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the effect of the magnitude of inequality »**

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# Cooperation across the inequality divide: the effect of the magnitude of inequality.\*

Rémi Suchon<sup>†</sup> & Vincent Théroude<sup>‡</sup>

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## Abstract

Cooperation has many economic and social benefits, yet it is vulnerable to inequality. This study examines how the magnitude of inequality affects cooperation, focusing on differences in behavior between individuals randomly assigned to high (i.e. the rich) and low endowments (i.e. the poor). To do so, we use a novel dataset that pools individual-level observations from 24 published experimental linear public good games with unequal endowments. Pooling many studies allows us to study the causal effect of inequality at the participant level, with a substantial variation in levels of inequality. Such a variation would be very hard to get with a single, properly powered experiment. We start by confirming that inequality reduces overall contributions, and that the rich contribute a lower share (“relative contribution”) of their endowment than the poor on average. We further identify a striking asymmetry: as inequality grows, the relative contributions of the rich decrease significantly, while the relative contributions of the poor are not significantly impacted. Therefore, the gap in contributions across statuses increases as inequality gets stronger. We provide a simple model of conditional cooperation that is compatible with our empirical findings. These results may inform the design of policies addressing inequality and social cohesion.

**Key-words:** Public good game, contribution gap, inequality, meta-analysis.

**JEL Classification:** C92, H41, D91

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# 1 Introduction

Cooperation - voluntarily incurring a cost to benefit others - has many economic and social benefits. Cooperative norms promote economic growth (e.g. [Knack and Keefer, 1997](#)), support environmental conservation (e.g. [Rustagi et al., 2010](#)), and enhance firm-level productivity by enabling decentralized management (e.g. [Bloom et al., 2012](#)). Yet, cooperation is fragile, and can break down in the presence of excessive inequality, leading to social fragmentation.<sup>1</sup> Therefore, the well-documented increase in inequality across entire economies ([Chancel and Piketty, 2021](#)) and within firms ([Song et al., 2018](#)) makes understanding how different levels of inequality affect cooperation particularly important. To address this question, we study the effect of inequality on cooperation in the context of linear public goods games. Public goods contributions in lab experiments are a classical measure of cooperation that predicts real-life cooperative behavior (e.g. [Rustagi et al., 2010](#); [Fehr and Leibbrandt, 2011](#); [de Oliveira et al., 2011](#); [Carpenter and Seki, 2011](#); [Reddinger et al., 2022](#)), and previous experiments have shown that the introduction of endowment inequality reduces contributions (e.g. [Cherry et al., 2005](#); [Hargreaves Heap et al., 2016](#); [Markussen et al., 2021](#)). However, less is known about how the *magnitude* of endowment inequality determines public goods contributions, and the individual behavior that underlie the effect of inequality on contributions. Here, we contribute to fill this gap by studying the *marginal* effect of endowment inequality on contributions, that is whether higher endowment inequality leads to a further decrease in cooperation. We focus on inequality in endowment because it closely aligns with inequality in wealth or income that are important features of modern economies.<sup>2</sup> We particularly focus on how the magnitude of endowment inequality influences relative contributions across statuses—“rich” participants, defined as those with endowments higher than the median, and “poor” participants—to investigate the drivers of the negative impact of inequality on cooperation.

As mentioned earlier, little is known about this specific question. Existing empirical literature

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<sup>1</sup>Inequality harms cooperation in various contexts, including team work (e.g. [Breza et al., 2017](#)) and participation in activities promoting social cohesion (e.g. [Alesina and La Ferrara, 2000](#))

<sup>2</sup>A different but related question is the effect of inequality in return from the public good or in productivity. See e.g. [Nikiforakis et al. \(2012\)](#), [Gangadharan et al. \(2017\)](#) or [Tan \(2008\)](#).

faces two important limitations in identifying the interaction effect of status and inequality on cooperation. First, empirical studies often rely on natural or survey data, where cooperative behavior is measured through proxies or self-reported, non-incentivized measures. Second, it is hard to identify the causal effect of inequality on cooperation using natural data. Indeed, the rich and poor might differ on unobserved characteristics, for instance social preferences, that might determine their cooperative behavior. Moreover, individuals experiencing high levels of inequality in their everyday lives may also differ systematically from those experiencing low levels of inequality. Laboratory experiments address these challenges by employing incentivized measures of cooperation (public goods contributions) and inducing both status and inequality exogenously, facilitating causal analysis. However, most lab experiments compare a baseline without inequality to a treatment (or several treatments) with inequality, while the *magnitude* of inequality is rarely manipulated. This limitation is likely due to the sample size (and resources) it would require. Thus, these experiments do not expose participants to a sufficient range of inequality levels to measure the effect of the magnitude of inequality, and consequently cannot capture the interaction effect of the magnitude of inequality and status on cooperation.

In this paper, we address these limitations using a meta-dataset of past experiments introducing unequal endowment in linear public goods games. Notably, this meta-dataset aggregates individual-level observations. This approach presents two types of advantages. First, it leverages the specific advantages of lab experiments over survey or naturally-occurring data. All the experiments we include respect the methodology of experimental economics, real incentives are used and the no-deception rule is strictly respected, which means that we study decisions with actual material consequences. More importantly, participants are randomized into treatments and, most of the time, endowments are randomly attributed (and when it is not the case, we can control for it). Therefore, we can capture the causal effect of inequality and relative income status on cooperation. Second, our approach presents a decisive advantage with respect to unitary experiments. Pooling numerous different experiments allows us to include many different levels of inequality, which could not have been possible with a

single experiment due to budget constraints.<sup>3</sup> It also allows us to run high-power statistical analyses. This makes our empirical approach both original and robust. Additionally, the linear public goods game has a rather standard implementation, hence, the data pooled in our datasets are very homogeneous. Therefore, we can identify the causal effect of the level of inequality (our variable of interest), *controlling* for all the other design parameters we recovered either from the original datasets or from the papers. Finally, we observe decisions at the *individual* level which allows us to run empirical analysis at a micro level - in particular, we can study the effect of inequality depending on status.

We first use our dataset to test the effect of inequality on aggregate cooperation, i.e. cooperation observed at the group level. Our results confirm that inequality is detrimental to cooperation. We further show that the effect of inequality is present at the margin: increasing inequality further reduces contributions. We then turn to the main focus of this paper: the effect of inequality on the contributions of the rich and the poor. We define the rich as those with endowments above the group's median and the poor as those with endowments at or below it. We find that, on average, the poor contribute a similar share of their endowment than members of the equal groups, while the rich contribute a significantly lower one. Turning to the effect of the magnitude of inequality, we find that the poor and the rich contribute very similar shares of their endowment for low levels of inequality. However, as inequality increases, the share of their endowment that the rich contribute (relative contribution hereafter) decreases significantly while those of the poor do not. Therefore, increasing inequality leads to an increase in the relative contribution gap between the rich and the poor. We run sub-sample analyses to test the robustness of our result: We split the sample according to some important design features, and show that this result holds with or without punishment and with exogenous or endogenous endowment. However, we do not replicate our result in the very first round of the game, suggesting that some dynamic effects are at play.

Our results offer some perspective on the theory of cooperation under inequality. Our results

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<sup>3</sup>A small number of past papers adopted a similar approach to ours to overcome the limitations of unitary experiments. For instance, Mengel (2018) pools many published prisoners' dilemma experiments to study the impact of game parameters on cooperation.

are not consistent with models of inequality aversion (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000), which predict that the “rich” should contribute a larger share of their endowment than the poor regardless of the level of inequality to reduce payoff inequality (see e.g. Buckley and Croson, 2006). We introduce a simple utility model where individuals derive utility from both their monetary payoff and from matching (their beliefs about) the average relative contributions of others, which captures conditional cooperation in a simple, yet general way. In this model, the rich contribute lower shares of their endowment than the poor because the absolute monetary cost of contributing a given share increases as endowment increases. In addition, this simple model is able to explain that the relative contributions of the rich decrease when inequality increases, while these of the poor are either positively or not affected. Therefore, this model explain that the contribution gap increases as inequality grows. This suggests that public goods contributions under inequality are not primarily motivated by the reduction of payoff inequality. Rather, behavior are more consistent with limiting inequality in relative contribution, which could be traced back to notions of fairness including equity.

The rest of the paper is structured as follows. Section 2 outlines our contributions to the literature. Section 3 presents the method and the dataset used in this paper. Section 4 introduces our results. Section 5 introduce a simple model to interpret our results. Finally, section 6 discusses the results and concludes.

## 2 Related literature

Our results contribute to the existing literature in several important ways. *First*, our results contribute to the broad literature on the negative impact of resource inequality on prosociality (e.g. Yang and Konrath, 2023), social cohesion (e.g. Alesina and La Ferrara, 2000; Alesina and La Ferrara, 2002; Costa and Kahn, 2003) and cooperation (Fehr et al., 2020). More precisely, we provide a synthesis of the effect of endowment inequality on contribution in linear public goods games. While the bulk of the literature finds that endowment inequality decreases cooperation in linear public goods games (e.g. Cherry et al., 2005; Hargreaves

Heap et al., 2016; Markussen et al., 2021), some papers show no or even positive effects (e.g. Hofmeyr et al., 2007; Reuben and Riedl, 2013; Visser and Burns, 2015).<sup>4</sup> Our dataset allows us to aggregate the results of these studies, and to confirm unambiguously that inequality is detrimental to cooperation. Relatively close to our paper, Yang and Konrath (2023) also use a meta-analysis and find an overall negative effect of inequality on prosocial behavior. However, their dataset does not contain individual-level decisions. Individual-level decisions is the gold standard for creating meta-datasets, and allows for various analyses at the individual level that are impossible when one focus on study-level effect sizes. In addition, taking advantage of the wide range of inequality in our dataset, we also provide compelling evidence that inequality is detrimental at the margins—that is, higher inequality further reduces contributions.

*Second*, we contribute to the literature on the effect of income or wealth status (rich or poor) on prosociality. The evidence is somewhat mixed: some studies find that the rich are more selfish (McClelland and Brooks, 2004; Buckley and Croson, 2006; Wiepking, 2007; Piff et al., 2010; Piff, 2014), some find the opposite (Fehr et al., 2020; Andreoni et al., 2021), and some find no significant difference in relative contributions (Andreoni and Vesterlund, 2001; Blanco and Dalton, 2019; Meer and Priday, 2021). To the best of our knowledge, we are the first to present results on this topic using a meta-dataset comprising individual-level observations of real-stakes choices. Therefore, we can make a compelling case for a *causal* negative effect of being rich on incentivized prosocial choices, with a much higher statistical power and across a large set of parameters than allowed by single experiments (Cherry et al., 2005; Buckley and Croson, 2006). In addition, we can also compare the rich and the poor to a benchmark that does not exist with real word data (or in Buckley and Croson (2006)): the members of equal groups. We find that the rich contribute a smaller share of their endowment compared to members of equal groups, while the poor contribute a similar share to that of members of equal groups. This suggests that the negative effect of inequality is primarily driven by the behavior of the rich.

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<sup>4</sup>The results of Hofmeyr et al. (2007); Visser and Burns (2015) maybe due to the specific context of South Africa, one of the most unequal countries in the world at the time of the data collection, according to the World Bank.

*Last*, and very importantly, we contribute to an active literature on how status and the level of inequality jointly determine prosociality. The existing results are somewhat disparate (Côté and Willer, 2020). Côté et al. (2015) find that higher inequality reduces the prosociality of the rich, while Schmukle et al. (2019); Schmukle and Egloff (2020) find no effect and Von Hermann and Tutić (2019) find the opposite effect. These studies rely on survey data and use various measures of generosity as their dependent variables, including self-reported charitable donations and volunteering (Schmukle et al., 2019; Von Hermann and Tutić, 2019), contributions in an incentivized dictator game involving lottery tickets (Côté et al., 2015), and behavior in an incentivized variant of the trust game (Schmukle et al., 2019). They primarily examine the influence of real-life (usually household) income and actual levels of inequality measured at the state or country level. Our approach differs in several ways: first of all, our dependent variable is cooperation rather than generosity. Second, the experiments included in our meta-analysis took place in the laboratory and therefore both the level of inequality and status are exogenously implemented - which allows for the identification of causality. Third, actions of the participants have immediate and certain monetary consequences. Our results shed new lights on this debate with an emphasize on causality and real-stake behavior. In particular, we provide evidence that rising inequality mainly reduces the prosociality of the rich, while the prosociality of the poor is unaffected.

## 3 Methods

### 3.1 The linear public goods game

The linear public goods game is a classical social dilemma, widely used to study cooperation. In this game, participants are divided into groups of  $N$  participants. Each participant receives an endowment of  $e_i$  Experimental Currency Unit (ECU) and has the opportunity to contribute any amount between 0 and  $e_i$  to a group account. Every token contributed to the group account yields  $\alpha$  ECU to every group member -  $\alpha$  is known as the Marginal Per Capita Return (hereafter MPCR) of the public good. Every token not contributed yields 1 ECU only to the decision maker. Participants' payoff function is given by Equation 1.

$$\pi_i = (e_i - c_i) + \alpha \times \sum_{k=1}^N c_k \quad (1)$$

There is a tension between self interest and the group interest when  $\alpha$  is smaller than 1 (meaning that contributing to the group account is individually costly) and  $N \times \alpha$  is higher than 1 (meaning that contributing is socially efficient). In this case, the Nash equilibrium for self-interested participants is to contribute 0. Contributions above 0 are interpreted as cooperation, since it favors collective interest at the expense of narrow self-interest.

The literature on public goods games has highlighted several noteworthy patterns ([Ledyard, 1995](#); [Zelmer, 2003](#); [Chaudhuri, 2011](#)). First, participants consistently contribute positive amounts, deviating from the purely selfish Nash equilibrium. Second, in repeated games, contributions generally decline over time. Third, the presence of institutions that enforce sanctions or rewards helps to maintain cooperative behavior. The prevalent explanation for these observations is conditional cooperation, wherein most individuals are willing to contribute as long as others contribute too. However, a minority of individuals free-ride, leading to a deterioration in overall cooperation ([Fischbacher et al., 2001](#); [Kurzban and Houser, 2005](#); [Burlando and Guala, 2005](#); [Fischbacher and Gächter, 2010](#)). Inequity aversion, reciprocity, and norms regarding contributions are among the possible underpinnings of conditional cooperation ([Katušćák and Miklánek, 2023](#)).

## 3.2 Inclusion

### 3.2.1 Inclusion criteria

To build a dataset for studying the effect of inequality in linear public goods games, we include studies that meet the following criteria:

1. The studies include an experiment using the linear public goods game with  $\frac{1}{N} < \alpha < 1$ . This ensures that there exists a tension between self- and social interest. Positive contributions, i.e. deviations from pure self-interest, can be interpreted as cooperation.
2. There is at least one treatment in which group members have unequal endowments.

This follows from our objective to explore the effect of inequality on cooperation.

3. The studies are published in an academic journal and offer new experimental data. This inclusion criterion ensures access to the raw dataset, which might have been more difficult to obtain from unpublished papers due to concerns from authors about the risk of their work being scooped.
4. The number of participants within a group is strictly greater than 2. We excluded pairs because we think that they are fundamentally different from larger groups. For instance, in pairs direct reciprocity is feasible while it is not with larger groups, which could impact the interpretation of cooperative behavior.<sup>5</sup>
5. The experimental design respects the main tenets of experimental economics methodology: decisions are incentivized and the no-deception rule is strictly enforced.

### 3.2.2 Inclusion procedure

We first performed an exhaustive search through both the Research Paper in Economics website (repec.org) and Google Scholar. We searched for papers using keywords such as “Heterogeneity + VCM”, “Heterogeneity + PGG”, “Inequality + VCM”, “Inequality + PGG”, “Heterogeneity + Voluntary Contribution Mechanism”, “Heterogeneity + Public Goods Game”, “Inequality + Voluntary Contribution Mechanism”, and “Inequality + Public Goods Game” in their titles or abstracts. This yielded 87 papers. Subsequently, we reached out to the mailing list of the Economic Science Association<sup>6</sup>, a prominent network of experimental economists, to request references that we might have missed. Altogether, this yielded a total of 113 papers that we considered for inclusion.

**Screening:** We read the identified papers to determine whether they met our inclusion criteria. This led to a list of 30 papers published between 1988 and 2023. To obtain the original dataset for each study, we adopted two approaches: (i) When feasible, we obtained the data directly from online open repositories and publishers’ websites; (ii) alternatively, we

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<sup>5</sup>Note that we identified only one article that studied groups of 2 while matching all our other criteria, namely [Hauser et al. \(2019\)](#).

<sup>6</sup>Experimental Methods Discussion: <https://groups.google.com/g/esa-discuss/about>

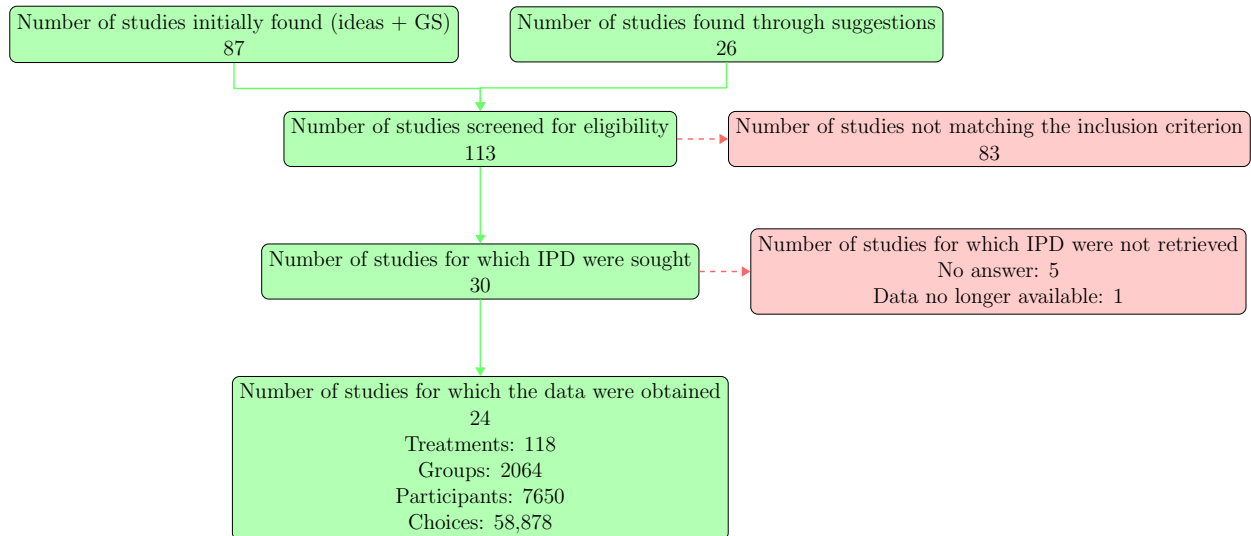


Figure 1: Inclusion diagram.

**Note:** For one paper (Levati et al., 2007), we could only recover the data at the group level, therefore there are 9 out of 118 treatments and 124 out of 2064 groups for which we only have group level observations.

requested the data from the corresponding authors via email, outlining the objective of our research. When initial emails went unanswered, we sent up to four reminders. Most authors kindly responded by sharing their data; and we successfully retrieved datasets from 24 out of the 30 initially identified papers. The data collection took place between summer 2020 and fall 2023, with most datasets collected by fall 2023. The full list of included papers is available in Appendix A and the screening procedure is detailed in Figure 1.

### 3.3 Description of the dataset and method

We combined the datasets from the 24 included articles to create a meta-dataset. This dataset includes a number of control variables that were either present in the original dataset, extracted from the corresponding paper, or retrieved from public data repositories. The variables cover those that have been identified to impact public goods contributions (e.g. Zelmer, 2003), including the size of the group, the number of periods, the availability of punishment, or the MPCR, among others. Table 1 summarizes the variables included in our dataset.

Name	Definition	Mean	Standard Deviation	Min	Max
ID study	A string variable that indicates the name of the study in which the decision-maker participated	-	-	-	-
ID treatment	A categorical variable that indicates the treatment in which the decision-maker participated	-	-	1	118
ID session	A categorical variable that indicates the session in which the decision-maker participated	-	-	1	728
ID group	A categorical variable that indicates the group in which the decision-maker belonged	-	-	1	2116
ID participant	A categorical variable that indicates the ID of the decision-maker	-	-	1	8026
Year	A variable that indicates the year of publication of the study	-	-	1988	2023
Gini endowment	A continuous variable that indicates the Gini coefficient of the distribution of endowments during the decision period	0.15	0.16	0	0.51
Inequality dummy	A dummy variable equals to 1 when there is inequality in endowments during the decision period	0.65	0.48	0	1
Equal baseline	A dummy variable equals to 1 when the study includes a baseline with no inequality	0.76	0.43	0	1
Efficiency index	A continuous variable that indicates the share of the sum of the endowments in a group that is contributed by its members	0.51	0.29	0	1
Period	A count variable that indicates the period in which the decision is made	7.05	5.55	1	40
Number of period	A count variable that indicates the number of period for which the decision-maker participates	12.53	7.34	1	40
Size of the group	A count variable that indicates the number of participants in the group of the decision maker during the decision period	4.07	0.60	3	5
Mean MPCR	A continuous variable that indicates the average number of tokens earned by group members for each token contributed to the public good during the decision period	0.46	0.07	0.3	0.93
Inequal MPCR	A dummy variable equals to 1 when there is inequality in MPCR among group members	0.04	0.19	0	1
Punishment	A dummy variable equals to 1 when punishment is available for members of a contribution group during the decision period	0.31	0.46	0	1
Communication	A dummy variable equals to 1 when communication is available for members of a contribution group during the decision period	0.06	0.23	0	1
Other mechanism	A dummy variable equals to 1 when one mechanism other than communication and punishment (vote, leader, exclusion, penalty, identity, reward) was implemented to promote cooperation during the decision period	0.33	0.47	0	1
Endogeneous endowment	A dummy variable equals to 1 when the endowment depends on actions in earlier stages of the experiment	0.18	0.38	0	1
Endogeneous group	A dummy variable equals to 1 when the composition of the group is not random but depends on earlier stages	0.06	0.24	0	1
Observed contribution	A dummy variable equals to 1 when participants were able to observe the contributions made by other group members	0.88	0.33	0	1
Observed endowment	A dummy variable equals to 1 when participants were able to observe the endowment owned by other group members	0.85	0.36	0	1
Gini country	A continuous variable that indicates the Gini coefficient of the country in which the experiment takes place	0.41	0.11	0.28	0.64
Stakes	A continuous variable that indicates the value of the decision maker endowment in 1998\$US after having controlled for purchasing power	6.03	13.18	0.04	364.66
Weird	A dummy variable equals to 1 when the country in which the experiment was run is "western, educated, industrialized, rich and democratic"	0.71	0.46	0	1

Table 1: Description of the variables

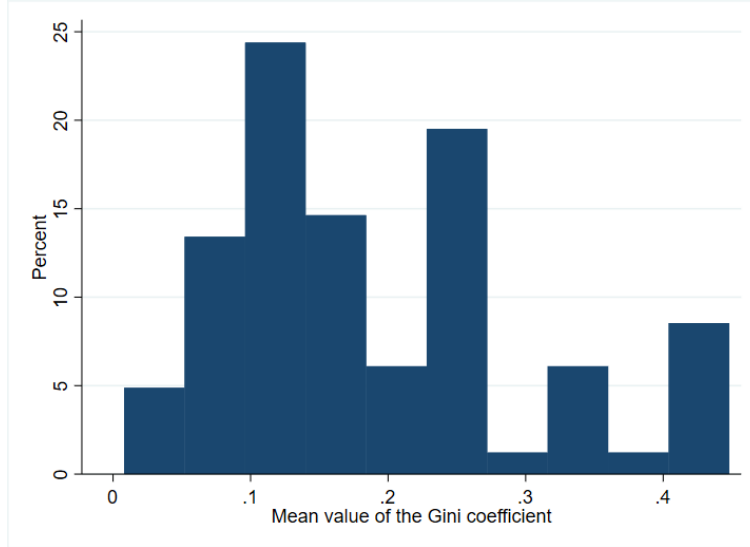


Figure 2: The distribution of Gini coefficient of endowments in our database (10 bins).

**Note:** This figure reports treatment averages. We exclude treatments with equal endowments.

For each observation, we computed the Gini coefficient of the distribution of endowments within a group which gives us a homogenous measure of inequality across groups. Figure 2 shows the distribution of the Gini coefficient of endowments within groups with inequality using treatment averages. It shows that we have substantial variations in the levels of inequality, which would hardly be done with a single experiment.<sup>7</sup>

### 3.4 Comments on the resulting dataset.

In this section, we discuss three important features of our dataset: Our focus on the linear public goods game, the risk of publication bias in the set of included studies, and the structure of the dataset.

**Focus on linear public goods games.** We specifically concentrate on linear public goods games, and do not consider other types of public goods games such as non-linear public goods games or threshold public goods games for instance. In these later games, in contrast with the linear public goods game, positive contributions may constitute a Nash-equilibrium

<sup>7</sup>Although a detailed discussion of the advantages and limitations of the Gini coefficient compared to other measures of inequality is beyond the scope of this paper, we replicate our main results using alternative inequality measures in Appendix E.1.

even for finite repetitions and full contributions can be inefficient. Therefore, while positive contributions are easily interpreted as cooperation in linear public goods games, it is not the case in non-linear ones. In addition, non-linear games potentially introduce complexity and noise that might be compounded by inequality, leading to a complex interpretation of the data. Last, this choice allows us to build a very homogeneous dataset, which allows to control the effect of covariates in a very standardized way.<sup>8</sup>

**Publication bias.** We included only published studies to ensure access to the original datasets, as obtaining data from unpublished studies could have been challenging. Accessing the original datasets has many advantages, such as allowing analyzing individual decisions with a homogeneous method, however our approach comes at a risk. Indeed, the publication process may distort the kind of data that are published, a phenomenon called “publication bias”, and this may in turn bias our dataset. A most common example of publication bias is the so-called “null-result penalty”, when null results are less likely to be published than positive ones (on the incidence of publication bias in economics and its explanation, see e.g. [Brodeur et al., 2016, 2023](#); [Chopra et al., 2023](#)). We discuss this risk in the following paragraph.

First, note that our main result leverages variation of the level of inequality *between studies*, which, by definition, is not the focus of any individual study. This limits the risk that publication bias pollutes our results. However, we examine the possibility of publication bias using funnel plots ([Egger et al., 1997](#)). In funnel plots, effect sizes of individual studies are plotted against their standard errors. The idea is that if publication bias exists, imprecise studies are more likely to be published when they report the *expected* result—here, a negative effect of inequality on contributions—than when they report the opposite. This should result in an asymmetric funnel plot. Figure 3 reports two funnel plots. The left panel uses data aggregated at the group level. To perform it, we regress separately for each study including a baseline ( $n = 16$ ), the sum of contributions divided by the sum of endowments on a

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<sup>8</sup>Important work on the effect of inequality in non-linear games include [Chan et al. \(1997\)](#). While we do not include the data from non-linear games, Table B.1 in Appendix B summarizes the main results from the literature. Overall, the results are more mixed than in linear public goods games.

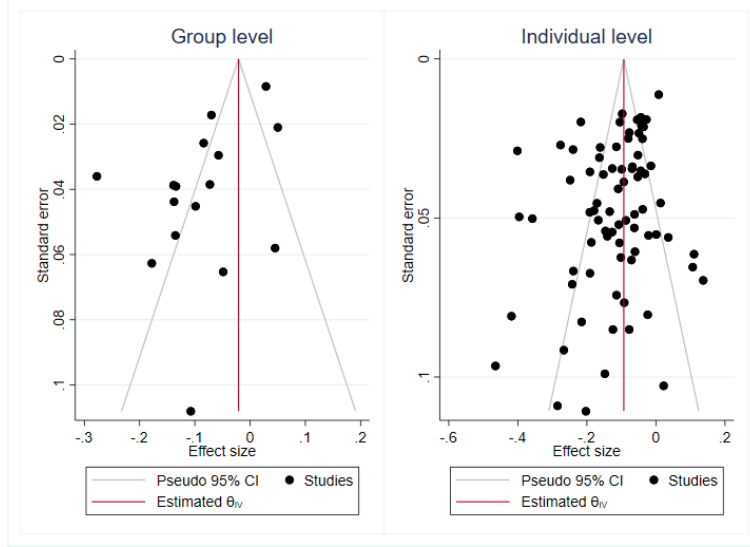
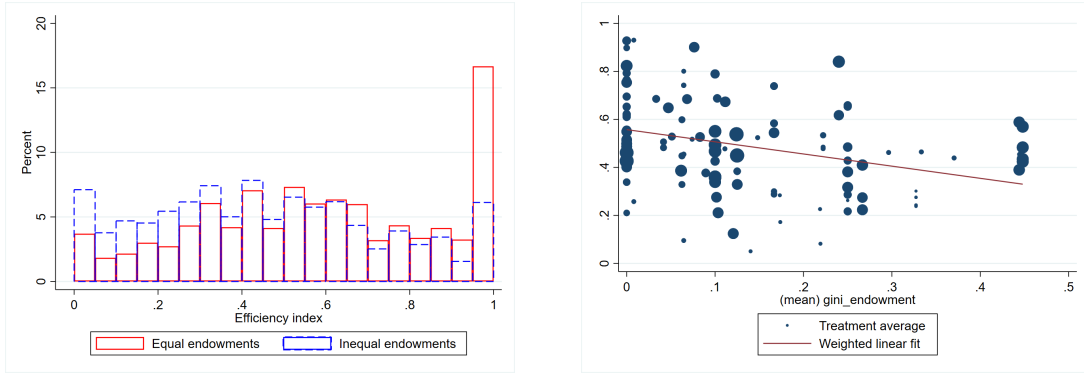


Figure 3: Funnel plots for effect size at the group (left) and individual (right) levels.

dummy variable indicating inequality. We use OLS with standard errors clustered at the group level. We then plot the estimated coefficient against its standard error. The right panel uses individual data, from treatments with inequality only ( $n = 66$  treatments, the number of treatments with inequality for which we have individual level data). We regress individual proportion of endowment contributed to the public good on a dummy variable indicating that a subject is rich using OLS and standard errors clustered at the group level. Visual inspection of the funnel plot does not reveal strong asymmetry in either panel, which is confirmed by Egger tests ( $p = 0.222$  for group level and  $p = 0.121$  for individual level). We conclude that our sample is not overly polluted by small study or publication bias, which reinforces our confidence in the reliability of our results.

**Structure of the dataset and empirical method.** Our dataset comprises individual-level observations nested within groups, sessions, treatments, and experiments. To account for this hierarchical structure, we employ mixed-effects models, as recommended by [Moffatt \(2020\)](#). Mixed-effects models help address intra-level correlation by incorporating random effects, which capture unobserved heterogeneity at different hierarchical levels. In our regressions, we introduce random intercepts at the experiment, session, group, and individual levels, allowing us to control for variation across these dimensions. We believe this approach is well-suited to the structure of our data. However, to ensure robustness, we replicate all



(a) Histogram of aggregate contributions. (b) The marginal effect of inequality on aggregate contributions.

Figure 4: Descriptive statistics at the aggregate level.

our main results using other models, including OLS and standard random-effects models, in Appendix D.

## 4 Results

### 4.1 Preliminary results: the effect of inequality at the aggregate level.

We start with a succinct analysis of the effect of inequality on aggregate contributions. The dependent variable is the proportion of the sum of endowments contributed in a given group, for a given period. Panel (a) of Figure 4 displays the histogram of treatment averages for aggregate contributions in equal and unequal groups. Contributions amount to 58.6% of endowments in equal groups, compared to 45.6% in unequal groups, and the distributions are significantly different (Mann-Whitney U test,  $p = 0.001$ , treatment averages). Panel (b) plots aggregate contributions averaged at the treatment level as a function of the Gini coefficient of endowment for this treatment. The size of the dots is determined by the number of groups in each treatment. Panel (b) also includes a weighted-linear fit line.<sup>9</sup>

<sup>9</sup>While we think that weighting observations this way allows us to represent an important feature of our dataset, not using weights leads to very similar results.

**Result 1: Inequality lowers aggregate cooperation. The effect of inequality is present at the intensive margin: more inequality leads to less cooperation.**

**Support:** Figure 4 shows a negative relationship between the Gini coefficient of endowments and aggregate contributions. This relation is highly significant, as shown by the outcome of mixed-effects models presented in Table C.1 of Appendix C. Our specifications include random-effects at the experiment, session and group levels, the control variables defined in Table 1, and use robust standard errors clustered at the level of the experiment.

In addition, we estimate the marginal effect of inequality for different inequality brackets, namely low, moderate and high inequality. To do so, we only use observations in which the Gini coefficient is strictly positive (i.e. in presence of inequality). We extend our mixed-effects models by including a quadratic term for the Gini coefficient alongside the linear term. We use the outcome of these regressions to compute the marginal effect of inequality (Gini coefficient) for low, moderate, and high levels of inequality.<sup>10</sup> The results are presented in Table 2. The marginal effect of inequality is negative and significant for low, moderate and high levels of inequality. Therefore, the effect of inequality is observed at the margin; higher levels of inequality are associated with lower contributions, regardless of the initial degree of inequality.

## 4.2 Contributions of the equals, the rich and the poor.

We now turn to the analysis of individual contributions, where the dependent variable is “relative contributions” — defined as the proportion of one’s endowment contributed to the public good. In what follows, we define for unequal groups “rich participants” as those whose endowments are above the median in their group, and “poor participants” as those whose endowments are at or below the median. Figure 5 shows the mean relative contributions of the rich, poor, and equal (those in the baseline with no inequality) participants on its left panel. On average, the poor contribute 55.3% of their endowments, and the rich 43.2%. This

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<sup>10</sup>Low inequality corresponds to 25th percentile of the distribution of Gini coefficient, moderate inequality corresponds to the 50th percentile and high inequality corresponds to the 75th percentile.

	(1)	(2)
	Agg. Contributions	Agg. Contributions
Marginal effect of Gini Endowment for:		
Low inequality	-0.603****	-0.617****
$0 < Gini < .1$	(0.172)	(0.157)
Moderate inequality	-0.520***	-0.504****
$.1 < Gini < .25$	(0.170)	(0.126)
High inequality	-0.417**	-0.363***
$.25 < Gini$	(0.205)	(0.119)
Observations	11374	11374
Nb clusters (Experiments)	24	24
Underlying model	Mixed	Mixed
Control variables	No	Yes

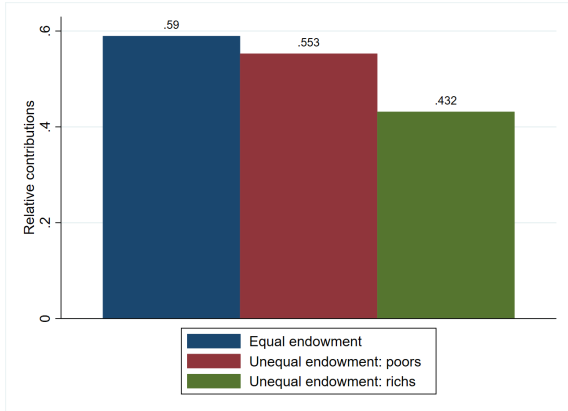
Standard errors in parentheses are clustered at the experiment level. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ , \*\*\*\*  $p < 0.001$ . Marginal effects from mixed-effects models with random effects at the experiment, session and group levels.

Table 2: The marginal effect of inequality for the different levels of the Gini coefficient.

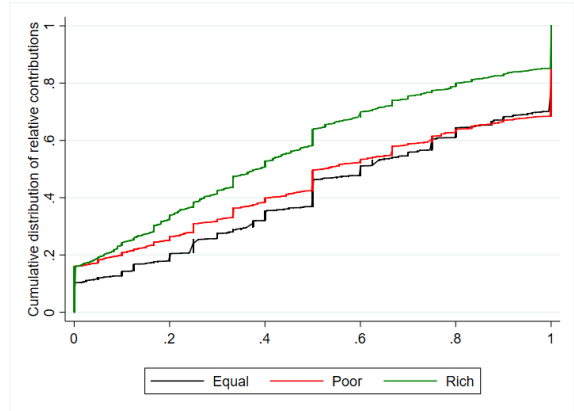
difference is significant (Mann-Whitney U test,  $p < 0.001$ , group averages). As a benchmark, members of equal groups contribute 58% of their endowments. This contribution is significantly different from that of rich participants (Mann-Whitney U test,  $p < 0.001$ , group averages) but not from that of poor participants (Mann-Whitney U test,  $p = 0.392$ , group averages). The right panel of Figure 5 shows the cumulative distribution of contributions, providing a visual representation of contribution heterogeneity among poor participants, rich participants, and members of equal groups.

**Result 2: The rich contribute a smaller share of their endowments compared to both the poor and members of equal groups, while the poor contribute a similar share compared to members of equal groups.**

**Support:** The non-parametric analysis above provides first support for Result 2. To further support this result, we run a series of regressions, using mixed-effects models. We introduce random effects at the experiment, session, group and participant levels. We use robust standard errors clustered at the level of the experiment. We regress relative contributions at the individual level on a categorical variable indicating whether one is rich or poor, while being a member of an equal group is the reference category. In the interest of concision, the



(a) Mean contributions of the rich, poor and equal.



(b) Cumulative distributions of contributions of the rich, poor and equal.

Figure 5: Contributions of the rich, poor, and members of equal groups.

outcome of these regressions are presented in Table C.2 in Appendix C.2. The outcome of these regressions shows that being rich reduces relative contributions by approximately 10% ( $b = -0.10$ ,  $p = 0.003$ , in Model (2)). On the other hand, the effect of being poor is never significant ( $b = 0.006$ ,  $p = 0.834$  in Model (2)).

### 4.3 The magnitude of inequality and the contribution gap.

The previous result shows that the rich contribute a smaller proportion of their wealth compared to the poor on average, an observation we refer to as the *contribution gap*. We now examine whether — and how — the contribution gap depends on the magnitude of inequality. To do so, from now on, we drop observations from “equal baselines” and we focus on data from treatments with inequality. Our analysis will compare the marginal effect of inequality on the relative contributions of the rich and poor. We use mixed-effects models explaining relative contributions by an interaction term between a dummy variable indicating status (rich or poor) and the Gini coefficient of endowments. We include random effects at the experiment, session, group, and individual levels. We use robust standard errors clustered at the level of the experiment. Table C.3 in Appendix C.3 reports the outcome of these regressions. We use it to compute the marginal effect of Gini endowment for the rich and poor, and compare it. Table 3 reports the marginal effect of Gini coefficient on the contributions of the rich and the poor. In Model (3), we exclude null and full contributions.

	(1)	(2)	(3)
	Rel. Cont.	Rel. Cont.	Rel. Cont.
<i>Marginal effect of Gini endowment for:</i>			
Poor	-0.176 (0.246)	-0.148 (0.214)	-0.149 (0.186)
Rich	-0.596** (0.261)	-0.569** (0.224)	-0.571*** (0.198)
<i>p</i> -value diff.	< 0.001	< 0.001	< 0.001
Observations	38130	38130	34909
Nb clusters (experiment)	23	23	23
Control variables	No	Yes	Yes
Underlying model	Mixed	Mixed	Mixed

Standard errors in parentheses are clustered at the level of the experiment. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ , \*\*\*\*  $p < 0.001$ .

Mixed-effects models with random effect at the experiment, session, group and subject level.

In Model (3), we restrict the observation to interior contributions.

Table 3: Econometric analysis of the effect of the magnitude of inequality on the contribution gap.

**Result 3: As inequality increases, the rich reduce their contributions significantly while the poor do not. As a consequence, the contribution gap widens.**

**Support:** In models (1) to (3), in Table 3, the marginal effect of inequality on relative contribution is only significantly negative for the rich. Importantly, the effect is significantly more negative for participants who are classified as “rich” than for those classified as poor (see line *p*-value diff., all *p*-values < 0.001). To illustrate the previous result, we computed the predicted relative contributions of the rich and the poor for several levels of inequality. We use Model (2) from Table 3, which controls for random effects and covariates. The results, presented in Table 4 below, show that relative contributions of the rich (column (2)) are slightly lower than these of the poor (column (1)) for low levels of inequality and the gap (column (3)) widens as inequality increases: for a low level of inequality, the difference is 0.035pp ( $p < 0.001$ , column (4)), while for high levels of inequality, the difference is almost 20 percentage points ( $p < 0.001$ ).

	(1)	(2)	(3)	(4)
	Poor	Rich	Diff ((1)-(2))	p-value ((1)-(2))
Low inequality (Gini=0.0625)	.562	.526	.035	< 0.001
Moderate-low inequality (Gini=0.125)	.552	.490	.062	< 0.001
Moderate-high inequality (Gini=0.25)	.531	.410	.121	< 0.001
High inequality (Gini=0.448)	.505	.307	.198	< 0.001

Notes : low inequality corresponds to the first decile, moderate-low corresponds to the first quartile, moderate-high corresponds to the second quartile, and high corresponds to the 9th decile.

Table 4: Predicted contributions of the rich and the poor, depending on the level of inequality.

### 4.3.1 Sub-sample analysis

Last, we explore the sensitivity of our main result to three meaningful sample restrictions, which correspond to important design features of the linear public goods game. First, we consider punishment, which is an effective means to sustain cooperation (see e.g. [Chaudhuri, 2011](#), for a review). One may think that the presence of such cooperation-enhancing mechanism might mitigate our main results, for instance if the poor use punishment to sanction the rich for contributing too little. We also consider the source of endowments, that is whether endowments, and therefore status (rich or poor), are endogenous (or earned) or purely exogenous. Our motivation is based on the literature that has shown that inequality is perceived to be more legitimate when it results from some form of effort or skills rather than pure luck (see e.g. [Konow, 2000](#), on the accountability principle). Clearly, this might affect willingness to cooperate when inequality varies: for instance, the poor might be less willing to contribute when they perceive their status as illegitimate. Last, we check whether our results are found already in the very first round of the game or if some dynamics takes place. It is well known that cooperation tends to decline over time as a consequence of conditional cooperation. Conditional cooperation, where participants adjust contributions based on others' actions, could exacerbate the negative effects of inequality over time, especially if normative expectations diverge between the rich and the poor.

**Result 4: The marginal effect of inequality on the contribution gap is found with and without punishment, and both when endowments are earned or exogenous. However, it is not found when focusing solely on the first period of the game.**

**Support:** Table 5 reports the outcome of regressions estimated using mixed-effects models. We use the same model as Model (2) in Table 3, but use different estimation samples: we split our samples according to whether punishment is available (Model (1)) or not (Model (2)), whether the endowment was exogenous (Model (3)) or earned (Model (4)) and whether we consider only the first period (Model (5)) or all periods starting period 2 (Model (6)). The results reported in Table 5 largely replicate our main result. However, it should be noted that the difference in marginal effect of inequality on the rich and poor may be more pronounced when punishment is not available, as can be seen by comparing the marginal effect reported in Columns (1) and (2) of Table 5 (Column (1):  $diff = -.44$ ,  $p < 0.001$ , Column (2):  $diff = -.16$ ,  $p = 0.061$ ). Second, we retrieve the contribution gap when endowments are earned ( $p = 0.002$ ) and when they are purely exogenous ( $p < 0.001$ ). Finally, we find no effect of the magnitude of inequality on the contribution gap in very the first period ( $p = 0.932$ ). This last observation suggests that the widening of the contribution gaps has a dynamic element.

## 5 A simple utility model of conditional cooperation

The analysis of individual contributions yields two important results: (i) the rich contribute a lower share of their endowments compared to the poor, and (ii) increasing inequality further reduces the relative contribution of the rich. These results are inconsistent with standard models of inequality aversion (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000), where individuals derive disutility from inequality in payoffs. These models predict that the rich contribute a higher share of their endowment than the poor, to reduce inequality in payoffs (for a demonstration, see e.g. Buckley and Croson, 2006). This is clearly at odds with what we observe. Therefore, payoff inequality-aversion alone cannot explain the observed behavior. Instead, we propose a simple utility model based on conditional cooperation, in which individuals adjust their contributions in response to their beliefs about the contributions of others. Although alternative models could also account for our results, this model provides a simple, yet plausible, explanation for the observed patterns.

	(1)	(2)	(3)	(4)	(5)	(6)
	Punishment=0	Punishment=1	Earned endowment=0	Earned endowment=1	First period	All Periods > 1
<i>M.E. of Gini Endow. for:</i>						
Poor	-0.051 (0.190)	-0.426**** (0.042)	0.166* (0.092)	-0.442**** (0.064)	-0.087 (0.145)	-0.143 (0.230)
Rich	-0.496** (0.194)	-0.588**** (0.081)	-0.232**** (0.082)	-0.631**** (0.021)	-0.073 (0.211)	-0.502** (0.216)
p-value diff.	< 0.001	.06	< 0.001	.002	.932	< 0.001
Observations	25764	12366	29163	8967	4289	33841
Nb clusters (experiments)	23	6	22	6	23	19
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Underlying model	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed

Standard errors in parentheses are clustered at the session level. \* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ , \*\*\*\* $p < 0.001$ . Marginal effects are reported. The underlying models are mixed-effects models with random effect at the experiment, session, group and subject level.

Table 5: Sensitivity analysis: the effect of the magnitude of inequality on the gap depending on some design features.

We consider individuals in groups of  $N = n_p + n_r$ , where  $n_p$  represents the number of poor individuals in the group and  $n_r$  the number of rich individuals. Each individual  $i$  can contribute some of their endowment  $e_i$  to a linear public good, and keep the remainder of their endowments.  $s(e_i)$  denotes the proportion of their endowment contributed by agent  $i$ , and  $\hat{s}$  denotes the belief about the average relative contribution of the other group members. Individuals derive utility from money, and incur a psychological cost from deviating from (their belief about) the group's average relative contribution. This follows from the well-established fact that most individuals are conditional cooperators, i.e. they want to contribute more when they expect others to contribute more (Fischbacher and Gächter, 2010) but they generally do not want to contribute more than the others (Fehr and Gächter, 2000). While conditional cooperation can be driven by various motivations, such as reciprocity or conformity (e.g., to norms) (Katušćák and Miklánek, 2023), it is not necessary for our purposes to specify its underlying source. The following utility function captures these two dimensions of preferences:

$$U(s_i) = \left[ e_i - s_i(e_i) \times e_i + \Pi(s_i(e_i), s_{-i}) \right] - \gamma \left[ (s_i(e_i) - \hat{s})^2 \right]. \quad (2)$$

The first term of the equation represents the utility from money, which is the sum of the money kept ( $e_i - s_i(e_i) \times e_i$ ) and the money received from the public good  $\Pi(s_i(e_i), s_{-i})$ , which depends both on  $i$ 's contribution  $s_i$  and others' contribution  $s_{-i}$ . Note that, given that we are in a linear public good situation,  $\frac{\partial \Pi}{\partial s_i} = \alpha \times e_i$ , with  $\alpha$  the MPCR from the public good. The second term captures preference for conformity. We assume that participants seek to match their (beliefs about) contributions of others in relative terms denoted  $\hat{s}$  and suffer from a convex cost as they deviate from this value. Preference for conformity is captured by the parameter  $\gamma > 0$ . The optimal relative contribution  $s_i^*$  is the solution of the first-order condition below:

$$\frac{\partial U}{\partial s_i} = 0 \Leftrightarrow -e_i + \alpha e_i - 2\gamma(s_i^* - \hat{s}) = 0 \quad (3)$$

$-e_i + \alpha e_i$  represents the marginal monetary cost of increasing one's relative contribution to the public good, which is constant given that we are in a linear public good game.  $-2\gamma(s_i - \hat{s})$

is the marginal utility of increasing one's relative contribution to the public good, and it is positive as long as  $s_i < \hat{s}$ . Therefore, there is a trade-off between keeping one's money and contributing to match one's beliefs about the group's average relative contribution.<sup>11</sup> The optimal relative contribution is given by:

$$s^*(e_i) = \hat{s} - \frac{(1 - \alpha) \times e_i}{2\gamma}, \quad (4)$$

which depends on the endowment  $e_i$ . With  $e_r$  the endowment of the rich, and  $e_p$  the endowment of the poor, such that  $e_r > e_p$ , it is obvious that  $s^*(e_r) < s^*(e_p)$ . The interpretation is straightforward: contributing a given share of one's endowment requires a greater *absolute* contribution from the rich. Therefore, rich group members should contribute a lower share of their endowment than the group's average relative contribution, as the psychological costs are offset by the larger absolute amount of money they retain.

We now turn to the effect of increasing inequality. To focus on the effect of inequality, we assume that the sum of endowments in the group  $E = n_r e_r + n_p e_p$  is fixed. An increase in inequality occurs when some endowment is reallocated from the poor to the rich for a given endowment, which yields the following relationship between the change in the endowments of the poor  $e_p$  and of the rich  $e_r$ :

$$de_p = -\frac{n_r}{n_p} de_r. \quad (5)$$

We derive the optimal relative contributions of the rich  $s^*(e_r)$  and of the poor  $s^*(e_p)$  according to  $e_r$ , the variation of which fully captures the variation in inequality given that we assume a fixed sum of endowments. This yields for the rich:

$$\frac{\partial s^*(e_r)}{\partial e_r} = \frac{\partial \hat{s}}{\partial e_r} - \frac{(1 - \alpha)}{2\gamma}, \quad (6)$$

and for the poor:

$$\frac{\partial s^*(e_p)}{\partial e_r} = \frac{\partial \hat{s}}{\partial e_r} + \frac{n_r}{n_p} \frac{(1 - \alpha)}{2\gamma}. \quad (7)$$

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<sup>11</sup>If an individual is purely self-interested (i.e.  $\gamma = 0$ ), we assume that their contribution is null,  $s_i^*(e_i) = 0$ .

The effect of increasing inequality depends on two forces: a direct effect, and a belief effect.  $-\frac{(1-\alpha)}{2\gamma}$  is the direct effect of increasing the endowment of the rich. As stated earlier, a higher endowment leads to a lower relative contribution. For the poor, the direct effect  $\frac{n_r}{n_p} \frac{(1-\alpha)}{2\gamma}$  is positive, since an increase in inequality corresponds to a reduction of their endowment.  $\frac{\partial \hat{s}}{\partial e_r}$  is the belief effect, which captures how individuals adjust their expectations about others' relative contributions in response to an increase in inequality. There are three possible cases, depending on how inequality affects participants expectations about the relative contribution of others, which is captured by the sign of  $\frac{\partial \hat{s}}{\partial e_r}$

- Case 1: If participants expect that others will contribute relatively more as inequality rises (i.e.,  $\frac{\partial \hat{s}}{\partial e_r} > 0$ ), then the poor should increase their relative contributions due to the positive impact of both the direct and indirect (belief) effects. In contrast, the effect on the rich is ambiguous, as the negative direct effect is counteracted by the positive belief effect.
- Case 2: If participants expect no effect of inequality on the average relative contribution of others (i.e.  $\frac{\partial \hat{s}}{\partial e_r} = 0$ ), then inequality unambiguously reduces the relative contributions of the rich (due to the negative direct effect and the null belief effect) and increases those of the poor (due to the positive direct effect and the null belief effect).
- Case 3: If participants expect that others contribute relatively less as inequality rises (i.e.  $\frac{\partial \hat{s}}{\partial e_r} < 0$ ), then the rich contribute less as inequality increases (both effects are negative), while the effect on the poor is ambiguous (due to the positive direct effect counteracted by the negative belief effects).

Given that we observe a decline in the relative contributions of the rich but no significant change in those of the poor, our results are most consistent with a negative belief effect. The assumption that beliefs decrease with inequality is a natural one, as previous literature has shown that heterogeneity causes pessimistic beliefs about others' willingness to cooperate (e.g., [Fischbacher et al., 2014](#); [Markussen et al., 2021](#)). Therefore, if we make the very plausible and natural assumption that beliefs about others' cooperation is negatively affected by inequality, our simple model provides a natural interpretation for our results. The model suggests that the observed behavior are driven by a mix between two motives, namely monetary

gains and conformity with others' contributions. Interestingly, therefore, our results can be explained without any reference to payoff inequality, which suggests that norms of (relative) contributions may matter more than the impact of contributions on payoff inequality.

## 6 Conclusion

In this paper, we addressed the effect of inequality on cooperation in a social dilemma. We constructed a meta-dataset of past public goods game experiments in which inequality in endowment is introduced. By exploiting the exogenous variation of inequality and status, we identified the causal effect of the level of inequality on contributions, with a specific focus on the interaction between inequality and status (i.e., whether one is relatively rich or poor). Our paper makes several important contributions to the literature on the impact of inequality on cooperation.

First, we summarize past evidence and unambiguously confirm that inequality reduces cooperation. We then leverage the fact that our dataset aggregates the data from many experiments inducing different levels of endowment inequality to show that inequality has a negative *marginal effect*, namely a marginal increase in inequality leads to a marginal decrease in cooperation. Turning to the individual behavior underpinning these patterns, we find that, on average, the rich contribute a lower share of their endowments than the members of equal groups or than the poor, while the poor contribute a similar share than the members of equal groups. This not only confirms past results (e.g. [Buckley and Croson, 2006](#)) but also extends them on two grounds, namely power and generalization to a wide range of parameters and secondary design choices. Moreover, higher inequality exacerbates this disparity: the relative contributions of the rich decrease significantly as inequality increases, while those of the poor do not. Therefore, the contribution gap between the rich and poor widens as inequality increases. This important new result is only made possible by relying on a meta-dataset that combines many experiments, therefore allowing to measure the effect of a broad range of inequality levels on behavior.

Although our motivation is primarily empirical, our results provide perspective on theoretical models of the interactions between inequality and social status and can contribute to their advancement. Our results suggest that a theory of cooperation under inequality should ideally predict (i) that the rich contribute a lower share of their endowment than the poor, and (ii) that the marginal effect of inequality on prosocial behavior is negative for the rich but not for the poor. [Buckley and Croson \(2006\)](#) show that, if individuals want to reduce payoff inequality as suggested by inequality aversion models ([Fehr and Schmidt, 1999](#); [Bolton and Ockenfels, 2000](#)), the rich should contribute a higher share of their endowment than the poor to leverage the redistributive nature of public goods, which is not what we observe. On the other hand, we show that our results can be explained by a simple utility model in which individuals derive utility from both their monetary payment and the fact to contribute a share of their endowment that is conform to (their beliefs about) the average contribution of others. This suggests that reducing payoff inequality is not the main driver of contributions in the context of a public goods game. Rather, individuals may be more concerned by matching the average relative contribution in their group, which could be explained by conformity to contribution norms or reciprocity ([Katušćák and Miklánek, 2023](#)).

Taken together, our findings suggest that, at least within our specific context, the negative effect of inequality on cooperation is primarily driven by the disengagement of the rich. Therefore, inequality may generate a self-reinforcing cycle: as inequality grows, the wealthy contribute relatively less to the public good, in turn reducing the effectiveness of the public good in taming inequalities. This mechanism could deepen societal divisions, highlighting the need for specific redistributive policies to preserve social cohesion.

Our findings open several avenues for further research. First, experiments could be designed to guide theoretical modeling beyond the scope of this study, particularly on the role of beliefs and the conditional behavior of the rich and poor as inequality changes—both of which are crucial to understanding the interaction between status and inequality. Second, future studies could explore how preferences are constructed, how individuals perceive the legitimacy of real-world inequality, and how beliefs shape cooperative behavior, helping bridge

the gap between laboratory results and real-world data. Finally, extreme inequality is absent from our dataset: the highest Gini coefficient in our study (0.51) is lower than that of many countries, including Brazil and South Africa.<sup>12</sup> While our results suggest that greater inequality reduces cooperation, extreme inequality may fundamentally alter how individuals perceive their strategic environment—potentially shifting from a reciprocal mindset to a distributive one. Understanding how cooperation changes under extreme inequality is therefore an interesting direction for future research.

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<sup>12</sup>This data is from <https://data.worldbank.org/indicator/SI.POV.GINI>.

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## A Included studies

Study	N Treatments	N Sessions	N Subjects	N Groups	N Periods	Gini Endowment	Equal Baseline?
Balafoutas et al. (2013)	1	8	72	24	15	0.22	0
Cadigan et al. (2011)	3	9	136	34	10	0.09	1
Charness et al. (2014)	6	22	176	92	24	0.15	1
Cherry et al. (2005)	4	4	124	31	1	0.25	1
Carolyn Chisadza and Yitbarek (2023)	2	223	900	224	1	0.166	1
Corazzini et al. (2010)	1	3	48	12	20	0.103	0
De Geest and Kingsley (2019)	3	18	350	70	18	0.24	1
Dickinson (2001)	5	10	40	10	40	0.054	0
Fung and tung Au (2014)	10	4	96	32	10	0.246	1
Gächter et al. (2017)	8	22	656	164	11.22	0.112	1
Hauser et al. (2021)	6	180	900	180	9.725	0.446	0
Hargreaves Heap et al. (2016)	6	15	210	70	20	0.26	1
Hofmeyr et al. (2007)	2	1	80	20	10	0.125	1
Isaac and Walker (1988)	10	7	92	23	20	0.047	1
Kamei (2018)	4	14	185	37	1	0.327	0
Kesternich et al. (2018)	2	4	96	24	10	0.25	0
Anastasios Koukoumelis and Weisser (2012)	2	2	128	32	10	0.1	0
Levati et al. (2007)	9	10	-	124	24	0.0745	1
Markussen et al. (2021)	2	112	1344	336	1	0.25	1
Martinangeli (2021)	4	6	360	90	10	0.25	1
Oxoby and Spraggon (2013)	5	16	316	79	1	0.187	0
Reuben and Riedl (2013)	8	11	210	70	10	0.166	1
Visser and Burns (2015)	4	17	567	144	6	0.12	1
Weng and Carlsson (2015)	11	11	576	144	10	0.25	1

Table A.1: Studies included in the analysis

## **B Inequality in non-linear public goods games.**

Table B.1 reports the effect of inequality on contributions in non-linear public goods games. In the different games present in this table (see column 2), both null contributions and full contributions can be individually inefficient. For this reason, an increase in contributions cannot be considered unambiguously as willingness to cooperate. Additionally, in some game, such as threshold public goods game or best shot game, inequality, instead of blurring the social norm about what should be contributed, helps participants to coordinate. In best shot game, most rich participants agree that they have to contribute ("noblesse oblige") while in threshold public goods game, the rich and the poor agree to reach the threshold proportionally to their initial endowment. As there is no such target in the linear public goods game, inequality is likely to generate heterogeneous views about the social norm.

Table B.1: Results of inequality in non-linear public goods game

Name of the study	Nature of the game	Baseline without inequality	Gini index	Main Result
Brekke et al. (2017)	Threshold public goods game	No	0.167	Same relative contributions between the rich and poor in 3 treatments out of 4. The poor contribute a lower absolute amount of their endowment in all treatments.
Brown and Kroll (2017)	Threshold public goods game	Yes	0.125	Inequality increases contributions in 1 treatment out of 3 but the effect is null in the 2 other treatments.
Chan et al. (1996)	Non-linear public goods game	Yes	0.067/0.167 0.267/0.367	Inequality increases contributions.  The rich overcontribute while the poor undercontribute with respect to the Nash Equilibrium.
Chan et al. (1997)	Non-linear public goods game	Yes	0.067/0.167	The rich undercontribute while poor overcontribute with respect to the Nash Equilibrium which is consistent with a model of inequality aversion.
Chan et al. (1999)	Non-linear public goods game	Yes	0.067	Inequality generally increases contributions. The effect of information on inequality is heterogeneous.
Cherry et al. (2013)	Best-shot public goods game	Yes	0.25	Inequality in endowment is better homogeneity in endowment to achieve better coordination. The rich contribute more than the poor.
Kingsley (2016)	Non-linear public goods game	Yes	0.1	Inequality does not affect contributions when there is no punishment w.r.t. equality. Inequality leads to lower contributions in presence of punishment w.r.t. equality. The rich contribute more in absolute value than the poor in early periods (with and without punishment). The <i>absolute</i> contribution gap decrease over time <i>only</i> in the treatment without punishment.
Kroll et al. (2007)	Best-shot public goods game	Yes	0.25	Inequality can help achieving better coordination. The rich contribute a higher share of their endowment.
Maurice et al. (2013)	Non-linear public goods game	Yes	0.125	Inequality does not decrease contributions. The poor tend to overcontribute with respect to the Nash Equilibrium significantly more than the rich.
Nishi et al. (2015)	Network public goods game	Yes	0.2 / 0.4	Inequality itself slightly decreases welfare but when inequality becomes public knowledge, the effect gets stronger. When inequality is visible, the rich tend to defect more.
Rapoport (1988)	Threshold public goods game	No	0.24	Contribution is a dummy variable. No differences in the number of periods in which participants contributed between the rich and the poor.
Rapoport and Suleiman (1993)	Threshold public goods game	No	0.16	Inequality reduces contributions. Same relative contributions between the poor and the rich.
Rouaix et al. (2015)	Non-linear public goods game	Yes	0.375	Inequality increases contributions. Contributions of new poor are lower than contribution of subjects that were poor since the beginning.
Tavoni et al. (2011)	Threshold public goods game	Yes	0.09	Inequality reduces contributions. Communication helps to reach the target in presence of inequality The rich contribute more to decrease inequality
Uler (2011)	Non-linear public goods game	Yes	0.188	The poor overcontribute with respect to the Nash Equilibrium.
Vicens et al. (2018)	Threshold public goods game	Yes	0.181	Inequality does not lead to lower efficiency. The rich contribute a higher absolute amount than the poor but a lower relative one.
Waichman et al. (2021)	Threshold public goods game	Yes	0.1	Inequality does not lead to lower efficiency. The rich contribute the same relative amount than the poor.

## C Omitted regressions.

### C.1 Regressions supporting Result 1.

In this section, we present the regressions that support Result 1 which states that an increase in inequality leads to lower aggregate contributions. Table C.1 reports the results of mixed-effects models, where the dependent variable is the Efficiency Index—defined as the share of total endowments contributed to the public good. The key explanatory variable is the Gini index of endowments within the group for the given period, which serves as our continuous measure of inequality. Model (1) includes no additional controls. Model (2) introduces covariates, and Model (3) also includes covariates but focuses on the subsample where the Gini Endowment is greater than zero (i.e. we exclude equal groups). In all models, we account for random effects at the experiment, session, and group levels, and we cluster standard errors at the experiment level. Across all models, the coefficient on Gini Endowment is consistently negative and significant, indicating that greater inequality is associated with lower contributions. Furthermore, the significant negative effect observed in Model (3) suggests that not only the presence of inequality matters, but also its magnitude. These results provide strong support for Result 1.

### C.2 Support for Result 2.

To further support Result 2 - the fact that the rich contribute less than the members of equal groups and that the poor contribute the same amount, we run a series of regressions, using mixed-effects models. We introduce random effects at the experiment, session, group and participant levels. We use robust standard errors clustered at the level of the experiment. Table C.2 reports the outcome of these regressions. Models (1) and (2) explain relative contributions by a categorical variable indicating whether the participant is rich or poor. The reference category is being a member of an equal group. In Model (2), we add standard controls. We see that being “rich” significantly decreases relative contributions in every specification, while being poor has no effect. Specifically, once we introduce control variables, we estimate that the rich contribute roughly 10.7 percent less of their endowments than the members of equal groups, and 10 percent less than the poor. Model (3) restricts the sample

	(1)	(2)	(3)
	Efficiency index	Efficiency index	Efficiency index
Efficiency index			
Gini Endowment	-0.428** (0.180)	-0.417*** (0.151)	-0.441*** (0.159)
Year		0.002 (0.005)	0.004 (0.005)
Period		-0.010**** (0.003)	-0.011**** (0.003)
Nb period		0.007 (0.006)	0.006 (0.006)
Size of the group		0.045**** (0.010)	0.062**** (0.012)
Mean Mpcr		0.251* (0.133)	0.357** (0.144)
Inequal Mpcr		0.069 (0.073)	0.067 (0.085)
Punishment		0.178**** (0.051)	0.223**** (0.052)
Other mechanism		0.276**** (0.072)	0.311**** (0.066)
Endogenous Endowment		0.054** (0.026)	0.001 (0.042)
Endogenous group		0.005 (0.095)	0.012 (0.082)
Observed Contribution		0.002 (0.076)	-0.004 (0.081)
Observed Endowment		0.045 (0.057)	0.120**** (0.033)
Communication		0.310**** (0.029)	0.467**** (0.073)
Weird		-0.116 (0.115)	-0.107 (0.123)
Stakes		-0.001** (0.000)	-0.001**** (0.000)
Gini Country		0.000 (0.003)	0.002 (0.003)
Observations	17528	17528	11374
Nb clusters (Experiment)	24	24	24
Control Variables	No	Yes	Yes
Model	Mixed	Mixed	Mixed

Standard errors in parentheses are clustered at the experiment level. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ , \*\*\*\*  $p < 0.001$ . Mixed-effects models with random effects at the experiment, session and group levels.

In model (3), we restrict the sample to observations with inequality, i.e. with Gini Endowment  $> 0$ .

Table C.1: The effect of inequality on aggregate contributions (Regression results supporting Result 1).

to “interior” contributions (i.e. neither full nor null), with very similar results. Therefore, our results is not due to “corner effects”. Overall, these regressions provide strong support for Result 2.

### C.3 Regression supporting Result 3.

Table C.3 presents the underlying models that support Table 4. Specifically, these three regressions, based on mixed-effects models, exclude observations where the Gini Endowment equals zero. The analysis focuses on the interaction between being rich and the Gini Endow-

	(1)	(2)	(3)
	Rel. Cont.	Rel. Cont.	Rel. Cont.
Rel. Cont.			
Rich	-0.108**** (0.032)	-0.107*** (0.036)	-0.084** (0.036)
Poor	0.009 (0.031)	0.006 (0.030)	0.035 (0.026)
Gini Endowment	-0.136 (0.201)	-0.124 (0.182)	-0.158 (0.157)
Year		0.001 (0.004)	0.002 (0.003)
Period		-0.004 (0.003)	-0.005* (0.003)
Nb period		0.004 (0.003)	0.003 (0.003)
Size of the group		0.050**** (0.012)	0.054**** (0.008)
Mean Mpcr		0.403*** (0.132)	0.364**** (0.093)
Inequal Mpcr		0.020 (0.050)	0.001 (0.054)
Punishment		0.138*** (0.044)	0.119**** (0.027)
Endogenous Endowment		-0.006 (0.049)	-0.014 (0.048)
Endogenous group		0.299**** (0.072)	0.284**** (0.058)
Observed Contribution		-0.057 (0.066)	-0.074 (0.059)
Observed Endowment		-0.003 (0.059)	0.069*** (0.024)
Communication		0.331**** (0.032)	0.354**** (0.060)
Weird		-0.082 (0.068)	-0.042 (0.061)
endowment		-0.000*** (0.000)	-0.000** (0.000)
Stakes		-0.001*** (0.000)	-0.001**** (0.000)
Gini Country		-0.001 (0.002)	0.001 (0.002)
Observations	58878	58878	52135
Nb clusters (experiment)	23	23	23
Control variables	No	Yes	Yes
Underlying model	Mixed	Mixed	Mixed

Standard errors in parentheses are clustered at the experiment level. \* p<0.10, \*\* p<0.05, \*\*\* p<0.01, \*\*\*\* p<0.001 Mixed-effects models are used, with random effects at the Experiment, session, group and individual levels.

Table C.2: The effect of status on relative contributions (Regression results supporting Result 2).

ment, as this coefficient captures how the contribution gap between rich and poor evolves with increasing inequality.

Model (1) includes no controls, Model (2) incorporates covariates, and Model (3) focuses on interior contributions. In all models, we account for random effects at the experiment, session, and group levels, and we cluster standard errors at the experiment level.

The results indicate that neither being rich nor inequality alone is associated with lower relative contributions. However, the significant interaction between being rich and the Gini Endowment suggests that inequality primarily reduces the relative contributions of the rich, while the contributions of the poor remain unchanged. Consequently, the rich contribute the same relative amount as the poor for low level of inequality but as inequality increase, they contribute a lower share of their endowment, increasing the gap in relative contributions.

	(1)	(2)	(3)
	Rel. Cont.	Rel. Cont.	Rel. Cont.
Rich=1	-0.013 (0.351)	-0.009 (0.433)	-0.015 (0.301)
Gini Endowment	-0.176 (0.475)	-0.148 (0.489)	-0.149 (0.424)
Rich=1 × Gini Endowment	-0.420**** (0.000)	-0.421**** (0.000)	-0.422**** (0.000)
Year		0.003 (0.469)	0.003 (0.477)
Period		-0.004 (0.231)	-0.004 (0.196)
Nb period		0.000 (0.986)	-0.001 (0.758)
Size of the group		0.072**** (0.000)	0.062**** (0.000)
Mean Mpcr		0.599**** (0.000)	0.484**** (0.000)
Inequal Mpcr		-0.010 (0.886)	-0.029 (0.656)
Punishment		0.163**** (0.000)	0.141**** (0.000)
Endogenous Endowment		-0.123**** (0.000)	-0.112**** (0.000)
Endogenous group		0.315**** (0.000)	0.306**** (0.000)
Observed Contribution		-0.066 (0.323)	-0.082 (0.174)
Observed Endowment		0.098** (0.021)	0.068** (0.018)
Communication		0.525**** (0.000)	0.354**** (0.000)
Weird		-0.025 (0.747)	-0.010 (0.886)
endowment		-0.000**** (0.000)	-0.000**** (0.000)
Stakes		-0.001**** (0.000)	-0.001**** (0.000)
Gini Country		0.000 (0.867)	0.001 (0.743)
Constant	0.554**** (0.000)	-6.755 (0.470)	-5.335 (0.488)
Observations	38130	38130	34909
Nb clusters (experiment)	23	23	23
Control variables	No	Yes	Yes
Underlying model	Mixed	Mixed	Mixed

Standard errors in parentheses are clustered at the level of the experiment. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ , \*\*\*\*  $p < 0.001$ . Mixed-effects models with random effect at the experiment, session, group and subject level. In Model (3), we restrict the observation to interior contributions.

Table C.3: Regressions used to compute the marginal effect reported in Table 3.

## D Robustness checks: replication of our results with OLS and random-effect models.

The robustness checks are as follows: for each results, we present a table which reports the parameter of interest across several relevant specifications. The models are close to those used in Appendix C or in the core of the text, except that here, we use either ordinary least square (OLS) or random effects models (RE). For the latest, we introduce random effect at the group level for aggregate analysis, and at the individual level for individual analysis. We also use standard errors clustered at the level of the experiment.

The results of the analyses presented in sections D.1 to D.4 show that our main results are robust to change in the econometric specifications.

### D.1 Result 1

In Table D.1, we replicate the regression obtained in C.1 in models (2) and (3), in which we controlled for covariates. We find that an increase in inequality is associated with a decrease in the efficiency index, both when estimated with Ordinary Least Squares (OLS) and Random Effects (RE) models. However, the results presented in Table D.2 are more nuanced. In this table, we try to replicate the results presented in Table 2, by mimicking model (2) with OLS and a random effects model. While the OLS estimation indicates a negative yet statistically insignificant relationship between inequality and cooperation, the Random Effects model reveals a negative and statistically significant impact of inequality on cooperation at low and moderate levels of inequality which is in line with what we observe with mixed effects models.

	(1)	(2)	(3)	(4)
	Agg. Contributions	Agg. Contributions	Agg. Contributions	Agg. Contributions
Gini Endowment	-0.517****	-0.462****	-0.426**	-0.512****
	(0.127)	(0.123)	(0.174)	(0.153)
Observations	17528	17528	11374	11374
Control variables	Yes	Yes	Yes	Yes
Model	OLS	RE	OLS	RE
Nb cluster (sessions)	24	24	24	24

Standard errors in parentheses are clustered at the level of the experiment. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ , \*\*\*\*  $p < 0.001$ . RE indicates random effects models with a random effect at the group level. OLS indicates ordinary least square.

Table D.1: Replication of the results presented in Table C.1 [Models (2) and (3)] with ordinary least square (OLS) and random effects models (RE).

	(1)	(2)
	Agg. Contributions	Agg. Contributions
Gini Endowment		
Low inequality	-1.554	-0.773*
$0 < Gini < .1$	(1.057)	(0.426)
Moderate inequality	-0.277	-0.646**
$.1 < Gini < .25$	(0.614)	(0.295)
High inequality	-0.491	-0.205
$.25 < Gini$	(0.687)	(0.303)
Observations	11374	11374
Control variables	Yes	Yes
Model	OLS	RE
Nb cluster (sessions)	23	23

Standard errors in parentheses are clustered at the level of the experiment. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ , \*\*\*\*  $p < 0.001$ . RE indicates random effects models with a random effect at the group level. OLS indicates ordinary least square. Marginal effects reported.

Table D.2: Replication of the results presented in Table 2 [Model (2)] with ordinary least square (OLS) and random effects models (RE).

## D.2 Result 2

In Table D.3, we retrieve with a OLS and a random effects model, the results obtained in Table C.2, namely the rich contribute a lower relative amount than the members of equal groups while the poor contribute a similar relative contribution. In the replications, we control for covariates.

	(1)	(4)
	Rel. Cont.	Rel. Cont.
Rich	-0.130*** (0.045)	-0.115*** (0.039)
Poor	-0.011 (0.040)	-0.001 (0.033)
Observations	58878	58878
Control variables	Yes	Yes
Model	OLS	RE
Nb cluster (sessions)	23	23

Standard errors in parentheses are clustered at the session level. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ , \*\*\*\*  $p < 0.001$ . RE indicates random effects models with a random effect at the group level. OLS indicates ordinary least square.

Table D.3: Replication of the results presented in Table C.2 with ordinary least square (OLS) and random effects models (RE).

## D.3 Result 3

In Table D.4, we recover with a OLS and a random effects model, the main result of our article obtained in Table 3. As inequality increases, the rich contribute a lower relative amount while the poor do not change their relative contribution. It leads to an increase in the contribution gap between the rich and the poor.

## D.4 Result 4

In Table D.5, we replicate result 4 (Table 5) using a random effects model (except for Model (5) where we use OLS since we have only one observation per participant). We confirm that the contribution gap increases as inequality increases irrespective of the presence of punishment, and both when endowments are earned or windfall. Once again, we do not find an increase in the contribution gap if we focus on the first period only (Model (5)).

	(1)	(2)
	Rel. Cont.	Rel. Cont.
<i>Effect of Gini Endowment for:</i>		
Poor	0.025 (0.181)	-0.097 (0.160)
Rich	-0.330* (0.179)	-0.539*** (0.179)
p-value diff.	< 0.001	< 0.001
Observations	38130	38130
Control Variables	Yes	Yes
Model	OLS	RE
Nb clusters (sessions)	23	23

Standard errors in parentheses are clustered at the level of the experiment. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ , \*\*\*\*  $p < 0.001$ . RE indicates random effects models with a random effect at the group level. OLS indicates ordinary least square.

Table D.4: Replication of the results presented in Table 3 [Model 2] with ordinary least square (OLS) and random effects models (RE).

	(1)	(2)	(3)	(4)	(5)	(6)
	Punishment=0	Punishment=1	Earned endowment=0	Earned endowment=1	First period	All Periods>1
<i>Effect of Gini Endowment for:</i>						
Poor	0.027 (0.157)	-0.470*** (0.089)	0.063 (0.196)	-0.473*** (0.055)	0.024 (0.192)	-0.027 (0.172)
Rich	-0.482*** (0.183)	-0.677*** (0.050)	-0.318* (0.181)	-0.703*** (0.093)	0.028 (0.288)	-0.403** (0.156)
Observations	25764	12366	29163	8967	4289	33841
p-value diff.	< 0.001	< 0.001	< 0.001	0.085	0.984	< 0.001
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Model	RE	RE	RE	RE	OLS	RE
Nb clusters (sessions)	23	23	23	23	23	23

Standard errors in parentheses are clustered at the session level. \* p<0.10, \*\* p<0.05, \*\*\* p<0.01, \*\*\*\* p<0.001. RE indicates random effects models with a random effect at the group level. OLS indicates ordinary least square. Marginal effects reported.

Table D.5: Replication of the results presented in Table 5 RE indicates random effects models with a random effect at the group level. OLS indicates ordinary least square.

## E Other measures of inequality.

In the core of the manuscript, we measure inequality in endowment with the gini coefficient of endowments. Our choice is motivated by the widespread use of the Gini coefficient both in academia and in policy making. However, there are numerous other measures of inequality, which captures different dimensions of inequality, and emphasize different part of the distribution of resources (here, endowment). Here, we replicate our main result with several such measures.

### E.1 Result 3

We run the same model as Model (2) from Table 3, only changing the measure of inequality. The results are reported in Table E.1 below.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Cov_endowment	GEI-1	GEI-0	GEI-1	GEI-2	Atkinson_0	Atkinson_1	Atkinson_2
Poor	-0.021 (0.070)	0.027 (0.017)	-0.034 (0.125)	-0.057 (0.231)	-0.037 (0.239)	-0.123 (0.403)	-0.066 (0.172)	-0.052 (0.084)
Rich	-0.206*** (0.070)	-0.185**** (0.015)	-0.411*** (0.138)	-0.483* (0.251)	-0.402 (0.260)	-1.003** (0.439)	-0.534*** (0.186)	-0.336**** (0.088)
Observations	38130	38130	38130	38130	38130	38130	38130	38130
p-value diff.	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Underlying model	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed

Standard errors in parentheses are clustered at the level of the experiment. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ , \*\*\*\*  $p < 0.001$ . The title of each columns is the measure of inequality used in the model. The model is the same as model (2) in Table 3, except for the measure of inequality used.

Table E.1: Replication of Result 3 with different measures of inequality.

Table E.1 shows that our results are very similar if we use different measures of inequality.