Accounting for real wealth in heterogeneous-endowment public good games[1]

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Abstract

Wealth heterogeneity influences people's behavior in several socioeconomic environments, especially when groups consisting of *"unequal"* members have to take a collective action which affects all members *equally* or proportionally. After eliciting real out-of-lab wealth, we form 4-player groups playing an one-shot public good game with heterogeneous laboratory endowments. Endowing subjects according or against their real wealth gives rise to a series of interesting results. Endowment heterogeneity, lack of real relative wealth information and being "rich" both inside and outside the lab raise contributions. Finally, when eliciting subjects' beliefs, we find out that only relatively "poor" subjects expect others to contribute more than what they actually are prepared to do theirselves.

Keywords: Public goods, experiment, endowment heterogeneity, real wealth.

JEL class.: C92, D31, H41

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1 Introduction

Wealth heterogeneity is present in several real-life contexts in which people voluntarily contribute to a public good. However, the effect of wealth disparities on individual contributions to a public good is not fully understood. Similarly, the role of public information regarding these disparities is also far from clear. For example, there is a general tendency to introduce transparency on people's true income as a means of reducing tax evasion, while, as we show in this paper, the effectiveness of this policy may not be as straightforward as it sounds.

So far, experimentalists wishing to study the effects of wealth inequality on public good contributions use endowment heterogeneity as the laboratory analogous of real-life wealth differences (see Buckley and Croson, 2006[4], Cherry et al., 2005[9], Anderson et al., 2008[1], Chan et al., 1996[7], 1999[8], Fisher et al., 1994[11]. Also see Zelmer, 2003[20] for a metanalyis and Ledyard, 1995[12] for a detailed review of Public Good Games.). To our knowledge, there are no laboratory Public Good experiments investigating the interaction between real and experimental income heterogeneity.

Even in Cardenas (2003)[6] and Burns & Visser (2008)[5]) where Public Good *field* experiments with real wealth and experimental income are conducted the interaction between these two factors was out of the authors' research interest. Actually, in neither experiment was subjects' real wealth distribution revealed among members of the same group. Therefore, the interplay between laboratory endowment and real income heterogeneity has not been studied so far neither in the laboratory nor in the field. However, if we admit that overall wealth affects contribution levels, it is reasonable to ask how endowment heterogeneity induced in the lab interacts with wealth heterogeneity outside the lab in order to determine a subject's contribution.

In this paper, we address this issue. Our design is based on a pre-play elicitation of our subjects' disposable income which is then used to form specific heterogenous four-player combinations of wealth and endowment heterogeneity. We also consider the alternative of random endowment heterogeneity which corresponds to the usual practice of not controlling for real-life income when inducing endowment heterogeneity in the lab. Furthermore, we study the effect of knowing one's relative position in the group in terms of real wealth, in isolation from the income and endowment heterogeneity effects themselves. Finally, we look at the relation between subjects' beliefs on others' contributions (with the same or different endowment and wealth level) and the actual contribution of each subject.

Buckley and Croson's (2006)[4] experiment can be considered as the most relevant to our study. They conduct a repeated Public Good game with heterogeneous endowment, where subjects are informed about others' wealth before each period starts. In contrast with our design where real out-of-lab wealth is elicited and announced to all members of the same group, they use experimental "wealth" which corresponds to the cumulative profits[3] from earlier periods.

[3]Actually, before each period the following information is revealed a)their earnings from

In our study, the elicitation of real wealth was one of the most challenging tasks. This is mainly due to the fact that, generally speaking, information on real income or wealth should be used jointly with an individual's spending needs and saving habits. We tackle this issue by using a rather homogeneous subject pool of economics students at the University of Crete with little if any saving behavior. Our strategy was aimed at identifying both personal and indirect sources of the student's disposable income, like parents' wealth and that of other family members supporting the student with monetary gifts in a relatively regular basis. The final index of a subject's wealth is a composite measure of parents' salaries and monthly allowances coming from other family assets.

Our main findings are the following. Subjects contribute a lower percentage of their laboratory income if they receive the high endowment. Furthermore, contrary to previous results that report negative (i.e. Anderson et al., 2008[1], Cherry et al. 2005[9], Bagnoli and McKee (1991)[2]) or no effect (Marwell and Ames 1979[13],1980[14], Sadrieh and Verbon, 2004[18]) of inequality, we find that group heterogeneity increases the level of voluntary contributions. On the contrary, the availability of information on real wealth heterogeneity reduces contribution levels and the relative size of contributions as a percentage of laboratory endowments. Furthermore, out-of-lab wealth may have a positive effect on contributions, as long as a rich subject receives the high endowment and a poor subject the low one. People who are "rich"both in and out of the lab contribute a significantly higher percentage of their endowment compared to people who are "poor"in and out of lab. Finally, looking at beliefs, poor subjects tend to adopt the most irresponsible and selfish attitude of someone who expects others to contribute more than what he actually is prepared to do himself.

The paper proceeds as follows. In Section 2 we give a brief overview of experimental papers that study endowment heterogeneity in Public Good settings. In Section 3 we discuss our experimental design and procedures. Section 4 presents the experimental results of contributions and beliefs both in absolute and relative terms. Finally, Section 5 concludes.

2 Literature Review

The literature in heterogenous endowment Public Good games is extensive and reports a variety of results. Nevertheless, to the best of our knowledge, there is no experiment studing the interplay between real and experimental income. As mentioned before, the most relative laboratory experiment to our study is the one by Buckley and Croson (2006)[4]. Disregarding the experimental origin of "wealth", the main result of that study is in contrast with our findings. While they report that relative contributions by individuals with low wealth are significantly higher than those by individuals with high wealth[4], we find that the relative contributions of "rich"people are the highest, no matter their

the last round, b)their earnings to date (wealth) c) the average wealth of the group to date.

[4]In absolute terms the corresponded contributions are not different.

experimental endowment. In the same study, it is also rejected the hypothesis that individuals with a high endowment will contribute a larger amount and percentage of their per-period income to the public good than subjects with a low endowment.

Along the same line, in Sadrieh et al. (2004)[18], endowments vary in a dynamic setting, where each round earnings are added to the available endowment in the following round. In this design, which did not include a baseline treatment of equality, they found that contribution levels did not vary with the degree of inequality.

In another study by Anderson et al. (2008)[1] it is tested whether inequality (in initial endowments) within a group reduces individual contributions. They find that only when made salient through public information about each individual's standing within the group, inequality reduces contributions to the Public Good for all group members. Our analysis approaches this result in the sense that when we informed subjects about real wealth inequality their contributions were also decreased. However, this result was independent of endowment heterogeneity.

Furthermore, Cherry et al. (2005)[9] represents repeated linear[5] Public Good game where experimental income heterogeneity was introduced by giving to subjects different (10,20,30,40€) initial endowments. In contrast to our results, they suggest that contribution levels were significantly lower when groups had heterogeneous rather than homogeneous endowments. However, as it is also proved in our analysis, contributions were not affected by the origin[6] of endowment. Once more, real wealth and its interaction with experimental endowments was not taken into account.

In Zelmer (2003) [20], 27 studies (representing a total of 711 groups of participants) are pooled and analysed. Among other results, he finds that *heterogeneous endowments to subjects*, experienced participants, and soliciting subjects beliefs regarding other participants behavior prior to the start of the session/period had a negative and significant effect.

Giving a glance to the studies before 1995, the seminal paper by Ledyard (1995)[12] gives a detailed review of several studies examining inequality (among endowments or the value of the public good) in linear public goods setting. The results are contradictory. For example, Bagnoli and McKee (1991)[2] find that inequality reduces contributions to the group account, while Marwell and Ames (1979[13],1980[14]) report that inequality has no effect on contributions. In another linear public goods game, Brookshire et al. (1993)[3] interact inequality in the value of the public good with information; in some cases, group account contributions are unaffected by inequality, while in others, contributions increase.

Finally, as mentioned in the introduction, there are two field experiments

[5]The income heterogeneity is also investigated in no-linear Public Good games (see Chan et al. 1996[7], 1999[8], Rapoport and Suleiman(1993)[17]). Even in these cases, results regarding the impact of endowment heterogeneity are mixed or even contradicting while real wealth and its effect on contributions is out of authors' investigation interest.

[6]Of course a different endowment origin is tested in their design (windfall versus by effort) as compared to ours (windfall versus by design).

which take into account real out-of-lab wealth. The first one by Cardenas (2003)[6], explores how wealth and inequality can affect self-governed solutions to commons dilemmas by constraining group cooperation. In contradiction with our results, participants' wealth and inequality reduced cooperation when groups were allowed to have face-to-face communication between rounds.

The second field Public Good experiment by Burns and Viser (2008)[5] shows that contributions to the public good are increasing in income levels, and that income heterogeneity is associated with greater contributions towards the public good, especially by those at the lower end of the income distribution. While both experiments study the effect of real wealth on contributions, neither one makes public the relative real wealth of participants in the same group.

As it will be described in detail in the next session, the participants of our experiment were informed explicitly on their own and other participants relative real wealth position in the sample.

3 Experimental design and method

The experiment was conducted in three separate stages: elicitation of real wealth, participation in a Public Good game and belief elicitation. In the first stage, subjects, who were recruited among economics students at the University of Crete (Campus at Gallos, Rethymnon), were asked to answer a questionnaire eliciting their real wealth. To this aim, we had to take into account that all our subjects were students whose disposable income, in most of the cases, depended on family wealth. It is also true that it is rather difficult for them to know exactly their families' wealth.

For this reason, we constructed a questionnaire which followed a *maieutic* method, in the sense that it made students think about their families' economic situation before making any family income estimation. In particular, they were asked to describe family assets (i.e. number of cars, houses and field properties in m^2 etc.) while, additional questions were asked, regarding their own spending habits. At the end of the questionnaire, after assuring them for their answers' anonymity, they are asked to reveal their parents' monthly salary and to make an estimation of other family assets returns. Finally, they were asked to make an estimation of their own relative wealth position[7] compared to other participants' wealth.

Following this exercise, subjects were classified into two different wealth groups according to their answers. Subjects whose reported wealth was higher than the median[8] were characterized as relatively rich (henceforth R), while subjects whose wealth was lower than the median were labeled as the relatively poor (henceforth P) of their session. From the 96 subjects, 39 subjects had placed themselves in the same category as we also did, 50 had reported that

[7] They had to choose among 5 answers: very poor, poor, neither poor nor rich, rich, very rich.

[8] Family wealth was calculated by adding parents' monthly salary to monthly income from other assets.

they were neither R nor P and only 5 had placed themselves in a different to our categorization group. Finally, there were two subjects who did not want to comment on their families' relative income position.

The second stage of the experiment was a standard paper-and-pencil linear public good game (see Ledyard (1995)[12]). Each one of four individuals in a randomly and anonymously formed group decides how to spend his/her initial endowment splitting it between a private account and a public good. All money placed in one's private account were directly added to the subject's earnings, while money placed in the public account was multiplied by 2 and divided equally among the group members. While the social optimum is for each subject to contribute his/her entire endowment to the public account, the Nash equilibrium is for each person to allocate his entire endowment into his private account. There are three baseline (type B) treatments taking place in our setting:

***B1020*:** Heterogeneous groups with two subjects randomly endowed with 10€ and another two with 20€.

***B10*:** Homogeneous groups with all subjects endowed with 10€.

***B20*:** Homogeneous groups with all subjects endowed with 20€.

In treatment R, 4-member groups of 2 *Rs* and 2 *Ps* were formed and randomly endowed with 10€ and 20€. Each member of the group was informed about the random endowment process and its final own and other members' real relative wealth. As a result of this randomization three different types of group are formed ex-post:

***RP10*:** Two *Ps* were randomly endowed with 10€ and two *Rs* with 20€.

***RP20*:** Two *Ps* were randomly endowed with 20€ and two *Rs* with 10€.

***RP1020*:** One *P* was randomly endowed with 20€ while the other with 10€ and one *R* was also endowed with 20€ while the other with 20€.

Apart from the above "windfall"endowing mechanism, we are also interested in testing the effect of other endowing mechanisms. As a result, two more treatments where heterogeneous endowments were allocated to either *Ps* or *Rs* not randomly but by design[9] were introduced:

***DP10*:** Two *Ps* were by design endowed with 10€ and two *Rs* with 20€.

***DP20*:** Two *Ps* are by design endowed with 20€ and two *Rs* with 10€.

In our analysis we will also refer to *RP10* and *DP10* as *unfair allocations* and to *RP20* and *DP20* as *fair allocations*.

[9]For instance in *DP10*, *Ps* were instructed that they received 10€ *because* they were relatively poor while *Rs* receive 20€ *because* they were relatively rich. The reverse reasoning was followed in *DP*20.

Finally, in the third stage of our experiment, subjects are asked to reveal their beliefs on others' contributions. Depending on the treatment's degree of heterogeneity subjects were asked to reveal their beliefs on other subjects' of the same or of other type contributions. In the end of this stage, subjects were also asked about their beliefs on what other subjects "ought" to contribute.

4 Results

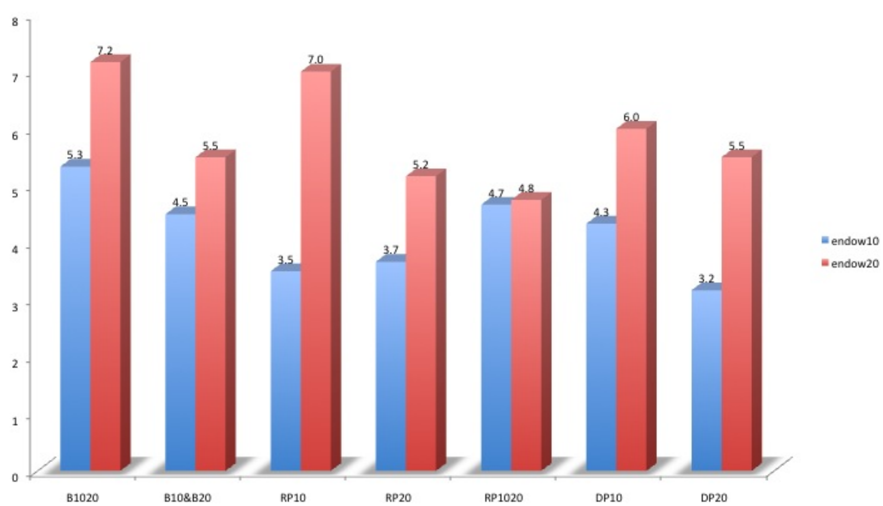
Results are divided in to two basic subsections: contributions and beliefs on others' contributions. In each subsection, both graphical and regression analyses are performed.

4.1 Relative and Absolute Contributions

4.1.1 Summary Statistics

The public good game was played only once to remove any inter-temporal belief formation and strategic choices or signaling. While 132 students participated in the first stage of the experiment, only 96 participated in the three Public Good sessions. Sessions lasted about 1 hour, including reading the instructions while the average compensation per subject was about 25€, including a 5€ participation fee.

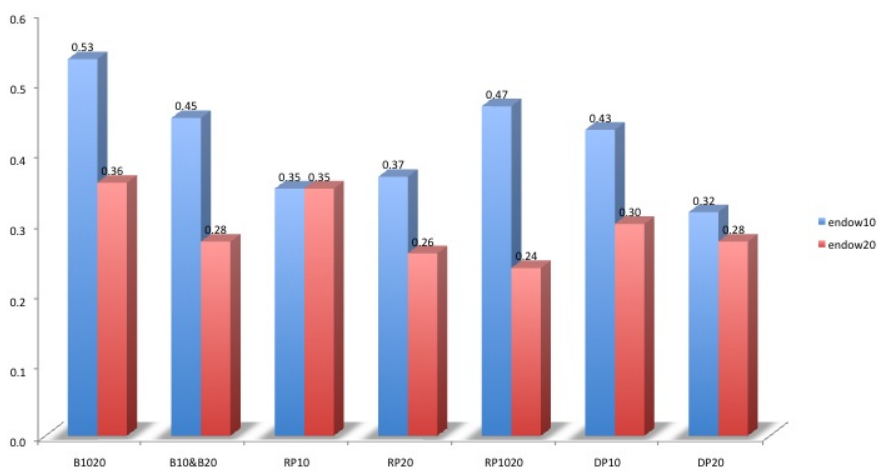
Figure 1: Absolute Contributions



In figures 1 and 2, relative and absolute contributions by treatment and endowment category are illustrated[10]. Note that that the level of endowment (10€ or 20€), when it is related to a specific treatment, reveals the wealth level of the participant. For instance, the *endow10* person in DP20 treatment is also a *Rich* person. The only exception (for facilitating illustration) is RP1020 treatment in which *endow10* (or *endow20*) can be either *Rich* or *Poor*.

Using a Mann-Whitney test we find significant treatment effects in both absolute and relative contributions. Checking for endowment effects within treatments we find that in the DP20 treatment, P20 subjects contribute in absolute terms significantly (p = .094) more than R10 subjects and in the RP1020 treatment, subjects (both R and P) endowed with 10€ contribute a significantly (p = .059) higher percentage of their endowment compared to the relative contributions of the high endowed participants.

Figure 2: Relative Contributions



Aggregating data from all treatments, we find that subjects endowed with 20€ contribute significantly less (p = .003) in relative terms and significantly more (p = .045) in absolute terms compared to subjects endowed with 10€. Moreover, a between treatments comparison reveals that the overall contributions from all participants in the base treatment B1020 are significantly higher both in absolute (p = .069) and relative (p = .081) terms compared to the overall contributions when pooling data from RP20 and DP20[11]. Therefore,

[10] The corresponded table of actual values (with standard errors) and Box Plots are included in Appendix 1.

[11] Pooling data from groups RP20 and DP20 is not meaningless since both groups have the same characteristics regarding endowment and wealth while a Mann Whitney test has confirmed that there is no significant difference between the two treatments. The same argument is even more supported when the variable *design* is proven not significant in any of the regressions performed in the next section.

such a comparison shows that: *fair allocations, no mater their origin (random or by design), have a significant negative effect on both absolute and relative contributions.*

When comparing absolute contributions in the baseline treatment B1020 with contributions in treatments R (RP10, RP20 and RP1020), we find that the latter's group contributions are significantly ($p = .087$) lower. Taking into account that the only condition changing between these two treatments is the fact that, in the latter, subjects are additionally informed about their relative real wealth, we can conclude that: *Informing people about their own and others' relative real wealth has a negative effect on absolute contributions.*

4.1.2 Regression Analysis

In the following paragraphs regression analysis is discussed. A Tobit model has been selected as the most adequate, censoring data both from the left and the right. A cluster specification[12] on the seven different treatments is also used[13]. The dependent variable in all regressions is either absolute contribution (henceforth $|c|$) or relative contribution (henceforth %c). The following dummy variables are introduced as independent regressors:

info : indicating whether subjects in the group are informed about their own and other's relative real wealth (R+D treatments).

design : indicating whether subjects receives their endowment by design rather than randomly (D).

hetero2 : indicating groups with 2 different types of subjects (B1020+RP10+RP20+D).

hetero4 : indicating groups with 4 different types of subjects (R1020).

endow20 : indicating whether subjects have been endowed with 20€.

rich : indicating whether the subject is relatively rich outside the lab.

rich20 : the interaction of the *endow20* and *rich* variables.

Finally, we define two control dummy variables capturing subject's gender and whether a subject has received a game theoretic class in the past and a continuous control variable with the subject's year of studies.[14]

Table 1 reports the coefficients and the standard errors (in parenthesis) for four independent tobit regressions. In the first two (columns 1(a) and 1(b)) the

[12]Tobit regressions without the cluster specification are also available in the Appendix 2. As expected, results keep in the same line, although weakened.

[13]Cluster specifies that the standard errors allow for intra-group correlation, relaxing the usual requirement that the observations be independent. That is, the observations are independent across groups (clusters) but not necessarily within groups.

[14]Although these variables are introduced as controls in all regressions, their coefficient estimates are not reported because they are not significant.

dependent variable is $|c|$ while in the following two (columns 2(a) and 2(b)) the dependent variable is %c, all with the aforementioned cluster specification. The regressions of type (b) differ to ones of type (a) in the interaction term *rico20*. No multicollinearity problem was reported in any of our regression models.

Table 1: TOBIT REGRESSIONS ON CONTRIBUTIONS

Variable	*|contributions|*		*%contributions*	
	1(a)	1(b)	2(a)	2(b)
info	-3.75***	-3.93***	-.22***	-.23***
	(.61)	(.90)	(.03)	(.04)
design	.11	-.64	-.01	-.02
	(.90)	(.46)	(.05)	(.03)
hetero2	3.30***	3.94***	.18***	.21***
	(.46)	.45	(.03)	.02
hetero4	4.41***	5.09***	.26***	.29***
	(.79)	1.05	(.05)	.05
endow20	.63	-1.49	-.15***	-.23***
	(.65)	(1.02)	(.04)	(.05)
rich	-.44	-2.63***	-.01	-.09*
	(.59)	(.91)	(.03)	(.05)
rich20		4.06***		.16**
		(1.36)		(.08)
constant	5.13	6.35	.46***	.50***
	1.68	(1.58)	(.08)	(.07)
N	94	94	94	94
cens. obs.	10/4	10/4	10/4	10/4

* significant at 10%; ** significant at 5%; *** significant at 1%

Below, we summarize the main results emerging from the regressions. It is more than obvious (at 1% significance level) in all regressions the negative effect of information and the positive of heterogeneity. Therefore, the first two results are the following:

Result 1 : Informing people about their relative real wealth has a negative effect both on absolute and relative contributions.

Result 2 : Endowment (lab) inequality (no matter the degree) increases both absolute and relative contributions.

It is also clear from all regressions that design has no significant effect on the depended variables.

Result 3 : Endowment origin (randomly or by design) has no effect on contributions.

The negative sign of variable *endow20* in regression (2a) (but not in (1a)), means that *all* highly endowed people contribute less in relative terms:

Result 4 : Laboratory endowments affect relative contributions only. Subjects contribute a lower percentage of their laboratory income if they receive the high endowment.

When the interaction term *rich20* is incorporated in regression (2b), *endow20* represents only the *poor20* subjects. Therefore, the following result clarifies:

Result 5 : The negative endowment effect on relative contributions is due to "poor"subjects endowed with 20€. *rich20* subjects contribute a significantly higher percentage of their endowment compared to *poor10* people.

Finally, focusing on absolute contributions, we see that *rich* becomes significant only after the interaction term is added:

Result 6 : Out of lab wealth may have a positive effect on absolute contributions, as long as a rich subject receives the high endowment and/or a poor subject the low one. *rich20* contribute significantly more and *rich10* significantly less than *poor* subjects[15]. Therefore, out of lab wealth explains contributions as long as laboratory endowments reproduce subjects' income positions in the real world.

4.2 Beliefs on Contributions

In this section, we shed light to subjects' beliefs about other subjects' performance. In all treatments, subjects are asked about their beliefs on the contributions of other subjects in the same group. In B10 and B20 homogeneous treatments, subjects, who are of the same type regarding their initial endowment, reveal their beliefs on the contributions of same type (henceforth b_s) other subjects.

However, in treatments B1020, RP10, RP20, DP10 and DP20, we always have two different types of subjects (regarding their endowment and wealth level) within the same group. Therefore, subjects are asked on their beliefs regarding others' contributions of the same (b_s) or of the other (b_o) type. For instance, in DP10 treatment which consista of two P10 and two R20 subjects, P10 subjects are asked to make two separate estimations on the absolute contributions of the others. The first one, b_s, corresponds to the contribution of the remaining one P10 subject of the group, while the second one, b_o, corresponds to the average contribution of the two R20 subjects of the same group.

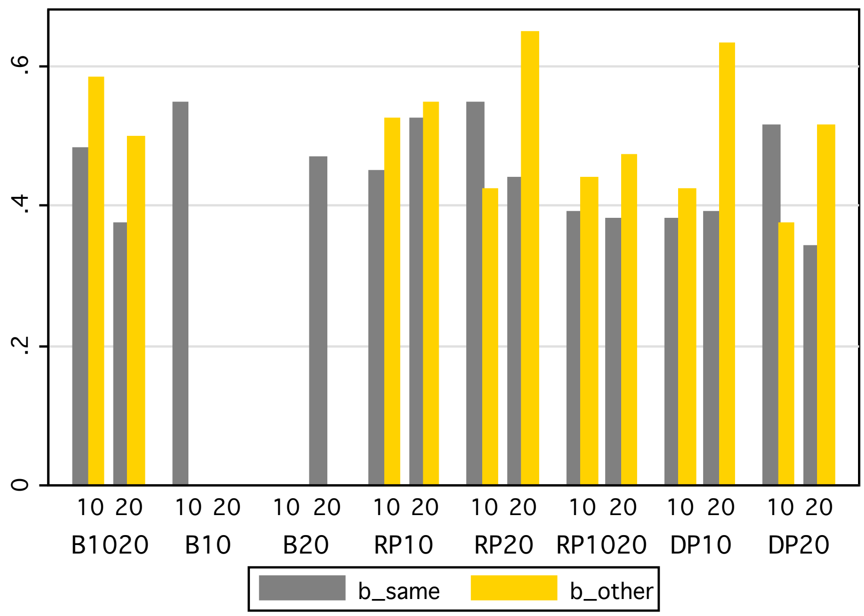
Finally, in treatment RP1020, all four subjects of the same group are of different type (P10, R10, P20, R20) which means that subjects are asked only for b_o.

Because in all treatments, b_s and b_o correspond always to different initial endowment levels, the relative values of the above variables are used, so that meaningful comparisons can be made. Figure 3 illustrates the mean belief on

[15] Although in this regression the control group is *poor10*, when we use as a regressor all *poor* people the result still holds.

contributions of same and other type per treatment and endowment category. Once more, the level of endowment (10€ or 20€), when it is related to a specific treatment (except in the case of RP1020), reveals the wealth level of the participant. Thus, the grey bar in DP10 treatment with endowment 10, indicates the belief of a *Poor* subject endowed with 10€ on the contribution of the other *Poor10* of the group. The yellow bar, corresponded to the same person shows the the belief of the same *Poor10* on the average contribution of the remaining two *Rich20* subjects of the group.

Figure 3: Mean of Beliefs of Same and Other type Contributions



A first observation is that in almost all treatments b_o is higher than b_s, indicating that no matter the endowment level or the specific treatment, subjects tend to believe that subjects of the other type contribute more. When pooling data from all treatments and performing a Wilcoxon[16] test, this claim is supported in $p < 0.01$ significant level.

Strangerly, there are two exceptions bearing however very similar characteristics. *Rich* subjects from RP20 and DP20 are the only ones endowed (either randomly or by design) with 10€ who believe that subjects of their own type contribute more than other type. Although they are low-endowment subjects, they believe that real wealth may be more important than initial endowment

[16]It is about the matched-pairs signed-ranks test (Wilcoxon 1945) testing the equality of matched pairs (b_s and b_o) of observations.

and they expect that b_s are higher than b_o, no matter if "others"are highly endowed. However, such a claim is not supported by Wilcoxon test.

We have also performed Wilcoxon tests for different subsamples of the pooled data. We found that highly endowed (but not low-endowed) and "*Poor*"(but not "*Rich*") subjects believe that subjects of the same type contribute significantly ($p < 0.01$) less than the ones of the other type.[17] In the case of highly endowed subjects, the result seems to be self-explained by the effect of the variable itself (i.e. 50% of 20€ is double than 50% of 10€, so highly endowed expect a higher percentage offered by the low-endowed subjects). Along the same argument, when performing a Wilcoxon test between the absolute values of b_s and b_o of highly endowed subsample, the former now turns significantly higher ($p < 0.01$) than the latter. Moreover, in the low-endowed subsample, absolute b_s is significantly ($p < 0.01$) lower than b_o.

However, the explanation does not seem that simple in "*Poor's*"subsample. While"*Poor*"subjects believe (both in absolute[18] and relative terms) that b_s is lower than b_o the contrary relation is not confirmed by the "*Rich*"subsample. "*Rich*"subjects believe that b_s is not different to b_o. These differences in beliefs may be the explanation of the lower actual contributions of "*Poor*"subjects demonstrated in the previous section. In accordance with theories of selective perception/interpretation (see Pinkley et al., 1995[16] on information processing errors, Dana et al., 2007[10] about moral wriggling room and Stewart, 2009 [19] about selective beliefs), we claim that "*Poor*"subjects opportunistically choose the fairness ideal that benefits them most ("*Rich*"should contribute more) justifying in this way their selfish behavior (contributing less). On the other hand "*Rich*"subjects ignore signals that cause their posterior beliefs to conflict with their self interest. Therefore, for the latter, the relative initial laboratory endowment is more important than the relative out-of-lab wealth.

Finally, when comparing beliefs in figure 3 with the relative actual contributions of figure 2 we observe that, in all treatments, the average relative contributions are always less than beliefs on others' contributions. This fact makes us think that it might be better to study the two variables in parallel.

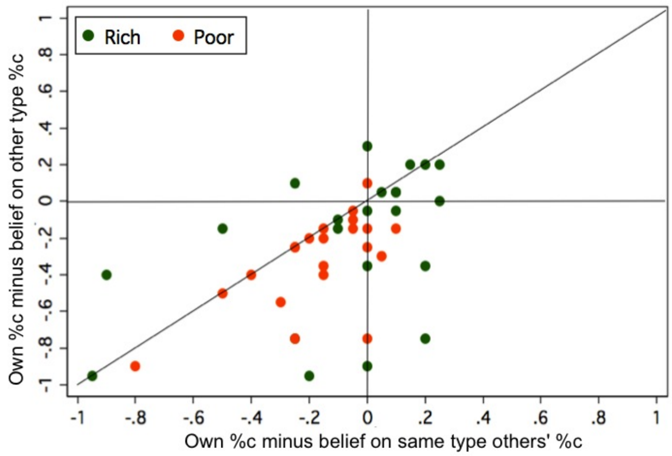
Let us look at the relation between subjects' beliefs on others' obligations to contribute and the actual contribution of each subject. In order to perform meaningful comparisons between subjects with different endowments, we focus on contributions expressed as a percentage of own endowment. Figure 4 refers to subjects with high endowments. It plots the difference between each subjects contribution and his/her belief of what others of the same, b_s, or the other, b_o, type should contribute. Red dots correspond to poor subjects, whereas green dots correspond to rich ones.

The diagonal line indicates that a subject believes that others of either type should contribute equal percentages of their endowments to the public good (b_s=b_o). The vertical (horizontal) line shows the level of own contributions

[17]The differences between beliefs on same and other type relative contributions for the subcategories of *Rich20, Rich10, Poor20, Poor10* can also been seen in Figure 12 of Appendix 3. In the same figure are also illustrated the beliefs on what other subjects ought to contribute.

[18]The corresponded Wilcoxon test is significant in 10% sicnificant level.

Figure 4: High-Endowment Subjects (endow20)



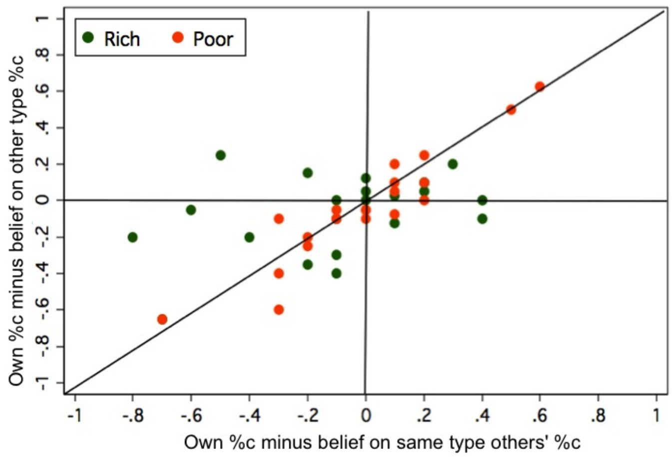
which are equal to the subjects belief of what others of the same (other) type should contribute. The area below the diagonal line and to the left of the vertical one corresponds to subjects whose actual contribution is less than what they believe their similars should contribute, while they expect subjects of the other type to contribute more than themselves. A fortiori, these subjects contribute also less than they expect subjects of the other type to contribute. In this area, we find the vast majority of poor subjects and only exceptionally some of the rich ones.[19] On the contrary, rich subjects are scattered among the four quadrants with slightly higher frequency in the upper right area of higher contributions than what expected from others of any type.

In few words, poor subjects tend to adopt the most irresponsible and selfish attitude of someone who expects others to contribute more than what he actually is prepared to do himself. There are two things that can be learned from this result. First, real wealth should be taken into account because it may affect subjects beliefs and actions. Second, information on players real income will serve as an excuse for the poor to develop a selfish behavior which deviates even from their own moral standards.

When we look at the same type of figure for subjects with low endowments, the picture becomes less clear, because now some of the poor subjects are found in the upper right quadrant. It seems that these subjects behave in an over-responsible way contributing more than others, despite the fact that they are poorer out of the lab and are worse endowed in the experiment. Therefore, while a higher endowment to poor subjects seems to lead to an excessively selfish

[19]A similar pattern is obtained in a baseline session in which subjects incomes are elicited but not made public to the participants. Although this is established with a much smaller sample, it indicates that it is the real income and not the announcement responsible for this effect.

Figure 5: Low-Endowment Subjects (endow10)



behavior, a lower endowment makes some of the poor subjects to behave in the most generous way possible, maybe in an effort to generate more of the public good, and, thus, increase their earnings. Interestingly, poor subjects form the same beliefs on the contributions of both high and low-endowed subjects (i.e. in figure 5, red dots are close to the diagonal).

We have estimated alternative econometric models in which the dependent variables are departures of a subject's absolute (relative) contribution from his/her absolute (relative) beliefs on what others of the same or the other type, respectively should contribute. Differences between normative expectations and actual behavior could be considered as the result of dissonance between a subject's moral standards and actions or may reflect a subject's concerns for a fairer distribution of wealth. Finally, such differences may simply be the result of conflict between one's own *homo politicus* and a more strategic *homo oeconomicus* (see Nyborg 2000[15]).

Table 2: Regressions on Contributions			
Variable	$\|c - b_s\|$	$\%(c - b_s)$	$\%(c - b_o)$
	3(a)	3(b)	3(c)
info	-4.59***	-.32***	-.23***
	(.58)	(.04)	(.04)
design	1.27***	.76***	.04
	(.22)	(.02)	(.04)
hetero2	5.05***	.32***	-.12***
	(.60)	(.04)	(.02)
hetero4	6.84***	.47***	
	(.85)	(.06)	
endow20	-4.51***	-.24***	-.29***
	(1.07)	(.07)	(.06)
rich	-1.66*	-.13*	-.04
	(.86)	(.06)	(.05)
rich20	4.38***	.27***	.13
	(1.17)	(.06)	(.11)
constant	.41	.08	.28
	(1.2)	(.08)	(.15)
N	94	94	82

* significant at 10%; ** significant at 5%; *** significant at 1%

While our specification cannot distinguish between these alternative explanations, our estimates give us interesting hints about the underlying motivators of the observed behavior. Comparing variables' coefficients and significances of $|c - b_s|$ and $\%(c - b_s)$ with the ones in table 1 of the previous section we notice many similarities: the robust negative effects of relative wealth information and of the high endowment given to *Poor* subjects and the robust positive effect of heterogeneity. Being rich and highly endowed (in comparison to being poor and poorly endowed) not only keeps its positive effect on the dependent, in each case, variable but also makes it more robust[20]. Moreover, for the first time the origin of endowment has a significant ($p < 0.01$) effect. Endowing subjects by design and not randomly has a positive effect on a subject's (relative and absolute) contribution deviation from his/her belief on others of same type.

Finally, when the distance between relative contributions and b_o is measured, the homogenous treatments are excluded from the sample. For this reason, the dummy variable *hetero4* is now excluded and is used as the control group. *Hetero2* turns negative because it is compared not to homogeneity but to *hetero4*. Moreover, the effect of *design* is neutralized once more and endowment effects holds only for *poor* subjects.

[20]Robustness maintains its strength even when cluster specification is not used in the regression (see Apendix 2)

5 Conclusions

Endowment heterogeneity in the lab has been studied together with wealth heterogeneity outside the lab. We have found that heterogeneity in the lab affects both absolute and relative contributions positively, contradicting results from previous experimental studies finding negative or no effect (i.e. Anderson et al., 2008[1], Buckley and Croson, 2006[4], Cherry et al., 2005[9] etc.) of heterogeneity.

Incorporating real out-of-lab heterogeneity in our analysis, at a first glance, did not give any significant results. However, from the interaction between out of lab and laboratory-induced heterogeneity interesting results have been obtained. High endowments lead to higher contributions (both $|c|$ and $\%c$) only the relatively richer people. Being relatively poor outside the lab makes highly endowed subjects contribute relatively less (but the same in absolute terms). This finding made us believe that *Poor* and *Rich* subjects have a different way of facing the same situation.

Trying to shed light to this aspect, we analyzed subjects' beliefs about others' contributions. We see that almost all subjects (with the exception of *Rich10* in RP20 and DP20) no matter their types, they expect that subjects of the other type will contribute more. As mentioned in Dana et al. (2006)[10]: *Subjects may feel compelled to give in some situations, because they do not want to appear selfish either to themselves or to others. Thus, the underlying motivation driving much fair behavior might be self-interest, coupled with a desire to maintain the illusion of not being selfish. This means that the same people who give [...] may actual prefer the self-regarding and unfair outcome, as long as they have an excuse not to have to give.*

In our design, apart from the experimental anonymity protocols which secure that subjects do not appear selfish to others, it has also given to *Poor* subjects the excuse not to have to contribute to the Public Good and therefore not to appear selfish even to themselves. The fact that they are *Poor* and more importantly, that this is both confirmed and common knowledge from everybody, gives them the excuse to adjust their beliefs and finally to contribute less compared to *Rich.* On the other hand, *Rich* subjects do not perceive or simply avoid such an "excuse "since it drives them to higher contributions and probably to lower profits.

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7 Appendices

7.1 Appendix 1 : Table of Averages and Box Plots.

Table 3: Average Contributions

Treatment	|*contributions*|			%*contributions*		
	all	end10	end20	all	end10	end20
All sample$_{(n=96)}$	5	4.22	5.72	.35	.42	.29
	(3.26)	(2.43)	(3.75)	(.23)	(.24)	(.19)
B1020$_{(n=12)}$	6.25	5.33	7.17	.45	.53	.36
	(3.17)	(3.14)	(3.19)	(.25)	(.31)	(.16)
B10$_{(n=4)}$	4.5	4.5		.45	.45	
	(1.3)	(1.3)		(.13)	(.13)	
B20$_{(n=8)}$	5.5		5.5	.28		.28
	(3.12)		(3.12)	(.16)		(.16)
RP10$_{(n=12)}$	5.25	3.5	7	.35	.35	.35
	(5.36)	(2.07)	(7.18)	(.28)	(.21)	(.36)
RP20$_{(n=12)}$	4.42	3.67	5.17	.31	.37	.26
	(2.31)	(1.63)	(2.79)	(.16)	(.16)	(.14)
RP1020$_{(n=24)}$	4.71	4.67	4.75	.35	.47	.24
	(2.60)	(3)	(2.26)	(.25)	(.30)	(.11)
DP10$_{(n=12)}$	5.17	4.33	6	.37	.43	.30
	(4.13)	(2.88)	(5.25)	(.27)	(.29)	(.26)
DP20$_{(n=12)}$	4.33	3.17	5.5	.30	.32	.28
	(2.64)	(1.83)	(2.95)	(.16)	(.18)	(.15)
	Standard errors in parenthesis.					

Figure 6: Box Plot(1): Absolute Contributions

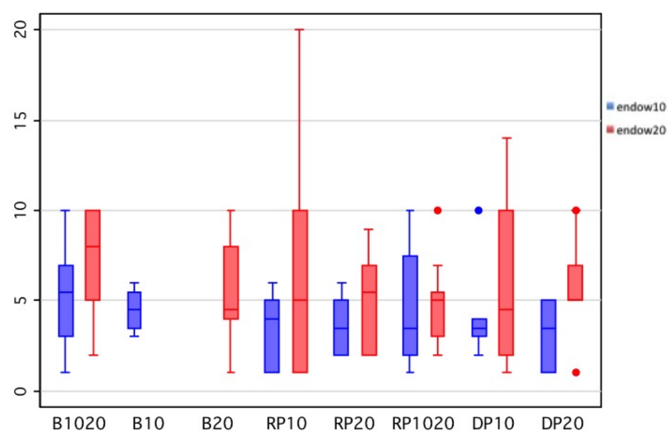
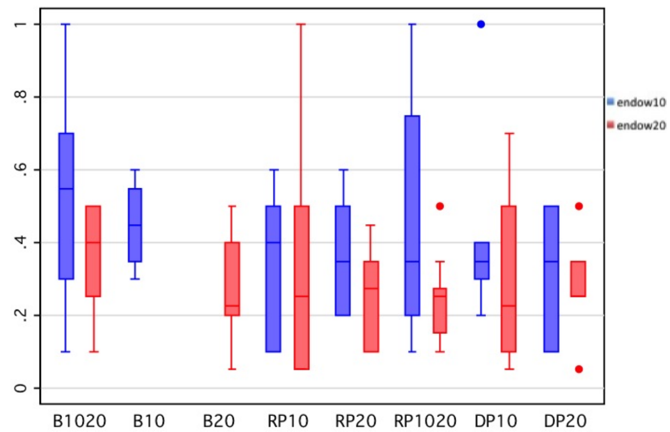


Figure 7: Box Plot(2): Relative Contributions



7.2 Appendix 2: No-clustered Regressions.

Table 4: Tobit Regressions on Contributions

Variable	|*contributions*|		%*contributions*	
	1(a)	1(b)	2(a)	2(b)
info	-3.75**	-3.93**	-.22**	-.23**
	(1.8)	(1.75)	(.10)	(.09)
design	.11	-.64	-.01	-.02
	(1.35)	(1.32)	(.07)	(.07)
hetero2	3.30*	3.94**	.18*	.21*
	(2.0)	1.99	(.11)	.11
hetero4	4.41*	5.09**	.26*	.29**
	(2.05)	2.46	(.13)	.13
endow20	.63	-1.49	-.15***	-.23***
	(.97)	(1.40)	(.05)	(.08)
rich	-.44	-2.63*	-.01	-.09*
	(.97)	(1.42)	(.05)	(.08)
rich20		4.06**		.16
		(1.98)		(.11)
constant	5.13***	6.35***	.46***	.50***
	1.92	(1.97)	(.10)	(.11)
N	94	94	94	94
cens. obs.	10/4	10/4	10/4	10/4

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Regressions on Contributions

Variable	$\lvert c-bs \rvert$	$\%(c-bs)$	$\%(c-bo)$
	3(a)	3(b)	3(c)
info	-4.59***	-.32***	-.23***
	(1.71)	(.11)	(.11)
design	1.27	.76	.04
	(1.28)	(.08)	(.08)
hetero2	5.05***	.32***	-.12
	(1.94)	(.12)	.09
hetero4	6.84***	.47***	
	(2.41)	(.15)	
endow20	-4.51***	-.24***	-.29***
	(1.36)	(.08)	(.10)
rich	-1.66	-.13	-.04
	(1.39)	(.09)	(.10)
rich20	4.38**	.27**	.13
	(1.92)	(.12)	(.14)
constant	.41	.08	.28
	(1.94)	(.12)	(.20)
N	94	94	82

* significant at 10%; ** significant at 5%; *** significant at 1%

7.3 Appendix 3: Beliefs on relative contributions of other (same type) subjects.

Figure 8: Average Beliefs on %c of other (same type) subjects

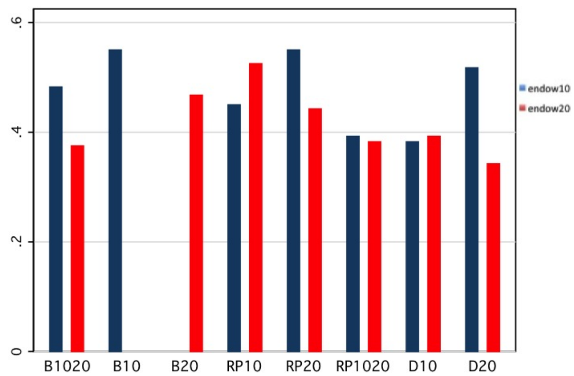


Figure 9: Box Plot(3): Beliefs on %c of other (same type) subjects

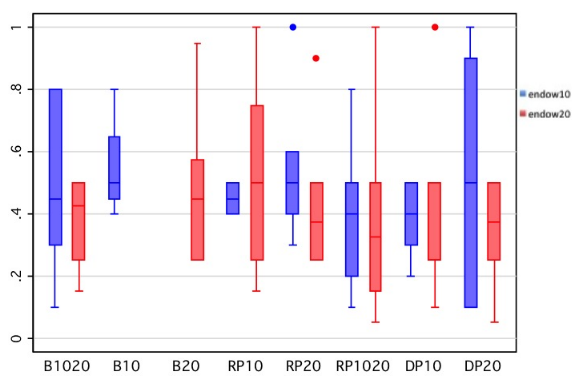


Figure 10: Mean of Actual %c - Beliefs on %c of other (same type) subjects

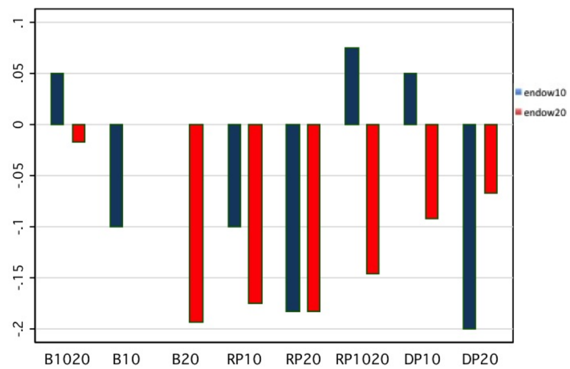


Figure 11: Box Plot (4) Actual %c - Beliefs on %c of other (same type) subjects

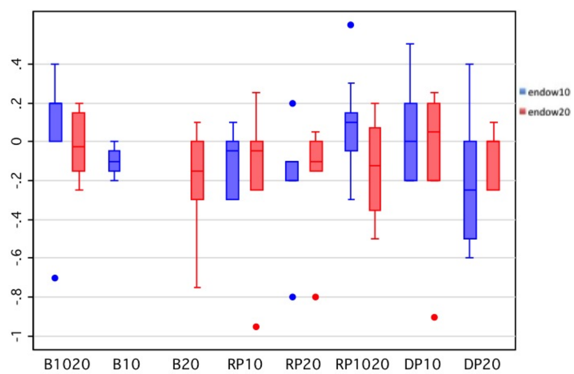


Figure 12: Beliefs and Liabilities