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# Equity and bargaining power in ultimatum games

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## Abstract

This paper studies the extent to which offers and demands in ultimatum games are consistent with equity theory when there is a joint endowment to be distributed. Using a within-subject design, we also investigate the importance of the bargaining power by comparing the subjects' behavior in the ultimatum and the no-veto-cost game, which differ in the possible cost of responders rejecting the proposers' offer. Our findings suggest that proposers are willing to reward responders for their contribution to the joint endowment in any of the two games. As for responders, their behavior is consistent with equity theory only in the no-veto-cost game (in which a rejection is costless for them) when the game is first played. When the no-veto-cost game is played after the ultimatum game, we observe that the responders' demands usually exceed their contribution to the endowment. Finally, this paper reports evidence that the ultimatum and the no-veto-cost game differ in terms of efficiency and rejection rates.

**Keywords:** equity, fairness, bargaining power, ultimatum game, no-veto-cost game, joint production, efficiency, rejection rates.

# 1 Introduction

A team's members all contribute to the production of a joint endowment. Because there might be some external factors influencing the size of the endowment, complete contracts that specify how to distribute the total production are not always feasible ex-ante, and negotiation needs to take place ex-post (Hackett, 1993). In this setting, two elements likely to affect the bargaining outcome are *i*) the extent to which subjects care about equity (i.e., their willingness to incur efficiency losses to implement an agreement that reflects their contribution to the joint endowment) and *ii*) differences in the bargaining power of subjects (i.e., whether or not their payoffs will be contingent on the bargaining outcome). This paper is an attempt to study how these two elements affect bargaining behavior by using a laboratory experiment.

In our design, the bargaining phase is preceded by the production of a joint endowment. The value of the endowment depends not only on the subjects' performance in a real effort task, but also on external factors beyond the subjects' control (Konow 2003, Frohlich et al. 2004, Cappelen et al. 2007, 2010, Almas et al. 2010, Rodriguez-Lara and Moreno-Garrido 2012). Our aim is to test if equity considerations are relevant so far as subjects' decisions in the bargaining phase are affected by their performance in the production phase. We assess the importance of bargaining power by considering the ultimatum (Güth et al., 1982) and the no-veto-cost game (Fellner and Güth, 2003), which differ in the cost for responders to reject the proposers' offer. More specifically, whereas disagreement results in no payoffs for either the proposer or the responder in the ultimatum game, the proposer is the only one affected in the no-veto-cost game when her offer is rejected by the responder.<sup>1</sup>

If subjects care about equity and do not obtain their contribution to the joint endowment, this may result in disagreement and generate efficiency losses, as a result. The discrepancy between what one contributes and what is obtained in return is indeed a major reason for conflict, as has been demonstrated by many revolts, strikes or legal disputes, etc. Arguments of equity were put forward by players during the 2011 NBA lockout that delayed the start of the season with important economic consequences (Coates and Humphreys, 2001). More recently, supporters of the separatist movement in Catalonia (Spain) decided to defy the Spanish Government and initiate the process of independence by declaring that *"Catalonia contributes much more to*

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<sup>1</sup>This game is inspired by Suleiman (1996) where the endowment to be shared is decreased by  $\delta \in [0, 1]$  after a rejection. The  $\delta$ -ultimatum game has been useful to study all the intermediate situations between the ultimatum game ( $\delta = 0$ ) and the dictator game ( $\delta = 1$ ). The no-veto-cost game in Fellner and Güth (2003) makes  $\delta = 0$  for the proposer and  $\delta = 1$  for the responder. In the impunity game (Bolton and Zwick, 1995), the proposer always keeps the share she decided to keep for herself. Güth and Kocher (2014) summarize some recent findings in these variants of the ultimatum game.

*the Spanish treasury than most regions, but get disproportionately less in return*".<sup>2</sup> As for the importance of bargaining power, one instance in which this seems to affect the subjects' willingness to implement an agreement reflecting their contributions would be the distribution of TV rights in La Liga. Here, clubs negotiate their own TV contracts and the 'big two' football clubs (Real Madrid and Barcelona) take together about half the money.<sup>3</sup>

Although the importance of equity and bargaining power should be clear from previous discussion, there currently exists no systematic investigation of how both elements affect behavior in bargaining games when there is a joint endowment to be distributed. Our paper pertains to recent research on fairness that studies behavior using games with production. Using evidence from dictator games, Konow (1996), Frohlich et al. (2004), Cappelen et al. (2007, 2010), Almas et al. (2010) or Rodriguez-Lara and Moreno-Garrido (2012), among others, identify a non-negligible fraction of dictators that rely on equity theory in distributional problems. This is in line with recent experimental evidence using impartial observers (Fischbacher et al. 2012, Luhan et al. 2014), and recent findings in ultimatum games that highlight the importance of the equity principle when the endowment to be divided is not a windfall but produced by participants (Gächter and Riedl 2005, 2006, Königstein 2000, Gantner et al. 2001, Fischbacher et al. 2012, Bediou et al. 2012, Franco-Watkins et al. 2013, Feng et al. 2013).<sup>4</sup> One common feature in this literature is the existence of entitlements over the endowment to be distributed. In Gächter and Riedl (2005, 2006) these entitlements are determined by performance in a quiz, while the size of the endowment depends on individual choices (rather than on subjects' performance in a real effort task) in Königstein (2000) and Gantner et al. (2001). The closest paper to ours, then, is Fischbacher et al. (2012), where subjects have to answer one question to determine the size of the joint endowment.<sup>5</sup> Fischbacher et al. (2012) highlight the importance

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<sup>2</sup>See the article in The Guardian: <http://www.theguardian.com/commentisfree/2013/sep/10/spain-catalonia-independent-referendum> (Last accessed March 2016).

<sup>3</sup>The matches of Real Madrid and Barcelona are really the ones sought after by TV companies in Spain. In the past, the clubs have threaten to run away from La Liga and commence a competition with other European clubs if they do not have a financial advantage in the share of TV rights. Thus, the two clubs have drawn the attention to the fact their earnings would not be much affected if there were a disagreement.

<sup>4</sup>Along similar lines, Garcia-Gallego et al. (2008) show that behavior in the ultimatum game is affected by whether or not responders perform a real-effort task after accepting the offer (see also List and Cherry (2000) for the effects of entitlements in ultimatum bargaining). The work of Karagözoğlu (2012) and Konow and Schwettmann (2016) summarize behavior when there is a joint endowment to be distributed. See Conte and Moffatt (2014) and Moffatt (2015) for the economic modeling of social preferences and fairness ideals and Elster (1989), Miller et al. (2011) or Birkeland and Tungodden (2014) discuss how the existence of different fairness motivations can result in disagreement.

<sup>5</sup>Importantly, subjects may be informed about the correct answer to the question in their design. The opportunity of allowing subjects to study the answer of some questions is interpreted as the possibility of education in Eisenkopf

of equity in bargaining games using evidence from an ultimatum game and a dictator game in which a third party distributes the joint production. We complement their findings by looking at the importance of bargaining power when subjects may receive asymmetric payments in case of disagreement.

Our within-subject design is suited to capture the interplay between equity concerns and the power to influence the final outcome when one of the players is giving or taking away more power in the bargaining process (see Bediou et al. 2012, Feng et al. 2013, Hennig-Schmidt et al. 2013, Ubeda 2014, Vileval and Rustichini 2014, or Ridinger 2015, for other within-subject studies).<sup>6</sup> While other studies investigate how outside options influence bargaining behavior (Ciampaglia et al. 2014, Hennig-Schmidt et al. 2013, Anbarci and Feltovich 2013, Ridinger 2015), we consider a setting in which the joint endowment to be distributed depends on the subjects' performance in a real-effort task, thereby using a framework in which equity theory can be tested directly. The study of the bargaining power in games with production relates our paper to other studies that manipulate property rights and entitlements. Rode and Le Menestrel (2011), for example, show the influence of the power structure in distributive decisions by considering a setting in which one of the subjects works to produce the endowment to be distributed (see also Ruffle 1998, Cherry et al. 2002, Oxoby and Spraggon 2008, Leliveld et al. 2008, Heinz et al. 2012). In their experiment, the decision power is studied by giving the role of dictator to the subject that (did not) produce the endowment, respectively. They complete the puzzle by considering a treatment in which subjects bargain over the endowment in a repeated Nash demand game. Along similar lines, Bolton and Karagözoğlu (2015) allow subjects to communicate and bargain over a joint endowment in the context of unstructured bargaining. The authors investigate the importance of hard and soft leverage by giving one of the players the option of making an ultimatum offer at any point in time (see Gächter and Riedl 2005, Luhan et al. 2014 or Karagözoğlu and Riedl 2014 for other experimental studies in unstructured bargaining, where subjects are allowed to exchange proposals during the bargaining phase).

Besides looking at whether (and how) equity considerations are relevant for choices in the ultimatum and the no-veto-cost game, we also study how these games differ in terms of conflict; i.e., rejection rates and efficiency losses. In terms of the ultimatum game, the equal split has been frequently considered to be the fair solution. Nonetheless, there exists overwhelming evidence

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et al. (2013).

<sup>6</sup>The FIFA (International Federation of Association Football) has recently sanctioned some clubs with a transfer ban that disallows them to make any signings. This decision has modified the bargaining power of the sanctioned clubs, whose situation resembles the no-veto-cost game described above. In the presence of the transfer ban, disagreement with a football whose contract is about to expire would have different costs for the footballer and the sanctioned club: while the footballer can still sign a contract with another club, the sanctioned club will not be able to replace the footballer.

suggesting that offers of around 40 % of the endowment are rarely rejected (see, among others, Guth et al. (1982), Oosterbeek et al. (2004) or Guth and Kocher (2014) for a discussion of the results). This, in turn, indicates that proposers (most likely because of their first-mover advantage) end up getting a larger share of the endowment. In our paper, we look at the rejection rates in the ultimatum and the no-veto-cost game, and compare the rejection rates when proposers (responders) decide to keep (demand) a share of the endowment that reflects their contribution. By the same token, we report evidence showing how likely is for proposers and responders to get their contribution to the joint endowment in these two games. Thus, our paper touches upon the issue of procedural fairness in a setting with joint production.<sup>7</sup>

In Section 2, we present our experimental design. We detail our research questions in Section 3. Section 4 presents our results. Section 5 concludes with a discussion of our findings.

## 2 Experimental Design and Procedures

The experiment was conducted in the Laboratory for Theoretical and Experimental Economics (LaTeX) at the Universidad de Alicante using z-tree (Fischbacher, 2007). We recruited a total of 288 participants among students at the university, all of them reporting no previous experience in experiments.

We ran a total of 12 sessions, each of them with of 24 subjects. We had three different phases in each session. In Phase I, subjects performed a real-effort task to accumulate earnings that were distributed during a subsequent phase. We borrow the task from Rodriguez-Lara and Moreno-Garrido (2012), where subjects were asked to complete a questionnaire that consisted of 20 multiple-choice questions with 4 incorrect and 1 correct answer to each question. The questionnaire was common to all subjects (this was common information) and took 35 minutes.<sup>8</sup>

When subjects recorded their answers in the computer screen, they were randomly matched in pairs and assigned the role of Player A (hereafter, the proposer,  $i = p$ ) or Player B (hereafter,

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<sup>7</sup>As described in Herings and Predtetchinski (2015), “*procedures are deemed fair if they create equal chances for persons involved in the procedures*”. Of course, we do not claim that the ultimatum and the no-veto-cost game will give subjects the same opportunities to get their contribution to the joint endowment. However, we want to provide some empirical evidence along these lines. Hence we test whether equity-concerned subjects are equally likely to obtain their contribution to the joint endowment regardless of whether they are in the role of proposers or responders in these two games.

<sup>8</sup>The English version of the detailed instructions used in the experiment is available in Appendix A. Our questionnaire (available upon request) was intended to measure effort as questions were time-consuming but not hard to solve (see List and Cherry (2000), Gächter and Riedl (2005, 2006) or Karagözoğlu and Riedl (2014) for a similar task).

the responder,  $i = r$ ).<sup>9</sup> Both members received information about the joint endowment to be distributed in Phase II. This includes information about the number of correct answers  $q_i \in \{0, 1, \dots, 19, 20\}$  and the reward level  $a_i > 0$  of each member  $i = \{p, r\}$ . Let  $a = (a_p, a_r)$  and  $q = (q_p, q_r)$  denote the vector of reward levels and correct answers, respectively. The joint endowment to be distributed  $X(a, q)$  is then obtained as follows:

$$X(a, q) = x_p(q_p, a_p) + x_r(q_r, a_r) = q_p a_p + q_r a_r$$

Reward levels were beyond the subjects' control and were announced after subjects completed the questionnaire. The only information prior to completing the questionnaire was that each correct question would help to accumulate earning for a subsequent stage, and that each question would be paid at a certain reward level  $a_i \in [100, 200]$  that could possibly vary across individuals.<sup>10</sup> To introduce variability in the data, we fixed  $a_p = 150$  and varied  $a_r \in \{100, 150, 200\}$ . It was common information that the reward levels and the roles would be assigned at random, independently on the subjects' performance in the questionnaire.<sup>11</sup>

Once subjects were told their contribution and their roles, they proceeded to Phase III where subjects were asked to make decisions under two different scenarios. In the ultimatum game, the proposer had to make an offer to the responder, who simultaneously chose her minimum acceptable offer (hereafter MAO).<sup>12</sup> We hereafter denote  $\phi_p$  the proposer's offer and  $\mu_r$  the responder's MAO, where  $0 \leq \phi_p \leq X(a, q)$ , and  $0 \leq \mu_r \leq X(a, q)$ . Payoffs in the ultimatum game can then be obtained as follows:

- If  $\phi_p \geq \mu_r$ , then  $\pi_p(\phi_p, \mu_r) = X(a, q) - \phi_p$  and  $\pi_r(\phi_p, \mu_r) = \phi_p$
- If  $\phi_p < \mu_r$ , then  $\pi_p(\phi_p, \mu_r) = \pi_r(\phi_p, \mu_r) = 0$

where  $\pi_i(\phi_p, \mu_r)$  denotes final payoffs of subject  $i = \{p, r\}$ .

We gave the responder the threat power by considering the no-veto-cost game (Fellner and Güth 2003). In this game, disagreement results in no loss for the responder, who always receives

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<sup>9</sup>It was common information that roles were independent of performance. The role assignment (earned or randomly assigned) matters for the behavior in ultimatum bargaining as it is shown in Güth and Tietz (1990), Hoffman and Spitzer (1985), Hoffman et al. (1994) or Kimbrough and Sherbet (2014).

<sup>10</sup>All the reward levels referred to Pesetas, which were transformed into Euros to pay subjects at the end of the experiment (1 Euro  $\approx$  166 Pesetas).

<sup>11</sup>Reward levels and roles were assigned at random as follows. In each session, 12 subjects were rewarded  $a_i = 150$  and assigned the role of proposers, 6 subjects were rewarded  $a_i = 150$  and assigned the role of responders, 6 subjects were rewarded  $a_i = 200$  and assigned the role of responders, and 6 subjects were rewarded  $a_i = 200$  and assigned the role of responders. After being assigned the roles, proposers and responders were randomly matched in pairs.

<sup>12</sup>Given the within-subject design and the nature of the endowment, it is more convenient to ask recipients their MAO. Although our device imposes monotonic rejection strategies, this should not be a problem as most responders exhibit these strategies (Güth and Kocher, 2014)

the proposer’s offer regardless of whether or not it exceeds the MAO. The proposer, however, only receives the share of the endowment that she decided to keep if her offer satisfied the responder’s MAO. Payoffs in the no-veto-cost game can then be obtained as follows:

- If  $\phi_p \geq \mu_r$ , then  $\pi_p(\phi_p, \mu_r) = X(a, q) - \phi_p$  and  $\pi_r(\phi_p, \mu_r) = \phi_p$
- If  $\phi_p < \mu_r$ , then  $\pi_p(\phi_p, \mu_r) = 0$  and  $\pi_r(\phi_p, \mu_r) = \phi_p$

In our experiment, both the subjects’ role and the matching protocol were announced in Phase II and kept constant during Phase III; i.e., subjects made their decisions for the same pair in the two different games. The games were presented sequentially, therefore subjects received information about the second game to be played after making their choices in the first one. We control for the order in which the games were played; i.e., subjects played either the ultimatum or the no-veto-cost game first in half of the sessions. In addition, the experiment relies on a *no feedback design*; i.e., neither the offer of the proposer nor the MAO of the responder in the first game were announced to subjects before they played the second one.

As for the final payment, one of the two games was selected at random to pay subjects at the end of the session. Average earnings were roughly 12 Euros, including a 3 Euros participation fee. Each session lasted about 1 hour.

### 3 Research questions

Research on distributional justice highlights that equity and equality are two fundamentally different concepts when the endowment to be shared is the result of individual contributions. Whereas equality considers that all subjects should receive the same share of the joint endowment, equity theory proposes that subjects’ should receive a share of the endowment that reflects their contribution.<sup>13</sup> The accountability principle, as first proposed by Konow (1996), combines both equity theory (which makes the final allocation proportional to agents’ inputs), and attribution theory (which considers responsibility or control over inputs). More precisely, the accountability principle considers that subjects should be rewarded according to variables that they can influence (i.e., effort in the questionnaire) but not according to variables beyond their control (i.e., reward levels). Thus, the responder should receive a share  $\gamma_r^q = q_r / (q_p + q_r)$  of the joint endowment  $X(a, q)$ , where  $\gamma_r^q \in [0, 1]$  stands for the proportion of correct answers

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<sup>13</sup>As discussed in Young (1994), the idea that ‘what is just is what is proportional’ goes back to Aristotle. For early contributions in equity theory see Homans (1961) or Selten (1978). The interested reader in the different fairness ideals can consult Konow (2003). For a summary of recent experimental evidence see Karagözoğlu (2012) or Konow and Schwettmann (2016).



that correspond to her effort.<sup>14</sup>

In our experiment, subjects can assess their relative contribution to the pair because they receive information about each member’s contribution to the joint endowment.<sup>15</sup> The first question to be addressed concerns whether equity considerations are relevant to our design. In particular, we want to examine whether or not proposers are willing to compensate responders for their effort in the production of the joint endowment, as suggested by Königstein (2000), Gantner et al. (2001), Fischbacher et al. (2012) or Franco-Watkins et al. (2013), among others. By the same token, we want to test if responders are willing to incur in efficiency losses by demanding a share of the joint endowment that reflects their contribution. The first hypothesis that we want to reject is then as follows:

$H_0^1$  : *Subjects do not account for equity considerations. In particular, the responders’ contribution to the joint endowment does not affect the proposer’s offer or the responder’s MAO.*

One noteworthy aspect of our design is that responders have more power in the no-cost-veto game in that they always receive the proposer’s offer regardless of whether or not this exceeds the MAO. Although responders can then ask for their contribution to the endowment -or any other amount- at no risk in the no-veto-cost game, Fellner and Guth (2003) note that proposers (under the assumption that subjects only care about their own payoffs “*should completely neglect the threat power*” and choose the lowest possible offer” (page 55). This is because responders would accept all offers in equilibrium, given that their payoffs do not depend on whether or not the offer is accepted.<sup>16</sup> This would also be the prediction if responders had utilitarian preferences

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<sup>14</sup>The total endowment to be distributed in our experiment depends not only on the subjects’ performance, but also on the reward levels. Our design choice resembles real life situations in which (non-contractable) random events might affect performance. As already noted in Konow (1996, 2000) or Cappelen et al. (2007, 2010), the beauty of considering a procedure in which there are factors that subjects cannot influence relies on the existence of heterogeneous views with regard to what constitutes a fair division. Thus, the libertarian principle requires that subjects be held responsible for factors beyond their control and hence, responders receive their monetary contribution  $x_r(q_r, a_r)$  to the joint endowment  $X(a, q)$ . We deliberately focus on the accountability principle, which seems to be the equity principle that subjects employ the most (Konow 1996, Cappelen et al. 2007, Fischbacher et al. 2012) and the one preferred by impartial spectators (Fischbacher et al. 2012, Luhan et al. 2014). All our findings, however, hold when we consider the libertarian principle, as we shall discuss below. To see how people tradeoff different justice principles see Cappelen et al. (2007, 2010), Almas et al. (2010) or Conte and Moffatt (2014). The work of Cappelen et al. (2013) discusses how people treat inequalities that result from luck.

<sup>15</sup>The reader interested in bargaining behavior when subjects are uncertain about their contribution to the endowment can refer to Corgnet et al. (2011), Gantner et al. (2013), Gantner and Kerschbamer (2013), or Karagözoğlu and Riedl (2014). For experimental evidence in bankruptcy situations, where subjects have information about their claims but these exceed the available endowment, the interested reader can consult Herrero et al. (2010) or Cappelen et al. (2015).

<sup>16</sup>Theoretically, a low (zero) offer and a low (zero) demand would be the unique Nash equilibrium in the ultimatum

as suggested by Kritikos and Bolle (2001), Charness and Rabin (2002), Engelmann and Strobel (2004) or Lopez-Perez et al. (2015). In that case, proposers will demand low amounts both in the ultimatum and the no-veto-cost game so as to guarantee that the joint endowment is distributed in both games. The second hypothesis that we want to reject is then as follows:

$H_0^2$  : *Subjects do not account for the bargaining power. In particular, proposers and responders will behave in the same manner in the ultimatum game and in the no-veto-cost game.*

Although we lack experimental evidence showing how subjects behave in the no-veto-cost game when there is a joint endowment to be distributed, Fellner and Güth (2003) observe that proposers increase their offers, while responders tend to ask for more in the no-veto-cost game. We want to investigate whether or not these behavioral patterns will also be observed in our game with production, where subjects may exhibit preferences over equity.

Because our within-subject design considers both sequences, and subjects do not receive any feedback across games, we expect for the order of play to have no effect on the subjects' behavior. We then expect not to reject the following hypothesis.

$H_0^3$  : *Proposers' and responders' behavior is not affected by the order in which the games are played; i.e., their behavior in the ultimatum (no-veto-cost) game would be the same regardless of whether this game is played first or second.*

Besides assessing the impact of equity and the bargaining power on behavior, the current article attempts to study the extent to which the ultimatum and the no-veto-cost game differ in terms of conflict, efficiency and procedural fairness. Our last hypothesis to be rejected is then as follows:

$H_0^4$  : *The ultimatum and the no-veto-cost game do not differ in terms of rejection rates, efficiency or procedural fairness.*

The first two questions in  $H_0^4$  are relevant as the threat power may trigger more rejections, but rejections are indeed “cheaper” in that the responders' payoffs are not affected; i.e., when there

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game when subjects are self-interested and are merely concerned about their own material payoff. In the no-veto-cost game, any demand might be part of the Nash equilibria outcome for self-interested agents given that their own payoff is never affected by their demand. To see this, consider (for simplicity) the case in which the proposer can only choose one of two possible offers:  $\phi_p \in \{\phi_p^L, \phi_p^H\}$ , where  $\phi_p^L < \phi_p^H$ . We show that there is a Nash equilibrium in which the proposer offers  $\phi_p^L$  and the responder chooses to accept any of the two offers; i.e.,  $\mu_r = \phi_p^L$ . This situation yields payoffs  $\pi_p(\phi_p, \mu_r) = X(a, q) - \phi_p^L$  and  $\pi_r(\phi_p, \mu_r) = \phi_p^L$  for the proposer and the responder, respectively. Note that the proposer cannot get a better payoff given the MAO set by the responder. Similarly, the responder cannot benefit from deviating unilaterally as setting any other MAO (e.g.,  $\mu_r = \phi_p^H$ ) will not increase her payoff: i.e.,  $\pi_r(\phi_p, \mu_r) = \pi_r(\phi_p)$  in the no-veto-cost game. There is multiplicity of Nash equilibria, though. For example, it is also possible to have one equilibrium in which the responder demands everything and the proposer honor this MAO by offering the entire endowment (this would be the Nash equilibrium preferred by responders).

is disagreement in the ultimatum game both players get nothing, while the responder always receives the proposer’s offer in the no-veto-cost game, even if the offer is rejected. As for the issue of procedural fairness, we shall compare the likelihood of rejections when proposers (responders) decide to keep (demand) their contribution to the endowment, both in the ultimatum and the no-veto-cost game. We shall also look at the frequency of proposers and responders that obtain at least their contribution to the joint endowment in these two games.

## 4 Results

### 4.1 Descriptive statistics

Subjects have, on average, 10.5 correct questions in the questionnaire (Min: 3, Max: 19,  $SD = 3.35$ ). The amounts jointly earned in Phase I vary between 1750 and 5750 Pesetas (i.e., the endowment to be distributed is between 10.5 and 34.6 Euros). Next, we show the subjects’ average behavior. Because different pairs could make their choices over different endowments, we hereafter focus on the proportion of the endowment that the proposer decided to offer to the responder ( $\phi_p/X(a, q)$ ), and the proportion of the endowment that the responder demanded for herself ( $\mu_r/X(a, q)$ ). Figure 1 displays the distribution of these two variables. The behavior in the ultimatum (no-veto-cost) game is presented in the top (bottom) panel, respectively.<sup>17</sup> Table 1 below the figure presents the descriptive statistics for both games.

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<sup>17</sup>The (within-subject) difference between the share of the endowment offered or demanded in the no-veto-cost game and the share of the endowment offered or demanded in the ultimatum game is presented in the Appendix B1. This includes information about the share of proposers (responders) that offered (demanded) more in the ultimatum and the no-veto-cost game.

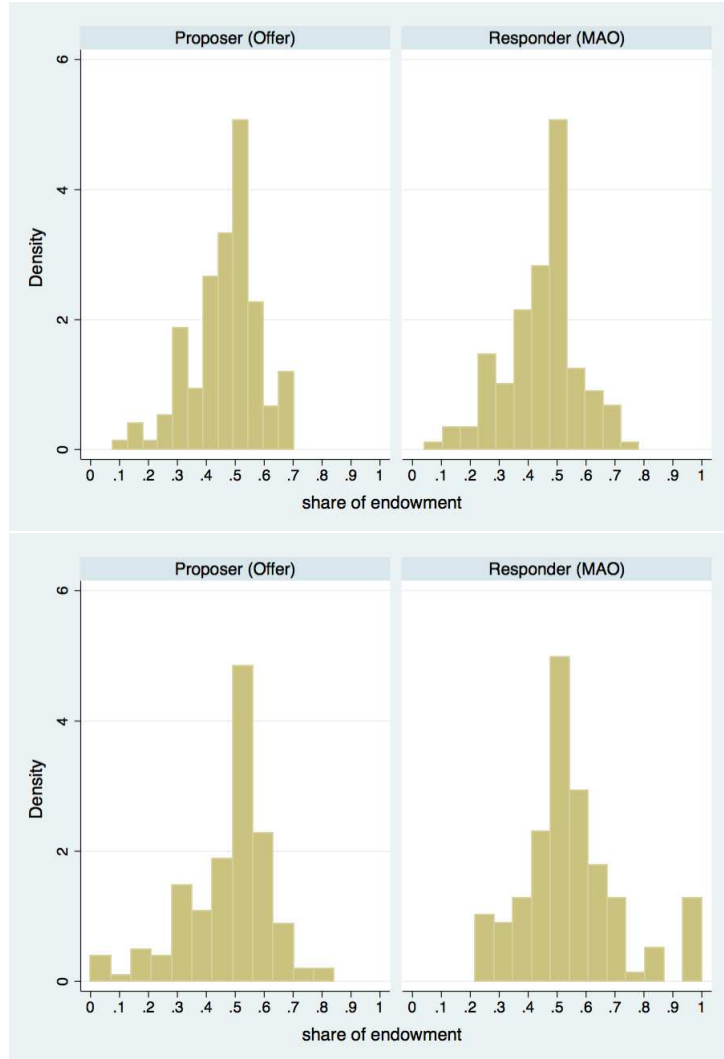


Figure 1: Distribution of choices in the ultimatum game (top panel) and the no-veto-cost game (bottom panel).

Although we observe a tendency towards the egalitarian split, both in terms of offers and demands, there are three behavioral patterns that are worth mentioning. First, a substantial share of proposers (responders) offered (demanded) more than half of the joint endowment. Second, neither the proposers nor the responders tend to offer or demand zero, what would be the outcome predicted by the subgame-perfect Nash equilibrium under the assumption that subjects are merely concerned about their own material payoffs and do not take into consideration fairness ideals.<sup>18</sup> Third, the threat of power seems to affect subjects' behavior in a different manner. More specifically, responders (on average) seem to increase their MAO substantially in the no-

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<sup>18</sup>Recall that there is multiplicity of equilibria in the no-veto-cost game, and that utilitarian preferences predict for responders to demand low amounts both in the ultimatum and the no-veto-cost game.

Table 1: Descriptive statistics

	Ultimatum game		No-veto-cost game	
	Proposer	Responder	Proposer	Responder
Mean	0.47	0.44	0.47	0.55
Standard deviation	0.11	0.13	0.15	0.18
Maximum	0.70	0.78	0.84	1
Minimum	0.08	0.04	0	0.22
Share offering/demanding nothing	0	0	0.01	0
Share offering/demanding contribution	0.18	0.09	0.16	0.08
Share offering/demanding above contribution	0.24	0.32	0.35	0.51
Share offering/demanding half	0.18	0.12	0.17	0.12
Share offering/demanding more than half	0.30	0.25	0.40	0.52

Note: There are 288 subjects in our data: 144 proposers and 144 responders.

veto-cost game whereas proposers do not seem to modify their offers as much; e.g., more than half of responders demanded more than what they have contributed in the no-veto-cost game and some of them even demanded the entire endowment (see Figure 1).

These findings suggest that contributions to the joint endowment and the bargaining power of responders may be important elements at stake. In what follows, we investigate the subjects' behavior in more detail. In Section 4.2, we test  $H_0^1$  and  $H_0^2$  by looking at the importance of equity in the ultimatum and the no-veto-cost game. This section includes the analysis for the different order in which the games are played so as to investigate  $H_0^3$ . We show in Section 4.3 the observed rejection rates and compare the two games in terms of efficiency and rejection rates. This is to shed some light upon  $H_0^4$ .

## 4.2 Behavior in the ultimatum and the no-veto-cost games with joint production

The chief question we want to address with our first hypothesis is whether equity considerations are relevant in the bargaining phase. Figure 2 displays the proposer and the responder's behavior in the ultimatum game (top panel) and the no-veto-cost game (bottom panel) as a function of the responder's relative performance in the questionnaire ( $\gamma_r^q$ ). We depict two lines at 0.5 to indicate the egalitarian prediction (horizontal line) and the point at which proposers and responders effort have contributed the same number of correct answers (vertical line). The 45 degree line represents the prediction of the accountability principle (i.e., the behavior that

is consistent with equity theory).<sup>19</sup> The Spearman’s rank correlation coefficient between the behavior in the games (Offer/MAO) and the responder’s relative performance is given in the table below the figure.<sup>20</sup> This includes disaggregated data by the order in which the games are played.

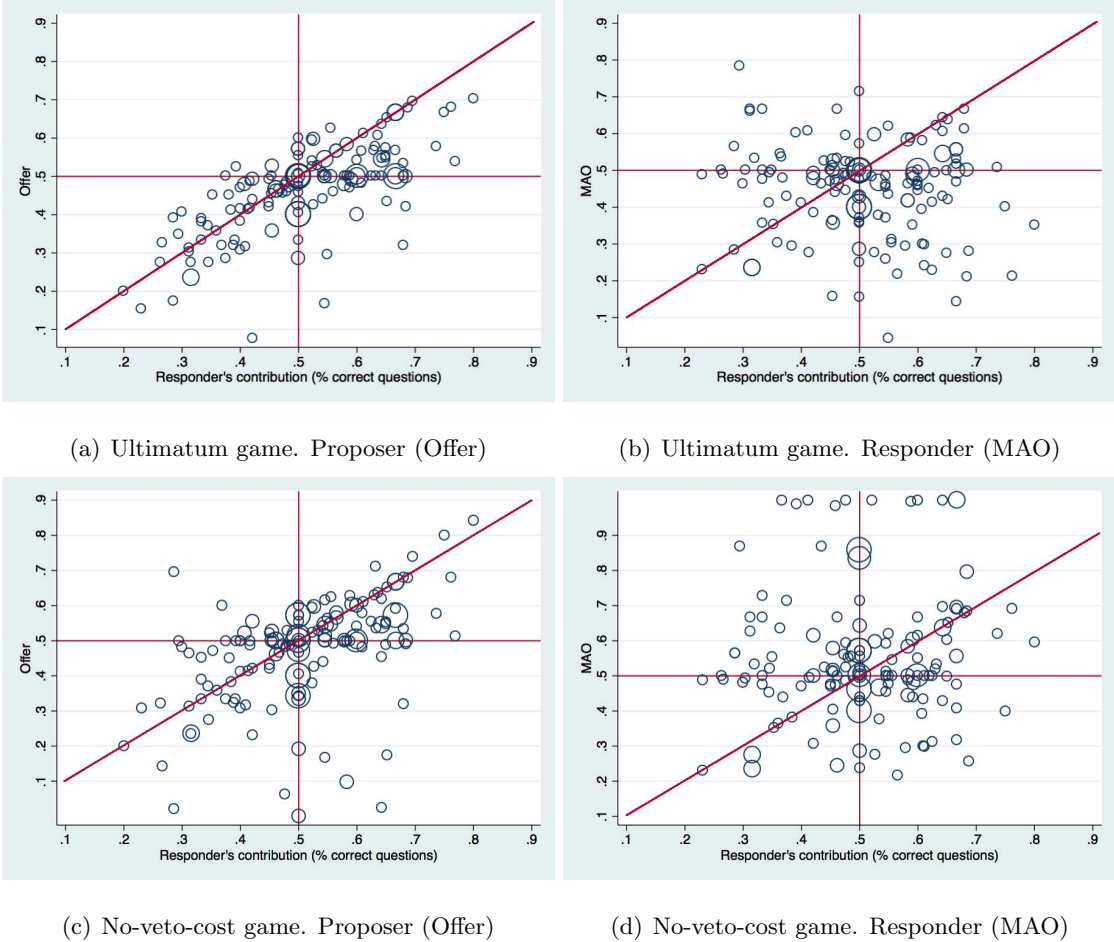


Figure 2: A bubble plot of choices in the ultimatum game (top panel) and the no-veto-cost game (middle panel)

Equity theory predicts a positive correlation between subjects’ choices and the responder’s contribution to the joint endowment. We observe that the proposer’s behavior is consistent with the idea of equity in that the Spearman’s rank correlation is positive and significant both in the ultimatum and the no-veto-cost game. This finding is robust when we look at the order in which the games are played in Table 2 ( $p$ -values  $< 0.001$ ). The evidence for responders is not so clear-cut. Their MAO in the ultimatum and the no-veto-cost game seems to be uncorrelated

<sup>19</sup>The results for the monetary contribution (i.e., the libertarian principle) follow a similar pattern and are available in Appendix B3.

<sup>20</sup>All our findings are robust if we consider the Pearson or the Kendall- $\tau$  rank correlation coefficients instead.

Table 2: Spearman’s rank correlation coefficient between subject’s behavior (Offer/MAO) and the responder’s contribution to the endowment, disaggregated by the order in which the games are played.

	Ultimatum game		No-veto-cost game	
	Proposer	Responder	Proposer	Responder
Correlation coefficient (All data)	0.71***	-0.07	0.56***	0.11
The game is played first	0.66***	-0.21*	0.55***	0.37***
The game is played second	0.74***	-0.01	0.58***	-0.17

Note: There are 288 subjects in our data: 144 proposers and 144 responders. Half of the data corresponds to the ultimatum (no-veto-cost) game being played first. Significance at the \*10%, \*\*5%, \*\*\*1% level.

with their performance in the questionnaire when we look at the pooled data ( $p$ -value  $> 0.18$ ). There is, however, evidence for order effects in that responders with better performance tend to demand an smaller (larger) share of the joint endowment in the ultimatum (no-veto-cost) game, but only when this is played first.

To account for multiple factors influencing behavior (e.g., differences in reward levels or the size of the endowment) we perform an OLS analysis. The results for the proposer (responder) are summarized Table 3 (Table 4), respectively. In both cases, the dependent variable is the share of the endowment that proposers (responders) decided to offer (demanded for themselves).<sup>21</sup> The set of independent variables include the percentage of the correct questions by responders ( $\gamma_r^q$ ) and a dummy variable that takes the value of 1 for the no-veto-cost game ( $I_{NVC}$ ). We control for the size of the endowment ( $X(a, q)$ ) and differences in reward levels by defining a dummy that takes the value of 1 when the proposer is rewarded more than the responder per each correct answer ( $I_{a_p > a_r}$ ), and a dummy variable that takes the value of 1 when the proposer is rewarded less than the responder per each correct answer ( $I_{a_p < a_r}$ ). A dummy variable ( $I_{UG/NVC}$ ) controls for the order in which the games are played, taking the value 1 if the ultimatum game is played first. Regressions (1) to (3) report our estimates for the pooled data. We perform a between-subject comparison in regression (4). This only considers observations from the first game to be played in each of the sessions. We investigate the importance of the order of games in the subjects’ behavior in regressions (5) and (6), which consider the ultimatum and the no-veto-cost separately. Regressions (7) to (10) present our estimates for each possible order and each possible game separately. The reported standard errors are robust and clustered at the individual level.

<sup>21</sup>Our findings are robust to models of censored data.

Table 3: Econometric analysis: OLS regressions for the proposer’s decision (Offer)

<b>Dependent variable:</b> Share of the endowment offered by proposers										
	All data (1)	All data (2)	All data (3)	Between- subject (4)	UG (5)	NVC (6)	UG First (7)	UG Second (8)	NVC First (9)	NVC Second (10)
Intercept	0.145*** (0.03)	0.177*** (0.04)	0.169*** (0.0406)	0.219*** (0.07)	0.107** (0.05)	0.224** (0.10)	0.157** (0.06)	0.128** (0.06)	0.214* (0.11)	0.354*** (0.120)
Responders’ effort ( $y_r^q$ )	0.628*** (0.06)	0.666*** (0.05)	0.662*** (0.06)	0.597*** (0.09)	0.696*** (0.07)	0.673*** (0.125)	0.568*** (0.08)	0.700*** (0.07)	0.683*** (0.12)	0.465*** (0.12)
No-veto-cost ( $I_{NVC}$ )	0.006 (0.01)	0.039 (0.05)	0.039 (0.05)	-0.048 (0.08)						
Interaction ( $y_r^q I_{NVC}$ )		-0.064 (0.09)	-0.064 (0.09)	0.069 (0.16)						
Reward levels ( $I_{a_p > a_r}$ )		0.018 (0.02)	0.018 (0.02)	0.027 (0.03)	0.007 (0.02)	0.028 (0.03)	0.005 (0.02)	0.008 (0.03)	0.0464 (0.05)	0.008 (0.04)
Reward levels ( $I_{a_r > a_p}$ )		-0.012 (0.02)	-0.012 (0.02)	-0.002 (0.02)	-0.024 (0.01)	-0.006 (0.02)	-0.029* (0.02)	-0.017 (0.02)	0.028 (0.04)	-0.041* (0.02)
Endowment size ( $X(a, q)$ )		-1.68e-05 (1.03e-05)	-1.68e-05 (1.04e-05)	-1.83e-05 (1.35e-05)	2.29e-07 (8.33e-06)	-3.58e-05** (1.71e-05)	1.14e-05 (1.10e-05)	-7.93e-06 (1.22e-05)	-3.99e-05* (2.23e-05)	-3.04e-05 (2.83e-05)
Order of games ( $I_{UG/NVC}$ )			0.019 (0.01)	0.0793 (0.06)	0.112 (0.09)					
Interaction ( $y_r^q I_{UG/NVC}$ )				-0.122 (0.11)	-0.175 (0.18)					
Wald-test	50.97***	27.47***	27.16***	15.61***	32.55***	13.86***	13.45***	32.45***	14.51***	7.07***
Observations	288	288	288	144	144	144	72	72	72	72
R-squared	0.34	0.35	0.36	0.33	0.52	0.28	0.44	0.57	0.33	0.20

In Table 3, we observe that the estimate for the intercept is always positive and significant, what indicates that proposers are willing to compensate responders after attempting the questionnaire.<sup>22</sup> The effect of the responder’s effort on the proposer’s offer is also positive and significant, even after controlling for the reward levels, the endowment size and the order in which the games are played (regressions 1 to 3). This is confirmed by the between-subjects analysis (regression 4), or when we disaggregate the data by the order in which games are played (regressions 7 to 10). We indeed find no order effects in the proposer’s behavior in the ultimatum or the no-veto-cost game (regressions 5 and 6). Thus, our findings confirm that proposers behave according to equity theory in any of the games. As for the importance of the responder’s power of threat, we cannot reject the null hypothesis that proposers behave the same in the ultimatum and the no-veto-cost game ( $p$ - values > 0.44) (regressions 1 to 4).

**Result 1.** *Proposers take into account equity considerations. They offer to responders a share of the joint endowment that corresponds to their effort, that is, the number of correct questions in the questionnaire. The threat power of responders and the order in which the games are played do not seem to affect the proposers’ behavior.*

When we look at responders’ behavior in Table 4, we find that the intercept is always positive and significant. Hence, responders are willing to incur efficiency losses by demanding a positive share of the endowment. This, in turn, would suggest that efficiency motives are not driving the responder’s behavior, as their demand is significantly different from zero both

<sup>22</sup>See Ruffle (1998), Oxoby and Spraggon (2008), Heinz et al. (2012) or Rode and Le Menestrel (2011) for related evidence in the dictator game, and Garcia-Gallego et al. (2008) for evidence in the ultimatum game.



Table 4: Econometric analysis: OLS regressions for the responder's decision (MAO)

<b>Dependent variable: Share of the endowment demanded by responders</b>										
	All data (1)	All data (2)	All data (3)	Between- subject (4)	UG (5)	NVC (6)	UG First (7)	UG Second (8)	NVC First (9)	NVC Second (10)
Intercept	0.440*** (0.05)	0.495*** (0.08)	0.461*** (0.08)	0.578*** (0.07)	0.413*** (0.09)	0.412*** (0.11)	0.527*** (0.07)	0.394*** (0.12)	0.427*** (0.11)	0.620*** (0.16)
Responders' effort ( $\gamma_r^q$ )	0.013 (0.09)	-0.101 (0.09)	-0.096 (0.09)	-0.133 (0.12)	-0.072 (0.14)	0.269** (0.13)	-0.133 (0.10)	-0.071 (0.13)	0.298** (0.13)	-0.115 (0.23)
No-veto-cost ( $I_{NVC}$ )	0.103*** (0.01)	-0.003 (0.0494)	-0.003 (0.05)	-0.173* (0.09)						
Interaction ( $\gamma_r^q I_{NVC}$ )		0.211** (0.10)	0.211** (0.10)	0.414** (0.18)						
Reward levels ( $I_{a_p > a_r}$ )		-0.023 (0.03)	-0.0229 (0.02)	-0.001 (0.02)	-0.018 (0.02)	-0.022 (0.03)	-0.011 (0.03)	-0.025 (0.04)	0.008 (0.04)	-0.053 (0.05)
Reward levels ( $I_{a_r > a_p}$ )		-0.039 (0.03)	-0.039 (0.03)	-0.029 (0.02)	-0.034 (0.03)	-0.039 (0.04)	-0.085*** (0.02)	0.017 (0.02)	0.031 (0.04)	-0.105 (0.08)
Endowment size ( $X(a, q)$ )		7.54e-06 (1.66e-05)	7.19e-06 (1.59e-05)	-7.12e-06 (1.27e-05)	1.82e-05 (1.48e-05)	-3.93e-06 (2.23e-05)	1.60e-05 (1.33e-05)	1.92e-05 (2.36e-05)	-2.42e-05 (2.00e-05)	2.39e-05 (4.61e-05)
Order of games ( $I_{UG/NVC}$ )			0.065*** (0.02)	0.097 (0.09)	0.264 (0.14)					
Interaction ( $\gamma_r^q I_{UG/NVC}$ )				-0.069 (0.18)	-0.384 (0.27)					
Wald-test	31.25***	11.47***	9.85***	2.19**	2.84**	1.83*	6.34**	0.40	2.65**	1.44
Observations	288	288	288	144	144	144	72	72	72	72
R-squared	0.10	0.12	0.16	0.09	0.100	0.07	0.20	0.02	0.11	0.07

in the ultimatum and the no-veto-cost game. To see whether or not the performance in the questionnaire influences the MAO in the ultimatum game, we look at the estimated coefficient of  $\gamma_r^q$ . This is never significant when we control for the reward levels, the endowment size and order of the games (regressions 1 to 3) or when disaggregate the data by games (regressions 7 and 8), thus suggesting that the responders' performance has no predicting power in their MAO in the ultimatum game. In line with our previous discussion, however, we find a significant effect of the interaction term ( $\gamma_r^q I_{UG/NVC}$ ), what indicates that responders might take their contribution to the joint endowment into consideration in the no-veto-cost game (see regressions 2 to 4). Our estimates confirm that the effect of the responders' performance in their MAO is only important when the no-veto-cost game is played first (see regressions 9 and 10). As for the influence of the order in which the games are played, we find that the order in which the ultimatum game is played does not matter for responders' behavior (regression 5), but it does the order in which no-veto-cost game is played (regression 6,  $p$ -value = 0.061). Finally, we find evidence for the influence of the threat power in that responders demand a higher share of the joint endowment in the no-veto-cost game, compared with the ultimatum game (see the estimated coefficients of  $I_{NVC}$  and  $\gamma_r^q I_{NVC}$  in regressions 1 to 4).

**Result 2.** *Responders only demand a share of the joint endowment that corresponds to their effort in the questionnaire in the no-veto-cost game, when this is played first. Responders demand more in the no-veto-cost game than in the ultimatum game.*

We provide further evidence on the order effects in the responders' behavior in Figure 3, which summarizes the different behavioral patterns that could be observed across games. In the

horizontal (vertical) axis, we plot deviations from equity in the ultimatum (no-veto-cost) game, respectively. Thus, observations in the positive domain correspond to responders that demand more than what they have contributed in these two games. As for the comparison of behavior across games, the dotted line represents responders that demand the same in the ultimatum and the no-veto cost game (roughly 30% of the data). Observations above this line (Regions A and B) correspond to responders who demand more in the ultimatum game than in the no-veto-cost game (roughly 60% of the data), while observations below this line (Region C) correspond to responders who demand more in the no-veto-cost game (roughly 10% of the data).

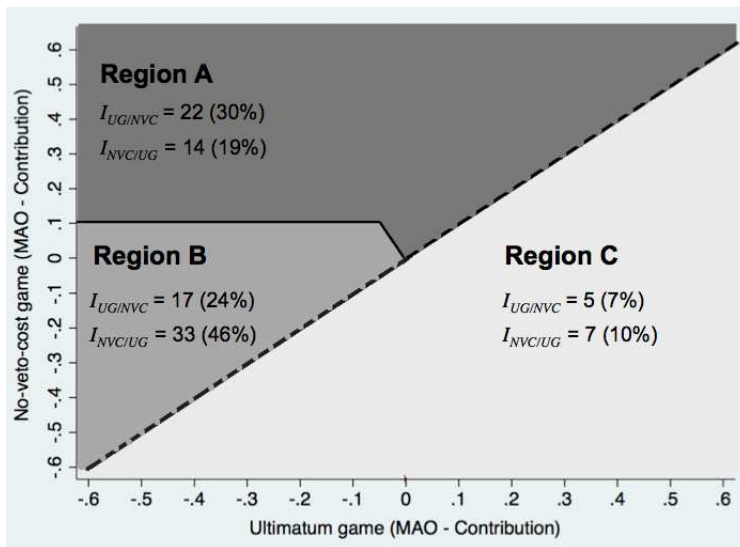


Figure 3: Within-subject heterogeneity and behavior across games

When the ultimatum game is played first ( $I_{UG/NVC}$ ), roughly one third of the data (30% of responders) is located in Region A. These are responders that increase their demand in the no-veto-cost game and demand a share of the endowment that largely exceeds their contribution. In sharp contrast, roughly half of the data (46% of responders) is located in Region B when the no-veto-cost game is played first ( $I_{NVC/UG}$ ). These are responders that demand more in the no-veto-cost game than in the ultimatum game without asking much more than what they have contributed.

When we test for differences in behavior across orders, the Fisher's exact test finds significant differences in behavior depending on the order in which games are played ( $p$ -value = 0.025).<sup>23</sup>

<sup>23</sup>We note that our results are robust if we discard from responders in the dotted line that demand the same in both games or if we consider a different classification of the data. For example, we have allowed for responders in Region B to demand in the no-veto-cost game up to 0.10 more than what they have contributed. If we consider only responders who demand exactly their contribution or consider those who demand up to 0.05, the Fisher's exact

**Result 3.** *When the no-veto-cost game is played first, responders ask their contribution to the joint endowment, but then decrease their demand in the ultimatum game. When the no-veto-cost game is played after the ultimatum game, responders tend to increase their demand and ask more than what they have contributed.*

We support this finding by looking at the proportion of responders that demand more than what they have contributed in the no-veto-cost game when this is played first (45%) and second (57%).<sup>24</sup> As for the possible effect of the responders' contribution in the responders' behavior, we find no correlation between the increase in the MAO and the responders' performance in the questionnaire when the no-veto-cost game is played after the ultimatum game. When the ultimatum game is played after the no-veto-cost game, responders with better performance seem to decrease their MAO proportionally more (see Appendix B1 for a detailed analysis).

In the next section, we investigate the extent to which differences in behavior result in differences in rejection rates and efficiency gains in the ultimatum and the no-veto-cost game.

### 4.3 Rejection rates, efficiency and procedural fairness in the ultimatum and the no-veto-cost game

Figure 4 shows the observed frequency of rejections in the ultimatum game (dark grey) and the no-veto-cost game (light grey); i.e. the frequency of times in which the proposer's offer was below the responder's MAO. The average final payoffs are also given in Figure 4.

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test will yield qualitative the same results ( $p$ -values  $< 0.05$ ). The interested reader can consult Appendix B2 for several robustness checks, including the case in which Region A is halved to consider demands above and below the responders' contribution in the ultimatum game.

<sup>24</sup>This is in sharp contrast with the proportion of responders (roughly 32%) that demand more than what they have contributed in the ultimatum game. In addition, we find that those responders that decided to demand the entire endowment in the no-veto-cost game did it when the game was played after the ultimatum game. We discuss these findings and provide an interpretation of the data in Section 5.

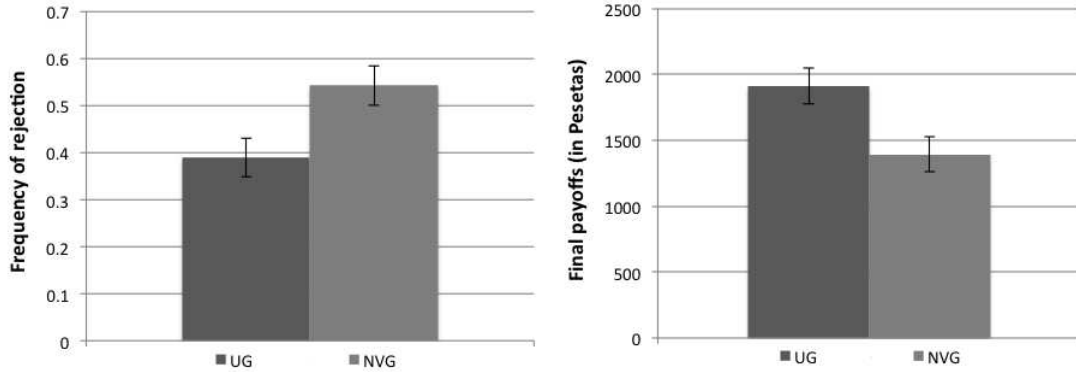
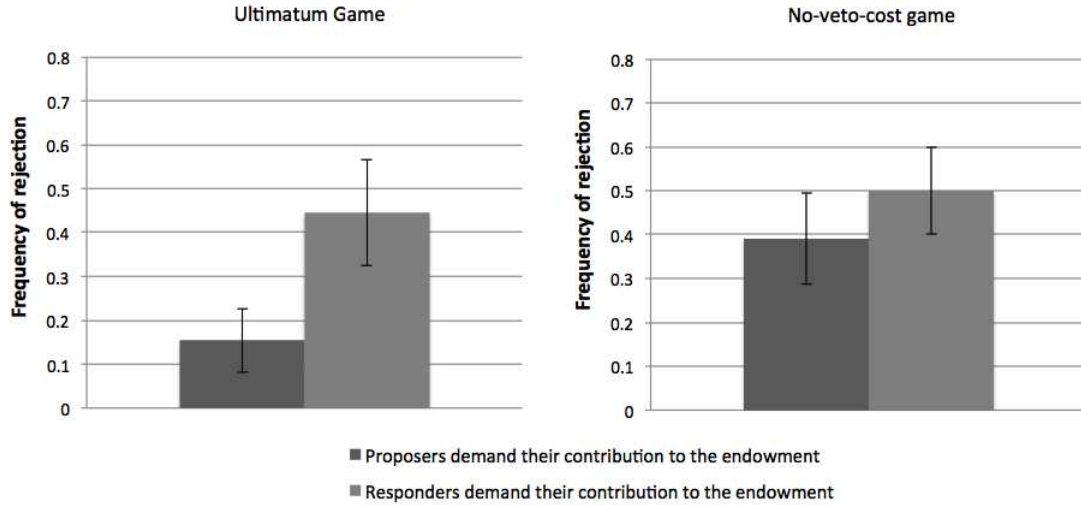


Figure 4: Rejection rates (left panel) and average final payoffs (right panel) in the ultimatum and the no-veto-cost game. Error bars are standard errors of the mean.

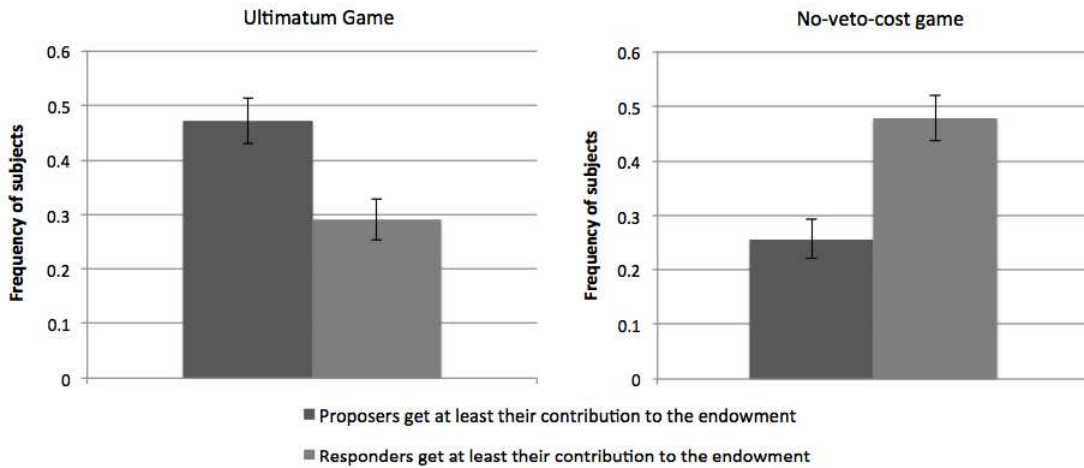
We find more rejections in the no-veto-cost game than in the ultimatum game ( $p$ -value < 0.001). We also see that efficiency (as measured by the sum of final payoffs) is higher in the ultimatum game than in the no-veto-cost game ( $p$ -value < 0.001). These results are robust when we consider the sequence in which the games are played.

**Result 4.** *Rejections are more likely to occur in the no-veto-cost game than in the ultimatum game. In the no-veto-cost game, efficiency losses are also higher than in the ultimatum game.*

Our data suggest that settlements are more (less) likely when offers are above (below) the responders' contribution or above (below) half of the endowment, both in the ultimatum and in the no-veto-cost game. By the same token, we observe more settlements for MAOs below the responders' contribution or below half of the endowment, compared with MAOs above the responders' contribution or above half of the endowment (see Appendix B4 for further details). These findings being noteworthy, relevant to the current study is whether equity-concerned subjects get their contribution to the joint endowment. Our analysis is presented in the top panel of Figure 5. This displays the observed frequency of rejection when proposers decided to keep their contribution to the joint endowment (dark grey) so as to compare it with the observed frequency of rejections when responders decided to demand their contribution to the endowment (light grey), both in the ultimatum game (left panel) and the no-veto-cost game (right panel). The bottom panel of Figure 5 complements this analysis by displaying the frequency of proposers and responders that obtained at least their contribution to the endowment in each of the games.



(a) Rejection rates faced by proposers and responders that demand their contribution to the joint endowment



(b) Frequency of proposers and responders that get at least their contribution to the joint endowment

Figure 5: Procedural fairness in the ultimatum game (left panel) and the no-veto-cost game (right panel). Errors bar are standard errors of the mean.

We find that equity-concerned proposers who decide to keep their contribution to the joint endowment face less rejections in the ultimatum game than equity-concerned responder who decide to demand their contribution to the joint endowment ( $p$ -value  $< 0.016$ ). Differences are not statistically significant in the no-veto cost game ( $p$ -value = 0.20). Along similar lines, we observe that proposers are more likely than responders to obtain at least their contribution to the joint endowment in the ultimatum game ( $p$ -value = 0.002). The situation is reversed in the no-veto-cost game ( $p$ -value  $< 0.001$ ), where rejections only affect the proposers' payoffs.

**Result 5.** *In the ultimatum game, rejections are more likely when responders demand their contribution to the joint endowment, compared with the case in which proposers decide to keep their contribution to the joint endowment. This does not seem to occur in the no-veto-cost game. Similarly, it is more likely for proposers (responders) to get at least their contribution to the joint endowment in the ultimatum (no-veto-cost) game.*

Our findings in this section point out to tradeoff between outcomes in bargaining games (i.e., rejection rates and efficiency) and the issue of procedural fairness (i.e., the extent to which proposers and responder get their contribution to the joint endowment).

## 5 Concluding remarks

Since the seminal work of Güth et al. (1982), there is plenty of experimental evidence in showing that observed behavior in the ultimatum game departs from the equilibrium prediction assuming self-regarding preferences. One robust result along these lines refers to the emergence of the equal division as the modal outcome (see Oosterbeek et al. (2004) or Güth and Kocher (2014) for a recent discussion of the results). Although this has been interpreted as evidence of fair behavior, one challenge for this literature is to study the extent to which subjects' behavior is consistent with equity theory. There is mounting evidence suggesting that subjects exhibit preferences over equity in games with production (see, among others, Konow 1996, Frohlich et al. 2004 or Cappelen et al. 2007, 2010). It is also well documented that property rights (i.e., entitlements) and outside options significantly affect behavior (take, for example, Cherry et al. (2002), Garcia-Gallego et al. (2008), Rode and Le Menestrel (2011) and Franco-Watkins et al. (2013) for the former and Ciampaglia et al. (2014), Hennig-Schmidt et al. (2013) and Anbarci and Feltovich (2013) for the later). As a result, it seems of first order important to investigate how equity theory interacts with the bargaining power when there is a joint endowment to be distributed.

Using a within-subject design, we have studied behavior in the ultimatum and the no-veto-cost game with production, which differ in the cost to responders to reject the proposers' offer. We have shown that proposers compensate responders for their effort in the production of the joint endowment both in the ultimatum and in the no-veto cost game. Our results indicate that the proposers' behavior is not influenced by the threat power of the responders. This is not the case for responders, who react to their bargaining power by increasing (decreasing) their demand in the no-veto-cost (ultimatum) game when this is played after the ultimatum (no-veto-cost) game. Interestingly enough, our data suggest that the responders' demands are only consistent with equity theory in the no-veto-cost game, when this is played first. When the no-veto-cost game is preceded by the ultimatum game, we observe that responders' demand

become (strikingly) aggressive with nearly 60% of responders demanding more than what they have contributed to the endowment.

Taken together, our findings contribute to the still scarce literature on the study of equity in bargaining games (Königstein 2000, Gantner et al. 2001, Fischbacher et al. 2012, Franco-Watkins et al. 2013, Luhan et al. 2014) by suggesting that proposers and responders may account for equity and the decision power in a very different manner. Our results for proposers can be rationalized by assuming that proposers believe that responders will demand the same share of the endowment in the ultimatum and the no-veto-cost game. This would be a reasonable assumption given that responders cannot affect their payoffs in the later game. Proposers might also behave in the same manner in the ultimatum and the no-veto-cost game given that rejections are equally costly for them in both games; i.e., proposers may ignore that rejections in the ultimatum and the no-veto-cost game have different payoff consequences for responders. Finally, proposers might exhibit a strong preference for equity and be reluctant to offer responders more than what they consider is a fair offer; i.e., proposers might have a (large) disutility when their offers to responders deviate from their contribution.

As for the behavior of responders, they do not demand their contribution to the endowment in the ultimatum game, probably because there is a risk of rejection that will yield no payoffs for them. The fact that the responders' demand is higher in the no-veto-cost game could be then due to a desire for responders to demand their contribution to the joint endowment. Our findings that responders' behavior is consistent with equity in the no-veto-cost game only when this is played first, however, suggests that it is also important to account for the order in which the games were played. One possible reason for responders to demand more in the no-veto-cost game is to assume that responders suffer from *quasi-magical thinking* (Shafir and Tversky 1992), which refers to the erroneous belief that, by acting in a particular manner, subjects can influence an outcome beyond their control; i.e., responders may (erroneously) believe that by increasing their demand in the no-veto-cost game, they can increase their payoff. Responders might also be spiteful and demand more in the no-veto-cost game so as to increase the likelihood of rejection and urge proposers to get nothing as a result. Although there is no feedback across games, responders playing the no-veto-cost game after the ultimatum game could also realize that they were given more power in the second game and may have enjoyed using it. This interpretation, in turn, would suggest that increasing the bargaining power of responders during the bargaining process might lead them to exploit proposers by some sort of retaliation.

While our paper provides a set of important experimental findings into the relevance of equity considerations and the bargaining power in ultimatum games, we believe that further research is needed in this area. One fruitful direction would be eliciting fairness judgments or including a post-experimental questionnaire so as to enrich our understanding of the behavior in games

with joint endowment (Gächter and Riedl 2005, 2006, Rode and Le Menestrel 2011, Bediou et al. 2012, Vileval and Rustichini 2014, Luhan et al. 2014, Bolton and Karagözoğlu 2015). By the same token, it would be worth eliciting risk preferences or the background characteristics of subjects to account for their predictive power. This might be particularly helpful to better understand the responders' behavior in the ultimatum game. The possibility of assessing the importance of the bargaining power in other settings where subjects can communicate and exchange proposals (e.g., make promises and/or threats) seems to be a fertile research area as well (see Gächter and Riedl 2005, Luhan et al. 2014, Bolton and Karagözoğlu 2015). Along these lines, the fact that we employed a within-subject design without feedback might have contributed to our finding that responders demand more than what they have contributed in the no-veto-cost game, when this is played after the ultimatum game. Because proposers tend to offer responders their contribution to the endowment in the ultimatum game, it would be a good idea to see how responders react in the no-veto-cost game when they observe such behavior from proposers. Last, but not least, we think that the issue of procedural fairness deserves more attention. A third party that needs to set up the bargaining rules may be interested in giving all subjects the same possibilities to demand their contribution to the endowment during the bargaining process. While we do not address this issue directly, we have shown that the first-mover advantage in the ultimatum game and the asymmetry of power in the no-veto-cost game might help subjects to obtain their contribution to the joint endowment. This leaves the door open for exploring other settings (e.g., the Nash bargaining game) to test whether or not subjects will be awarded the same opportunities to obtain their contribution to the joint endowment.



## Appendix A: Instructions<sup>25</sup>

### Welcome to the experiment!

This is an experiment to study decision making, so we are not interested in your particular choices but rather in the individuals' average behavior. Thus, all through the experiment you will be treated anonymously. Neither the experimenters nor the people in this room will ever know your particular choices. Please do not think that we expect a particular behavior from you. However, keep in mind that your behavior might affect the amount of money you can win.

Next, you will find instructions on the computer screen explaining how the experiment unfolds. The instructions are the same for all subjects in the laboratory and will be read aloud by experimenters. Please follow them carefully, as it is important that you understand the experiment before starting.

Talking is forbidden during the experiment. If you have any questions, raise your hand and remain silent. You will be attended to by the experimenters as soon as possible.

### First phase

The experiment has three phases. In the first phase, you are able to accumulate money by solving a questionnaire. The quiz that you will face is the same for all subjects in the room and contains 20 multiple-choice questions with 5 possible answers (only one of them is correct). You have 35 minutes to solve the quiz. Each of your correct answers will be rewarded at a reward rate that will be the same for each correct answer but may vary across individuals. No questions will be rewarded higher than others and the reward of each correct answer will be randomly announced once you finish the questionnaire. This reward per correct answer lies between 100 and 200 pesetas and does not depend on your performance.

Next, you will now receive the questionnaire on a piece of paper. To answer the questions, you must use the computer screen. Please do not write on the questionnaire, and make sure that you have selected your answers correctly on the computer screen before continuing, as the computer will automatically check your answers at the end of this phase. Calculators cannot be used during the experiment. You will be provided an additional piece of paper to make computations if needed.

Remember that during the experiment you are not allowed to communicate with each other: you can only communicate with the experimenters.

### Second phase

In this second phase, you will be randomly matched with a subject in this room and your total earnings will be announced. Remember that the reward of each correct answer is randomly determined so it does not depend on your performance in the quiz.

In this phase you will also be assigned a type, that is, you will either be player A or player B. This type is randomly determined as well. Your type will be important for the next phase.

Please see your computer screen for a summary of your total earnings and detailed information about the number of correct questions and the reward level of each member of the pair.

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<sup>25</sup>This section presents the instructions (originally in Spanish) for the case in which the ultimatum game was played first. The instruction for the case in which the no-veto-cost game was played first the same, but changing the order of the Scenarios in the third phase.

### Third phase

In this final phase, you will be asked about how to distribute the total earnings in two different scenarios. In both of them, player A will act as the proposer. He/she will make an offer about how to distribute the total earnings, whereas player B has to decide what is the minimum amount that he/she will be willing to accept. Both player A and player B will make their decisions simultaneously (i.e., without knowing what the other member of the pair has done). At the end of the experiment, we will select one of the scenarios at random and you will be paid depending on the choices that you made, as we detail below.

**Scenario 1.** The subject that has been randomly selected as player A will make a proposal to player B, who will choose his/her minimum acceptable offer. If this scenario is selected to pay you at the end of the experiment, the payoffs will be as follows:

- If the amount that player A offers to player B exceeds (or is equal to) the minimum acceptable offer of player B, then the total earnings will be divided according the decision of player A.
- If the amount that player A offers to player B is below the minimum acceptable offer, then both players will get nothing.

Next, you will see some examples that show how payoffs are computed. Then, you will be asked to make your decision for the total earnings that you have accumulated.

Remember that your choices will be treated anonymously. Neither during the experiment nor after the experiment will you know the identity of the person you are matched with.

*We generated some examples in which the total earnings to be distributed were 100. The examples were the same for each subjects in the sessions: the computer randomly decided the offer in  $[0,100]$  and the minimum acceptable offer in  $[0,100]$ . For each example, the computer showed subjects how the final payoffs would be determined.*

*Only after making their choices for Scenario 1, subjects could see the instructions of Scenario 2. This was played receiving no feedback whatsoever about the decisions in Scenario 1. Both the matching and the subjects' role is kept constant, as we detail in Section 2. Before making their choices in Scenario 2, subjects were also presented some examples to make sure that they knew how payoffs were determined. Once again, the examples were the same for all subjects in the session.*

**Scenario 2.** The subject that has been randomly selected as player A will make a proposal to player B, who will choose his/her minimum acceptable offer. If this scenario is selected to pay you at the end of the experiment, the payoffs will be as follows:

- If the amount that player A offers to player B exceeds (or is equal to) the minimum acceptable offer of player B, then the total earnings will be divided according the decision of player A.
- If the amount that player A offers to player B is below the minimum acceptable offer, then player A will get nothing. Player B will get the amount that player A has decided to offer him/her in this scenario.

Next, you will see some example that show how payoffs are computed. Then, you will be asked to make your decision for the total earnings that you have accumulated.

Remember that your choices will be treated anonymously. Neither during the experiment nor after the experiment will you know the identity of the person you are matched with.

## Appendix B

### Appendix B1: Within-subject behavior

Figure 6 displays the distribution of the difference of choices between the two games within-subjects; i.e., we represent the difference between what each proposer (responder) offers (demands) in the no-veto-cost game and what each proposer (responder) offers (demands) in the ultimatum game. Table 5 summarizes the within-subject behavior, including information about the share of proposers and responders that increase and decrease their offers and MAO, respectively. In line with our description of the data, we observe that responders are more likely to increase their MAO than proposers are likely to increase their offer. This is a robust finding when we look at the order in which the games are played.

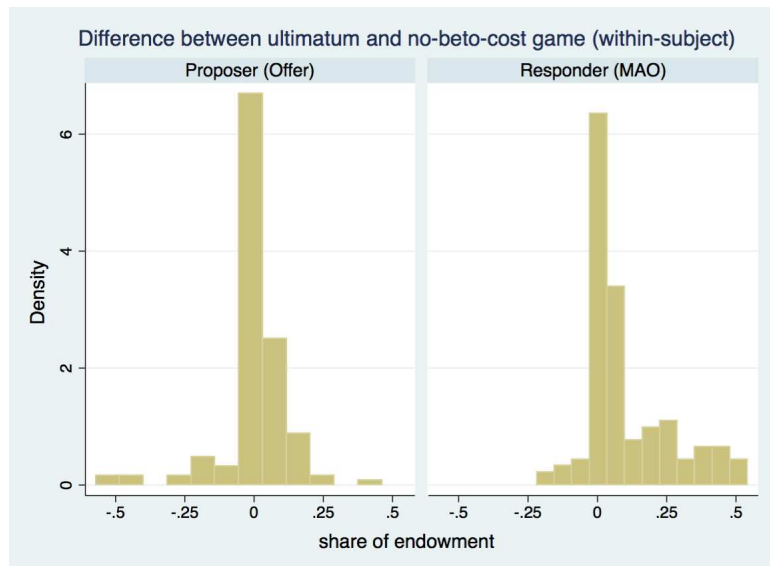


Figure 6: Differences in choices in the two games (within-subject)

Table 5: Differences in behavior (within-subject)

	Within-subject difference	
	Proposer	Responder
Mean	0.01	0.10
Standard deviation	0.12	0.16
Maximum	0.52	0.54
Minimum	-0.57	-0.22
Share offering/demanding more in the no-veto-cost game	0.41	0.60
Share offering/demanding the same in both games	0.44	0.32
Share offering/demanding more in the ultimatum game	0.15	0.08
<b>Ultimatum game is played first</b>		
Share offering/demanding more in the no-veto-cost game	0.46	0.54
Share offering/demanding the same in both games	0.42	0.39
Share offering/demanding more in the ultimatum game	0.12	0.07
<b>No-veto-cost game is played first</b>		
Share offering/demanding more in the no-veto-cost game	0.36	0.65
Share offering/demanding the same in both games	0.46	0.25
Share offering/demanding more in the ultimatum game	0.20	0.10

Notes: There are 288 subjects in our data: 144 proposers and 144 responders

Figure 7 displays the difference in behavior in the two games (within-subject) as a function of the responders' contribution. The behavior of the proposer (responder) is presented in the left (right) panel, respectively. We present the pooled data in the top panel, where we report differences in behavior in the no-veto-cost game and the ultimatum game. The data, disaggregated by the order in which the games are played, is presented in the middle and bottom panel (in each case, differences in behavior are obtained by subtracting the offer or the demand in the second game and the offer or the demand in the first one). The Spearman's rank correlation coefficient between the differences in the MAOs and the responder's performance in the questionnaire is given in the figures.

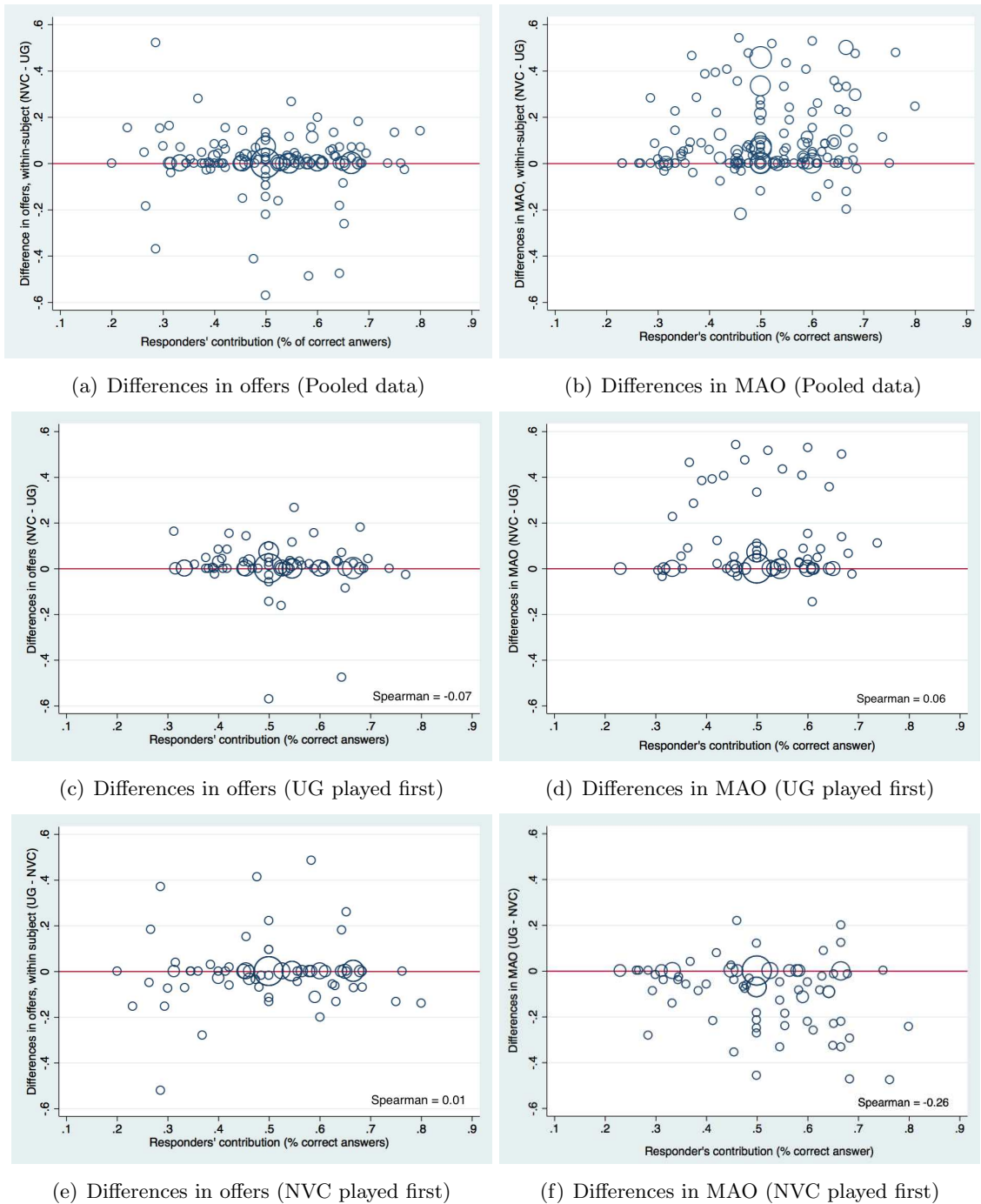


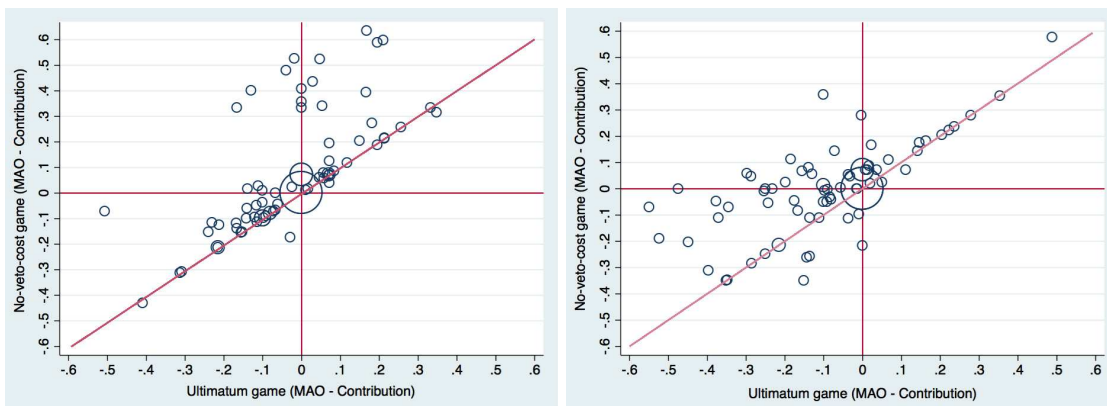
Figure 7: A bubble plot for (within-subject) differences in choices in the no-veto-cost game and the ultimatum game for each possible order of games.

As already suggested in the main text, we observe that proposers' behavior is quite stable in the two games, and no effect of the responders' contribution is identified in the proposers' decision to increase or decrease the offer ( $p$ -values  $> 0.57$ ). As for responders, we observe that majority of the data are above (below) the horizontal line when the ultimatum (no-veto-cost)

game is played first. This highlights the effect of the threat power in the responders' behavior in that responders demand more in the no-veto-cost game; i.e., responders increase (decrease) their MAO in the no-veto-cost (ultimatum) game when this is played after the ultimatum (no-veto-cost) game. The reported correlation coefficients suggest a negative relationship between differences in the MAO and performance in the questionnaire ( $p$ -value = 0.028) when the no-veto-cost game is played first. Thus, responders with better performance tend to decrease their MAO more. When the ultimatum game is played first, the Spearman's rank correlation coefficient suggests that the changes in the MAO are independent of the responders' performance in the questionnaire ( $p$ -value = 0.60). This later result was, to some extent, unexpected, as it seems to suggest that responders increase their MAO in the no-veto-cost game but do not increase it to behave according to equity theory. We provide further evidence for this behavior in the next section (Appendix B2)

## Appendix B2: Responders' behavior and order effects

We have identified effects of order in responders' behavior, both in our econometric analysis of Table 4 and the graphical analysis of Figure 3. Next, we provide some further evidence into the responders' behavior, as a robustness check. First, Figure 8 presents our data by displaying the responder's deviations from equity in each of the game, depending on the whether the ultimatum game (left panel) or the no-veto-cost game (right panel) is played first. Observations lying on the vertical (horizontal) line should be interpreted as responders demanding their contribution to the joint endowment in the ultimatum (no-veto-cost) game. Observations on the 45 degree line correspond to responders that demand the same in both games. In line with previous discussion, we observe that responders ask for more in the no-veto-cost game in that majority of observations are above the 45 degree line.



(a) Deviations from equity (UG played first)

(b) Deviations from equity (NVC played first)

Figure 8: Responder's deviations from equity in the ultimatum game (horizontal axis) and the no-veto-cost game (vertical axis), for each possible order of games

If responders demanded more in the no-veto-cost game to ask for their contribution to the joint endowment, we should observe observations clustering around the horizontal line at 0. This does not seem to be the case when the no-veto-cost game is preceded by the ultimatum-game (left panel), but when it is the first game to be played (right panel). Overall, this confirms our findings that responders demand more in the no-veto-cost game but demand their contribution only when the game is played first (see the econometric analysis in Table 4 in the main text).

In Figure 3 we have grouped the data by considering three different regions, depending on whether responders demand more in the no-veto-cost game and whether or not their demand in the no-veto-cost game exceeds their contribution to the joint endowment. Using our classification, the Fisher's exact test suggests that the order in which games are played play a role on the responders' behavior ( $p$ -value = 0.025). We might eliminate responders that demand the same in both games from the analysis, and the Fisher's exact test will yield qualitative the same

results ( $p$ -value = 0.040). We can also provide a different classification of the data, such as the one presented in Figure 9.

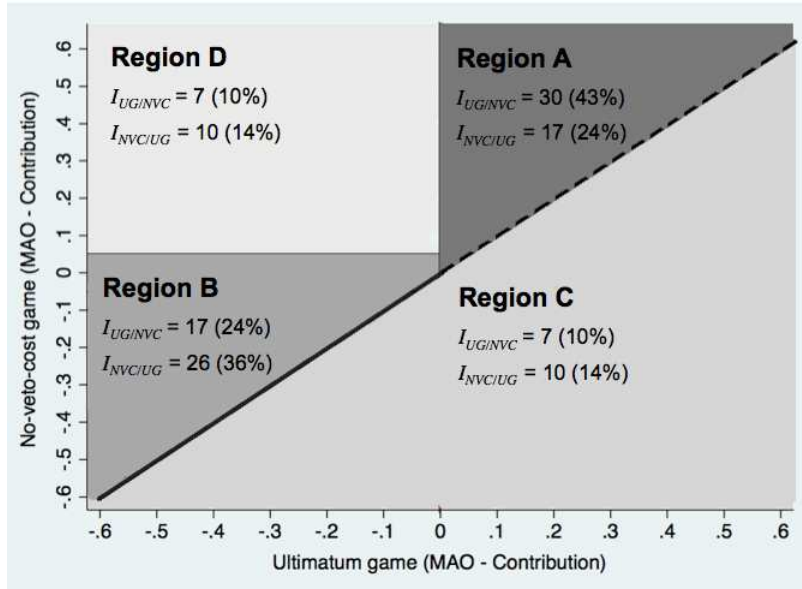


Figure 9: Within-subject heterogeneity and behavior across games

When the ultimatum game is played first, majority of the data (43% of responders) is located in Region A. This corresponds to responders that increase their demand in the no-veto-cost game and ask more than what they have contributed. In sharp contrast, majority of the data (36% of responders) is located in Region B when the no-veto-cost game is played first. These are responders that demand more in the no-veto-cost game than in the ultimatum game without asking much more than what they have contributed. When we test for differences in behavior across orders, the Fisher's exact test finds significant differences ( $p$ -value = 0.028). Again, these results are robust to other specifications. For example, we have allowed for responders in Region B to demand up to 0.03 more than what they have contributed. If we consider only responders who demand up to 0.10 or responders who demand exactly their contribution (i.e., when we consider the horizontal line at 0 to plot Region B), the Fisher's exact test would yield similar results ( $p$ -values < 0.038). Similarly, we have considered two different regions for responders that demand the same in both games, namely Regions A (where the MAO is below the responders' contribution) and the dotted line included as a part of Region A (where the MAO is above the responders' contribution). If we do not include the dotted line in Region A but consider this to be a different category, the results are qualitative the same ( $p$ -value = 0.055).



### Appendix B3: Equity and the libertarian ideal

While subjects seem to employ the accountability principle, there is also evidence that some subjects are libertarian (e.g., Cappelen et al. 2007, 2010, Bediou et al. 2012, Rodriguez-Lara and Moreno-Garrido 2012, Ubeda 2014). This appendix replicates part of our analysis in Section 4.2 to study the importance of equity theory when we focus on the libertarian ideal. This fairness view states that subjects should be rewarded for their monetary contribution to the joint endowment, despite that there exist external factors beyond their control (i.e., reward levels).

Figure 10 displays the proposer and the responder's behavior in the ultimatum game (top panel) and the no-veto-cost game (bottom panel) as a function of the responder's relative monetary contribution,  $\gamma_r^x = x_r(q_r, a_r)/X(a, q)$ . The Spearman's rank correlation coefficient between both variables is given in Table 6. This includes information disaggregated by the order in which the games are played.

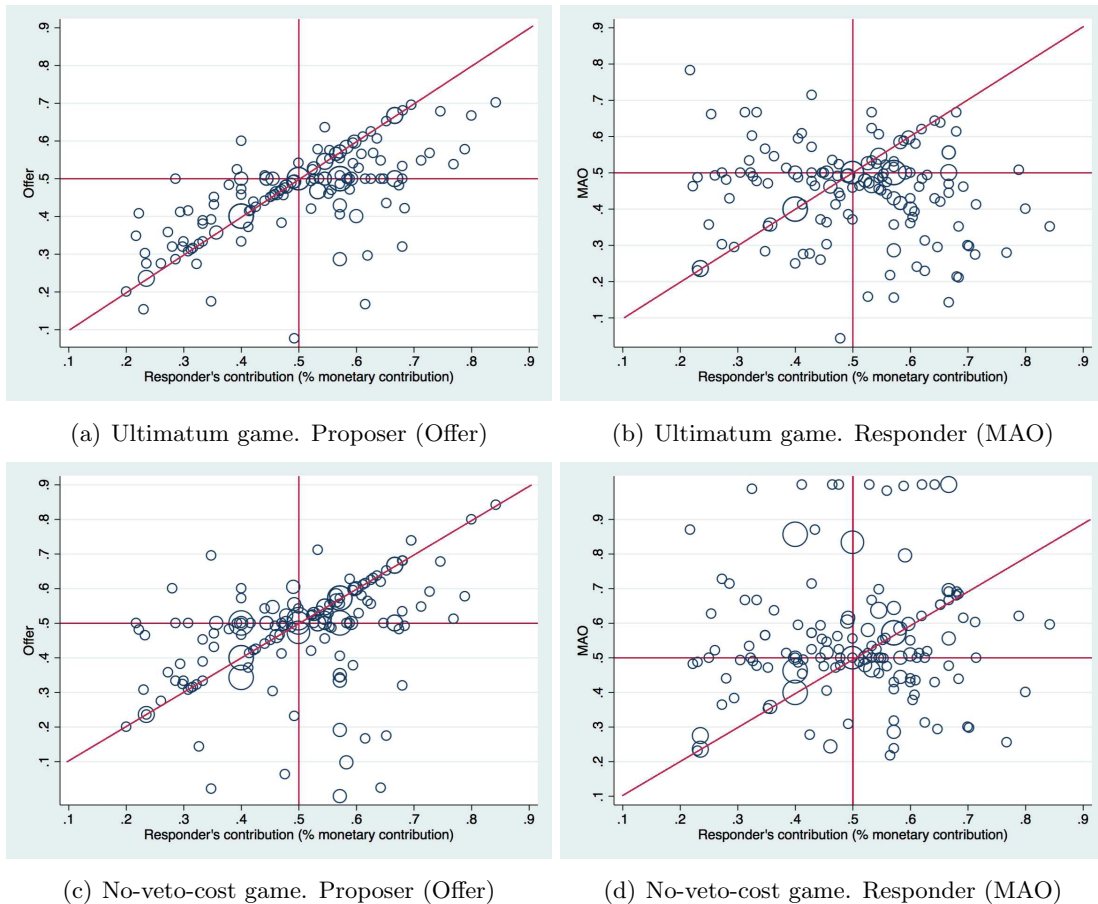


Figure 10: A bubble plot of choices in the ultimatum game (top panel) and the no-veto-cost game (bottom panel)

In line with our findings, the proposer’s behavior seems to be consistent with the idea of equity in that the correlation between the offer and the responder’s contribution is positive and significant in both games ( $p$ -values  $< 0.001$ ). The order of the games does not seem to affect the proposers’ decision to offer responders an amount that reflects their contribution to the joint endowment. As for the responders’ MAO, the correlation between the responders’ MAO and their monetary contribution is not significant in the ultimatum game or the no-veto-cost game when we consider the pooled data. There is, however, a significant correlation between the responders’ MAO and their contribution to the endowment in the no-veto cost game when this is played first ( $p$ -value = 0.010).

Table 6: Spearman’s rank correlation coefficient between subject’s behavior (Offer/MAO) and the responder’s contribution to the endowment, disaggregated by the order in which the games are played.

	Ultimatum game		No-veto-cost game	
	Proposer	Responder	Proposer	Responder
Correlation coefficient (All data)	0.68***	-0.09	0.51***	0.09
The game is played first	0.67***	-0.19 <sup>†</sup>	0.47***	0.30**
The game is played second	0.70***	-0.05	0.59***	-0.12

Note: There are 288 subjects in our data: 144 proposers and 144 responders. Half of the data corresponds to the ultimatum (no-veto-cost) game being played first. Significance at the \*10%, \*\*5%, \*\*\*1% level. <sup>†</sup>  $p$ -value equals 0.102.

## Appendix B4: Rejection rates

In Table 7 we report the observed frequency of rejections for offers and MAO that are above and below half of the endowment (top panel) and offers and MAOs that are above and below the recipients' contribution to the joint endowment (bottom panel).

Table 7: Rejection rates in the ultimatum and the no-veto-cost game for offers and MAO above and below half of the endowment, and offer and MAO above and below the recipients' contribution.

	Ultimatum game		No-veto-cost game	
	Proposer	Responder	Proposer	Responder
Offer/demand more than half	0.14	0.76	0.32	0.77
Offer/demand less than half	0.55	0.23	0.74	0.23
$\chi^2$ -test	18.90***	30.80***	21.70***	35.88***
Offer/demand more than contribution	0.41	0.79	0.45	0.83
Offer/demand less than contribution	0.44	0.19	0.66	0.22
$\chi^2$ -test	0.08	40.35***	5.11**	47.09***

Note: There are a total of 288 observations in each of the games: 144 proposers and 144 responders.  
Significance at the \*10%, \*\*5%, \*\*\*1% level

We observe that offers (MAO) are more likely to be rejected when they are below (above) half of the endowment, both in the ultimatum and the no-veto-cost game. Similarly, offers (MAO) are more likely to be rejected when they are below (above) the recipient's contribution to the joint endowment, both in the ultimatum and the no-veto-cost game. All pairwise comparisons are significant using a  $\chi^2$ -test, except in the ultimatum game, when we compare proposers' offers above and below the recipients' contribution.

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