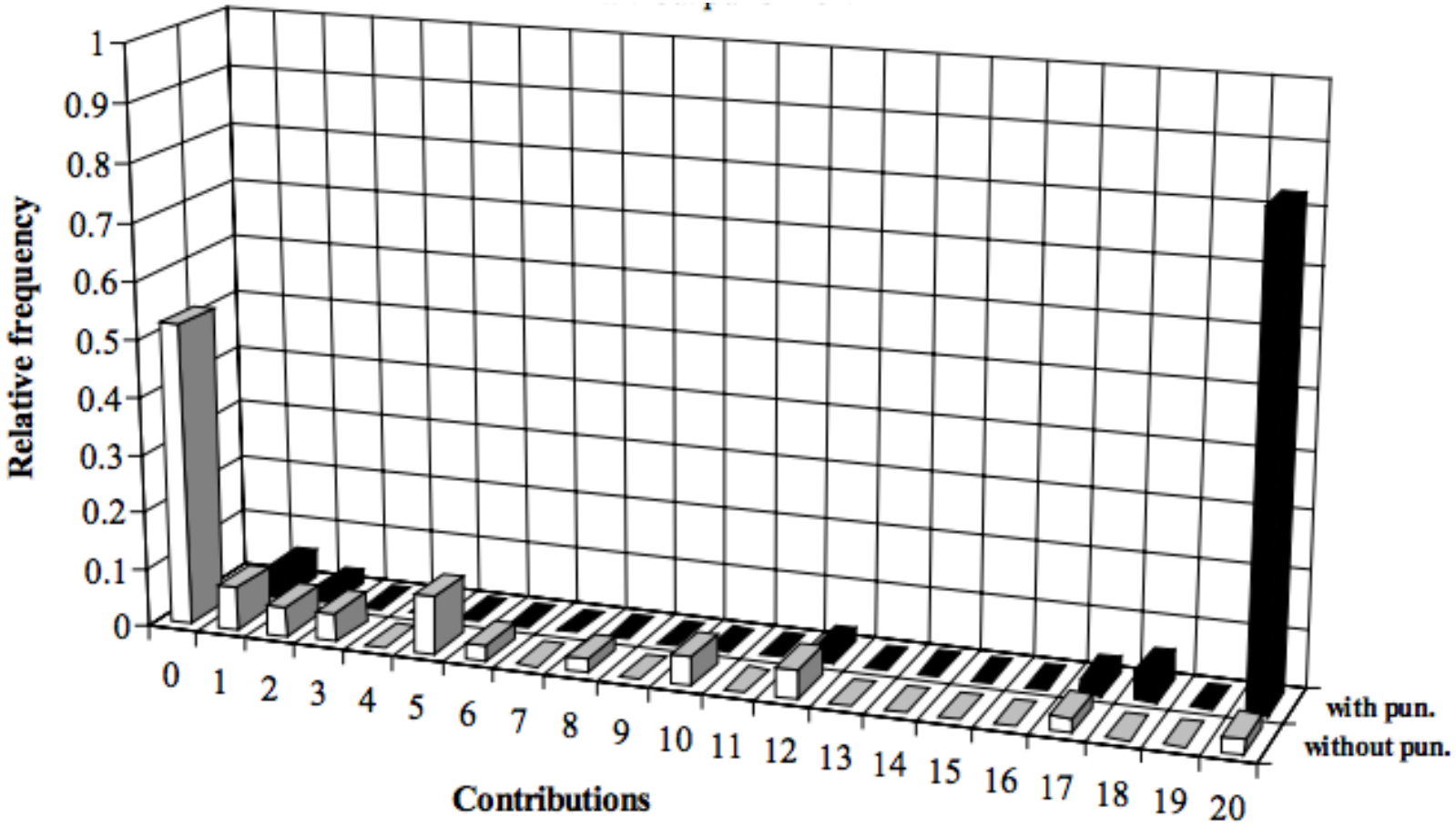

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- If you're expending a lot of resources, could end up, on net, inefficient to allow punishment.
- Early on, very inefficient but
- by the end of 10 periods groups on average earn more by allowing punishment.

Why do subjects punish even though it is not in their individual best interest to do so?

- Doesn't seem like altruism!
- Nor does it seem like confusion or standard forms of learning.
- Fehr and Gachter hypothesize that it is due to a strong negative emotion that leads to punishment and provide some evidence that this might be the case.

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Three effects of the ability to expel non-cooperators

- Fewer non-cooperators (higher cooperation rate)
- Conditional cooperators feel free to cooperate (higher cooperation rate)
- Desire to stay in group may cause non-cooperators to cooperate (higher cooperation rate)

Cinyabuguma et al. (2005)

A simple experimental design

- **Baseline:** Standard VCM with 16 players, \$10 in initial endowment, 15 periods and MPCR of 0.2
- **Expulsion:** Everyone starts in the "green" group with \$10
  - Each period, each subject can vote to "expel" any other member to the "blue" group.
  - In the blue group, subjects only have \$5 initial endowment.
  - A majority vote is sufficient for expulsion.
  - Everyone who votes for expulsion is charged \$0.25.
  - Full feedback on votes and contributions.

Two treatment types:

- **BE:** 15 periods of Baseline followed by 15 periods of Expulsion (BE1)
- **EE:** 15 periods of Expulsion (EE1) followed by another 15 periods of Expulsion (EE2).

Cinyabuguma et al. (2005)

Do people vote for expulsion?

- Yes – a majority do in fact!
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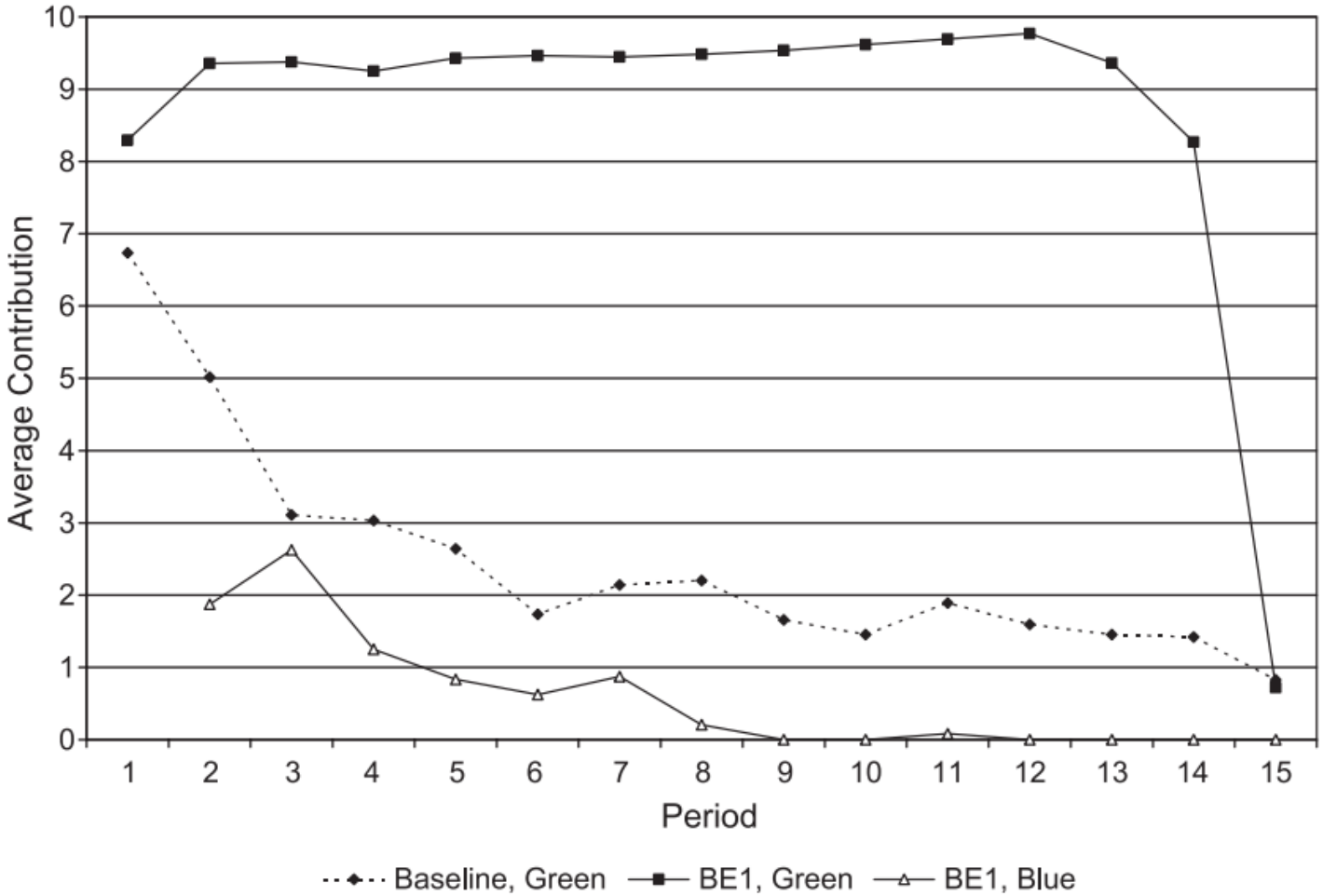
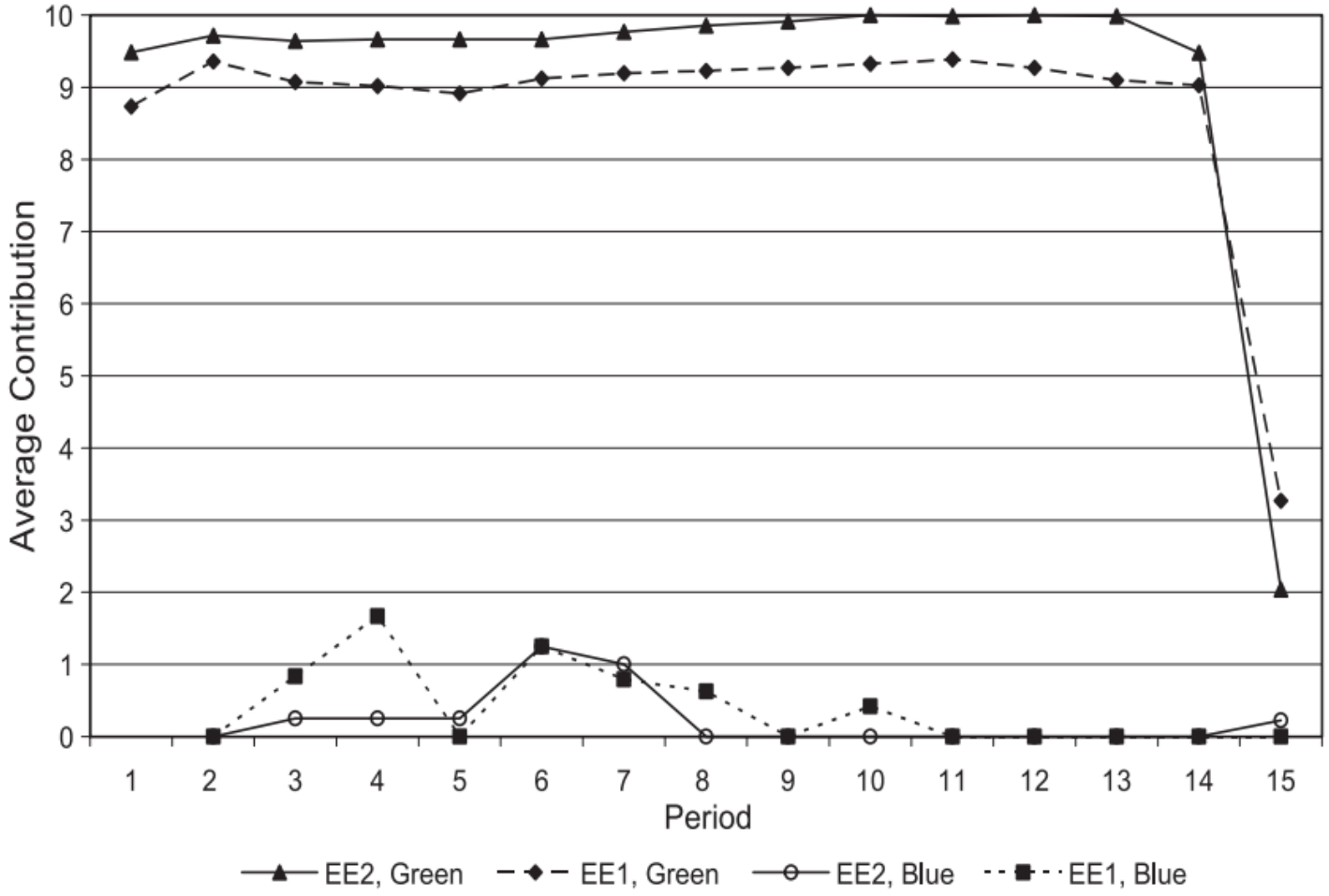


Cinyabuguma et al. (2005)

Same if we have two expulsion treatments in a row?



Cinyabuguma et al. (2005)

Is there a compositional effect on cooperation?

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Yes, two pieces of evidence:

- High cooperation rates in the first period.
- Complete collapse of cooperation in the last period (when there are no more possible threats of expulsion).

What is the overall effect on efficiency across **both** groups?

- It actually increases on net!
- Partly this is because most people don't get expelled – instead they get warning signals from votes and change their behavior.