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«An Empirical Study of Determinants in Decision-making Process»

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DR n°2006-10

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A THERORETICAL AND EMPIRICAL STUDY OF DETERMINANTS IN DECISION-MAKING PROCESS

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(Revised version: November 12, 2007)

ABSTRACT

A large body of experimental studies highlights the existence of social motivations besides self-interest in decision-making process. This paper proposes and tests new extensions of the well-known social preferences model of Fehr & Schmidt (1999). Extensions mainly concern the introduction of opponents' payoffs differences and a simple element of reciprocity. We run an experiment on a three-player dictator-ultimatum game to collect data and to underline subjects' behaviors in such context. Thereafter we use collected data to estimate fixed-effects logit models in order to test the relevance of proposed extensions and to compare the predictive success of the model of Fehr & Schmidt and the extended model. Results highlight a strong influence of intentions and opponents' payoffs differences. The latter doesn't display a sense of fairness but rather the desire to protect themselves and to maximise their own payoff.

Classification JEL: C25, C72, C91, D63

Keywords: social preferences models; experiment; panel data

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I. INTRODUCTION

Economic theory rests upon the hypothesis of individual rationality and self-centered preferences, i.e. selfish individuals who seek to maximise their utility function that depends solely on their own material payoff. Large bodies of laboratory experiments supply results which are by and large not compatible with the traditional economic paradigm, i.e. subjects frequently choose actions that do not maximise their monetary payoff when their actions affect others' payoffs and participants' behavior is moreover usually heterogeneous. Such results highlight the existence of social preferences that "*refer to how people rank different allocations of material payoffs to themselves and others.*" (Camerer & Fehr, 2004, p.55). Idea of social preferences or "*other regarding behavior*" is not recent (See Pollak, 1976), but experimental method leads to a growing literature which allows the emergence of models in economics. By extending the domain of preferences to fairness, reciprocity or altruism, such models provide a unified explanation within the framework of classical microeconomics for behavior in several experiments. The main focus of these models is on decomposing experimentally observed concern for the outcomes of others into underlying primary behavioral motives.

Existing models of social preferences fall into two categories that differ in how fairness is measured. In the first one - *intentions models* - subjects are concerned with the process leading to payoffs. Fairness is measured as intentions translated into individual's actions which the other party can reciprocate. Depending on the feasible action set, each subject compares the action of the other subject with the action expected and evaluates it as "*helping*" or "*hurting*" action and reciprocates accordingly. Rabin (1993) defined this concept of "*reciprocal kindness*" for normal form games, which is extended by Dufwenberg and Kirchsteiger (2004) for sequential games. All these models are based on the psychological game theory introduced by Geanakoplos et al., (1989)[2]. Social psychologists used game theory to propose social preferences models too (See Gallucci & Perugini, 2000, for a discussion related to the importance of social preferences and their reciprocity model). In the second category motivations are primarily defined by the outcome of the game. In these models – call *models of inequity aversion* – fairness refers to the distribution of individuals' payoffs differences (See pioneering models of Fehr & Schmidt, 1999 (henceforth F&S); Bolton & Ockenfels, 2000, as well as extensions provided by Kohler, 2005; Ottone &

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[2] Geanakoplos et al., (1989) provide a formal framework to analyse strategic situations in which hopes, intentions and emotions play an important role.

Ponzano; 2005; Montero, 2007; Hill & Neilson, 2007, for example). The basic idea is that individuals do not only care about their own payoff, but about how her payoff compare to that of her partners too.

Only, few models tempt to combine intentions and inequity aversion (See for example Falk & Fischbacher, 2006). The scarcity of such studies could mainly be explained by the complexity of their application.

In parallel, some researchers (F&S; Frohlich et al., 2004) show that individuals' preferences are context dependant which leads to the development of context-specific models of social preferences (See Bethwaite & Tompkinson, 1996; Bolton & Ockenfels, 2005, among others). However, no model takes into account opponents' intentions between them or differences in opponents' payoffs into the utility function. In this article, we propose to extend the model of F&S in two ways. To that purpose we introduce, into the utility function, opponents' payoffs differences and, in a basic way, reciprocity through dummies variables that represent intentions. This last element allows us to avoid the use of psychological game theory and the related strenuous application. We focus on games with a take-it-or-leave-it offer, as ultimatum games. Ultimatums situations are everywhere. Public administrations tell individuals to present documents at a certain time to perceived rights, a mother tells her child to do homework "or else…". In this paper, we use data obtained in a three-player dictator-ultimatum game experiment to test the robustness of proposed extensions. Results provided by fixed-effect logit models highlights that determinants introduced here have a strong influence on the decision-maker's utility and increase the accuracy of predictions.

The remainder of this paper is organized as follows. The next section presents the hypotheses of the model and confronts them with experimental regularities observed in a two-player ultimatum game. The third section details the experimental design of the three-player dictator-ultimatum game. The fourth section presents the main experimental results. The fifth section tests the robustness of proposed extensions and compares the predictive success of the model of F&S and ours. The final section provides conclusions.

II. MODEL

Hypotheses

We firstly define some notations. Let us a situation of negotiation between $n+1$ players in which only player n has a veto power. We'll call this last player the decision-maker. Letting

$N=\{0,\ldots,n-1\}$ be the set of opponents i, n_{opp} the number of elements in N. Players take their decision sequentially ($i=0$ acts first, followed by $i=1\ldots$) and decisions depend of the decisions of the previous player in the negotiation ($i=1$ takes her decision with respect to the one of $i=0$). An allocation is a vector $(x_0,\ldots,x_n)\in R_+^{n+1}$ with x_n the payoff of the decision-maker and x_i the payoff of opponent i. The decision-maker has preferences over allocations that can be represented by a utility function $U:R^{n+1}\to R$ established depart from the following hypotheses.

[H1]: Decision-maker cares to her absolute payoff and to payoffs differences.

This model is in line with models of inequity aversion. The decision-maker has a linear and separable additive utility function that consists in two elements: the decision-maker's absolute payoff and payoffs differences between players. Utility can be represented by means of an additive function of social utility which represents payoffs differences and a non social utility which represents decision-maker's payoff. We rejoin on this point Messick and Sentis (1985). The first one allows for inter personal comparison whereas the second allows for intra personal comparisons (See Handgraaf et al., 2003 for a related discussion of the relevance of intra and inter personal comparisons in decision-making process).

[H2]: Disadvantageous and advantageous inequity

Decision-maker is averse to disadvantageous inequity, i.e. when she obtains a smaller payoff than those of her opponents. Inequity aversion captures the idea that as x_i moves farther from x_n for some $i=0\ldots n-1$, inequity increases and the decision-maker should dislike the change. However, here, we suppose that the decision-maker dislikes inequity only in case of disadvantageous inequity ($\frac{\partial U_n(x)}{\partial(x_i-x_n)}<0\ \forall\ i\in[0;n-1]$). This inequity is weighted by α in the decision-maker's utility function. On the contrary, when the inequity is advantageous, it acts positively on her utility ($\frac{\partial U_n(x)}{\partial(x_n-x_i)}>0\ \forall\ i\in[0;n-1]$). This inequity is weighted by β in the decision-maker's utility function. This hypothesis represents a fundamental difference with F&S who suppose inequity aversion towards one's advantage and one's disadvantage; they exclude purely selfish individuals. Nonetheless, we keep F&S's assumption: $\alpha>\beta$. This hypothesis is due to "*Prospect theory*" (Kahneman & Tversky, 1979), according to which starting from a reference point, individuals are more sensitive to a loss or disadvantage than a gain or advantage of equal amount[3]. The weight of disadvantageous inequity (α) is thus higher than the weight of advantageous inequity (β).

As F&S we normalize inequity to ensure that the relative impact of inequity aversion on decision-maker's utility is independent of the number of players.

[H3]: Decision-maker cares to opponents' payoffs differences.

This feature represents a new pattern in social preferences model. Its exclusion is justified as follows by F&S: "*Furthermore, we assume for simplicity that the disutility from inequality is self-centered in the sense that player i compares himself with each of the other players, but he does not care per se about inequalities within the group of his opponents.*", (Fehr et Schmidt, 1999, p.824-825).

Here we suppose that the decision-maker is sensitive to opponents' payoffs differences in a selfish way. More precisely, we assume that disadvantageous inequity between her opponents ($x_i > x_{i+1}, \forall i \in [0, n-1[$) acts positively on her utility ($\frac{\partial U(x)}{\partial(x_i - x_{i+1})} > 0$). In fact, disadvantageous inequity could first suggest an unfair allocation and thereafter a fair division of this allocation by others opponents and notably towards her. Disadvantageous inequity is weighted by η. Conversely advantageous inequity between her opponents ($x_i < x_{i+1}, \forall i \in [0; n-1[$) acts negatively on her utility ($\frac{\partial U(x)}{\partial(x_{i+1} - x_i)} < 0$) since advantageous inequity could suggest a first fair allocation and thereafter an unfair division by opponents who adopt an opportunist behavior to maximise their monetary payoff. Advantageous inequity is weighted by χ. According to *"Prospect Theory"*, we assume $\chi > \eta > 0$. Furthermore, we suppose that the decision-maker is more sensitive to inequities between her and her opponents than inequities between her opponents, that leads to $\alpha > \chi > \beta > \eta > 0$ and $\{\chi, \beta, \eta\} \in]0,1[$.

[H4]: Maximisation of the utility function

Our model is based upon the idea that the decision-maker seeks to maximise her utility. So she will take her decision according to the following rule:

[3] For a discussion related to the evidence of references points and their consequences, see Herne (1998).

- If with the proposed allocation she obtains a negative utility $(U_n(x) < 0)$, then she rejects it. Indeed, a rejection leads to a null utility which is higher than the negative utility resulting from an acceptance.
- On the contrary, if with the allocation proposed she obtains a positive or null utility $(U_n(x) > 0)$ she accepts it.

[H5]: Intentions

We introduce reciprocity in a simple way. Since inequities take into account the gap between payoffs, we introduce only dummies variables which represent players' intentions. We study a class of games in which no subject has a property right on the amount to divide. In such a context, the fair split corresponds to the equal one. Thereafter, we could say that if a subject proposes an amount weaker than the equal split, she has unkind intentions; otherwise she has kind intentions.

I_i represents player i's intentions towards player $i+1$. If player i has kind intentions then $I_i = 1$, otherwise $I_i = 0$. Intentions between opponents are weighted by δ.

I_{n-1} represents the intentions of player $(n-1)$ towards player n. If she has kind intentions then $I_{n-1} = 1$, otherwise $I_{n-1} = 0$. Intentions towards the decision-maker are weighted by φ.

We assume that the decision-maker is more sensitive to intentions towards her than her opponents, i.e. $\varphi > \delta$.

[H6]: Complete information

The decision maker has complete information about opponents' actions and the payoffs distribution, since she infers the kindness of her opponents through her personal observation of their actions[4].

With these hypotheses, the utility function is written as follows:

$$\begin{aligned} u_n(x) = {} & x_n + \eta_n \frac{2((n_{opp}-2))!}{n_{opp}!} \sum_{i \in [0;n-1[} max\{x_i - x_{i+1};0\} - \chi_n \frac{2((n_{opp}-2)!)}{n_{opp}!} \sum_{i \in [0;n-1[} max\{x_{i+1} - x_i;0\} \\ & -\alpha_n \frac{1}{n_{opp}} \sum_i \max\{x_i - x_n;0\} + \beta_n \frac{1}{n_{opp}} \sum_i \max\{x_n - x_i;0\} + \delta_n I_i + \varphi_n I_{n-1} \end{aligned} \quad (1)$$

[4] It is a simplifying hypothesis but this avoids an important aspect: the decision-maker's belief about what the opponents believe about her acceptance threshold. According to this belief, opponents' action can be seen as a kind or unkind action.

Example with a two-player game

Characteristics of the decision-maker's utility function

Depart from our hypotheses we establish the utility function in the case of a two-player game with a take-it-or-leave-it offer, such as ultimatum games. Let i the proposer and n the decision-maker. Decision-maker's utility function becomes in such context:

$$u_n(x) = x_n - \alpha_n max\left\{x_i - x_n; 0\right\} + \beta_n max\left\{x_n - x_i; 0\right\} + \varphi_n I_i \tag{2}$$

where x_n and x_i denote the monetary payoffs to the decision-maker's and the proposer.

The associated marginal utilities are given by

$$\frac{\partial u_n(x)}{\partial x_n} = \begin{cases} 1+\alpha_n & if \;\; x_n < x_i \\ 1 & if \;\; x_n = x_i \\ 1+\beta_n & if \;\; x_n > x_i \end{cases} \tag{3}$$

Marginal utility is constant, positive and reaches its minimum in case of equal split and increases with inequities. An increasing in decision-maker's payoff has a higher impact on her utility if her payoff is weaker than that of her opponent. This result is in contradiction with those found by Ottone and Ponzano (2005) where marginal utility is positive, linear and decreasing but also contrary to F&S who obtain a constant and positive marginal utility that is minimal in case of advantageous inequity. These contradictions are mostly explained by the taste for advantageous inequity (hypothesis [H2]).

In order to determine the best response strategy, we normalize the amount of the initial endowment (X=1) and we note s the proposer's offer. The utility function can be written as follows:

$$u_n(s) = s - \alpha_n max\left\{1-2s; 0\right\} + \beta_n max\left\{2s-1; 0\right\} + \varphi_n I_i$$

According to the hypothesis [H4], acceptance will be a best response strategy if:

$$s \equiv \begin{cases} s_H \in \left]0.5;1\right] & \text{always} \\ s_E \in \left\{0.5\right\} & \text{always} \\ s_B \in \left[0;0.5\right[& \text{if } s_B \geq \max\left\{\dfrac{\alpha_n}{1+2\alpha_n};0\right\} \end{cases} \tag{4}$$

and to reject otherwise.

PROOF: Appendices A

Results confirm that a payoff at least equal to the equal split will be always accepted whereas the acceptance of a weaker payoff will depend on the weight of inequity aversion.

Confrontation between theoretical predictions and experimental results

This utility function provides an explanation of traditional results obtained in ultimatum games. Since the experiment of Güth et al., (1982), various experiments are carried out and it results that, when the initial endowment is 100:

1/ Modal offer is the division 60/40, which leads to:

$$u_n = 40 - \alpha_n Max\{(60-40);0\} + \beta_n Max\{(40-60);0\} + \varphi_n I_i$$

$$u_n = 40 - 20\alpha_n$$

$$u_n \geq 0 \; if \;\; \alpha_n \geq 2$$

The first condition is $\alpha_n \leq 2$.

2/ Offers lower than 20 are generally rejected:

$$u_n = 20 - \alpha_n Max\{(80-20);0\} + \beta_n Max\{(20-80);0\} + \varphi_n I_i$$

$$u_r = 20 - 60\alpha_r$$

$$u_n < 0 \quad if \quad \alpha_n > 1/3$$

Thus, for $\forall \alpha \in \left]\frac{1}{3}, 2\right]$, our model is able to predict correctly experimental regularities observed in ultimatum games.

Nonetheless, with a two-player game, the opponents' payoffs difference cannot intervene in the decision-maker's utility function. To test the influence of differences in opponents' payoffs the use of a game including at least three players is required. This leads us to use data obtained in a three-player dictator-ultimatum game (Bonein & Serra, 2007) and then we will test the relevance of each one of the utility function components.

III. EXPERIMENTAL DESIGN AND PROCEDURE

Game

We conduct a three-player dictator-ultimatum game experiment which proceeds as follows. Player 1, who has the opportunity to divide an amount of money, makes an offer to player 2. This player has no veto power. She has only to propose a division of player 1's offer to player 3. Finally, player 3 - the decision-maker - has the opportunity to reject or accept player 2's offer. In the first case, all players obtain zero, whereas in the second case each player receives the payoff contracted.

Most of studies on ultimatum games focus on proposer's behavior. Responders figure briefly in the analysis when it comes to examine rejections. Their behaviors are difficult to explore in more details since usual experiments allow them only to respond to a single offer. This generates a single observation for each pair of subjects. Although the ultimatum game allows responders to accept or reject an offer, it does not indicate how responders might react to other possible offers. It thus gives us only limited purchase on what is driving responder's choices. To overcome that, we rely on the Strategy Method - proposed by Selten (1967) - where responders have to indicate whether they will accept or reject each possible offer. The use of the Strategy Method, within this framework, has two advantages. First of all, offers made in ultimatum games are in general close to the equal split and, as a consequence, there is no rejection and the experimenter can not learn on subjects' capacity to accept or reject weak offers (Camerer & Fehr, 2004). The Strategy method provides information about responders' behaviors that are rarely observed in traditional experiments. Secondly, Strategy Method is essential to display the complete behavior of subjects as well as to know their true motivations[5].

This paper aims at highlighting the determinants of decision-maker's decision-makers' (player 3) behaviors. To that purpose, all players have complete information, i.e. player 2 knows the amount of player 1's initial endowment and player 1's offer when she takes her

[5] Economic theory supposes that individual preferences do not depend on the method of elicitation employed and preferences are stable. Nevertheless, data obtained with this method need some scrutiny since previous researches have shown that the method used implies differences in many situations. Oxoby and McLeish (2004) show however that behaviors observed in the ultimatum game are stable and invariant to experimental protocol. Similarly, Brandts and Charness (2000) experiment a prisoner dilemma game with two treatments of information: "hot" and "cold" treatment. They show that if the representation of the game is the same, there is no difference in results between these two treatments. They conclude that "*The Strategy Method may be a valid method for collecting a rich data set without affecting subjects' decisions significantly.*", (Brandts and Charness, 2000, p. 234).

decision. Similarly, when player 3 decides whether to accept or reject player 2's offer, she knows the amount of the initial endowment as well as the player 1's offer to player 2. Moreover, player 3 has the opportunity either to decide refuse player's 2 shares, whatever the amount, or to accept it starting from a threshold. We make the assumption of monotonicity in player 3's threshold (i.e. if player 3 establishes her threshold of Minimum Acceptable Offer (MAO) at a level x - for a given player 1's offer - then we suppose that she accepts all player 2's offers at least equal to x)[6].

At the beginning of the experiment, subjects drew cards to determine their role. The game is repeated 5 times, with a strangers design, but only one period, randomly chosen at the end of the experiment, has been paid.

Since we have used the Strategy method to determine the complete behavior of player 2 too, the final results are obtained according to the following process. For player 1's offer, we have associated player 2's share, and once this division selected, we have observed player 3's decision.

Altogether, seven sessions with 18 or 21 subjects by session, are conducted at the University Montpellier I. The 129 participants are mostly undergraduates' students and no subjects participate twice at the experiment. Subjects were given written instructions[7]. After all subjects have read instructions, an oral version was given. Then they had to fill out a questionnaire assessing their complete understanding of instructions. Once this questionnaire corrected, the experiment began.

Each session lasted for about one hour, starting for admission and ending with their remuneration. Subject's remuneration included a show up and the amount corresponding to their performance in the experiment.

IV EXPERIMENTAL RESULTS

We focus on the choices of critical third players, i.e. players whose choices determine whether the allocation is accepted or not. We proceed in two steps. We study firstly decisions undertaken in the first period to present the instantaneous behavior. Then we analyze the trend of decisions during the five repetitions.

[6] Studies using the Strategy method suggest that the logic of responses varies. Mitzkewitz and Nagel (1993) find that almost subjects are monotonic in their behavior. Conversely Bahry and Wilson (2006) show a violation of strict monotonicity.

[7] Instructions are available upon a request to authors.

Results obtained in period 1

First of all[8], among possible decisions, player 3 has the opportunity to reject all player 2's offers, for a given player 1's offer. We call this decision "*categorical rejection*". We note a substantial heterogeneity in individuals' behaviors (Fig. 1). 37.21% of subjects establish no "*categorical rejection*" whereas 62.79% of subjects decide to reject all player 2's offers for at least a given player 1's offer. The average "*categorical rejection*" is equal to 22.04% of player 1's endowment.

When player 3 doesn't reject all player 2's offers, for a given player 1's offer, they decide either to accept all player 2's offers – for a given player 1's offer – or to accept it starting from a threshold. Yet heterogeneous behaviors are observed. Only 2.33% of subjects act as game theory predicts and thresholds observed are sensitive to player 1's share. The modal MAOs is close to the equal split: 46.52% of subjects establish their threshold between 40% and 50% of player 1's offer to player 2. It is noteworthy to point out that 18.60% of subjects wish, on average, more than one half of player 1's offer (Fig. 2).

Knowing player 3's decision for each player 1's offer to player 2, we study the correlation between player 1's offer and the threshold established by player 3. If we avoid the decisions corresponding to the "*categorical rejections*", 54.76% of subjects demand an increasing share of player 1's offer (nonetheless only 48% of these correlations are significant at the 1% level). Conversely 45.24% of subjects demand a decreasing share of player 1's offer (74% of these correlations are significant at the 1% level). This last behavior suggests that the decision-maker does not take into account the amount obtained by player 2 when she takes her decision. She solely wants to obtain a significant amount. The sensitivity of player 1's offer on player 3's decision is confirmed by two regressions. We provide an econometric analysis of the absolute value of threshold and then of the relative value. Moreover, the data at our disposal allow us to use aggregate and individual information. However, for this last, the use of the Strategy method that provides several observations per subjects (one observation for each player 1's possible offer) requires using panel data to control for individual unobserved characteristics[9]. We rely on the Hausman test to determine whether a fixed or random specification is most appropriate. For both regressions the Hausman test suggests

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[8] Neither the Kruskal Wallis test nor the Mann Withney test reveal significant differences between each session. As a consequence, we study all data obtained as a whole.

[9] The use of panel method with data obtained by means of the Strategy method is usual (See for example Slonim, 2006).

rejecting the null hypothesis of random effects in favour of the fixed-effects models[10]. Finally, a cubic relation seems to exist between player 1's offer and player 3's threshold. In order to have an indication as to whether this specification is reasonable for the case under analysis, we proceed at linear and cubic regressions. For this last specification, we use centred variables to control for multicolinearity. Lastly, for all regressions, The Cochrane-Orcutt method is used to control for first-order auto-correlation and the White correction to control for heteroscedasticity. Standard errors shown in parentheses are robust.

Results reported in Tables 1 and 2 support the strong and positive influence of player 1's offer on threshold established by player 3, both at the aggregate and individual levels. Player 1's intentions towards player 2 are not significant which suggests that the decision-maker does not care about the fairness of the division between opponents. If we look at results of the relative value of thresholds, we note that the cubic specification is justified only at the aggregate level. Finally, whatever the specification - cubic or linear - the positive influence of player 1's offer on player 3's decisions is confirmed.

Evolution of behaviors

The game is repeated five times to study a possible learning effect[11]. At each new period, subjects knew the issue of the previous game – accepted or rejected – and the gains obtained by each player. One time this information revealed, a new period began and subjects knew that they cannot have the same partners.

If we look at Figure 3, we note a slight decreasing trend of thresholds. Thresholds go in direction of the theoretical equilibrium without reaches it. This small learning effect is confirmed by the Friedman test ($\chi^2(4) = 122.918, p < 0.001$). A closer inspection of thresholds at the individual level underlines the disappearance of thresholds at least equal to 60% of player 1's offer depart from the second period whereas the modal thresholds remains between 40% and 50% of player 1's offer during the five repetitions.

If we turn to the "*categorical rejections*", the learning effect is less pronounced (Figure 4). The average level observed in period 5 is quite similar to that of period 1 (21.77% and 22.03% respectively) and the frequency of subjects who decide to establish at least one

[10] The results are as follows: = 8.08, p=0.00176 for regression (iii), H=7.45, p=0.0063 for regression (iv) (Table 1) and H= 12.19, p=0.0159 for regression (e), H=11.18, p=0.0108 for regression (f), H= 8.08, p=0.0176 for regression (g), H=7.45, p=0.0063 for regression (h).

[11] More repetitions would be necessary to study a learning effect but we are constrained by the duration of the experiment. For five repetitions, the experiment lasted one hour. Moreover, since it is a three-player game and players have different partners at each period, more repetitions would imply more subjects for an experiment and we are constrained by the number of computer too.

"*categorical rejection*" tends slowly to decrease. This leads to similar categorical rejections, whatever the period considered. In all periods, the modal "*categorical rejection*" remains established between 20% and 30% of player 1's endowment and the frequency of subjects who establish "*categorical rejections*" until 50% or more of player 1's endowment does not decrease.

These findings suggest that five repetitions are insufficient to allow a clear learning effect. As a consequence, decisions undertaken at the beginning and at the end of the game are quite similar.

All these results do not provide any information about the determinants that affect individuals' behaviors and incite them to reject some divisions. To that purpose, we provide an econometric analysis with data collected during the experiment. The first data period only are used to avoid any potential influences of previous decisions or the result of the previous game on decisions.

V ROBUSTNESS

Methodology

We provide an econometric analysis to confirm or deny our hypotheses. The utility function of the decision-maker depends on the one hand on the monetary payoff of the decision-maker and, on the other hand, on payoffs differences, in differentiating disadvantageous from advantageous inequity. So, the decision-maker's utility function is given by

$$u_3(x)=x_3+\eta_3\, max\left\{x_1-x_2;0\right\}-\chi_3\, max\left\{x_2-x_1;0\right\}-\alpha_3\frac{1}{n_{opp}}\sum_i \max\left\{x_i-x_3;0\right\} \\ +\beta_3\frac{1}{n_{opp}}\sum_i \max\left\{x_3-x_i;0\right\}+\delta_3 I_1+\varphi_3 I_2 \tag{5}$$

where $u_3(x)$ denote the decision-maker's utility, x_3 her monetary payoff and x_i the monetary payoff of opponent i, with $i=\left\{1,2\right\}$.

In order to investigate on the relevance of each one of these factors in the utility of the decision-maker, we provide an econometric analysis. However, data obtained in our experiment do not provide the exact value of the decision-maker's utility. So a transformation is required. For that, we associate the individual's utility to the probability of rejection since we know, for each allocation, whether the decision-maker accepts or rejects the proposed allocation. Set the probability of rejection equal to 1.

We can say, according to the hypothesis [H4], that if the decision-maker accepts the division, this means that she obtains a positive utility with the proposed allocation. In a same manner, if she rejects it, this means that she obtains a negative utility. In other words, if a given variable leads the decision-maker to reject the proposed allocation (i.e. it acts positively on the probability of rejection) this suggests that this variable acts negatively on her utility. Conversely, if a given variable leads the decision-maker to accept the proposed allocation (i.e. it acts negatively on the probability of rejection) this suggests that this variable acts positively on her utility. This modelling enables us to use a Logit specification given by[12]

$$\begin{aligned}p(y=1) = \gamma_0 c + \gamma_1 x_3 + \gamma_2\, max\left\{x_1 - x_2; 0\right\} + \gamma_3 max\left\{x_2 - x_1; 0\right\} + \gamma_4 \\ \frac{1}{n_{opp}}\sum_i \max\left\{x_i - x_3; 0\right\} + \gamma_5 \frac{1}{n_{opp}}\sum_i \max\left\{x_3 - x_i; 0\right\} + \gamma_6\, I_1 + \gamma_7\, I_2 + \varepsilon_3\end{aligned} \tag{6}$$

where $\gamma_0 \ldots \gamma_7$ denote parameters to be estimated.

Nonetheless equation (1.6) cannot be immediately estimated. A collinearity problem occurs among the monetary payoff of the decision-maker and the advantageous and disadvantageous inequity between the decision-maker and the opponents. To avoid this problem the monetary payoff of the decision-maker is transformed into three dummies variables

$$\begin{cases} x_{31} = 1 \quad if \quad x_3 = 0 \; and \; 0 \; otherwise \\ x_{32} = 1 \quad if \quad 0 < x_3 < \frac{1}{3}\mathrm{X} \; and \; 0 \; otherwise \\ x_{33} = 1 \quad if \quad x_3 \geq \frac{1}{3}\mathrm{X} \;\; and \; 0 \; otherwise \end{cases} \tag{7}$$

The first dummy variable corresponds to the prediction of game theory (x_{31}). The second corresponds to a monetary payoff small that an equal split of the initial endowment (x_{32}). Finally, the third dummy variable corresponds to an offer equal or higher than an equal split of the initial endowment (x_{33}). One of these three dummy variables has to be dropped in the

[12] We suppose that the probability of rejection depends lineary on all elements of the decision-maker's utility function.

estimation process to avoid a problem of collinearity. We choose the variable that has the strongest correlation with other explanatory variables, i.e. x_{33}.

As we have previously seen, the Strategy method provides a richer information set (the knowledge of decision-maker's decision for each player 1's possible offer) and several observations per individuals which lead us to apply panel data techniques. We estimate is a fixed-effect Logit model. The iteration process uses the conditional likelihood to obtain convergent estimates. Nonetheless, the conditional likelihood does not provide the value of fixed-effects and excludes data of individuals for whom the dependent variable is the same in all alternatives (i.e. the probability of rejection is either 0 or 1 for all player 1's offers). This last point explains that in results reported in Table 4 we have 42 individuals although 43 individuals have taken part in the experiment.

Estimations

We estimate fixed-effects Logit model to compare the accuracy of the model of F&S and the one we propose. We recall that compared to F&S, we assume that opponents' payoff differences act significantly on the decision-maker's utility. Secondly the decision-maker has a taste for advantageous inequity between her and her opponents. Thirdly we introduce a simple element of reciprocity.

To that purpose, we apply to the F&S's model the same modifications applied to the presented model. In other words, we transform the utility function into the probability of rejection and the decision-maker's monetary payoff is transformed into three dummy variables. In the model proposed by F&S, the utility function includes the monetary payoff of the decision-maker, the average of payoffs differences between the decision-maker and the opponents. Moreover, these differences act negatively on the utility whether they are advantageous or disadvantageous. The F&S's utility function is given by

$$U_3(x) = x_3 - \alpha_3 \frac{1}{2}\sum_i \max\{x_i - x_3; 0\} - \beta_r \frac{1}{2}\sum_i \max\{x_3 - x_i; 0\} \tag{8}$$

And the correspoding logit specification

$$\begin{aligned} p(y=1) &= \gamma_0 c + \gamma_1 x_{31} + \gamma_2\, x_{32} + \gamma_3 x_{33} + \gamma_4 \frac{1}{2}\sum_i \max\{x_i - x_3; 0\} \\ &+ \gamma_5 \frac{1}{2}\sum_i \max\{x_3 - x_i; 0\} + \varepsilon_3 \end{aligned} \tag{9}$$

where γ denotes the vector of parameters to be estimated.

Column 1 reports the results of the pioneering model of F&S. We note that a payoff smaller than the payoff which corresponds to the equal split acts positively on the probability of rejection. In other words, the decision-maker’s utility is increasing with her payoff. We also note that disadvantageous inequity acts positively on the probability of rejection that confirms disadvantageous inequity aversion. However, our results deny advantageous inequity aversion since this variable has a strong negative influence on the probability of rejection. This means that the decision-maker has a taste for advantageous inequity. This last point is in contradiction with F&S’s hypothesis and attenuates the relevance of fairness as an explanation of observed behaviors. This result could be explained by the hypothesis of monotonicity in threshold of MAOs. Nonetheless, this hypothesis holds for player 2’s division only, since we suppose monotonicity in threshold of MAOs for a given player 1’s division. For example, the decision-maker could reject high player 1’s division (by rejecting all player 2’s divisions, whatever the amount) and she could accept smaller division.

We proceed now by step to measure the influence of each proposed extension. Depart from the model of F&S, the addition of opponents' payoffs differences increases the predictive power of the model for the decision of acceptance but decreases that for the decision of rejection (column 2). Even if the average predictive power is better than that of the pioneering model the Akaike information criterion suggests keeping the pioneering model of F&S. It is noteworthy that opponents’ payoffs differences are significant at the 1% level.

A different conclusion occurs when we add intentions to the model of F&S (column 3). In that case, beyond the significance of all variables at the 1% level (except dummy variables corresponding to the monetary payoff of the decision-maker which are significant at the 5% level), we obtain the best model with regard to the accuracy.

Finally, the addition of both opponent's payoffs differences and intentions (column 4) points out the non-significance of intentions underlying opponent's division which leads us to exclude the intentions between opponents and to reestimate the parameters of the model.

This last estimation (column 5) allows us to confirm all of our hypotheses (except intentions between opponents). It appears that the decision-maker's utility is increasing with her monetary payoff and the advantageous inequity between the decision-maker and the opponents. Conversely, the utility is decreasing with disadvantageous inequity. Opponents' payoffs differences are significant and they have the expected sign. This result highlights a new pattern in social preferences models. In previous models, only payoffs differences between the decision-maker and the opponents were significant. Results presented here highlight the influence of inequity between opponents on the decision of acceptance or rejection. Nonetheless, they hide selfish motivations: the decision-maker wants to maximise her payoff and doesn't care to equality between her opponents *per se*. Depart from this result we can deduce that - in our experiment - if player 2 obtains only a small share, this does not constitute a motivation to reject the allocation. This result has been already observed in the experiment of Güth and Van Damme (1998), who explain it by a decision-maker's strategic behavior: the decision-maker seeks to maximize her expected payoff without being concerned about other players' payoff. Lastly intentions underlying the division proposed to the decision-maker act positively on the utility which suggests that the decision-maker is sensitive to intentions, even if they are formalised in a simple way.

With regard to these results and statistical criteria (Akaike information criterion, McFadden R-square, % of good predictions), it appears that proposed extensions have a strong influence on the decision-maker's utility and increase the accuracy of the model (on average 84%). Results of the fixed-effect Logit model confirm the conclusion of our experiment: the decision-maker is not solely motivated by fairness concern. The decision-maker wants to punish an unfair behavior toward her as well as to obtain a high monetary payoff.

Depart from these results the decision-maker's utility function is given by

$$\begin{aligned} u_3(x) = x_3 + \eta_3\, max\left\{x_1 - x_2;0\right\} - \chi_3\, max\left\{x_2 - x_1;0\right\} - \alpha_3 \frac{1}{n_{opp}} \sum_i \max\left\{x_i - x_3;0\right\} \\ + \beta_3 \frac{1}{n_{opp}} \sum_{i \neq n} \max\left\{x_3 - x_i;0\right\} + \varphi_3 I_2 \end{aligned} \tag{10}$$

One may then determine the marginal utilities. They depend on the ranking of payoffs between the three players:

$$\frac{\partial U_3(x)}{\partial x_3} = \begin{cases} 1+\beta_3 & if \quad x_3 > x_1 > x_2,\ x_3 = x_1 > x_2, x_3 > x_2 = x_1, \\ & \quad\ x_3 > x_2 > x_1,\ x_3 = x_2 > x_1 \\ 1 & if \quad x_1 = x_2 = x_3 \\ 1+\alpha_3+\beta_3 & if \quad x_1 > x_3 > x_2,\ x_2 > x_3 > x_1 \\ 1+\alpha_3 & if \quad x_1 > x_2 > x_3,\ x_1 > x_2 = x_3, x_1 = x_2 > x_3, \\ & \quad\ x_2 > x_1 > x_3,\ x_2 > x_1 = x_3 \end{cases} \tag{11}$$

As we have seen in the two-player game, marginal utilities are positive and constant (i.e. independent of decision-maker's monetary payoff). Marginal utilities are increasing with inequities. In other words, it reaches its maximum in case of both advantageous and disadvantageous inequities (i.e. when player 3 obtains a payoff between than those of player 1 and player 2), then a little smaller in case of disadvantageous inequities, then in case of advantageous inequities and minimal in case of equal split.

Furthermore, acceptance is the best response strategy for the decision-maker *iff*

$$s = \begin{cases} s_H \in \left]\frac{1}{3};1\right] & always \\ s_M \in \left]\frac{1}{3};\frac{1}{2}\right] & always \\ s_E \in \left\{\frac{1}{3}\right\} & always \\ s_{MB} \in \left[0;\frac{1}{2}\right[& s_{MB} \geq s^A(\alpha,\chi,\beta,\eta,x_2) \\ s_B \in \left[0;\frac{1}{3}\right[& s_B \geq s^A(\alpha,\chi,\beta,\eta,x_2) \end{cases} \tag{12}$$

and to reject otherwise.

PROOF: Appendices B

Equation (12) confirms the self-centered motivations of the decision-maker. If the decision-maker obtains a payoff at least equal to the payoff corresponding to the equal split, the best response strategy consists in accepting it, whatever the payoffs of other players. On the contrary, the acceptance of payoff smaller than the amount corresponding to the equal split depends on the weights affected of inequities.

VI CONCLUSIONS

We propose to extend the pioneering model of inequity aversion of F&S in three ways. The first one consists in introducing payoffs differences between opponents. The second refers to payoffs inequities between the decision-maker and the opponents in which we allow subjects having a taste toward advantageous inequities. Finally, we introduce in a simple way reciprocity through dummy variables that represents player's intentions. Individuals in strategic interactions usually reject positive offer. Through this act, they reject clearly the hypotheses of the traditional economic paradigm. This paper aims at highlighting the determinants of such decision. To that purpose, we run an experiment on a three-player dictator-ultimatum game and then we provide an econometric analysis with collected data. Fixed-effect Logit models confirm the relevance of proposed extensions. The decision-maker care about inequities between opponents, but this last does not suggest a concern for fairness. On the contrary, the decision-maker is sensitive to opponents' payoffs differences so as to punish a potential unfair behavior towards her. Such self-centered interest is confirmed by the taste for advantageous inequity between the decision-maker and the opponents and intentions too. Proposed extensions enhance the accuracy of the pioneering model of F&S, notably for the decision of acceptance. Predictions provided by the extended model are robust with rejections observed in ultimatum games: subjects are not solely concerned by their own payoff, they care to payoffs inequities between them and the opponents, intentions and inequities between opponents too. Nonetheless, our findings attenuate the relevance of fairness motivation as an explanation to rejection of positive offers: results underline that motivation can be selfishness. We rejoin on this point Engelmann and Strobel (2004). Two directions for further researches would be interesting. The first one consists in confronting the extended model to data obtained in other environments where altruism or cooperation prevail in individuals' behaviors. The second refers to the specification used to introduce reciprocity. Dummy variables are certainly the easiest way to introduce reciprocity into models of inequity aversion. A next step consists in using the psychological game theory to formalize reciprocity. This method enables to take into account beliefs and the revision of beliefs in the decision process.

Acknowledgements

The author tanks participants at the ESA European Meeting Conference (Nottingham, September, 2006), the AFSE Congress (Paris, September, 2007), the LAMETA Annual meeting (Montpellier, November, 2007), Thierry Blayac, George Bresson, Heike Hennig-Schmidt, Brice Magdalou, Stéphane Turolla for their helpful comments and methodological advices. Lastly, we grateful thank the Laboratory of Experimental Economics of Montpellier for its financial support, Yves Rolland and Jeremy Celse for helping with the running of the experiments.

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Fig. 1 Heterogeneity in categorical rejections during the first period

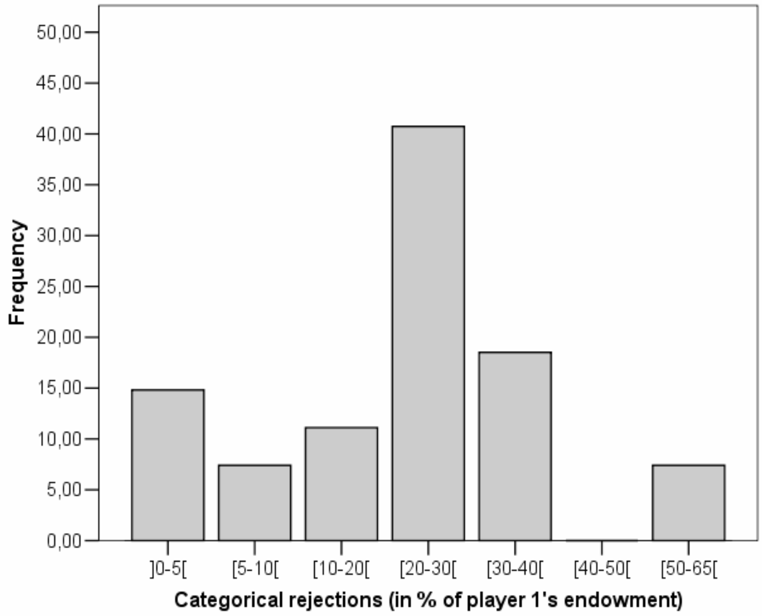

Fig. 2 Heterogeneity of MAOs during the first period

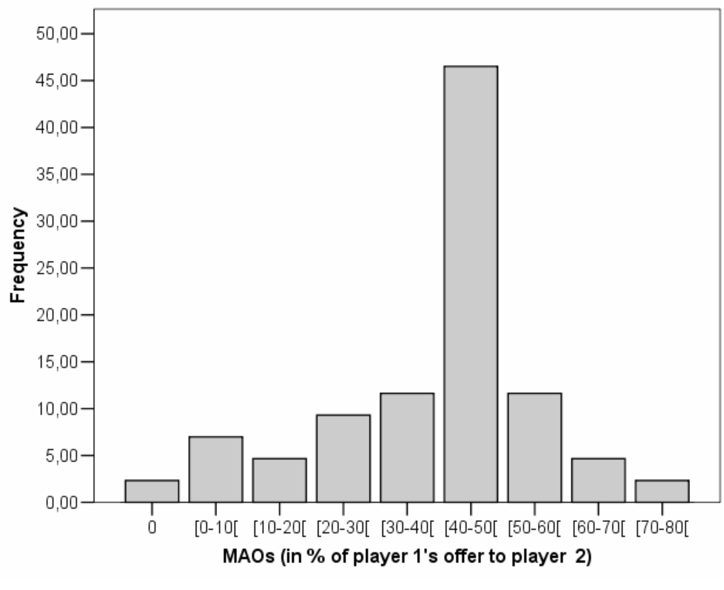

Table 1 OLS regressions with fixed effects on the value of MAO

	Aggregate data		Individual data	
	(i)	(ii)	(iii)	(iv)
Constant	-0.1116	-0.0503	-	-
	(0.1228)	(0.1135)		
Player 1's offer	0.4218***	0.4154***	0.3455***	0.3447***
	(0.0073)	(0.0047)	(0.0120)	(0.0083)
Player 1's intentions[a]	-0.1941	-	-0.0208	-
	(0.1733)		(0.1887)	
Adjusted R^2	0.9947	0.9942	0.659	0.659
Nb observations	40	40	1480	1480
Nb individuals	-	-	43	43
Akaike information criteria	-10.0443	-10.7359	7006.124	7004.132
F stat	3687.49	6734.85	886.24	1710.23
Prob > F	0.000	0.000	0.000	0.000
Log likelihood	8.0221	7.3679	-3500.062	-3500.066

Robust standard errors in parentheses. *** significant at 1% level.

[a]=0 if player 1 makes an offer lower than the equal split to player 2 and 1 otherwise.

Table 2: OLS and cubic regressions with fixed-effects on relative MAOs

	Aggregate data				Individual data			
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Constant	21.2457***	21.2445***	-0.2790	-0.1257	-	-	-	-
	(0.1628)	(0.1405)	(0.3070)	(0.2838)				
Player 1's offer	-	-	1.0544***	1.0386***	-	-	0.8637***	0.8617***
			(0.0184)	(0.0119)			(0.0301)	(0.0208)
Centering player 1's offer	0.9792***	0.9788***	-		0.9644***	0.8916***	-	-
	(0.0299)	(0.0200)			(0.0411)	(0.0379)		
(Centering player 1's offer)^2	-0.0006	-0.0007	-		0.0031	-0.0021	-	-
	(0.0009)	(0.0007)			(0.0022)	(0.0020)		
(Centering player 1's offer)^3	0.0002***	0.0002***	-		-0.0002	-0.0001	-	-
	(0.0001)	(0.0001)			(0.0002)	(0.0002)		
Player 1's intentions[a]	-0.0073	-	-0.4854		-1.2207**	-	-0.0521	-
	(0.4309)		(0.4333)		(0.5610)		(0.4718)	
Adjusted R^2	0.9975	0.9976	0.9947	0.9942	0.6613	0.6607	0.6599	0.6599
Nb observations	40	40	40	40	1480	1480	1480	1480
Nb individuals	-	-	-	-	43	43	43	43
Akaike information criteria	60.8554	58.8564	63.2589	62.5673	9716.316	9716.757	9718.345	9716.352
F stat	3899.85	5360.90	3687.49	6734.86	498.36	662.78	886.24	1710.23
Prob > F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Log likelihood	-25.4277	-25.4281	-28.6294	-29.2836	-4853.158	-4854.379	-4856.172	-4856.176

Robust standard errors in parentheses. *** significant at 1% level; ** significant at 5% level

[a]=0 if player 1 makes an offer lower than the equal split to player 2 and 1 otherwise.

Fig 3: Evolution of MAOs

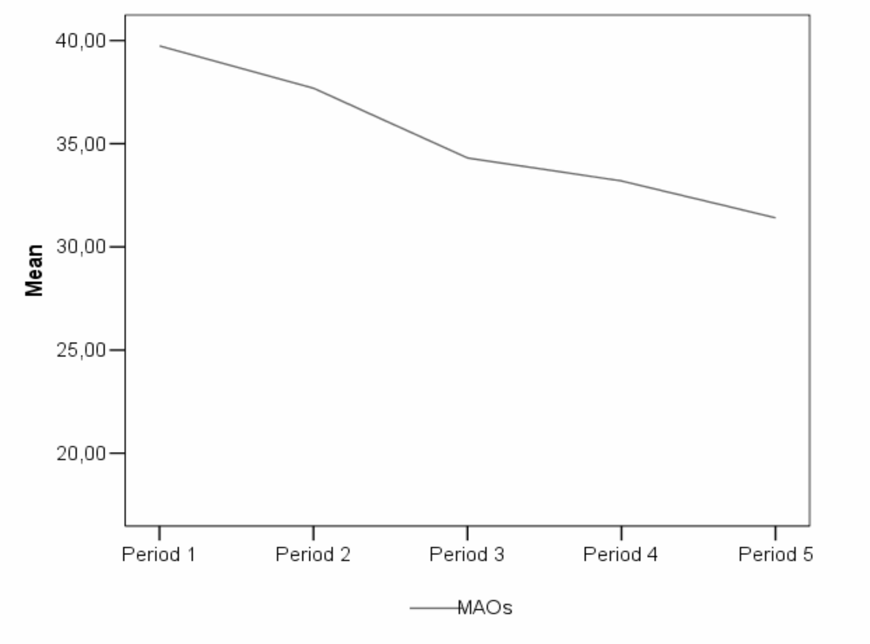

Fig 4: Evolution of categorical rejections

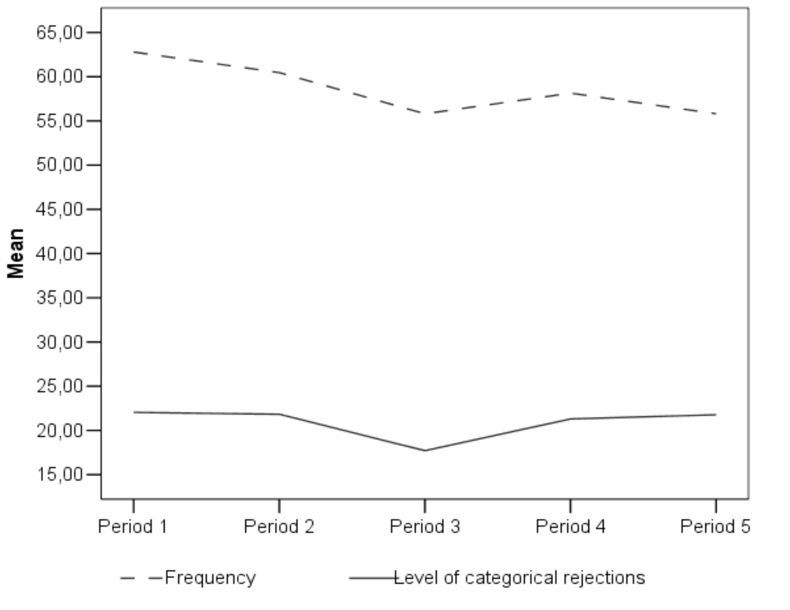

Table 3: Fixed-effects Logit on the probability of rejection

	Model F&S	Model F&S with opponents' payoffs differences	Model F&S With intentions	Complete model	Restricted model
	(1)	(2)	(3)	(4)	(5)
x_{31}	0.5271***	0.2657***	0.2205**	0.1891**	0.1879**
	(0.0979)	(0.0919)	(0.0981)	(0.0968)	(0.0963)
x_{32}	0.3761***	0.2692***	0.1284**	0.1345***	0.1334***
	(0.0493)	(0.0475)	(0.0512)	(0.0506)	(0.0502)
x_{33}	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*
Dis. Inequity (1/2)	-	-0.0276***	-	-0.0115***	-0.0118***
		(0.0016)		(0.0021)	(0.0020)
Adv. Inequity (1/2)	-	0.0076***	-	0.0059***	0.0066***
		(0.0016)		(0.0022)	(0.0017)
Dis. Inequity (i/3)	0.1070***	0.0892***	0.0757***	0.0740***	0.0733***
	(0.0035)	(0.0036)	(0.0036)	(0.0041)	(0.0040)
Adv. Inequity (i/3)	-0.0250***	-0.0167***	-0.0108***	-0.0079***	-0.0073***
	(0.0023)	(0.0021)	(0.0025)	(0.0025)	(0.0023)
Player 1's intentions[a]	-	-	0.2595***	0.0282	-
			(0.0328)	(0.0494)	
Player 2's intentions[b]	-	-	-1.0957***	-0.8765***	-0.8741***
			(0.0394)	(0.0455)	(0.0454)
Akaike information criteria	26938.69	27852.96	24308.61	25210.05	25266.80
Log L restricted	-22052.82	-22052.82	-22052.82	-22052.82	-22052.82
Log L unrestricted	-13465.35	-13920.48	-12148.31	-12597.02	-12626.40
LR χ^2	17174.95	16264.69	19809.04	18914.49	18852.85
Prob > χ^2	0.000	0.000	0.000	0.000	0.000
% concordant predictions (Y=1)	90.77	86.97	83.85	87.87	79.67
% concordant predictions (Y=0)	68.61	80.13	83.87	80.16	86.11
R^2 McFadden	0.39	0.37	0.45	0.43	0.43
Nb observations	36120	36120	36120	36120	36120
Nb individuals	42	42	42	42	42

Robust standard errors in parentheses. *** significant at 1% level; ** significant at 5% level

[a]=0 if player 1 makes an offer lower than the equal split to player 2 and 1 otherwise.

[b]=0 if player 2 makes an offer lower than the equal split to player 2 and 1 otherwise

APPENDICES

Appendices A: Acceptance as a best response strategy in a two-player game with take-it-or-leave-it offer

The decision-maker takes the decision that maximises her utility function. The decision-maker's utility function is:

$$u_n(s) = s - \alpha_n max\{1-2s;0\} + \beta_r max\{2s-1;0\} + \varphi_n I_i$$

Three situations could appear:

1/ If $s > 1/2$ acceptance will be the best response strategy. In fact, in such a situation, utility function becomes: $u(s) = s + \beta_n(2s-1) + \varphi_n$ which is strictly positive (with β_n >0 and $\varphi_n > 0$). Thus acceptance leads to a higher level of utility than the rejection.

2/ The same result occurs for $s = 1/2$. In that case, the utility function can be written as follows: $u(s) = s + \varphi_n$; $U_n(s) > 0$ due to hypothesis [H5] according to which $\varphi_n > 0$

3/ If $s < 1/2$, the utility function becomes: $u(s) = s - \alpha_n(1-2s)$. Acceptance will be the best response strategy if and only if $s \geq \dfrac{\alpha_n}{1+2\alpha_n}$.

Appendices B: Acceptance as a the best response strategy in the three-player dictator-ultimatum game

The decision-maker takes the decision that maximises her utility function:

$$U(s) = s + \eta_3 \max\{1-s-2x_2, 0\} - \chi_3 \max\{-1+s+2x_2, 0\}$$
$$-\alpha_3 \frac{1}{n_{opp}} \max\{x_i - s, 0\} + \beta_3 \frac{1}{n_{opp}} \max\{s - x_i, 0\} + \varphi_3 I_2$$

with $i = \{1,2\}$.

Several situations are likely to occur.

1/ If $s > 1/3$ acceptance will be the best response strategy. In that case the utility function depends on the ranking of payoffs between the three players and four situations are likely to occur:

- If $x_3 > x_1 > x_2$: $U(s) = s + \eta_3(1 - s - 2x_2) + \beta_3 \frac{1}{2}(3s - 1) + \varphi_3$
- If $x_3 = x_1 > x_2$: $U(s) = s + \eta_3(3s - 1) + \beta_3(3s - 1) + \varphi_3$
- If $x_3 > x_1 = x_2$: $U(s) = s + \beta_3 \frac{1}{2}(3s - 1) + \varphi_3$
- If $x_3 > x_2 > x_1$: $U(s) = s - \chi_3(-1 + s + 2x_2) + \beta_3 \frac{1}{2}(3s - 1) + \varphi_3$

In these four cases, utility will always be strictly positive since $s > 1/3$ and $\alpha > \chi > \beta > \eta > 0$ and $\{\chi, \beta, \eta\} \in]0,1[$.

2/ If $s \in \left]\frac{1}{3}, \frac{1}{2}\right[$, acceptance constitutes the best response strategy. This situation occurs if and only if $x_3 = x_2 > x_1$. In that case, the utility function becomes $U(s) = s - \chi_3(3s - 1) + \beta_3(3s - 1) + \varphi_3$. With respect to $s = 1/3$, $\alpha > \chi > \beta > \eta > 0$, $\{\chi, \beta, \eta\} \in]0,1[$, utility is strictly positive.

3/ If $s = \frac{1}{3}$, acceptance constitutes the best response strategy too. This situation occurs in case of equal split between the three players, i.e. $x_3 = x_1 = x_2$. In case of equal split, no payoffs differences exist and the utility function $U(s) = s + \varphi_3$ which is always positive.

4/ If $s \in \left]0, \frac{1}{2}\right[$, the acceptance as a best response strategy depends on opponents' payoffs.

- $x_1 > x_3 > x_2$: $U(s) = s + \eta_3(1 - s - 2x_2) - \alpha_3(1 - 2s - x_2) + \beta_3(s - x_2) + \varphi_3$. The decision-maker will accept the proposition if it procures a positive utility. For that, the MAOs that she is willing to accept is $s_{MB} \geq s_{\min} = \dfrac{-\eta_3(1 - 2x_2) + \alpha_3(1 - x_2) + \beta_3 x_2 + \varphi_3}{1 - \eta_3 + 2\alpha_3 + \beta_3}$.
- $x_2 > x_3 > x_1$: $U(s) = s - \chi_3(-1 + s + 2x_2) - \alpha_3(s + x_2) + \beta_3(2s - 1 + x_2)$. The decision-maker will accept the proposition if it procures a positive utility. In that case, the MAOs is $s_{MB} \geq s_{\min} = \dfrac{\chi_3(2x_2 - 1) + \alpha_3 x_2 - \beta_3(x_2 - 1}{1 - \varphi_3 + \alpha_3 + 2\beta_3}$.

5/ $s < \frac{1}{3}$, the acceptance as a best response strategy depends on opponents' payoffs and the weight of inequities. These last differ according to the ranking of payoffs.

- $x_1 > x_2 > x_3$: $U(s) = s + \eta_3(1 - s - 2x_2) - \alpha_3 \frac{1}{2}(1 - 3s)$. The decision-maker will accept the proposition if it procures a positive utility. Here, the MAOs corresponds to $s_B \geq s_{\min} = \dfrac{-\eta_3(1-2x_2) + \frac{1}{2}\alpha_3}{1 - \eta_3 + \frac{3}{2}\alpha_3}$.
- $x_1 > x_2 = x_3$: $U(s) = s + \eta_3(1 - 3s) - \alpha_3(1 - 3s)$. The decision-maker will accept the proposition if it procures a positive utility. For that, the minimum acceptable offer that she is willing to accept corresponds to $s_B \geq s_{\min} = \dfrac{-\eta_3 + \alpha_3}{1 - 3\eta_3 + 3\alpha_3}$.
- $x_1 = x_2 > x_3$: $U(s) = s - \alpha_3 \frac{1}{2}(1 - 3s)$. The decision-maker will accept the proposition if it procures a positive utility. Here, the MAOs established is equal to $s_B \geq s_{\min} = \dfrac{\frac{1}{2}\alpha_3}{1 + \frac{3}{2}\alpha_3}$.
- $x_2 > x_1 > x_3$: $U(s) = s - \chi_3(-1 + s + 2x_2) - \alpha_3 \frac{1}{2}(1 - 3s)$. The decision-maker will accept the proposition if she obtains a positive utility. For that, the MAOs established corresponds to $s_B \geq s_{\min} = \dfrac{\chi_3(2x_2 - 1) + \frac{1}{2}\alpha_3}{1 - \chi_3 + \frac{3}{2}\alpha_3}$.
- $x_2 > x_1 = x_3$: $U(s) = s - \chi_3(1 - 3s) - \alpha_3(1 - 3s)$. The decision-maker will accept the proposition if it procures a positive level of utility. For that, the minimum acceptable offer that she is willing to accept corresponds to $s_B \geq s_{\min} = \dfrac{\chi_3 + \alpha_3}{1 + 3\chi_3 + 3\alpha_3}$.

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[1] La liste intégrale des Documents de Travail du LAMETA parus depuis 1997 est disponible sur le site internet : http://www.lameta.univ-montp1.fr

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