# An experimental analysis of contribution choices in the linear public good game with non-uniform marginal returns

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# Introduction

- Several laboratory experiments have investigated situations of economic inequality, examining the diverse situations in which it becomes apparent. This study uses the public good game to analyse the choices of pairs of individuals with different capacity to contribute.
- Expanding upon prior research, particularly the study conducted by Heap and colleagues in 2016, which investigated heterogeneity related to initial endowments, our study focused on investigating variability in terms of the MPCR.

# Aim of the research

- Within our experimental framework, we contrasted three distinct treatments: T1 and T2 represented uniform conditions, where participants received a constant and symmetrical $\alpha$ of 0.6 in the first treatment and 0.8 in the second treatment. In contrast, the third treatment (T3) introduced variability within groups, where subjects exhibited different MPCR values.

When subjects have the same MPCR, the contribution choices in the uniform groups are not significant difference by those of subjects in the non-uniform groups

# Experiment

The experiment was carried out at CIMEO, the experimental laboratory of La Sapienza University of Rome and conducted with the Z-Tree software (Fischbacher, 2007). We enrolled 78 students from the Faculty of Economics.

Table 1: Experiment design

| Treatment | $\alpha$ | Number of subjects | Number of independent observations |
|---|---|---|---|
| T1 | 0.6 | 28 | 14 |
| T2 | 0.8 | 22 | 11 |
| T3 | 0.6,0.8 | 28 | 14 |

# Experiment

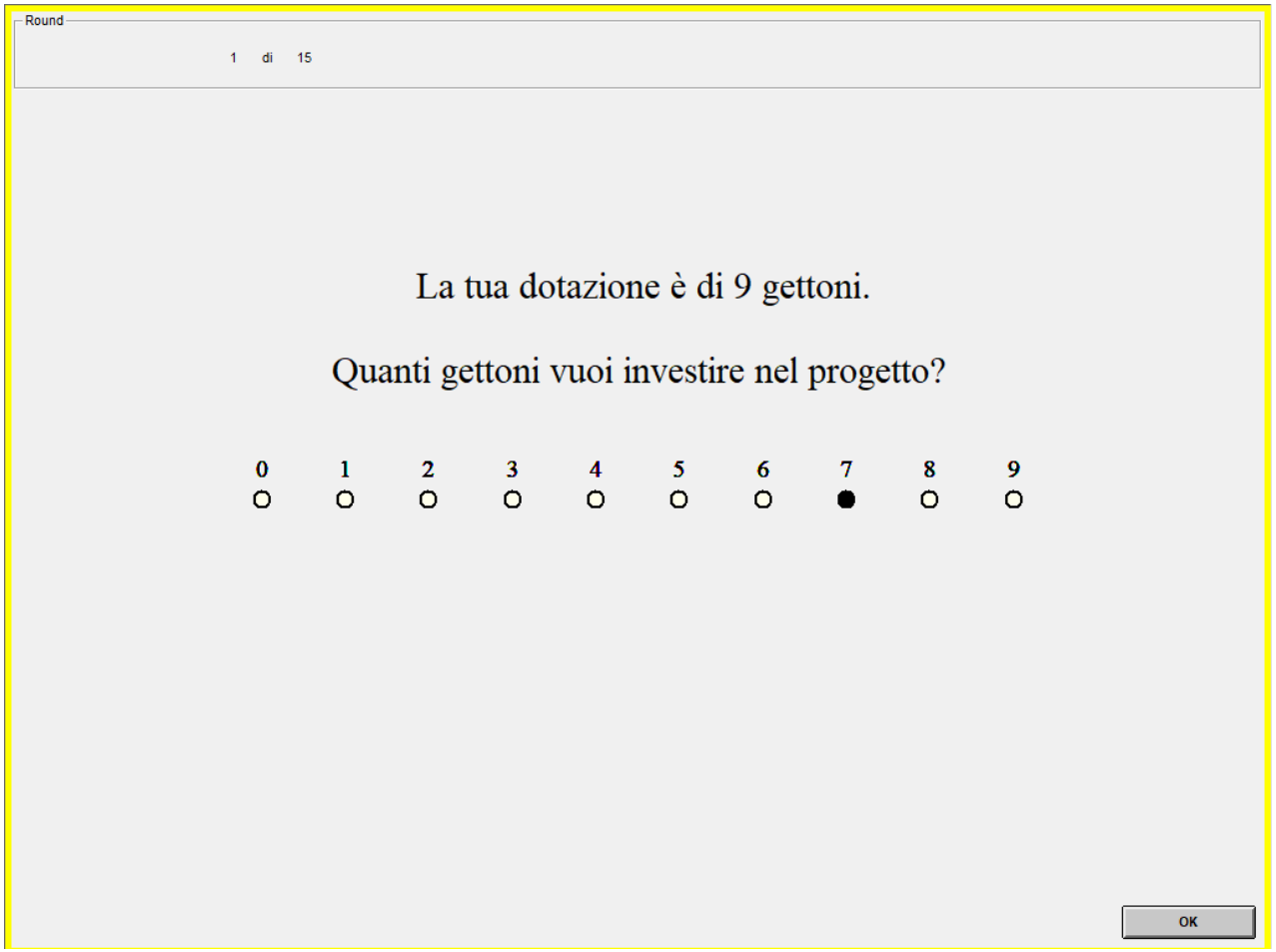



Figure 1: Contribution stage

# Results

## Result 1

With the same endowment, subjects increase their contributions if the MPCR increases.

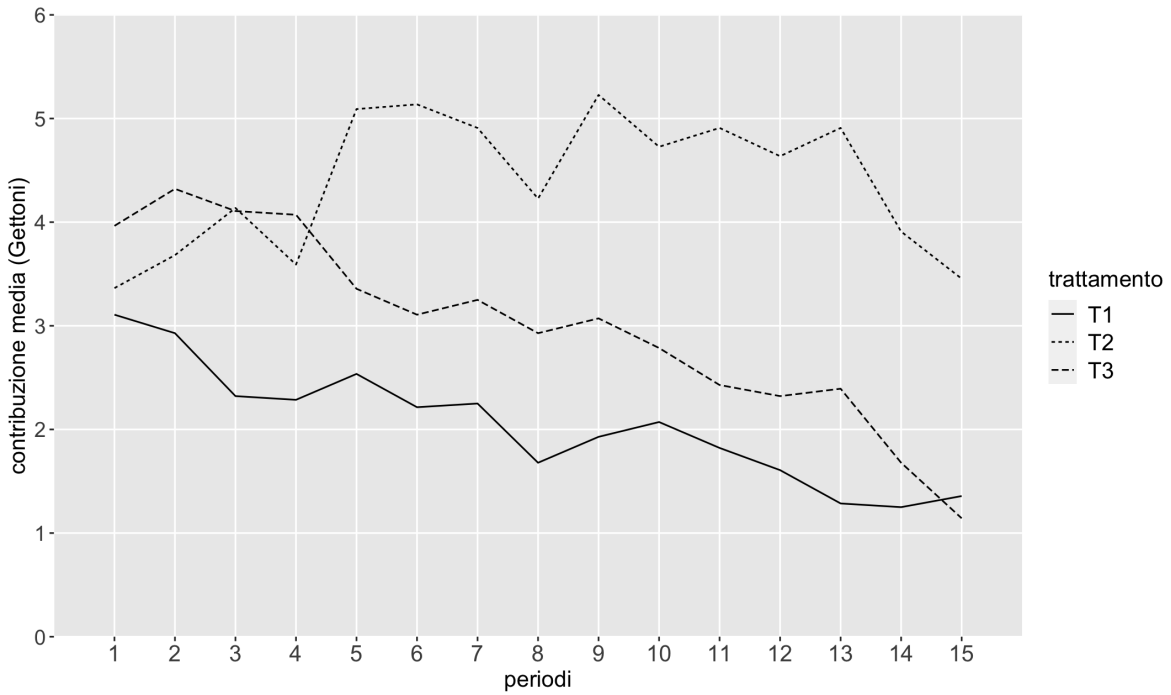
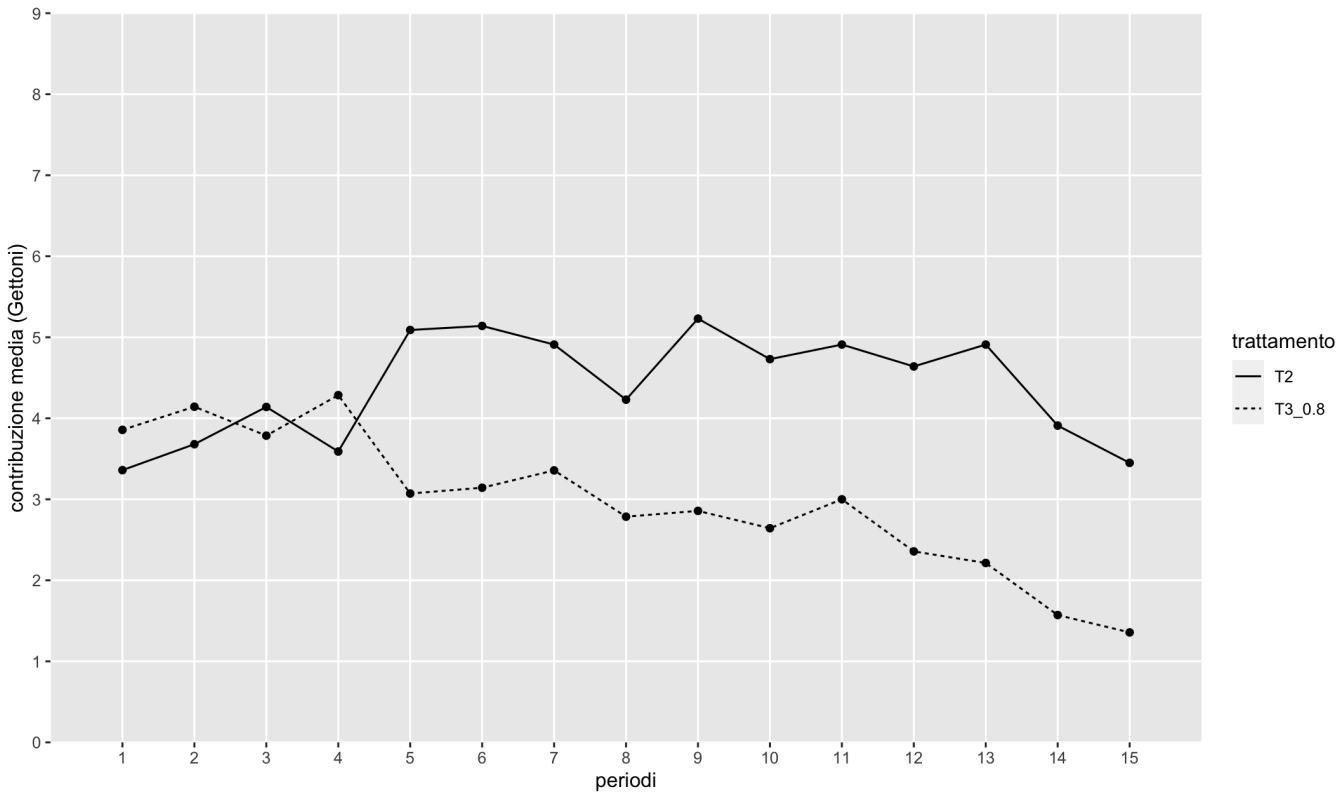



Figure 2: Average contributions in the three treatments

# Results

## Result 2

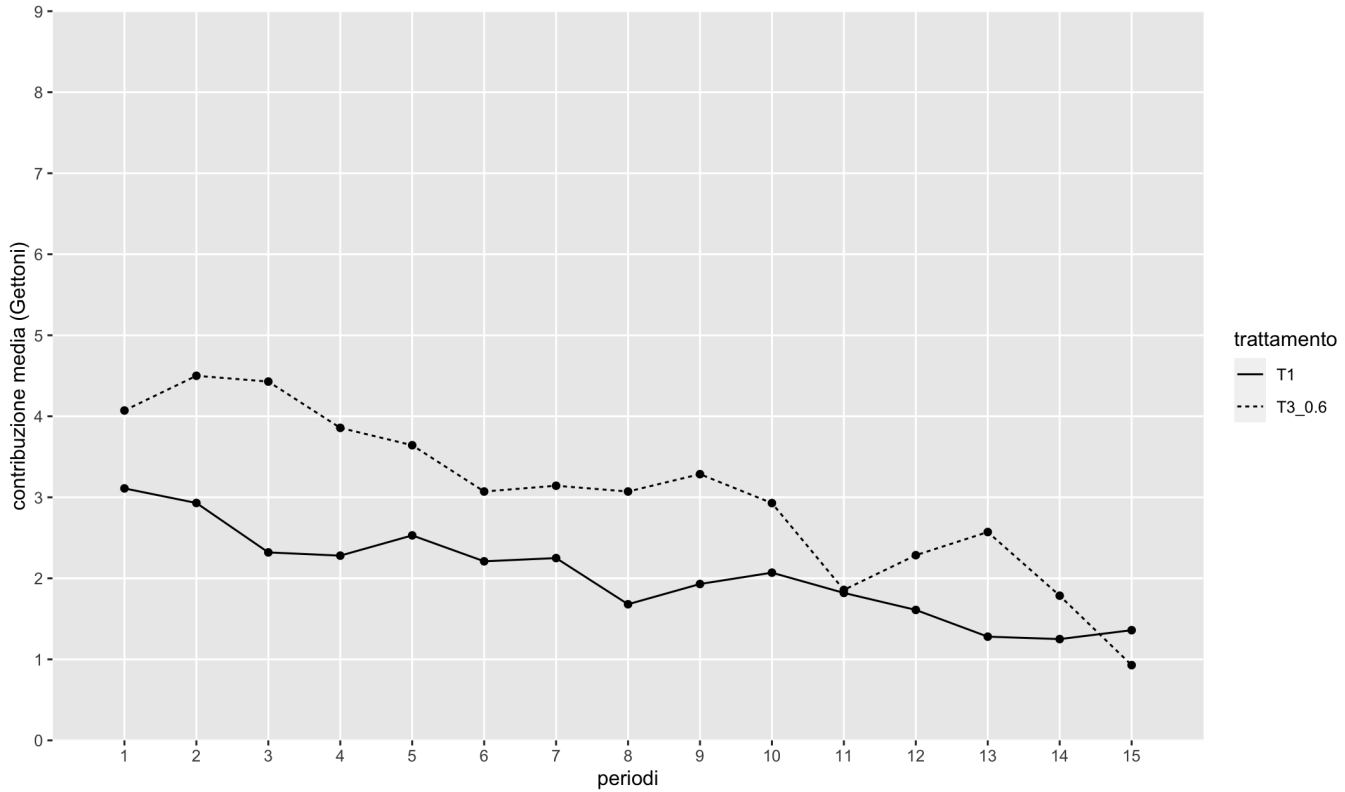
The contribution choices of subjects with $\alpha$=0.8 in the non-uniform groups are lower than those of subjects with identical $\alpha$ value, but belonging to uniform groups.



# Results

## Result 3

The contribution choices of subjects with $\alpha$=0.6 in non-uniform groups are higher than those of subjects with identical $\alpha$ value but belonging to uniform groups.



# Non-parametric test results

The results obtained by applying the Wilcoxon Mann Whitney test to examine the differences between the treatments are now presented. Evidence emerges of a statistically significant difference in the averages of the two groups between T1 and T2 treatments. However, it is important to emphasise that the absence of statistical significance does not exclude the presence of a significant effect.

Table 2: Wilcoxon Mann Whitney test results by treatment (p.value in brackets)

| | **T2** | **T3-0.6** |
|---|---|---|
| **T1** | W = 34.5 (0.02141) | W = 81 (0.4482) |
| **T3-0.8** | W = 103 (0.1624) | W = 101.5 (0.8902) |

# Regression results with random effects

We now turn to the random-effects regression model analysis to examine our key variables. We introduced the following variables:
1) the categorical variable **Treatment**, formed makes 4 categories: T1, T2, T3_0.6 and T3_0.8;
2) The variable **Period**, always significant;
3) The variable **C_Prec** representing the own contribution in the immediately preceding round;
4)The variable **C_Altr_Prec** representing the contribution of the other group member in the previous round.

# Regression results with random effects

**Tabella 3.7.** Regressione Panel con Random effects e con std. errors clustered indipendenti in 39 coppie (t-value tra parentesi)

| Var. indip. | Spec. 1 | Spec. 2 | Spec. 3 | Spec. 4 | Spec. 5 |
|---|---|---|---|---|---|
| Intercetta | 2.043*** (3.508) | 2.870*** (4.829) | 2.984*** (4.86) | 2.272*** (4.134) | 1.024*** (3.664) |
| T2 | 2.351** (2.677) | 2,351** (2.677) | 1.152 (1,244) | 1.280 (1,586) | 0.919* (2,556) |
| T3_0.6 | 0.985 (1.176) | 0.985 (1.175) | 1.739 (1.925) | 1.388 (1.827) | 0.303 (0.75) |
| T3_0.8 | 0.919 (1.096) | 0.919 (1.096) | 1.412 (1.562) | | 0.224 (0.553) |
| Periodo | | -0.103*** (-6.978) | -0.118*** (-4.83) | -0.085** (-3.208) | -0.054*** (-3.679) |
| T2:Periodo | | | 0.149*** (4.086) | 0.086* (2.231) | |
| T3_0.6:Periodo | | | -0.094* (-2.236) | -0.077* (-2.179) | |
| T3_0.8:Periodo | | | -0.062 (-1.462) | | |
| C_Prec | | | | 0.20*** (7.431) | 0.219*** (8.479) |
| C_Altr_Prec | | | | | 0.452*** (17.14) |
| AIC | 5371.713 | 5332.606 | 5313.78 | 5131.295 | 4703.881 |
| BIC | 5407.142 | 5373.09 | 5369.417 | 5181.638 | 4753,774 |
| Numero di osservazioni | 1092 | 1092 | 1092 | 1092 | 1092 |
| Numero di gruppi | 39 | 39 | 39 | 39 | 39 |

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Figure 3: Regression model analysis

# Outcomes *conditional cooperation*

The *conditional cooperation* occurs when an individual decides to contribute only if the other participants demonstrate the same level of cooperation. Using the method developed by Keser and Van Winden (2000), based on comparing an individual's choice with the average of the other individuals' choices in the previous round, we analysed the behaviour of the participants in the experiment.

Table 3: Conditional cooperation analysis T1

| Scenario | Contribution | Number of obs | Increased | Decreased | Equal |
|---|---|---|---|---|---|
| 1 | >other contrib. | 124 | 14.52 % | 64.52 % | 20.96 % |
| 2 | <other contrib. | 124 | 45.97 % | 7.26 % | 46.77 % |
| 3 | = other contrib. | 144 | 14.58 % | 11.11 % | 74.31 % |

# Outcomes *conditional cooperation*

Table 4: Conditional cooperation analysis T2

| Scenario | Contribution | Number of obs | Increased | Decreased | Equal |
|---|---|---|---|---|---|
| 1 | >other contrib. | 87 | 18.39 % | 59.77 % | 21.84 % |
| 2 | <other contrib. | 87 | 62.07 % | 17.24 % | 20.69 % |
| 3 | = other contrib. | 134 | 14.18 % | 9.70 % | 76.12 % |

Table 5: Conditional cooperation analysis T3

| Scenario | Contribution | Number of obs | Increased | Decreased | Equal |
|---|---|---|---|---|---|
| 1 | >other contrib. | 118 | 22.03 % | 58.48 % | 19.49 % |
| 2 | <other contrib. | 118 | 44.07 % | 20.34 % | 35.59 % |
| 3 | = other contrib. | 156 | 12.18 % | 5.13 % | 82.69 % |

Thank you