



CONDITIONAL COOPERATION: GROUP SIZE AND HETEROGENEOUS ENDOWMENT

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Abstract:

We study the impact of Conditional Cooperators on a set of public goods, using a questionnaire to divide the types of behavior of the subjects according to their contribution to a public good depending on the contributions of the other members of the group. Based on this we have compared the effect of the two treatment variables established: group size and heterogeneous endowment.

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1. Introduction

Nowadays, people confront difficult decisions as they have to assess what is good for the group and what would bring the greatest individual profit. For example, if you want to maintain the population of fish in the oceans, you have to take into account the need to conserve a sufficient proportion for each generation for breeding. However, when several people are allowed to fish commercially, there is a danger that overfishing will not allow the stock to recover. On the other hand, when people are free to pollute, disposing of their waste without any problems, it causes a serious situation of environmental degradation such as dirtier air, polluted soil and poisoned water. These costs are far greater than the profits that polluters make from disposing of their waste rather than acting differently with them.

It is this kind of situations that are known in the economic literature as the dilemma of voluntary contribution to public goods. The main characteristic is that the provision of public goods is an equation of the contribution of the agents in the society. In addition, these actors will profit, even if they have not contributed. This is why there is an incentive to take advantage of the contributions of others, thus increasing their individual profits by avoiding the costs of contributing to their production. As will be explained below, individuals who are not involved in the provision of the public good will be called Free Riders. But although they maximize their individual profits with this behavior, according to the experiments carried out in experimental economics on the theory of public goods, it is observed that a large part of individuals have another type of behavior, that of conditional cooperator. This behavior is based on contributing more as other individuals contributing more. Given the simplicity of this mechanism and its great theoretical and practical implications, the subject has been extensively addressed by experimental economics, which aims to explain the actions of individuals with public goods framework. The typical methodology adopted consists of four basic steps: first, the field of study is defined and delimited, second, a set of assumptions is proposed concerning the "rules of the game" and the objective equations of the players, third, from these assumptions a set of conclusions on behavior is drawn, usually using mathematical logic.

In previous experiments, such as the Fischbacher, Gächter and Fehr experiment (July 2000), it was found that 50% of the participants in the experiment were conditional cooperators; 30% were free-riders and 15% were classified as hump-shaped, the behavior of which started as a conditional cooperator but then decreased as the average group contribution became higher. The experiment was conducted with a total of 44 participants and divided into groups of 4. In this case the marginal per capita return was equal to 0.4 and the endowment of 20 tokens (experimental currency). It was a one-shot experiment in which participants had to make an unconditional decision and fill in a conditional decision table. The unconditional decision was based on deciding how much they would contribute to the public good without knowing how much the other members of the group would contribute, and the conditional decision table was about what you would contribute to the public good depending on the average contributions from the rest of the group. As the endowment was 20 tokens, the conditional decision table consisted of 21 decisions, i.e. one for each possible average of the group's contributions to the public good, between 0 and 20.

The results obtained in this experiment, as we will analyze later in the results section, were that 50% acted as Conditional Cooperators and 30% as Free Riders. It is because of this type of results that these types of studies are interesting, since the expected result would be that individuals would want to maximize their profits by acting as Free Riders but, in contrast, half of the participants acted as Conditional Cooperators, thus profiting the public good and consequently society.

Herrmann, B. & Thöni, C. 2009 reached results very similar to those of Fischbacher et al. (2000) although, in terms of Free Riders, they observed far fewer. On the other hand, Keser, C. and F. van Winden, (2000) observed that 80% of the participants in their experiment acted as Conditional Cooperators, that is, they chose their contributions based on the group's contribution.

But these are the cases where the endowments were homogeneous; it is also interesting to study how individuals vary their decisions when the endowments are heterogeneous. This was discussed in the experiments by Hofmeyr et al. (2007) and Chan et al. (1999). They study the variations in the decisions of individuals with heterogeneous endowments. But despite these being similar situations, the first of them concluded that there is a negative correlation between the heterogeneous endowment and the contribution to the public good and the second of them reaches the opposite conclusion: that the difference in the endowments does not affect the contribution to the public good.

As mentioned above, the experiment is based on the experiment by Fischbacher, Gächter and Fehr (2000) but with different treatment variables that are going to be mentioned below. That is why the different treatments are designed according to the experimental design of the same. To begin with, participants were told that they had a hypothetical endowment of 10€ (the endowment in Fischbacher et al. (2000) experiment was 20 tokens). The group size of our experiment can be either 4 or 2, depending on the treatment we are in; in Fischbacher's case there was only one treatment, in which the group size was 4. The situation that follows is the same in both experiments: deciding how much to contribute to a public good. This decision is divided into two types: an unconditional decision and conditional decisions. On the one hand, the unconditional decision is the decision in which the subject indicates how much he or she would contribute to the public good independently of what the rest of the group contributes. On the other hand, conditional decisions are the set of decisions taken by the subjects based on all possible contribution averages by the group. In the case of Fischbacher et al. (2000), the participants filled in a conditional decision table with 21 boxes to be filled in since the endowment was 20 tokens, the group average could be between 0 and 20 (increasing the average in units in each possible situation). In the case of our experiment, instead of filling in a table, 11 or 6 conditional questions had to be answered (depending on whether the endowment of the group members was 5 or 10 Euros). In addition, in the Fischbacher et al. (2000), participants have the opportunity to make a profit based on their responses, so they have greater incentives to base their responses on maximizing their profits. In our case, it is not possible to make any profit after answering the questionnaire, so we do not have that incentive. On the other hand, the marginal return per capita in our experiment will be equal to 0.6 and will not vary in any of the treatments, in the case of the Fischbacher et al. (2000), the MPCR was equal to 0.4. Finally, the great difference between this experiment and Fischbacher et al. (2000) is that in 4 of the 6 treatments the endowment will be heterogeneous, depending on the treatment that is the participants will have 10€ endowment and the rest of the group will have 5€ or the contrary, the participants 5€ endowment and the rest of the group 10€.

Six questionnaires were been created, each one of them a treatment, via "Google Questionarios" (web page: <https://docs.google.com/forms/u/0/>) to reach people through social networks and that could easily answer the questionnaire from anywhere. As an experiment based on that of Fischbacher et al. (2000), treatment 1 will be exactly the same as their experiment, with the exception of MPCR which instead of being 0.4 will be 0.6. In our case, we expect to find greater contributions to the public good since

there is no incentive to profit, as there was in the Fischbacher et al. (2000). This is why it is expected that there will be a higher percentage of conditional cooperators and a lower percentage of free-riders.

On the other hand, and also in order to be able to compare the results obtained in the first treatment; in the treatment 2 the group size will be changed, being $N=2$, in order to study whether the variation in the group size affects the average contributions of the participants. Contributions are expected to be even higher as a result of the downsizing of the group as the smaller the group; the more individual decisions will influence the public good.

Once the above comparisons are completed, the aim is to find out how the contributions to the public good of the participants change when the endowments are heterogeneous. In this case, the following treatment (3 and 4) will be based on heterogeneous endowment-rich¹ and heterogeneous endowment-poor², where the group size is equal to 4 so the treatment variable is the heterogeneous endowment. As the group size is the same as that of the first treatment (with homogeneous endowment), treatment 1, 3 and 4 will be compared with each other.

Finally, the last treatments (5 and 6) will be like the last two mentioned but changing the size of the group, being in this case $N=2$, so they will be compared with treatment 2 (homogeneous endowment and $N=2$). It is expected that when participants have a heterogeneous endowment-rich, they will contribute more to the public good than if they had heterogeneous endowment-poor or homogeneous endowment. Therefore, when they have a heterogeneous endowment-poor, they are expected to contribute less than if they had heterogeneous endowment-rich and homogeneous endowment.

The experimental design will explain in detail all the treatments that have been mentioned taking one of them as an example, and then, in the results of the experiment, we will observe if the expected contributions have been met or not.

Finally, the conclusion will discuss the economic importance of the results obtained.

¹ When the heterogeneous endowment-rich is indicated it will be because it is the participant who has the highest endowment with respect to the rest of the group.

² When the heterogeneous endowment-poor is indicated, it will be because it is the participant who has the lowest endowment with respect to the rest of the group.

2. Experimental design

The experimental design is based on a perfect one shot information game where players have to make an unconditional decision and then answer the conditional questions. As we have mentioned in the introduction, the game is based on Fischbacher et al (2000). That is why, later on, our results will be compared with those obtained in their experiment.

To collect the data, treatments were sent to different people in questionnaire format. As an example, one of the questionnaires³ is shown in Annex 1. At the beginning, the experiment is explained with a short story to put the subject in situation. To obtain the highest percentage of understanding from the participants, the public good situation was explained as a game between friends and the profits equation was broken down into three equations (that were presented in the questionnaire that can be found in Annex 1):

- Individual profit equation: Individual profit equal to 10€ minus the money invested in the public good.
- Public good profit equation: profit of the public good equal to the return of the public good (explained later in the profit equation of our experiment).
- Total profits equation: total profits equal to the sum of the individual profit plus the public good profit. The total would be equivalent to the profit equation of our experiment, which is explained below.

Later they had to answer three control questions⁴ to make sure they understood the questionnaire. As a result, questionnaires whose answers to the control questions had been incorrect were discarded, as the error in those answers was understood to mean that the participants did not correctly understand the wording of the experiment. This selection process was conducted in order to evaluate the behavior of the participants who did understand the questionnaire. Then, after the control questions, the unconditional question and the conditional questions⁵ were asked.

³ The questionnaire example in Annex 1 is in Spanish to ensure the full understanding of the people to whom it is sent, as they cannot guarantee the full understanding of English.

⁴ There were three questions where the participants had to answer which the profit was obtained in each case. In Annex 1, where an example of the questionnaires that were sent is found, you can see which control questions were carried out on all treatments.

⁵ 3 of the conditional questions that were asked can be found in Annex 1, where the example of a treatment that was sent to participants is found.

The treatment variables were heterogeneous endowment and group size. So we can divide between questionnaires with N=2 and N=4 (where "N" is the size of the group) if we speak of group size; and in homogeneous endowment, heterogeneous endowment-rich and heterogeneous endowment-poor, as mentioned in the introduction. With all this, we will arrive at a total of 6 different treatments (shown on the Table 2), which will be compared with each other (in addition to the results of Fischbacher et al. (2000)), as we will see in the results of the experiment

	ENDOWMENT		
GROUP SIZE	Homogeneous	Heterogeneous rich	Heterogeneous poor
N=4	Treatment 1	Treatment 3	Treatment 4
N=2	Treatment 2	Treatment 5	Treatment 6

Table 1: Treatment variables

As explained above, the subject has to decide how much of his or her endowment he or she will invest in the public good. To this end, the questionnaire guaranteed them the profits equation so that they could make the decision with as much information as possible. As can be seen in Annex 1 and as mentioned above, the profit equation presented to the participants was expressed in a simpler way, divided into three profit equations, to ensure understanding of the experiment. But, in the end, the profit equation of our experiment is as follows:

$$\pi_i = E - g_i + \left(\frac{Factor}{N}\right) \sum_{j=1}^N g_j \quad (1)$$

In the equation it can be observed that its profit will depend on its endowment, E, which can be 10€ or 5€ (depending of the treatment that we were in), of what it decides to invest in the public good, g_i , of the marginal return per capita, $\left(\frac{Factor}{N}\right)$; and of the sum of the endowments of the members of the group, including itself, $\sum_{j=1}^N g_j$. The MPCR was 0,6 in all treatments and the factor changes in function of the group size. Being the factor equal to 2,4 when N=4 and equal to 1,2 when N=2.

The optimal decision, which is Nash's equilibrium of the game, is not to contribute anything to the public good, as this is how profits are maximized. Imagine that we are in the treatment 2 (with homogeneous endowment and N=2). Imagine that the other member of the group contributes 8€ to the public good and the subject contributes 2€, the profit would be the following:

$$\pi_i = 10 - 2 + 0,6(8 + 2) = 14\text{€} \quad (2)$$

Let us now imagine that, given the same situation, the subject does not contribute anything to the public good, the profit would be the following:

$$\pi_i = 10 - 0 + 0,6(8 + 0) = 14,8\text{€} \quad (3)$$

As can be seen, when nothing is contributed, greater profits are obtained. However, as we will see from the results of the experiment, the vast majority of participants do contribute money to the public good.

Once the subject had a clear profit equation, he proceeded to answer the unconditional question: "How much would you be willing to contribute to the public good?" He was then asked the conditional questions. In the example of the treatment we have posed were 11 questions, since the endowment was homogeneous, 10€. The number of questions asked on the other treatments could range from 6 to 11, depending, as we said, on whether the endowment of the group members was 5€ or 10€, respectively. An example of the conditional questions they had to answer is the following: "How much would you be willing to contribute to the public good, knowing that the other member of the group has contributed 2€?" In Annex 1 you can see exactly what questions were asked of the participants. The question is not exactly the same, as it followed the initial statement that was proposed to them to explain the experiment.

The different results obtained in each of the treatments will be shown below.

3. Results of the experiment

As mentioned above, different treatments have been compared with each other. After carrying out the study, different types of behavior were observed among the participants, which were classified as follows:

- Conditional Cooperation (CC): players whose tendency to contribute to the public good is proportional to the contribution of the rest of the group, that is, as the group contributes more to the public good, they contribute more to the public good. He is the type of player most expected to be found in the results of

the experiment. Figure 4 shows the behavior of a perfect Conditional Cooperator:

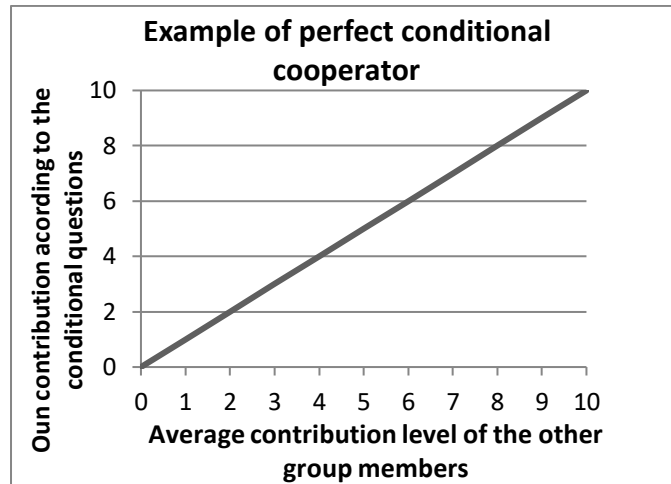


Figure 4: Example of perfect conditional cooperator

- Semi Conditional Cooperation (SCC): in this case the player acts as a Conditional Cooperator when the investments to the public good by the group members are low, but as they become higher (more or less when the amount invested is around half the endowment) they stop increasing their contribution as the rest of the group does invest it. Figure 5 shows the behavior of a perfect Semi Conditional Cooperator:

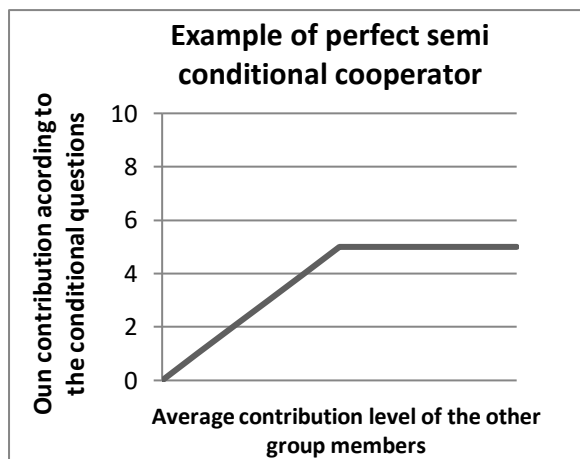


Figure 5: Example of perfect semi conditional cooperator

- Hump Shaped" Contribution (HS): this type of behavior is very similar to the previous one (SCC) but, in this case, instead of maintaining the amount of money invested in the public good when the average contribution is close to half the endowment, as was the case in the previous case; from the same moment their contributions begin to progressively decrease. Figure 6 shows the behavior of a perfect Hump Shaped Contributor:

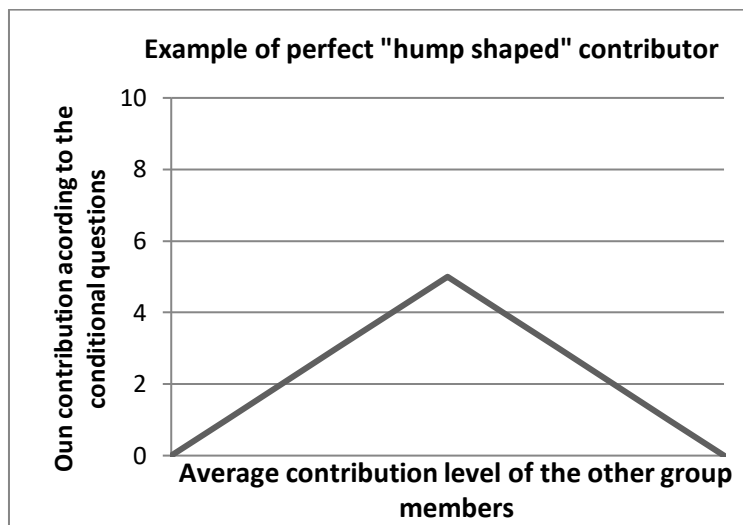


Figure 6: Example of perfect “hump shaped” contributor

- Free Riding (FR): subjects who have this type of behavior are those who do not invest anything in the public good under any circumstances.
- Nash-Player (NP): in this case we observe the same behavior as free riders except when the rest of the group contributes all their endowment to the public good; that is when the subject also contributes all their money to the public good.
- Full Contribution (FC): this behavior occurs when the subject contributes all his or her endowment in all circumstances. It would be the antithesis of the Free Rider.
- Half Contribution (HC): this case would be exactly the same as the previous one, although the contribution to the public good would be half of its endowment in all circumstances.
- Inverse Conditional Cooperation (ICC): This type of player would be the antithesis of the Conditional Cooperator, since as the average contributions to the public good increase, they decrease. The behavior of a perfect Inverse Conditional Cooperator is shown in Figure 7 (when the endowment is homogeneous):

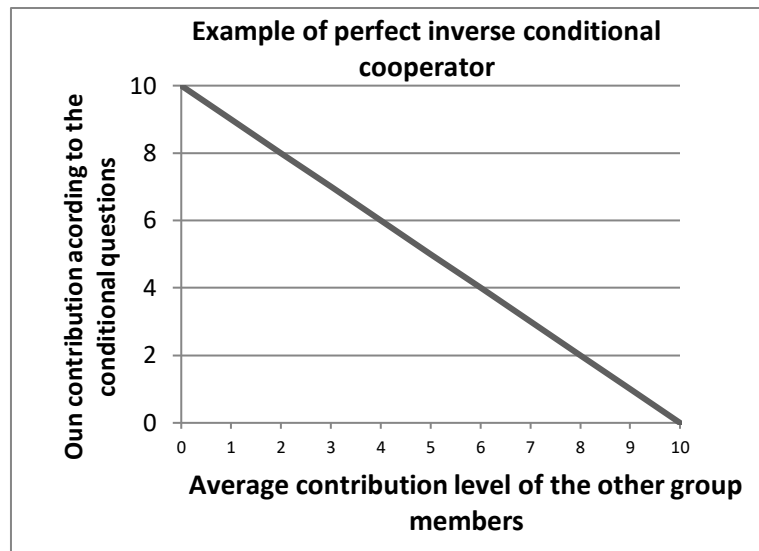


Figure 7: Example of perfect inverse conditional cooperator

- Other patterns (O): are the behaviors that have no pattern and the reason for their behavior cannot be explained.

Although we have found these 9 different behaviors, not all of them occur in all treatments. The following section will explain all the results obtained in each of the treatments and their respective comparisons.

3.1. Treatment 1. Homogeneous endowment and N=4

The questionnaire for treatment 1 was sent to a total of 29 people, 23 of whom answered the control questions correctly, so the answers of these 23 people were studied.

Once the answers have been studied, in Table 2 we observe the distribution of decisions divided into types of behavior and the average contributions in unconditional decision. In Annex 2 are representing the figures of the individual behavior of each subject.

Type of behavior	% Of subjects	Average unconditional decision (€)
Conditional Cooperator	30,43%	5,67
Hump Shaped	4,35%	0
Semi Conditional Cooperator	21,74%	4,6
Free Rider	30,43%	0
Nash Player	13,04%	3,33
Full Contributor	0,00%	-
Half Contributor	0,00%	-
Inverse Conditional Cooperator	0,00%	-
Others	0,00%	-

Table 2: Individual distributions treatment 1

As shown in Table 2, the highest percentages are those of Conditional Cooperation and Free Riding, sharing the total number of subjects of each type (30.43%). Next we find that 21.74% act as Semi Conditional Cooperators and 13.04% as Nash Player. Finally, with the lowest percentage, it is found that 4.35% act as "Hump Shaped" Contributors. Appendix 2 shows the individual figures of each of the subjects of this treatment. The horizontal axis shows the average of the group's contributions and the vertical axis shows the total contribution of the subject to the public good in each situation.

Table 2 shows the average of the unconditional decision of each type of behavior. We expect that answers comes according the type of behavior. So as we can see, in this case, the expected result is achieved: the Conditional Cooperators subjects are those who contribute most of their income, on average, to the public good (contributing an average of 5,67€). After that, Semi Conditional Cooperators contribute on average 4,6€ to the public good. Then, Nash Players contribute on average 3,3€ to the public good. It is considered a quite high average contribution since subjects with this type of behavior only contribute to the common good in the case where the rest of the group contributes their entire endowment. Nor is the average contribution of hump shaped contributors expected to be 0 as they contribute to the public good in almost all

situations. Finally, as expected, the average contribution of the free riders in their unconditional decision is 0.

The average contributions of the participants in each conditional question divided by type of behavior will then be shown in Figure 8, together with the average behavior of all the participants as a whole (the 23) and also compared with the diagonal showing what the behavior of a perfect Conditional Cooperator would look like (Figure 4), in order to be able to compare how much the participants have deviated with their behavior.

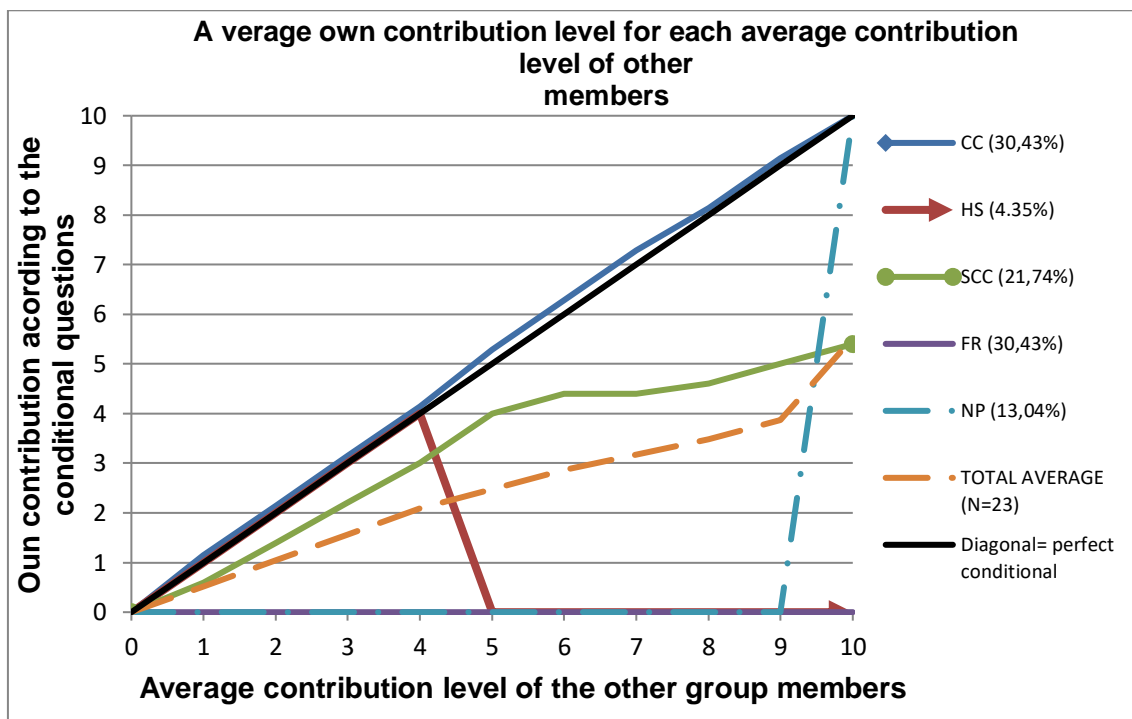


Figure 8: Average own contribution level for each average contribution level of the other members in treatment 1

As we can see from Table 2, the average contribution of the Conditional Contributors (CC) has not deviated from the diagonal of perfect conditional, moreover, it is slightly higher and we can conclude that the Conditional Cooperators increase their contributions even above the average contribution of the group. On the other hand, as the highest percentages are those of Conditional Contribution and Free Riding, it has caused the total average of the contributions of the participants to be between these two (discontinuous orange line). It is because of the great impact of the Free Riders and Nash Players that the overall average is so far from the perfect diagonal contribution.

Finally, we can observe the great similarity in behavior between the Hump Shaped Contributor and the Semi Conditional Contributor, since while the average contribution of the other group members to the public good is less than half of the group's endowment; they act as a Conditional Cooperator. Moreover, the distributions of the Conditional Cooperator, Semi Conditional Cooperator and Hump Shaped Contributor are hardly differentiated. It is between the average of contributions of the other group members are equal to 4 and 6 when the distributions of these two types of subjects are separated, with the Semi Conditional Cooperators following a positive trend (although not as much as the Conditional Cooperators) and the Hump Shaped Cooperator starting to decrease their contributions to the public good.

3.2. Treatment 2. Homogeneous endowment and N=2

In this case, the questionnaire of treatment 2 was sent to a total of 32 people, but the behaviors of the 26 people who answered the control questions correctly were studied. The behavior type distributions and the average contributions in unconditional decision are shown in Table 3 (individual behavior figures are found in Annex 2).

Type of behavior	% Of subjects	Average unconditional decision (€)
Conditional Cooperator	61,54%	5,63
Hump Shaped	0,00%	-
Semi Conditional Cooperator	0,00%	-
Free Rider	19,23%	0
Nash Player	0,00%	-
Full Contributor	3,85%	10
Half Contributor	0,00%	-
Inverse Conditional Cooperator	0,00%	-
Others	15,38%	-

Table 3: Individual distributions treatment 2

We observe a great difference with respect to the results of treatment 1. The amount of Conditional Contributors is 61.54%; almost double that of the previous case (see Table 2). In addition, the importance of Free Riders is much lower, at 19.23% and, in this case, 3.85% of Full Cooperators. These results indicate that the subjects are more willing to contribute more to the public good than in the treatment 1, when the members of the group were 4.

On the other hand, the average number of contributions in the unconditional question is also in line with expectations. Since conditional cooperators contribute an average of 5,63€ (the result is very similar to that of treatment 1, as can be seen in table 2), free riders contribute nothing and full cooperators contribute everything.

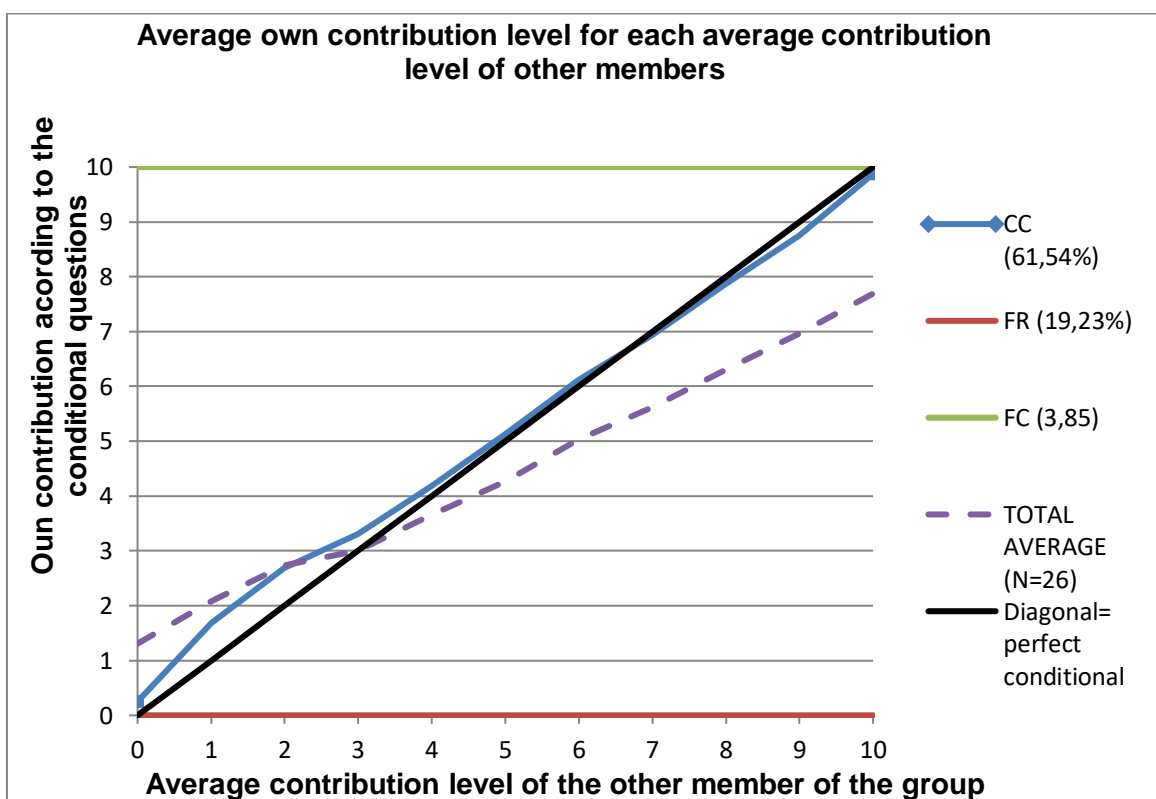


Figure 9: Average own contribution for each average contribution level of other members in treatment 2

We will now look at the figure showing the average contributions divided into types of behavior, as we have seen in Figure 9. As expected, we observed that the average contributions of all participants are very close to the diagonal of perfect conditional, given the great impact of subjects who behave in this way. Even at the beginning, when the group's contributions to the public good are lower, the average contribution of all the subjects exceeds the diagonal of perfect condition. Despite this, the distribution

of contributions from Conditional Cooperators is not above the diagonal in all circumstances, as was the case in the previous treatment (see figure 8).

3.3. Treatment 3. Heterogeneous endowment rich and N=4

As explained above, the following treatments that were designed were 4 more. Two with the group size equal to 4 and two with the group size equal to 2. The difference between them is that in each case the subject has a different endowment than the rest of the group. Let's start then with the case in which the size of the group is equal to 4 and the subject's endowment is twice that of the rest of the group, that is, he was told that his endowment was 10€ and the rest of the group was 5€.

We expect that the larger the endowment of the subjects, the greater their endowment with respect to the rest of the group, in order to compensate for the difference in money. This treatment was sent to 32 people and the study was performed at 23 people who answered the control questions correctly. The individual behaviors of each of the participants can be seen in Annex 2. The distributions of the types of behaviors of the participants and the average contributions in unconditional decision are shown in Table 4.

As in the previous cases, most of the subjects act as Conditional Cooperators, with 43.48% of the participants acting in this way. In order of the most common behaviors, it is followed by the Semi Conditional Cooperators, which are 17.39%. Next with 8.70% are the Half Cooperators, which are those who contribute half of their endowment under all circumstances. This behavior had not been the case in the previous cases, perhaps because in this case there are some participants who want to contribute to the public good equal to the maximum endowment that the rest of the group can contribute. Finally, 4.35% of participants were found with Full Cooperator and Inverse Conditional Cooperator behavior.

Type of behavior	% Of subjects	Average unconditional decision (€)
Conditional Cooperator	43,48%	4,8
Hump Shaped	0,00%	-
Semi Conditional Cooperator	17,39%	5
Free Rider	0,00%	-
Nash Player	0,00%	-
Full Contributor	4,35%	10
Half Contributor	8,70%	5
Inverse Conditional Cooperator	4,35%	5
Others	21,74%	-

Table 4: Individual distributions treatment 3

If we look at the average contributions to the public good in the unconditional decision in Table 4, the results deviate slightly from what we expect since the average contributions of the Semi conditional Cooperators are higher than those of the Conditional Cooperators. This variation can also be seen in Figure 10 which shows that the average contributions to the good of subjects with this type of behavior in conditional questions are higher than the average contributions to the good of the Conditional Cooperators. On the other hand, the average of contributions in the unconditional decision of the other types of behaviors do match the expected results since Full Cooperators contribute 10€, Half cooperators contribute 5€ and Inverse Conditional Cooperators contribute 5€ too.

As noted above, we expected contributions to the public good to be greater when the endowment was greater than that of the group. That's why it's no surprise to see a participant acting as a Free Rider. Next we will observe in Figure 10 the decisions of the participants grouped in the types of behaviors to be able to compare them among themselves, between the diagonal of perfect conditional and between the average total.

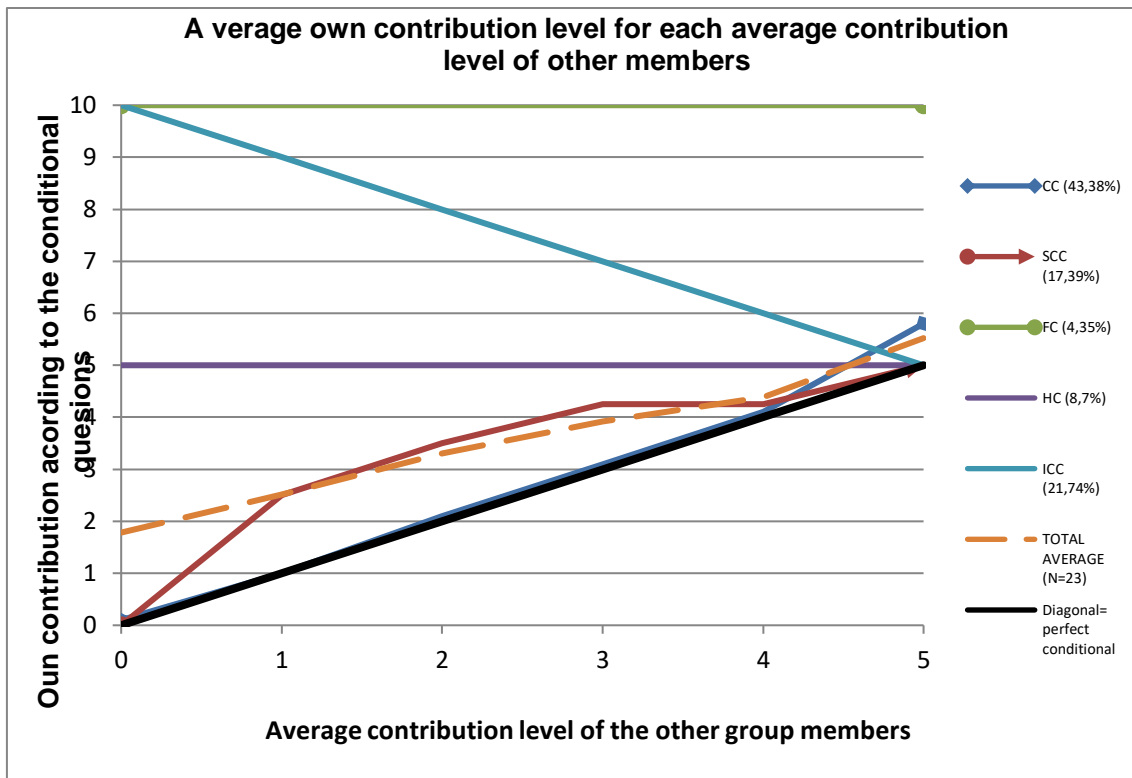


Figure 10: Average own contribution level for each average contribution level of other members in treatment 3

The first difference observed in the figure with respect to figures 5 and 6 (figures that show the results of the homogeneous endowment treatments) is that the diagonal of perfect contributor changes. In the previous cases, the maximum amount was 10€; but in this case, as the rest of the group has 5€ of endowment, the maximum contribution to the good being a perfect conditional cooperator is 5€, not 10€ (despite the fact that this amount is the endowment of the participants). This is why in this case the maximum of the horizontal axis is five, as it is the maximum average contribution to the good by the members of the group.

In this case, the participants did not attempt to compensate for the difference in endowments by contributing more to the good than the other members of the group. It is possible that the reason is that the participants contribute to the public good, most of the time, taking as a reference the contribution made by the rest of the group, without taking into account the difference in the endowment.

3.4. Treatment 4. Heterogeneous endowment poor and N=4

The questionnaire of treatment 4 was sent to the same 32 participants as in treatment 3, so the results of the 23 who answered the control questions were also studied. Table

5 below shows the distribution of decisions of each individual divided by the types of behavior of the participants and the average contributions in unconditional decision. The individual behavior figures can also be seen in Annex 2.

Type of behavior	% Of subjects	Average unconditional decision (€)
Conditional Cooperator	73,91%	4,3
Hump Shaped	0,00%	-
Semi Conditional Cooperator	8,70%	2,5
Free Rider	0,00%	-
Nash Player	0,00%	-
Full Contributor	4,35%	5
Half Contributor	0,00%	-
Inverse Conditional Cooperator	0,00%	
Others	8,70%	-

Table 5: Individual distributions treatment 4

We observe that there is a great impact of Conditional Cooperation behavior, reaching up to 73.91% of participants who act in this way, this impact being much greater with respect to the Conditional Cooperators of the Treatment 3. Following this, 8.70% are Semi Conditional Cooperators and, finally, 4.35% are Full Contributors. The explanation for the fact that there are more Conditional Cooperators could be that they want to compensate for their lower purchasing power by trying to invest the same amount in the good as the members of the group, who have a larger endowment. That is why on the column of contribution average in the unconditional decision we observe a highest quantity of contribution in respect of the endowment of the subjects. Conditional Cooperators contribute 4,3€ in average, whatever the other members of the group contribute, while their endowment is 5€. On the other hand, the contribution of Conditional Cooperators and Free Riders is as expected.

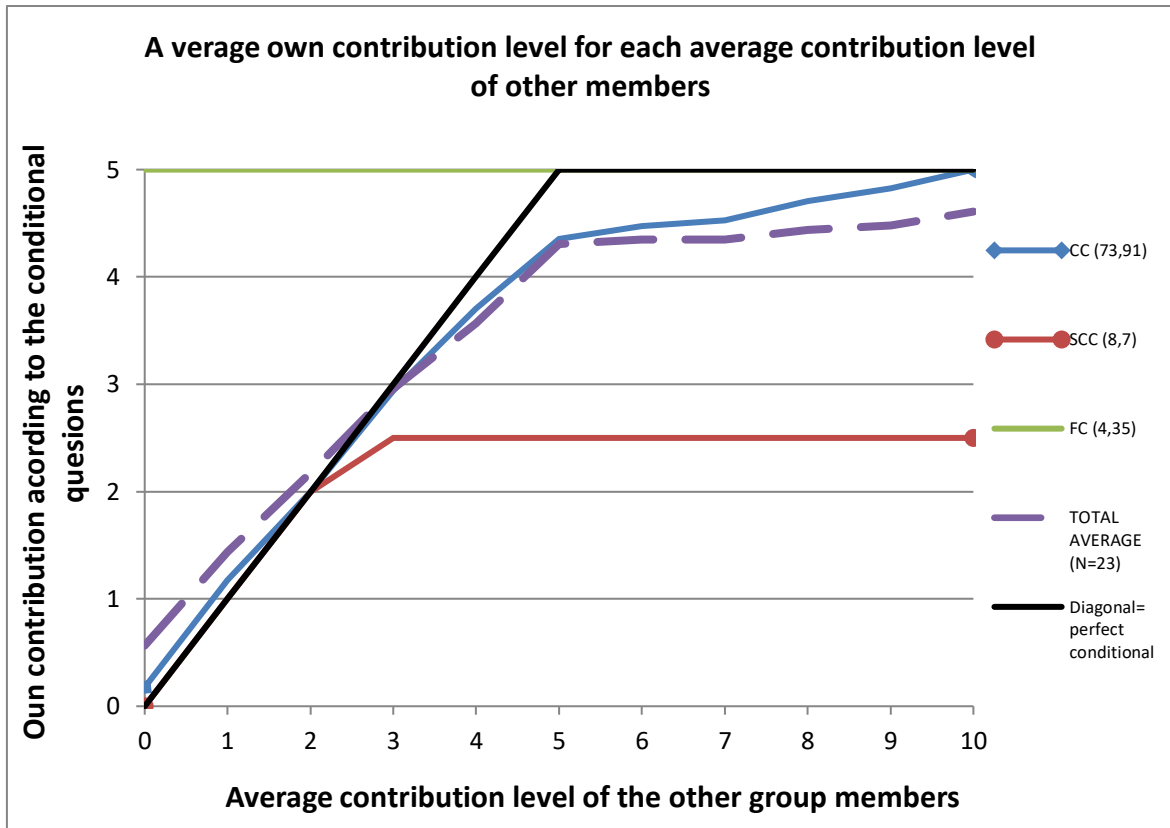


Figure 11: Average own contribution level for each average contribution level of the other members in treatment 4

In this case, as can be seen in Figure 11, the diagonal of the perfect conditional cooperator is different from all the previous ones. Until the average contribution level of the other group members is 5, it does not vary from the perfect conditional diagonal of the treatment 1, but since the subject cannot contribute more to the public good, and therefore cannot continue to act as a Conditional Cooperator since he or she has a heterogeneous endowment with respect to the group, when the rest of the group's contribution averages increase by 5, the subject continues to contribute 5 since it is his or her maximum.

As we can see, the average total curve is almost equal to that of Conditional Cooperator; this is due to the great impact of participants who act as Conditional Cooperator. On the other hand, the behavior of Semi Conditional Cooperators is almost the same as that of a perfect Semi Conditional Cooperator (see Figure 5).

3.5. Treatment 5. Heterogeneous endowment rich and N=2

The questionnaire of this treatment was sent to 24 people, 17 of whom responded correctly in control and for whom the study was carried out. The figures of the individual

behaviors are found in Annex 2. Table 6 shows the distribution of decisions divided into types of behavior obtained and the contributions average in the unconditional decision:

Type of behavior	% Of subjects	Average unconditional decision (€)
Conditional Cooperator	47,06%	5,6
Hump Shaped	0,00%	-
Semi Conditional Cooperator	0,00%	-
Free Rider	41,18%	0
Nash Player	0,00%	-
Full Contributor	5,88%	10
Half Contributor	0,00%	-
Inverse Conditional Cooperator	0,00%	-
Others	5,88%	-

Table 6: Individual distributions treatment 5

In this case the distribution shown is very clear, almost half of the participants acted as Conditional Cooperators, with 47.06% impact, and almost the other half acted as free riders, with 41.18% impact. On the other hand, 5.88% of the participants acted as Full Cooperators. There is a great difference in behavior, concentrated, as we have said, in Conditional Cooperators and Free riders. In addition, as we can see in table 6, the average contributions in the unconditional question are in accordance with the type of behavior of the participants, since the average contribution of the Conditional Cooperators is 5.6€, while that of the Free Riders is 0€ and that of the Full Cooperators is 10€.

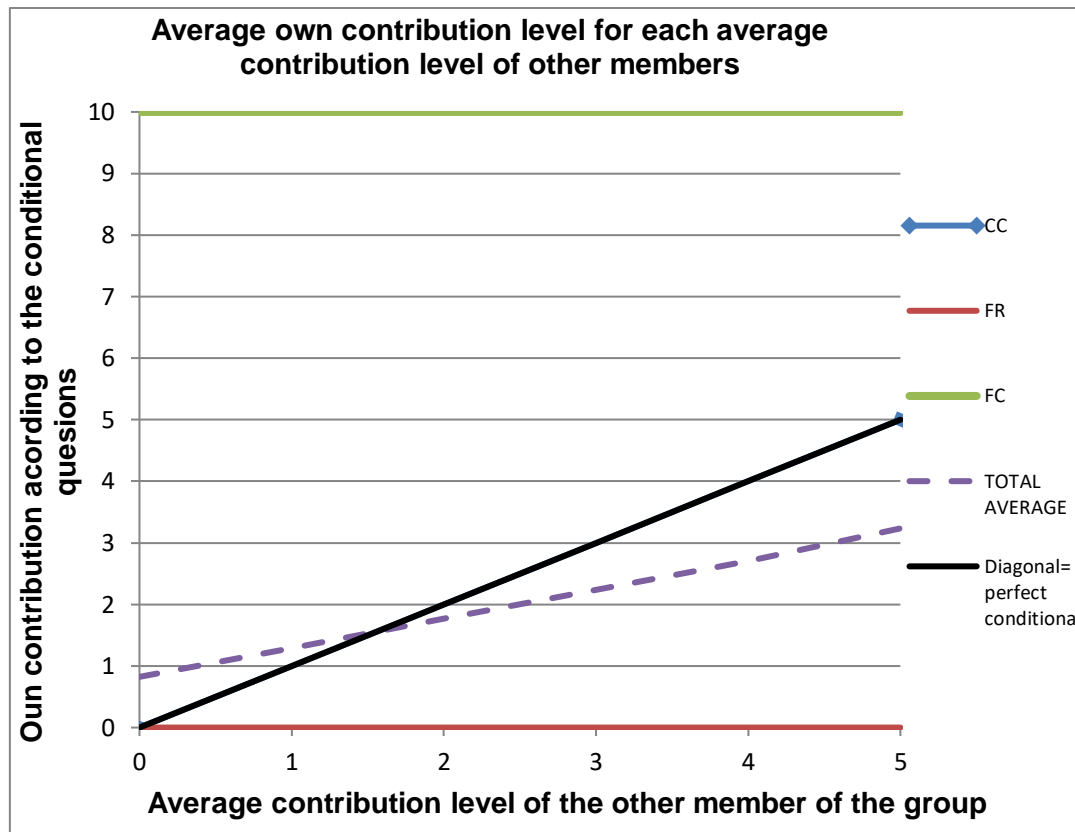


Figure 12: Average own contribution level for each average contribution level of other members in treatment 5

The contributions of the participants, grouped into the different types listed, will then be shown in Figure 12. In this case all those who act as Conditional Cooperators act according to the line of perfect conditional cooperation. Given the results obtained, it is expected that the average total curve will be between that of the Conditional Cooperators and that of the Free Riders, but in Figure 12 we observe that it is a little biased upwards due to the impact of the percentage of participants who acted as Full Cooperators.

3.6. Treatment 6. Heterogeneous endowment poor and N=2

As mentioned, in this case we expect contributions to the public good to be lower than in the previous case (treatment 5). This treatment was sent to the same 24 people as in treatment 5 and they were the same 17 who answered the control questions correctly, so it was the control questions' answers that were studied. Table 7 shows the distribution of decisions divided into types of behavior and the average contribution in the unconditional decision.

Type of behavior	% Of subjects	Average unconditional decision (€)
Conditional Cooperator	35,29%	2,2
Hump Shaped	5,88%	5
Semi Conditional Cooperator	5,88%	3
Free Rider	29,41%	0
Nash Player	5,88%	0
Full Contributor	5,88%	5
Half Contributor	0,00%	
Inverse Conditional Cooperator	0,00%	-
Others	11,76%	-

Table 7 Individual distributions treatment 6

In this case we observed a much greater variety of behavior than in the previous case (treatment 5): 35.29% of the participants who acted as Conditional Cooperator and 29.41% of those who acted as Free Rider. They are still the behaviors with the highest percentage but are not as high as in the treatment 5. There is also 5.88% behavior of Hump Shaped Cooperator, Nash Player, Half Cooperator and Semi Conditional Cooperator. If we realize, the participants who act as Half Cooperator only appear when the endowment is heterogeneous-rich, perhaps to provide the maximum that can contribute the other members of the group regardless of the situation.

In Table 7 we observe that the average contributions in the unconditional decision do not go according to the expected ones if we look at the contributions of the Conditional Cooperators and the Semi Conditional Cooperators, since the latter have a higher average than the former, being 3€ and that of the second ones 2,2€. On the other hand, the rest of the subjects make their unconditional decision according to their behavior, except for the Hump Shaped Cooperators, who contribute an average of their entire endowment.

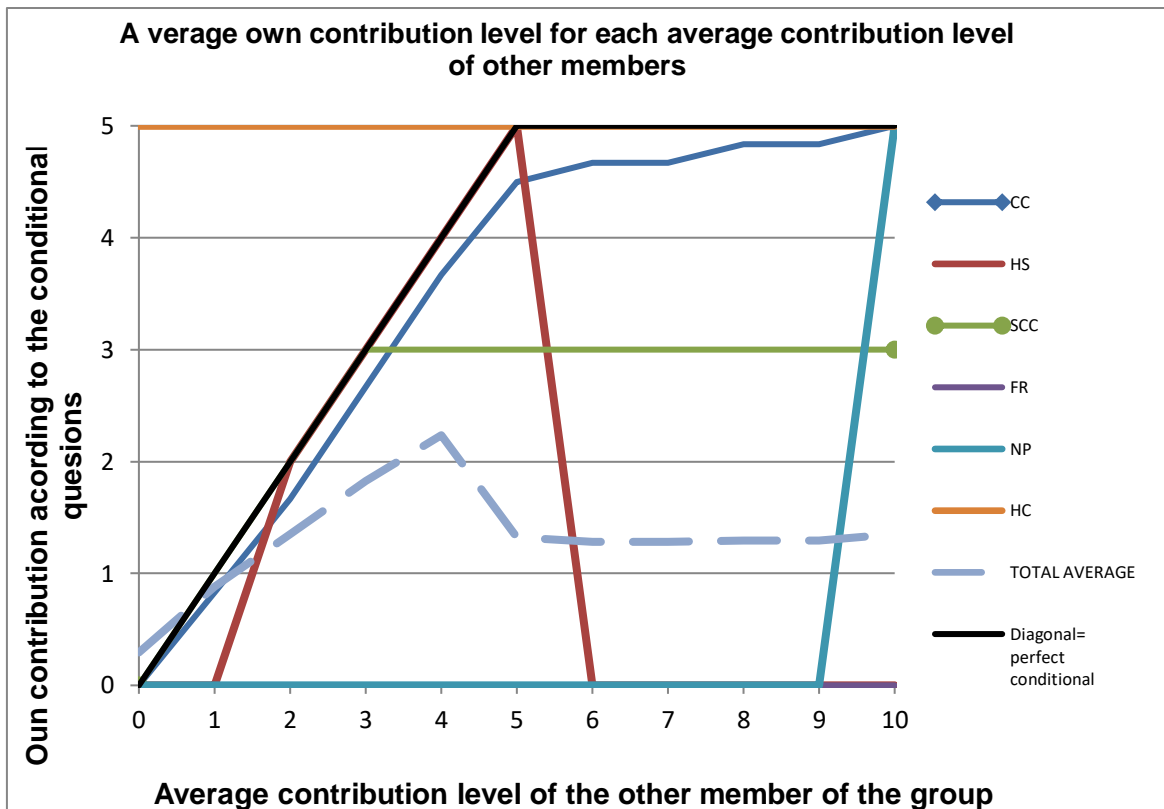


Figure 13: Average own contribution level for each average contribution level of other members in treatment 6

Figure 13 shows the average contributions of different types of behavior. In this case we observe that the Conditional Cooperators do not act exactly the same as the perfect cooperator line but they follow the same trend and reach almost equal values. On the other hand, the average total curve is observed with quite low values with respect to the perfect cooperator curve due to the fact that in this case the impact of Conditional Cooperators is lower. In section 3.9.2. we will see how, despite observing quite low average total values with respect to the rest of the treatments, it is very similar to the values observed in treatment 5.

3.7. Treatment 1 vs. Fischbacher et al. (2000)

At this point, these results can be compared with those obtained by Fischbacher et al. (2000), since the conditions are very similar: homogeneous endowment (in Fischbacher et al. (2000) case equal to 20 tokens), group size equal to 4 and MPCR=0.6 (in Fischbacher et al.(2000) case equal to 0.6). The Figure 14 shows the distributions of the subjects divided by type of behavior as well:

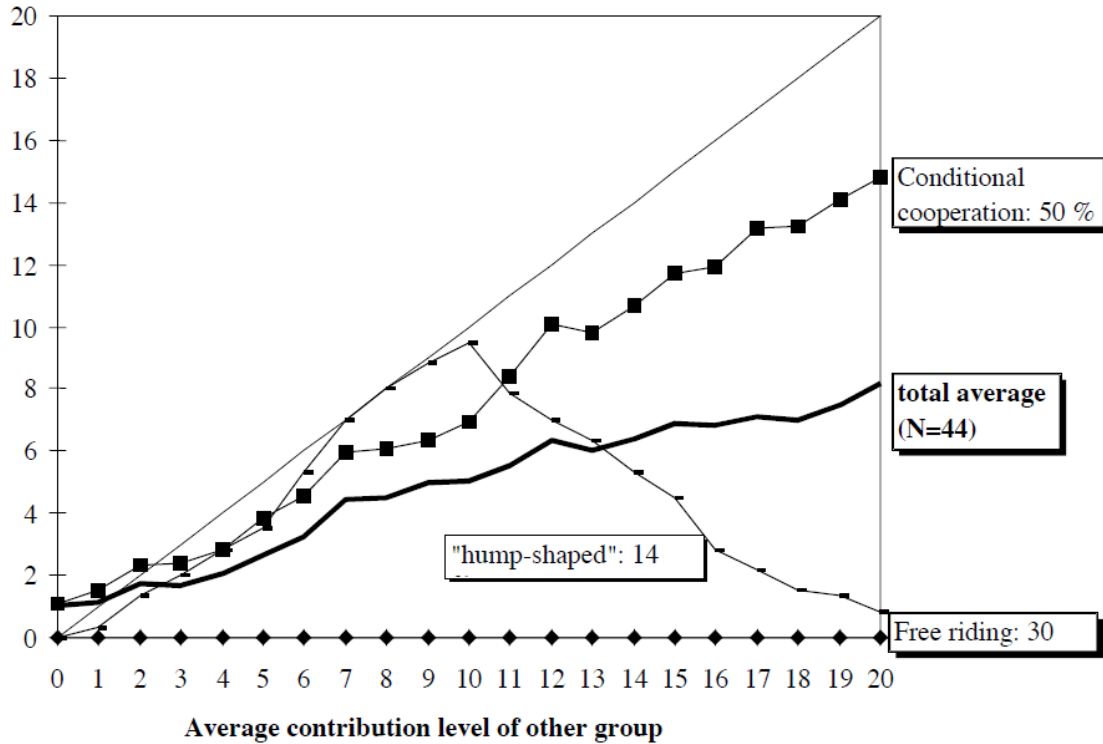


Figure 14: Fischbacher, U., Gächter, S. & Fehr, E. (2000)

In Table 8 we can observe the comparison between the percentages of behavior types of each experiment.

To begin with, the impact of Free Rider behavior is almost the same, in our case 30.43€ and in Fischbacher et al. (2000) it is 30%. On the other hand, the impact of Conditional Cooperators is quite different, as we can see in Table 8. Even so, if we were to add the Semi Conditional Cooperators and the Conditional Cooperators' percentages of our experiment, we would arrive at a very similar percentage to that of the Conditional Cooperators' impact of the experiment conducted by Fischbacher et al. (2000). Despite coming to very similar conclusions in the above-mentioned behaviors, the same is not true of the impact of Hump Shaped Contributors, as can be seen in Table 8, which is much lower in our experiment. Finally, it should be noted that in Fischbacher et al. (2000) no Nash Player behavior appears while in ours it does.

Type of behavior	% Of subjects treatment 1	% Of subjects Fischbacher et al. (2000)
Conditional Cooperator	30,43%	50%
Hump Shaped	4,35%	14%
Semi Conditional Cooperator	21,74%	0,00%
Free Rider	30,43%	30%
Nash Player	13,04%	0,00%
Full Contributor	0,00%	0,00%
Half Contributor	0,00%	0,00%
Inverse Conditional Cooperator	0,00%	0,00%
Others	0,00%	6,00%

Table 8: Treatment 1 vs. Fischbacher et al. (2000) behaviors

3.8. Treatment variable: group size

Once the results of all the treatments have been presented, it is interesting to observe how the contributions to the public good vary before the treatment variants. We'll start with the group size treatment variable. Therefore, we will compare treatments with the same endowment but with different group sizes.

3.8.1. Treatment 1 (N=4) vs. Treatment 2 (N=2). Homogeneous endowment

To better observe the results obtained, the Figure 15 compares Total average contributions of the two treatments.

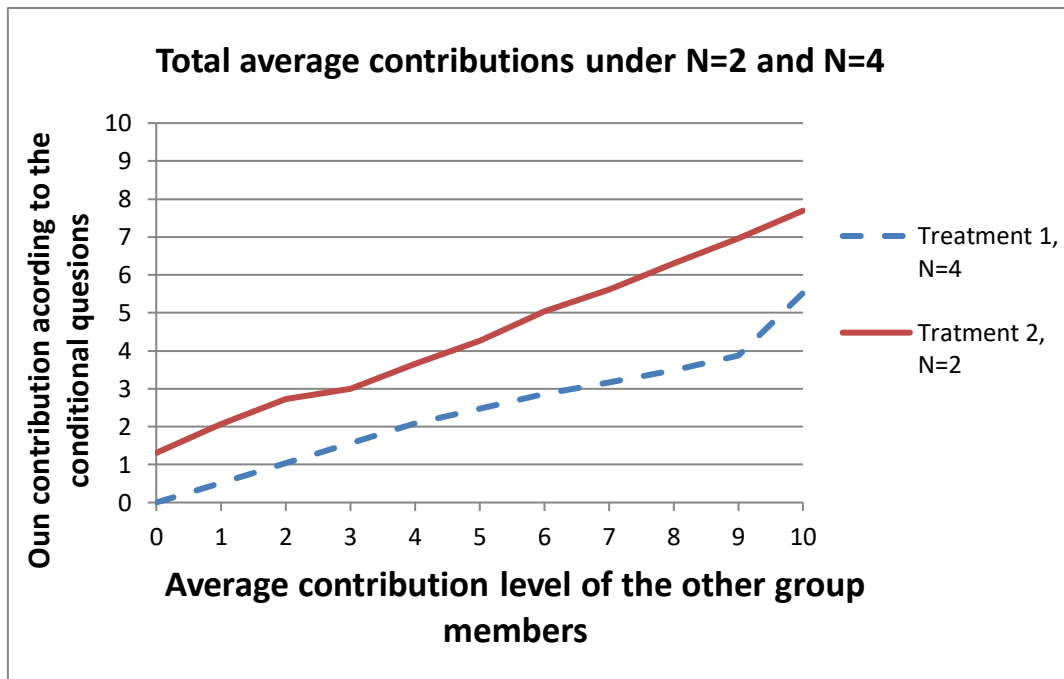


Figure 15: Total average contributions under N=2 and N=4. Homogeneous endowment

Clearly, the average of contribution to the public good follows a very similar trend in each of the treatments. But, as mentioned above, in the variable where the size of the group is smaller (N=2), the contributions to the public good obtained clearly exceed those of the other treatment where N=4. We conclude then that when the size of the group is smaller, the contributions to the public good increase. This may be due to the fact that the impact of the contribution to the group when the size of the group is smaller is greater, since its financing depends on fewer people and the individual contribution of the subject is therefore more important.

We have been concluded that the change in the size of the group does change the decisions of the participants, as the size of the group decreases, more money is contributed by subjects to the public good. All this has happened in a situation where the endowment of the subjects was homogeneous. Next, we will see what the conclusions are when the endowments are heterogeneous, that is to say, that the members of the group have double or half the endowment with respect to the subject.

3.8.2. Treatment 3 (N=4) vs. treatment 5 (N=2). Heterogeneous endowment rich

In this section we will compare treatments 3 and 5, with different group sizes and the same endowment, in this case heterogeneous endowment-rich, to see if there are differences in the contributions of the subjects when there are variations in the size of the group. As we have seen in the previous case, it is expected that when the size of the group is smaller, subjects contribute more to the public good.

In spite of this, as we can see in Figure 16, the results are totally opposite to those expected: treatment 3, with N=4, presents a higher average contribution than treatment 5, with N=2, in all situations.

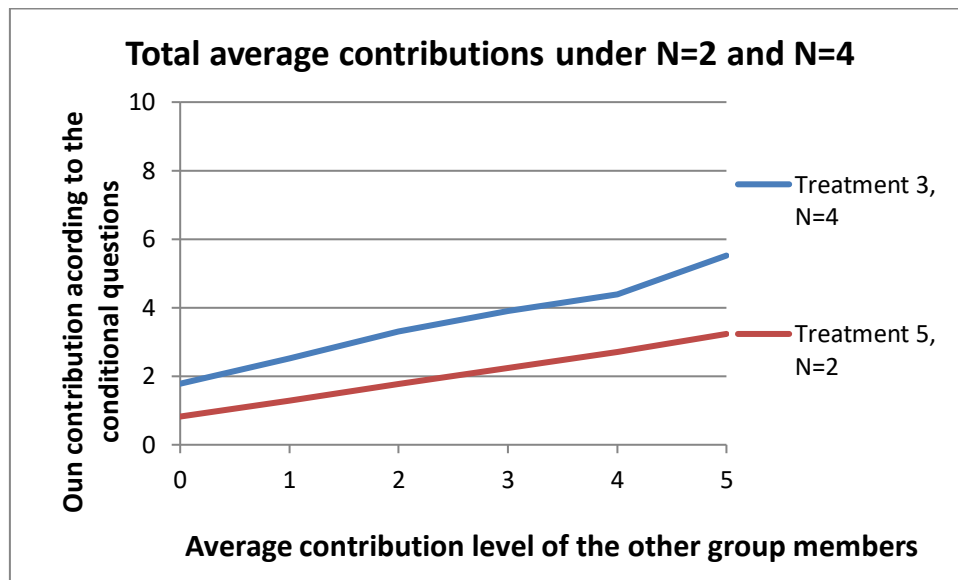


Figure 16: Total average contributions under N=2 and N=4. Heterogeneous endowment-rich

3.8.3. Treatment 4 (N=4) vs. treatment 6 (N=2). Heterogeneous endowment poor

Finally we will compare treatments 4 and 6, which also have different group sizes but both have heterogeneous endowment-poor, to see if there is a difference in the subjects' endowments in the face of variations in group size.

In Figure 17 we observe very similar results to the previous case, since our expectations are not met: treatment with larger group size (treatment 4) has a higher

average contribution to the good than treatment with smaller group size, in all the given situations.

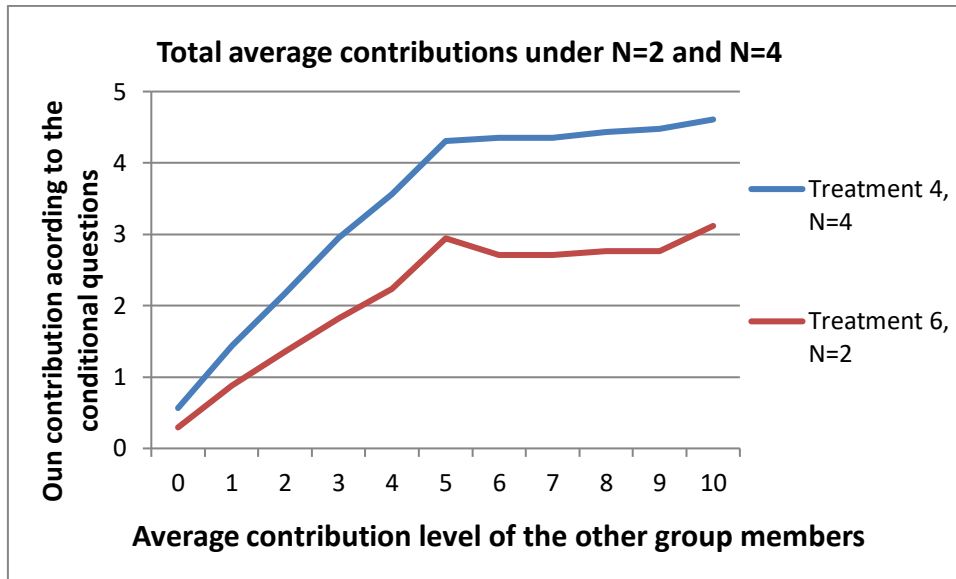


Figure 17: Total average contributions under N=2 and N=4. Heterogeneous endowment-poor

In conclusion, with heterogeneous endowments, both poor and rich, subjects contribute more to the public good when the size of the group is greater. It may be that when they find themselves with different endowments than the rest of the members of the group, they may be motivated to contribute in a different way from what they had a homogeneous initial endowment.

3.9. Treatment variable: heterogeneous endowment

After comparing the group size treatment variable, we will compare the results with respect to the heterogeneous endowment treatment variable in which we will compare the poor heterogeneous endowment and rich heterogeneous endowment treatments and then compare them with the homogeneous endowment treatment (with equal group size).

3.9.1. Treatment 1 (homogeneous endowment) vs. treatment 3 (heterogeneous endowment-rich) and treatment 4 (heterogeneous endowment-poor). Group size equal to 4

The results obtained do not contradict those expected respect the difference of contributions in treatments 3 and 4, since as we can see in Figure 18, the average total curve in the treatment where the subjects have a higher endowment is higher than the average total curve of the treatment where the subjects have a lower endowment. Moreover, it has a very similar slope, but in the case of treatment 3 the values are higher.

This is why we conclude that the impact of a difference in the endowment does vary the average contribution to a public good. This is greater when the difference favors the subject, that is to say, when the endowment is greater.

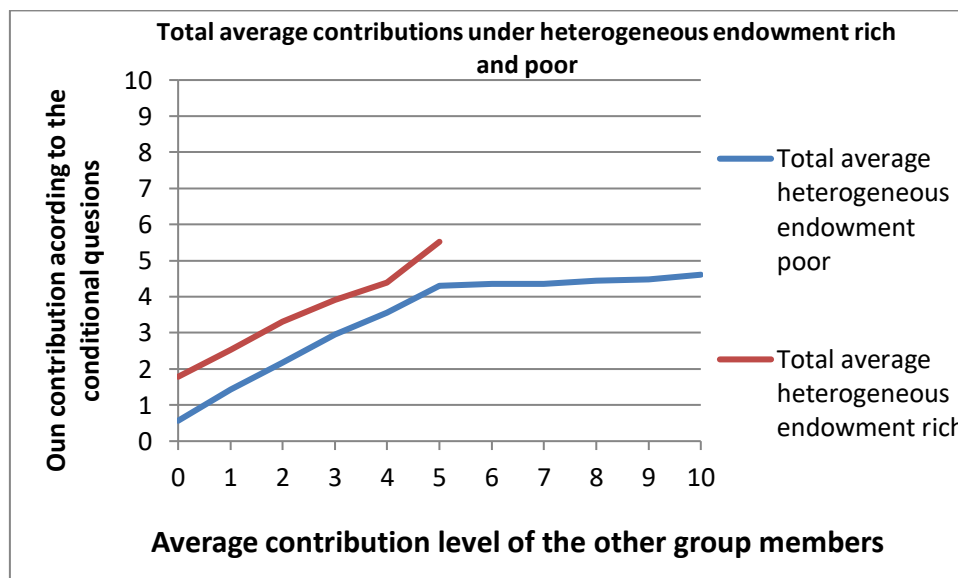


Figure 18: Total average contributions under heterogeneous endowment rich and poor

But we compare it now with the treatment 1, whose endowment is homogeneous. In this case we expected the average contribution to be higher than in the case of the heterogeneous endowment-poor and lower than in the heterogeneous endowment-rich. In figure 19 we can see that we are wrong, the curve of average total with homogeneous endowment also presents a similar positive slope but below the previous two. This may be due to the fact that the sum of the behavior of Free Rider and Semi Conditional Cooperator exceeds 50% of the total number of participants (see Table 5).

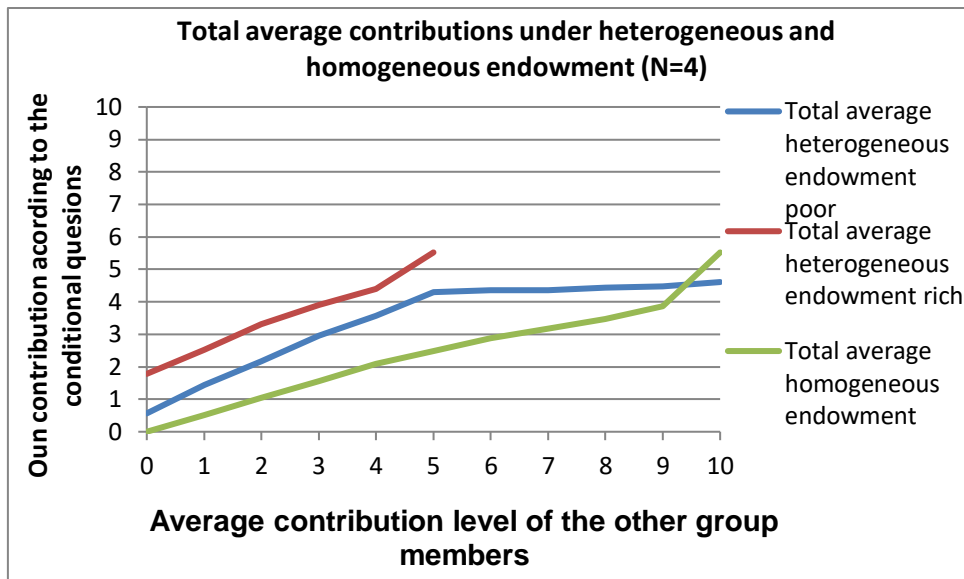


Figure 19: Total average contributions under heterogeneous and homogeneous endowment (N=4)

We can conclude that the difference in endowments does affect the behavior of the participants, although not as we expected. When the endowment is heterogeneous, participants do contribute more to the public good the greater their endowment. But with homogeneous endowment, participants invest even less in the public good than in previous cases, even less than when the endowment is lower than that of the rest of the group, the result being the opposite of what was expected. It may be that when they found themselves with an endowment compared to the rest of the group, they were more aware of wanting to maximize their profits in spite of the increase in the average endowment by the group.

3.9.2. Treatment 2 (homogeneous endowment) vs. treatment 5 (heterogeneous endowment-rich) and treatment 6 (heterogeneous endowment-poor). Group size equal to 2

There is a big difference in types of behavior between the treatment 5 and 6, since as we have seen, the impact of Conditional Cooperators and Free Riders is much higher in the first of them. In addition, Figure 11 shows how treatment 5 shows an average total curve with values very similar to those of the perfect cooperator. On the other hand, in figure 12 we observe that the treatment 6 presents a total average curve well below the values of the perfect cooperator line. In spite of this, the average total values recorded for each of the treatments are very similar, as can be seen in Figure 20. In this case it is also observed that the average endowment of the participants when their

endowment was the highest is higher than the average endowment when their average was lower. But the difference is smaller than that in Figure 20 (where comparisons of the total average of treatments 3 and 4 were made).

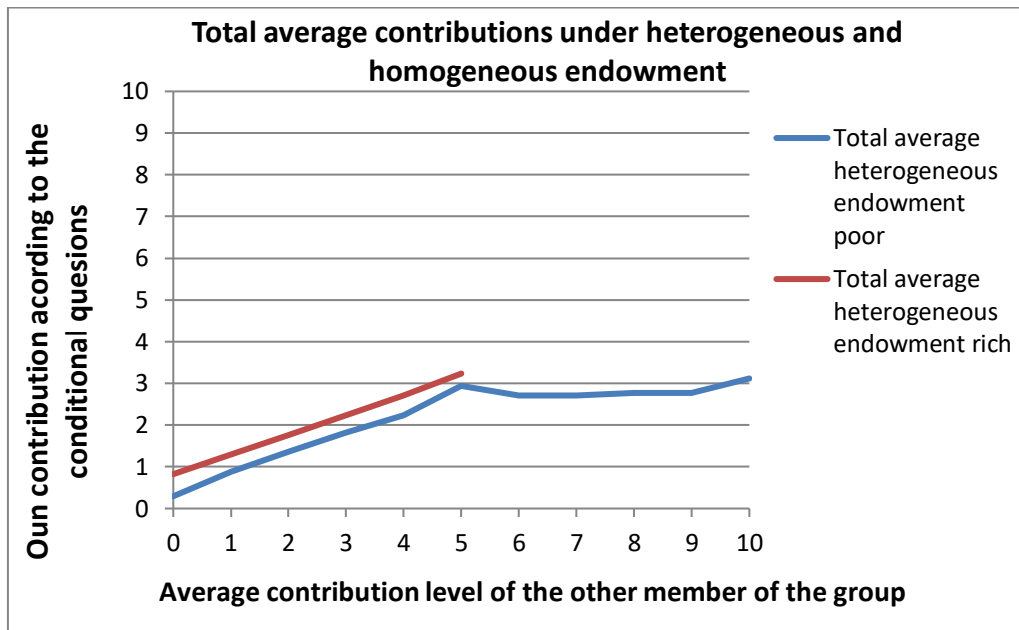


Figure 20: Total average contributions under heterogeneous and homogeneous endowment

In this case, although the difference is smaller, we came to the same conclusion as in the previous case, where the conditions were the same except for the size of the group. Let us now see in Figure 21 whether we also come to the same conclusions when comparing the average number of endowments to public good when the endowment is heterogeneous and when it is homogeneous.

The results are totally opposite to those of the previous case, with the average contribution being higher when the endowment is homogeneous with respect to when it is heterogeneous. This result was to be expected because, as we commented in point 3.8.1. (where we compared the average endowment when the endowment was homogeneous and the size of the group changed), we concluded that the smaller the size of the group, the greater the contribution to the public good.

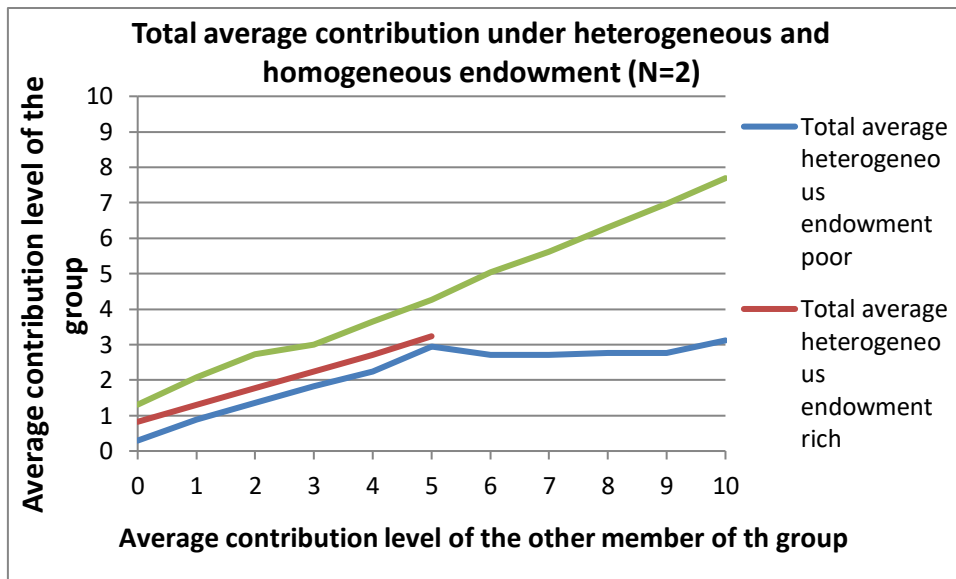


Figure 21: Total average contribution under heterogeneous and homogeneous endowment (N=2)

Given the results, in this case we cannot conclude that there is a difference in the average contributions to the public good when the endowment is homogeneous and when it is heterogeneous. For in each of the case studies we have come to a different conclusion. Nevertheless, we can conclude that when the participants present larger endowments than the rest of the group, they do have a contribution to the greater good.

4. Conclusions

At the beginning of the experiment we expected to find that most of the subjects would act as Conditional Cooperators, given the precedents in other experiments. Throughout the results we have verified that our expectations were not too misguided, since in all the treatments the impact of this type of behavior has been the most significant, even reaching 73.91% of the subjects who have acted in this way in treatment 4.

On the other hand, a high impact was also expected from Free Riders, although less than that of Conditional Cooperators. We have also been able to verify that the expectations have been fulfilled, being also the second type of behavior that has occurred in all the treatments with the exception of treatments 3 and 4.

This is why we can conclude that the majority of subjects base their choice of how much to contribute to the public good on how much the rest of the group members contribute, without being influenced by the loss they suffer individually as a result of investing part of their endowment in the public good. This is why we can conclude that the majority of subjects base their choice of how much to contribute to the public good

on how much the rest of the group members contribute, without being influenced by the loss they suffer individually as a result of investing part of their endowment in the public good. And, on the other hand, a more minority portion prefers not to invest in the public good and to think about their individual benefits: Free Riders.

The results of the treatments were then compared with the different treatment variables: group size and heterogeneous endowment.

On the one hand, we have compared treatments with heterogeneous endowment as a treatment variable. We hoped that the greater the endowment of the subjects, the greater the contribution to the public good. Being in the case of heterogeneous endowment-rich in which we thought we would see greater contributions, followed by the case of homogeneous endowment and finally by the case of heterogeneous endowment-poor. First of all, we have been able to conclude that, in fact, subjects contribute more to the public good when their endowment is greater than that of the rest of the group: more was contributed in treatments with heterogeneous endowment-rich than in treatments with heterogeneous endowment poor (with equal group size). In spite of this, in the case of homogeneous endowment, it has not been possible to reach a clear conclusion since, depending on the treatment, the subjects have contributed more to the common good than in treatments with heterogeneous endowment (both rich and poor) or contributed less.

On the other hand, the conclusions when comparing a group size treatment variable have not been clear either. It was expected that with a smaller group size, the subjects would contribute more to the common good since the impact of their contribution to the public good is greater. It is true that when we have compared treatments 1 and 2 (with homogeneous endowment) the expected results have been achieved, since the average contribution to the good has been higher in the case of $N=2$ than in the case of $N=4$. However, in the comparisons of the results of treatments 3 and 5 and of treatments 4 and 6, a completely different conclusion was reached: in treatments with larger group sizes there were greater contributions than in treatments with smaller group sizes. It is important to mention that in the last two cases the allocations were heterogeneous, so the difference in the allocation with respect to the rest of the group has been able to influence the subjects when making their decisions.

In conclusion, most subjects are influenced by the decisions of the other group members. On the other hand, the fact that the group size varies does not cause subjects to decide to vary their contribution. Finally, the fact that the endowment varies with respect to the rest of the members of the group (this being less or more than that

of the group) does mean that the subjects decide to contribute more to the public good when their endowment is the greatest to compensate for the inequality of money. Despite this, when the allocation is homogeneous, there is no tendency to vary its contribution with respect to cases where the allocation is heterogeneous.

5. Annexes

5.1. Annex 1

¿Estás seguro de saber manejar tu dinero?

Imagina que te vas de copas con tu amigo y que cada uno lleva 10€ en la cartera para pagar las consumiciones. Podéis decidir si pagarse las copas cada uno o aportar una cantidad de dinero en un bote común que servirá para pagar las consumiciones de los dos.

Una vez los dos decidís cuánto aportar al bote común, multiplicaremos por 1,2 y lo dividiremos a partes iguales entre los dos, independientemente de cuánto haya aportado cada uno. De este modo el dinero del que dispones es:

DINERO TOTAL= DINERO EN LA CARTERA + DINERO DEL BOTE

DINERO EN LA CARTERA= 10€ - DINERO QUE APORTES AL BOTE

DINERO DEL BOTE= [(TU APORTACIÓN + APORTACIÓN DE TU AMIGO)*1.2] /2

Figure 22: Explaining the experiment

As mentioned in the experimental design, the experiment was explained as a story between friends for better understanding. In Figure 22 you can see the story that the participants read and the profit features that were shown to them for their full understanding of the game.

Antes de empezar...

Queremos asegurarnos de que has entendido cómo funciona el juego. Para ello debes contestar a la siguiente pregunta de control.

PREGUNTA DE CONTROL: Asume que tu amigo aporta al bote común 0 y tú también aportas 0:

¿Cuánto dinero tienes en la cartera? *

Text d'una resposta breu

¿Cuánto beneficio obtienes del bote común? *

Text d'una resposta breu

Y, por último, ¿cuánto dinero tienes en total? *

Text d'una resposta breu

Figure 23: Control questions

In Figure 23 we see what control questions the participants had to answer to demonstrate that they had understood the experiment and could study their answers.

Empieza el juego!

A partir de ahora intenta contestar las siguientes preguntas con la mayor sinceridad posible, como si se tratase de una situación real.

¿Cuánto estás dispuesto aportar al bote común? *

0	1	2	3	4	5	6	7	8	9	10
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 24: Unconditional question

Figure 24 shows the beginning of the questionnaire, with the unconditional question that was asked of the participants.

Finally, in Figure 25 we observed an example of what kind of conditional questions we made on the questionnaires.

¿Cuánto estarías dispuesto a aportar al bote común si tu amigo ha decidido aportar 0€? *

0	1	2	3	4	5	6	7	8	9	10
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

¿Y si ha aportado 1€? *

0	1	2	3	4	5	6	7	8	9	10
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

¿Y si ha aportado 2€? *

0	1	2	3	4	5	6	7	8	9	10
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

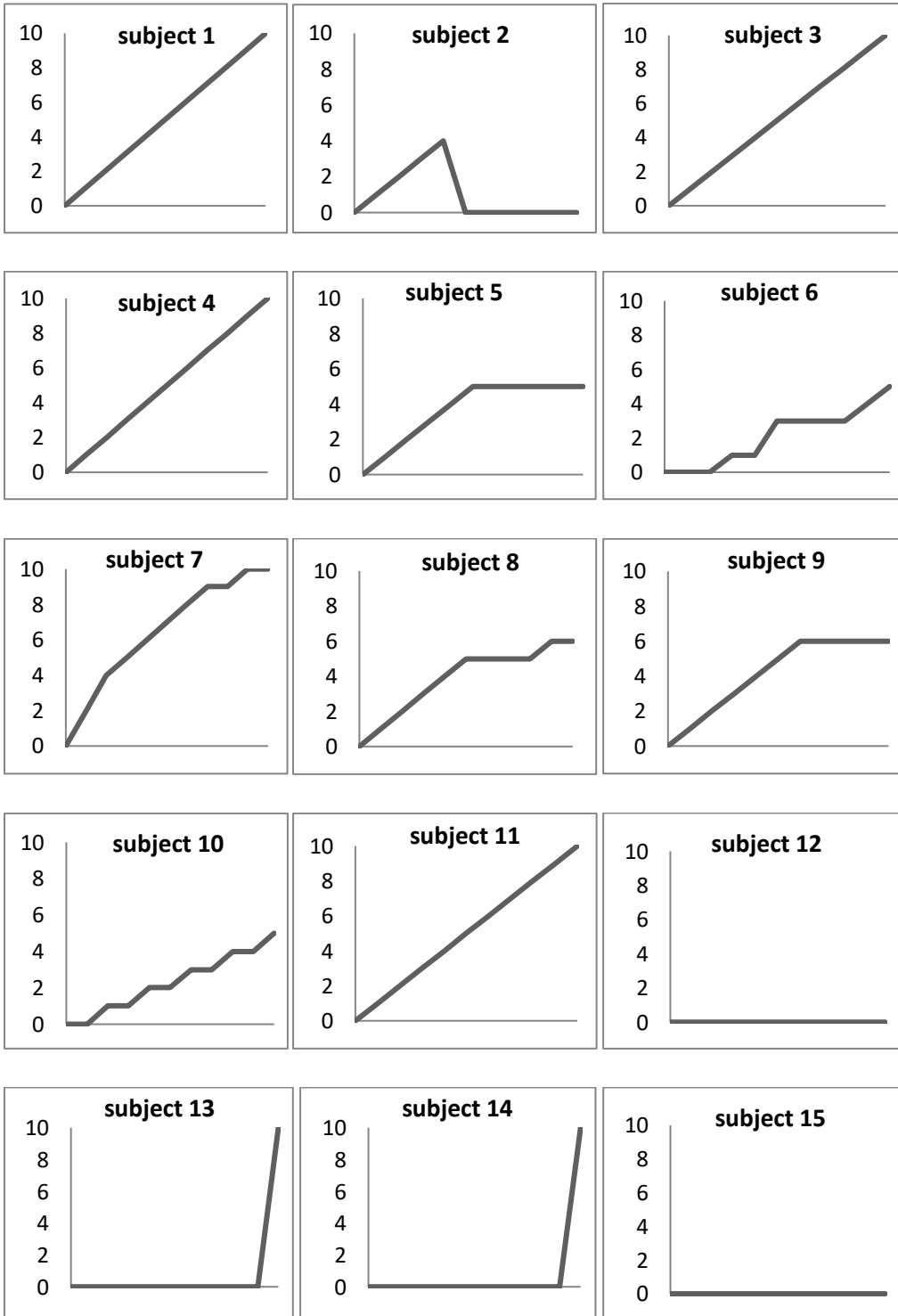
Figure 25: Conditional questions

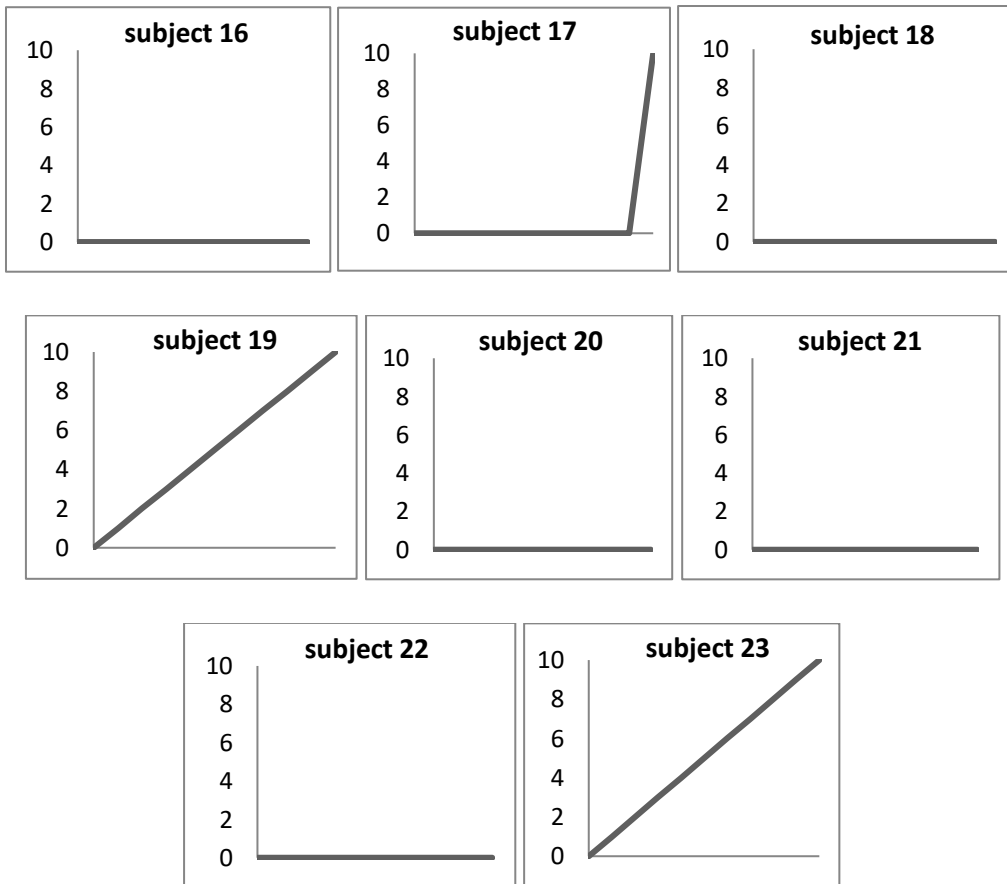
5.2. Annex 2

The figures shown in this annex do not present axes in order to ensure that, despite their small size, the figure represented can be seen with the greatest clarity. This is why we will explain below what the axes of all the figures to be displayed represent:

- Horizontal axis: the average contribution level of the group is represented, with a maximum of 5 or 10, depending on the treatment we are in.
- Vertical axis: the individual contribution according to the conditional questions is represented.

a. Individual behavior in treatment 1. Homogeneous endowment and N=4

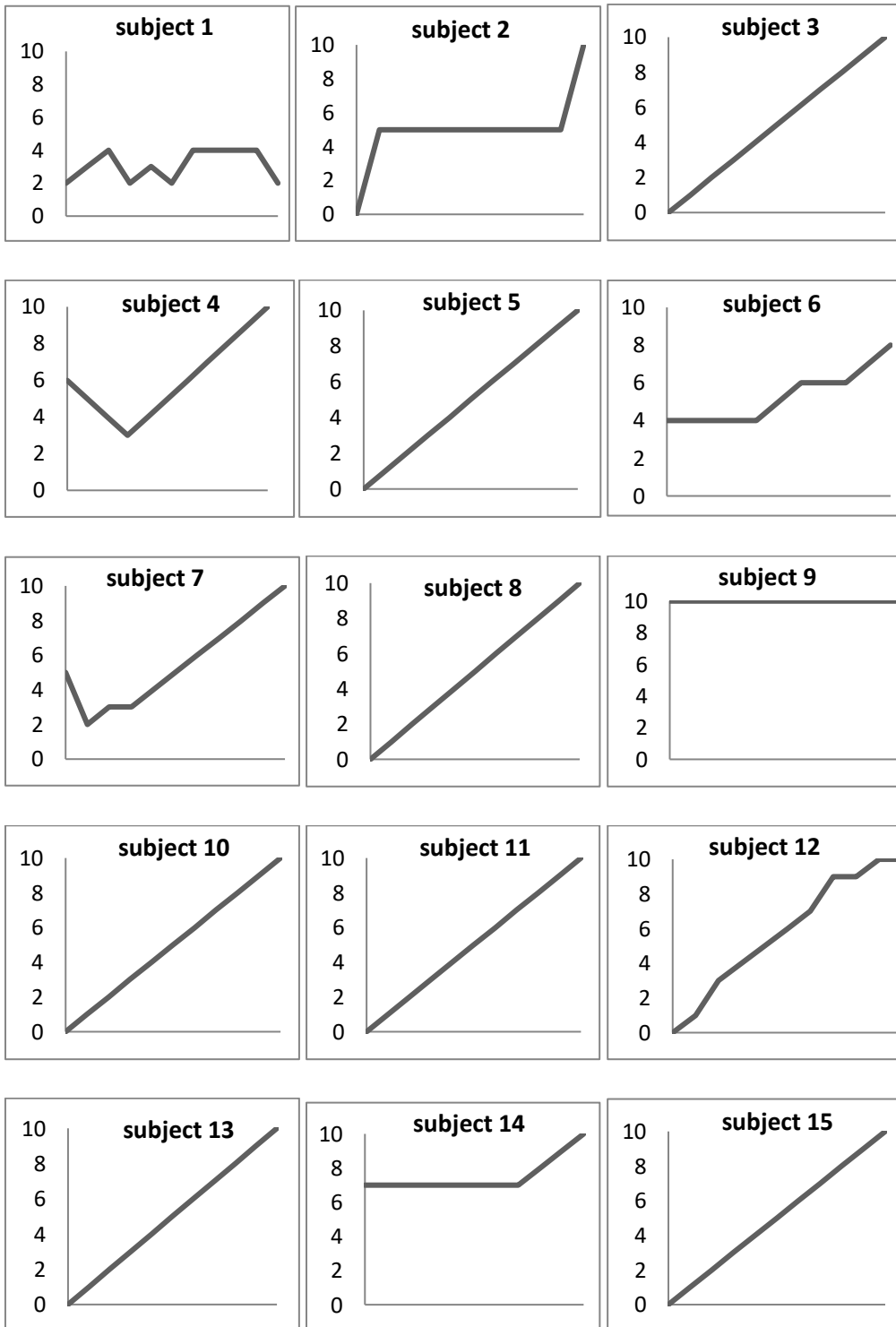


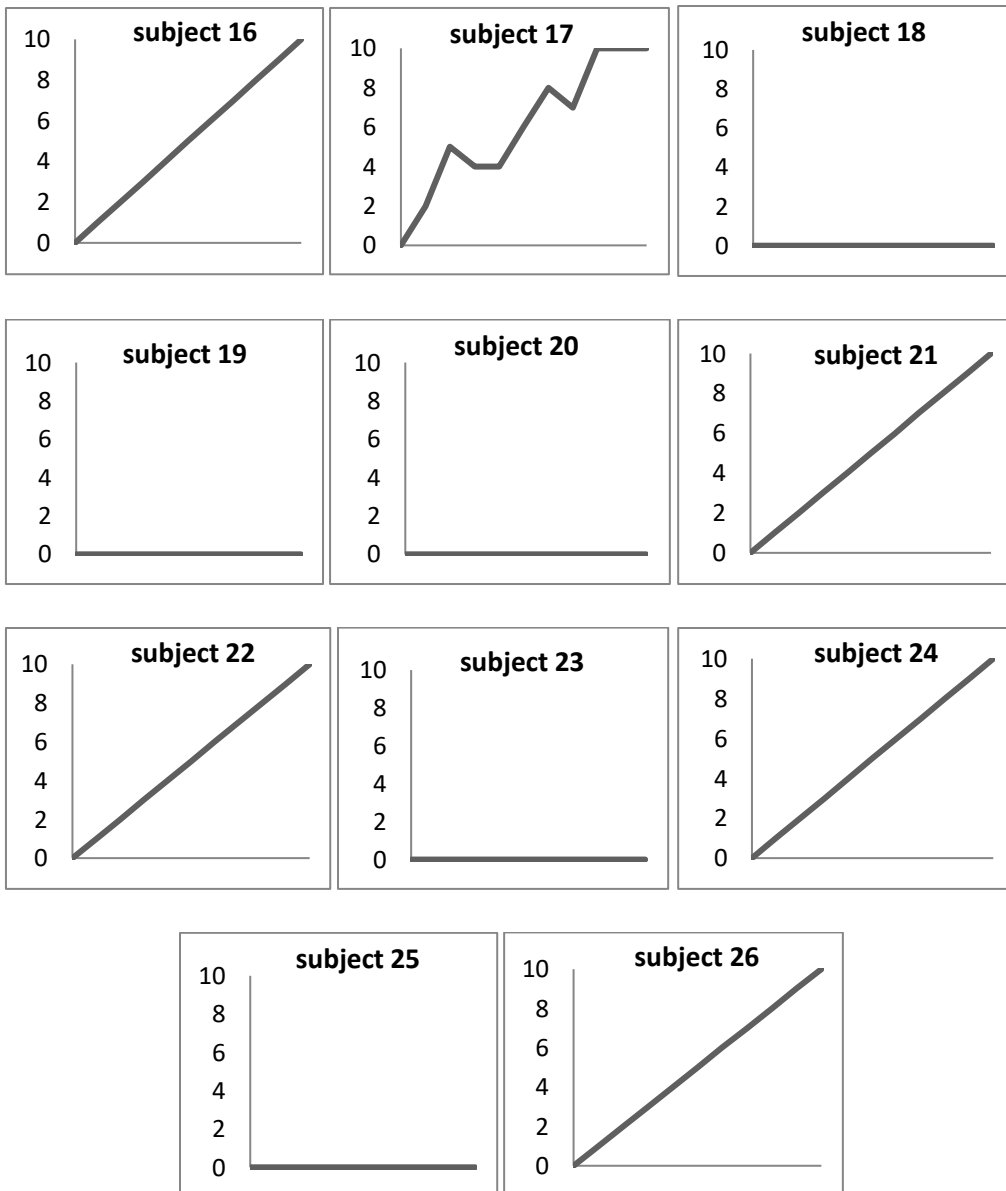


In Annex 2, point a., we look at the figures of the individual behavior of the participants. Throughout the work, it has been expressed as a percentage of the types of behavior, but it has not been explained how each one of the behaviors was classified in the different types. We will now show the number of subjects who were divided into each type of behavior, leaving unclassified those whose behavior cannot be explained and were called "Others".

- Conditional Cooperation: subjects 1, 3, 4, 7, 11, 19, and 23. Semi Conditional Cooperation: subjects 5, 6, 8, 9, and 10.
- Hump Shaped Contribution: subject 2.
- Nash player: subjects 13, 14, and 17.
- Free-rider: 12, 15, 16, 18, 20, 21, and 22.

b. Individual behavior in treatment 2. Homogeneous endowment and N=2

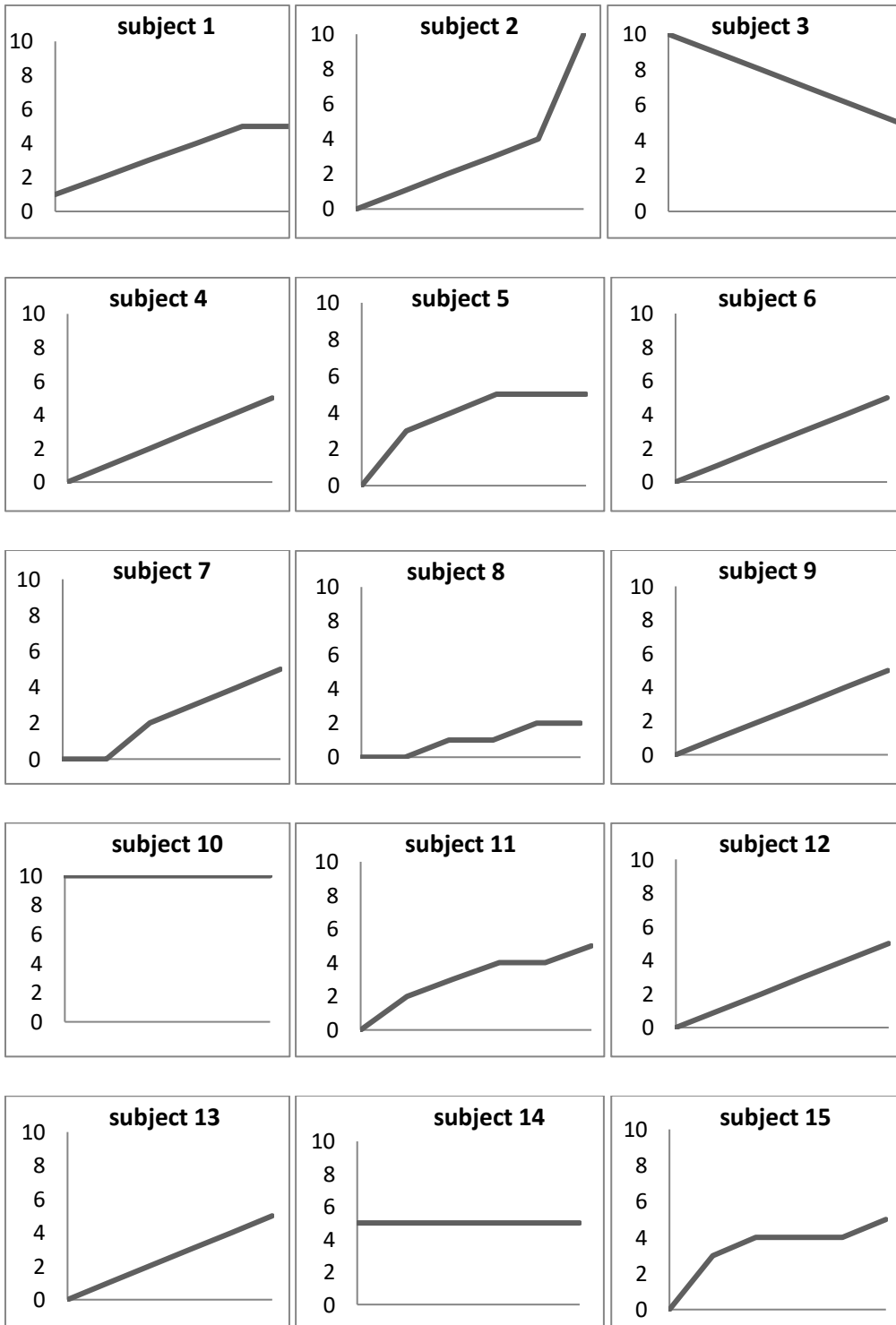


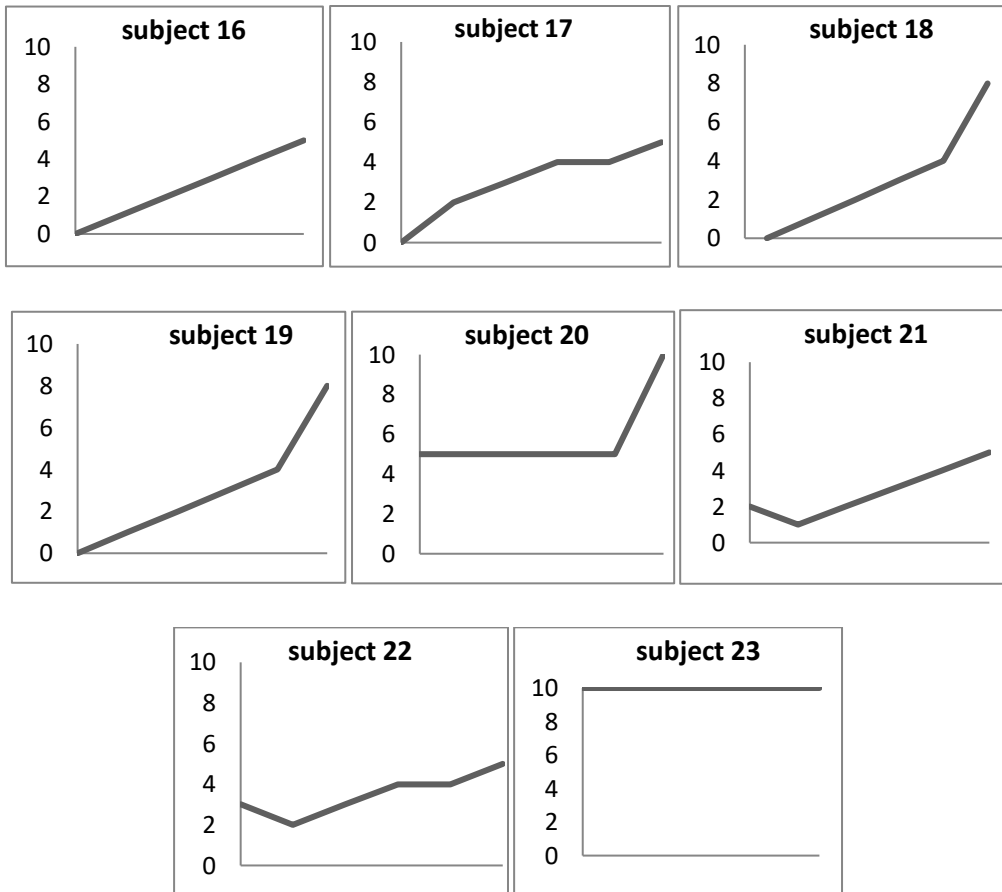


We will now show the number of subjects who were divided into each type of behavior, leaving unclassified those whose behavior cannot be explained and were called "Others".

- Conditional Cooperation: subjects 2, 3, 5, 6, 8, 10, 11, 12, 13, 15, 16, 17, 21, 22, 24, and 26.
- Full Contribution: subject 9.
- Free Rider: subjects 18, 19, 20, 23, and 25.

c. Individual behavior in treatment 3 .Heterogeneous endowment rich and N=4

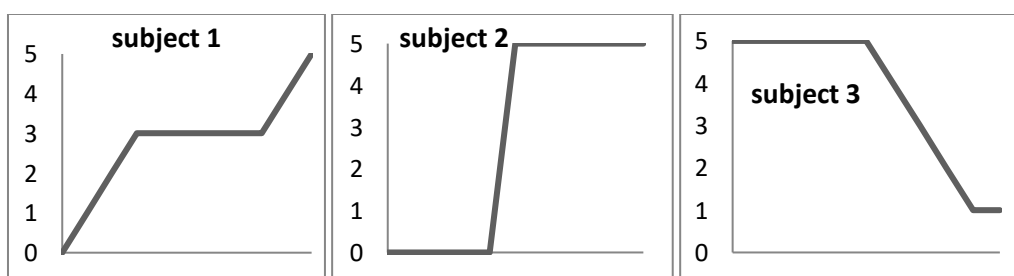


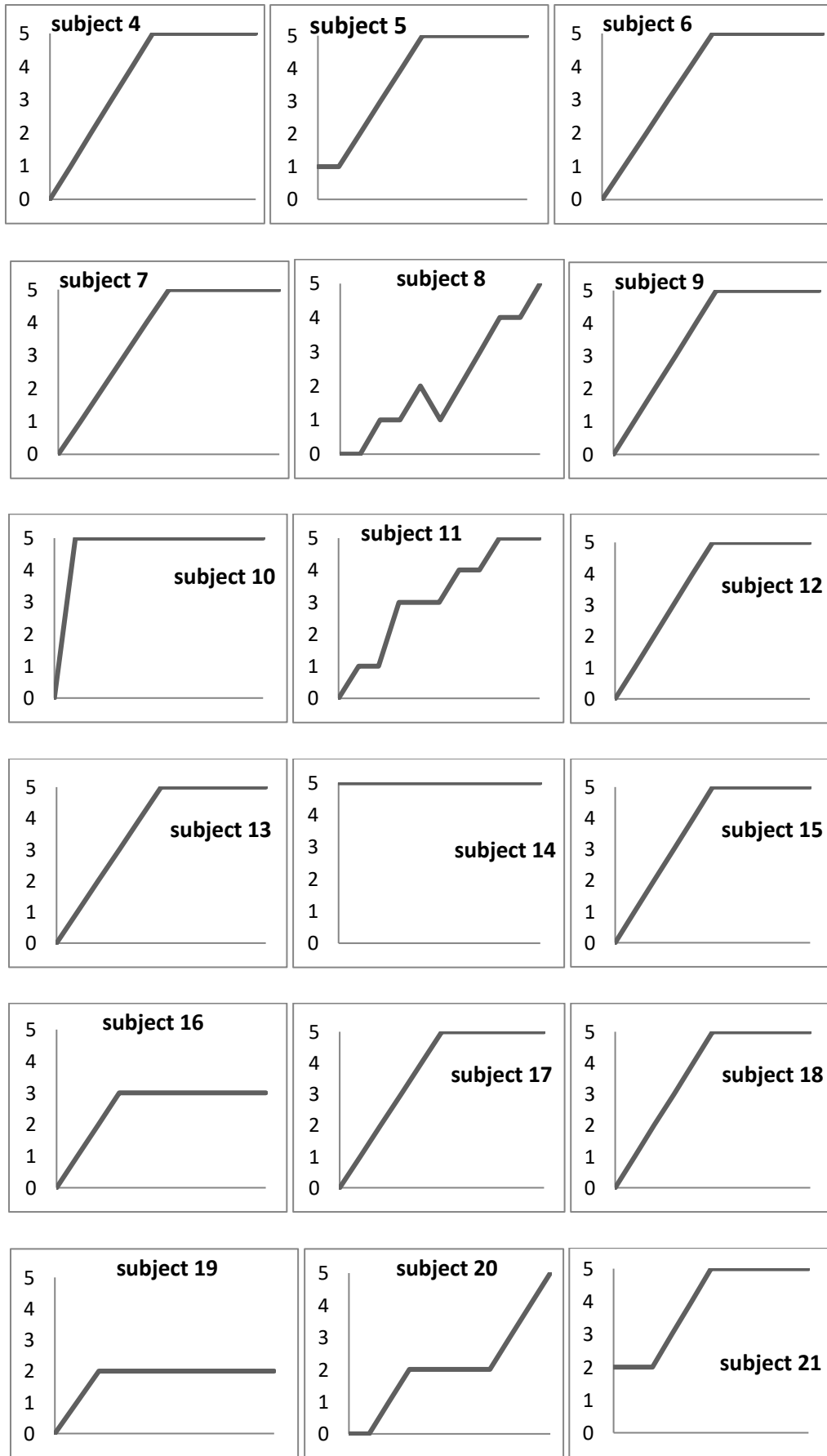


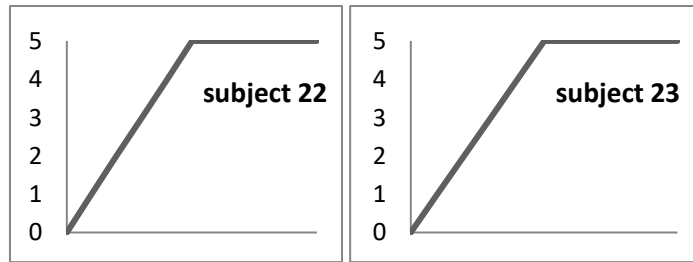
We will now show the number of subjects who were divided into each type of behavior, leaving unclassified those whose behavior cannot be explained and were called "Others".

- Conditional Cooperation: subjects 1, 2, 4, 6, 7, 9, 12, 13, 16 and 18.
- Semi Conditional Cooperation: subjects 5, 11, 15 and 17.
- Full Contribution: subject 10.
- Inverse Conditional cooperation: subject 3.
- Half Contribution: 14 and 23.

d. Individual behavior in treatment 4. Heterogeneous endowment poor and N=4



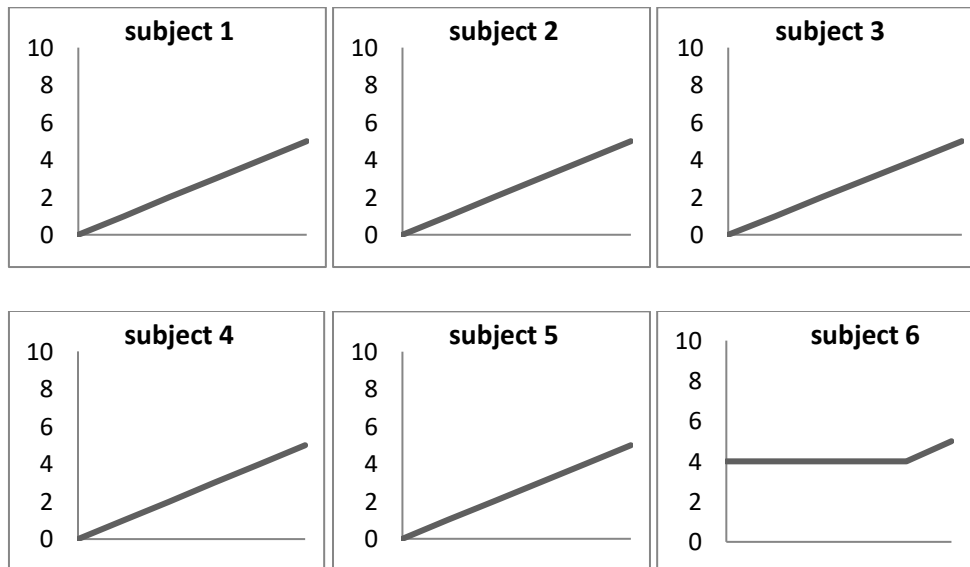


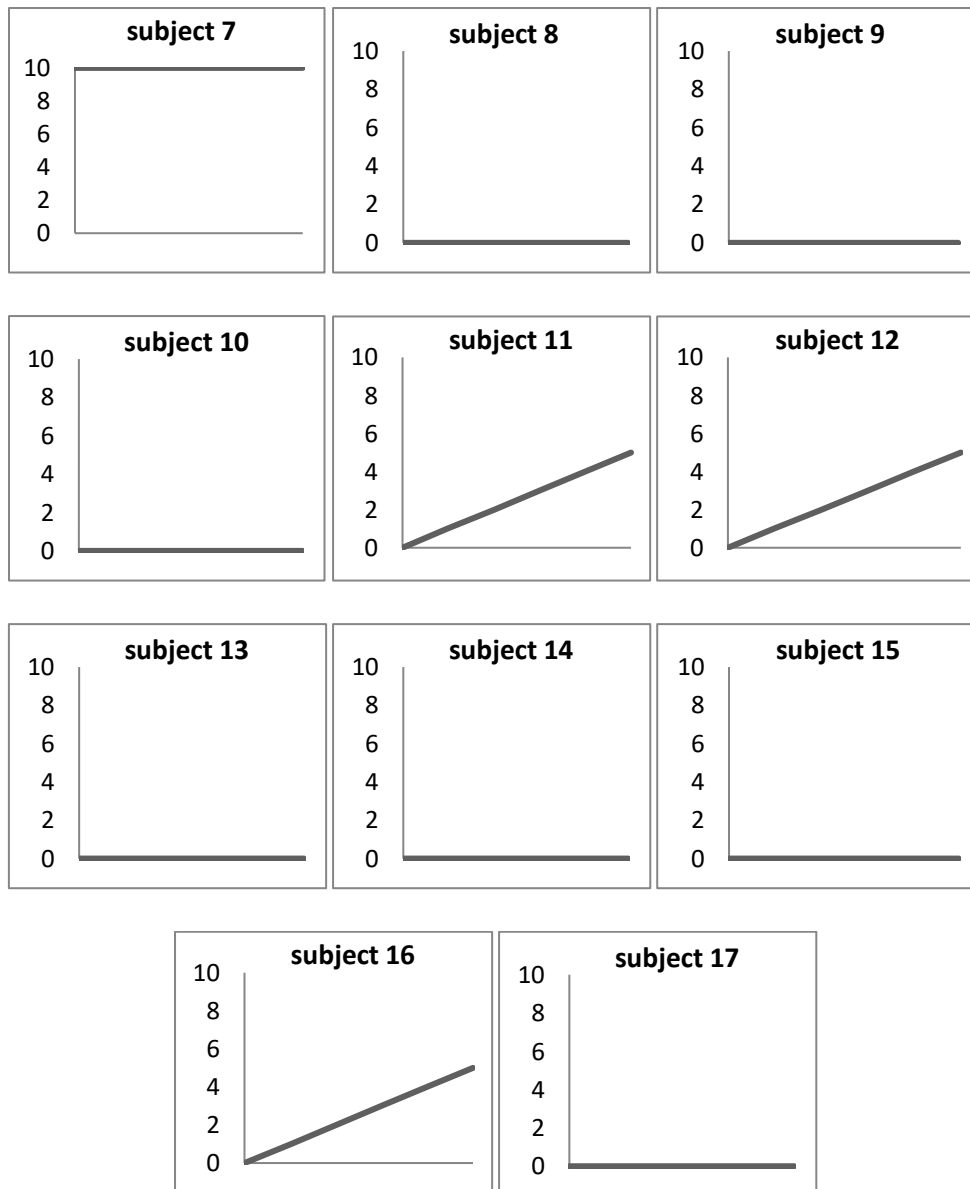


We will now show the number of subjects who were divided into each type of behavior, leaving unclassified those whose behavior cannot be explained and were called "Others".

- Conditional Cooperation: subjects 1, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 17, 18, 20, 21, 22 and 23.
- Semi Conditional Cooperation: subjects 16 and 19.
- Full Contribution: subject 14.
- Inverse Conditional Cooperation: subject 3.

e. Individual behavior in treatment 5. Heterogeneous endowment rich and N=2

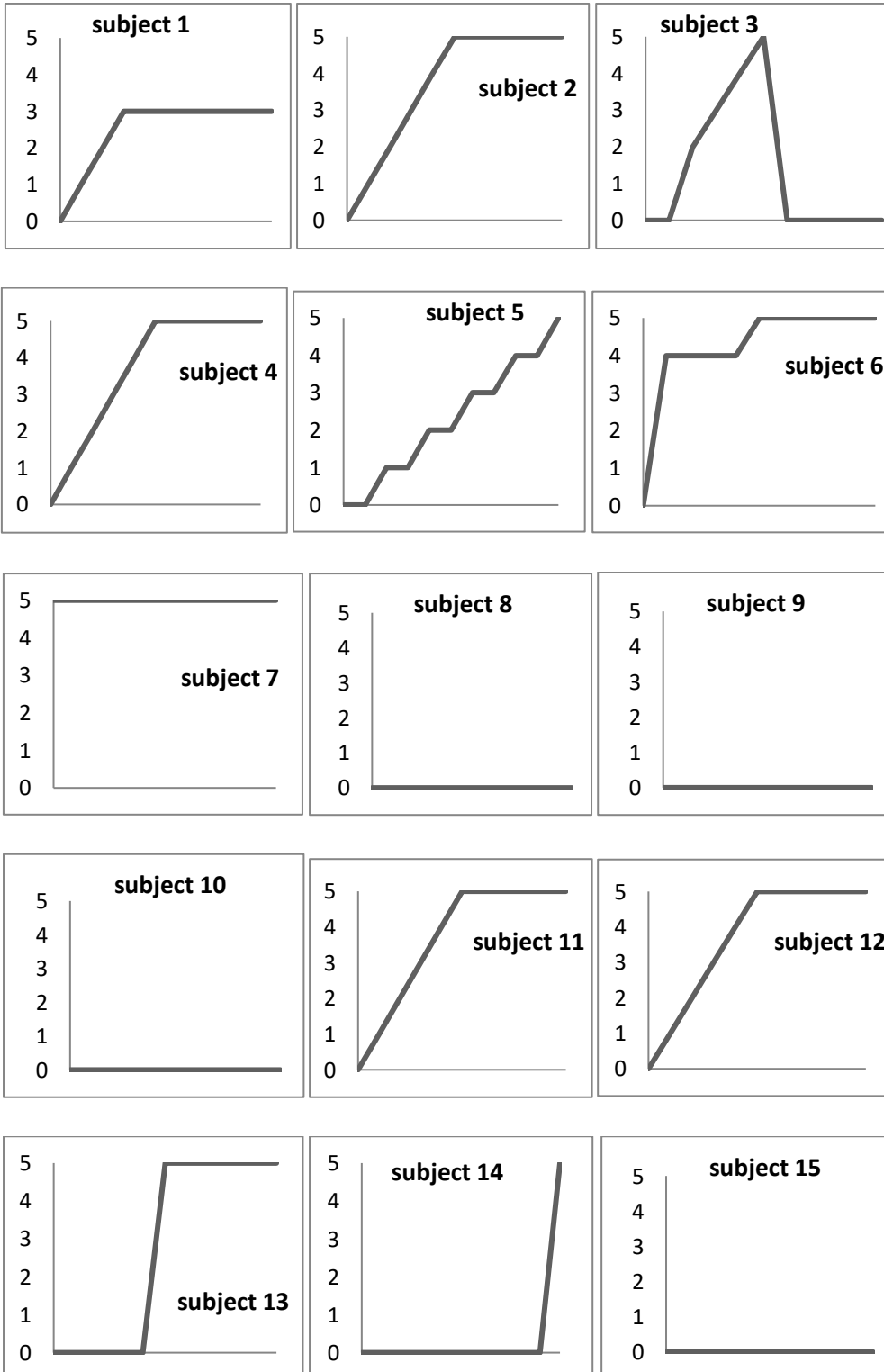


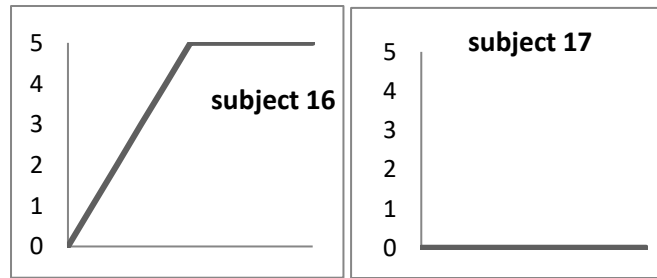


We will now show the number of subjects who were divided into each type of behavior, leaving unclassified those whose behavior cannot be explained and were called "Others".

- Conditional Cooperation: subjects 1, 2, 3, 4, 5, 11, 12 and 16.
- Full Contribution: subject 7.
- Free Rider: subjects 8, 9, 10, 13, 14, 15 and 17.

f. Individual behavior in treatment 6. Heterogeneous endowment poor and N=2





We will now show the number of subjects who were divided into each type of behavior, leaving unclassified those whose behavior cannot be explained and were called "Others".

- Conditional Cooperation: subjects 2, 4, 5, 11, 12 and 16.
- Semi Conditional Cooperation: subject 1.
- Hump Shaped Contribution: subject 3.
- Nash Player: subject 14.
- Free Rider: subjects 8, 9, 10, 15 and 17.
- Full Contribution: subject 7.

6. References

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