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## « Disentangling distributional motives »

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# Disentangling distributional motives

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## Abstract

In this paper we present the result of a distribution experiment where players must choose between a maximin, equity-dominant solution and a Hicks optimal, efficiency-dominant distribution. Three different information conditions are used. Under the certainty condition, inequity aversion has no observable effect on the choices of the players whose payoffs vary across distributions. The risk and the uncertainty conditions yield more contrasted outcomes.

*Keywords* : Distribution games; Inequity aversion; Hicks efficiency; Maximin

*JEL classification* : D03; D6; D7

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## 1. Introduction

Numerous experiments have shown that other-regarding preferences do influence players' choices. However, in the large stream of experiments exploring cooperation the collective output is usually simultaneously produced and distributed, so that cooperative choices and distributional preferences are entangled and it is often difficult to clearly identify individual motivations pertaining to one or the other.

In pure distribution games no strategic interactions are at stake and the efficient outcome can be differentiated from the cooperative outcome. Cooperation here is not identified *ex ante* since it is possible to consider either choice as a form of cooperation, towards the efficiency-dominant outcome maximizing the total group revenue in one case, or towards the equity-dominant outcome reducing payoff discrepancy within the group in the other case. Since both, or neither of these principles may be active in non-cooperative game settings it is necessary to study them separately in order to be able to tighten the attribution of cooperative choices to the relevant factors.

## 2. Related literature

The distribution games, from ultimatum and dictator games to the more recent voting games, are the closest attempts to carefully isolate and measure the weight of other-regarding preferences in experimental games.

### 2.1 *Ultimatum and dictator games*

The results of two-player dictator game experiments provide a first approximation of the willingness of subjects to reduce their own monetary pay-off in order to reduce the difference between their own pay-off and that of the other player. However, as already shown by many experimental investigations, transposing results from two-player settings into multiple-player settings is not straightforward and cautiousness requires to keep most parameters constant while exploring any specific dimension.

In the three-player ultimatum games presented in [Güth and van Damme \(1998\)](#) and [Bereby-Meyer and Niederle \(2005\)](#), where one of the players, the 'dummy', cannot voice his

preference, the outcome is on average worse for the dummy than the outcome of the dictator game is for the second player. Here again, though three players participate in the game, the outcome is the result of the interaction between two of them and of their consecutive choices.

## 2.2 *Efficiency, maximin and the two models of inequality aversion*

Engelmann and Strobel (2004), hereafter E&S, specifically address the relative predictive power of equity theories in three-player settings. They compare (i) maximin, (ii) efficiency (Hicks optimality), (iii) equity as defined by Bolton and Ockenfels (2000) in their theory of Equity, Reciprocity and Competition (ERC) and (iv) equity as defined by Fehr and Schmidt's (1999) theory of Fairness, Competition and Cooperation (FCC). In each of the games they used, players had to choose between three distributions determining the payoff to the three players in the group, two of these distributions being the solutions pointed to by one or more of the above theories.

The *maximin solution* simply involves choosing the distribution where the minimal payoff is the highest between the three, no matter the differences between each player's payoff and the payoff of any other player and no matter the total payoff for the group. The '*efficient solution*', in the sense of E&S, is defined according to Hicks optimality and is thus borne by the distribution in which the sum of the payoffs of the players is the highest, regardless of any other consideration. Both maximin and efficient solutions are based on the overall outcome for the group and assume thus that players' preferences are fully determined by considerations pertaining to the collective situation only. This assumption can be sustained in relation to one of the features of the experiment in E&S, namely that they compare only the choices made by the one player whose monetary payoff is not affected by the distribution, in order to keep selfish considerations out of the picture.

ERC and FCC are both based on a trade-off between selfish behavior - the player's own monetary payoff - and inequity aversion. Since the monetary payoff to the player whose choice is under scrutiny is kept constant through the three distributions, ERC and FCC solutions are determined by their respective treatments of inequity aversion. The *ERC solution* relies on the lowest difference between the player's payoff and the average payoff to the players in the group. The *FCC solution* in contrast is determined by the lowest absolute total difference between the player's own payoff and each of the other players' payoffs. In

ERC, subjects' choices are thus again determined by the group outcome, since they are comparing their situation to a characteristic of the collective situation, whereas FCC assumes that subjects are choosing according to the one-to-one relationship between players' payoffs.

All subjects in E&S had to indicate their preferred distribution as 'Person 2', the choice of which would determine the outcome for the three players selected to be in the same group. Groups were formed and roles attributed after subjects had indicated their choices, so that subjects did not know if their own choices would be picked up nor did they know the identity of the other players in their group. The former uncertainty on their situation in the group was used in order to "generate three times the data" since all subjects played 'as if' they would be Person 2, but may have generated some bias as non-certain situations usually do.

The matrices were designed in order to isolate one or more of the solutions from the other one(s) and to implement some variations in the choosing player's situation in order to generate more detailed results. The overall results indicate that ERC and FCC solutions are chosen only by a very small portion of the players (between 3% and 7% depending on the matrix) when either of the two points to a different distribution from the one bearing the three other solutions. By contrast, each of the maximin and efficiency solutions gathers a substantial amount of choices, respectively 53% and 40%, even when the three alternative solutions all support a different distribution. Thus, in the condition where the payoff matrix has one distribution supported by the maximin solution alone, the latter is chosen by a majority of the subjects, seemingly making maximin considerations the strongest motive in this distribution game series. This condition requires that the choosing subject gets the highest payoff in all cases, so the results imply that a majority of subjects tend to be less sensitive to overall inequity when it positively affects the difference between their own payoff and the other players' payoffs while favoring the lowest difference among other players. In all conditions where the maximin and the efficiency solutions supported the same distribution, not supported by the equity solutions, that distribution was chosen by 60% to 77% of subjects. When efficiency and ERC, on the one side, and maximin and FCC, on the opposite side, support the same distributions, these two distributions yield similar shares of the subjects' choices, around 40% each, while the intermediate distribution still gets 20%. E&S then conclude that maximin and efficiency can account for most of the observed outcomes, FCC and ERC solutions doing fairly poorly in comparison.

However, keeping the monetary payoff equal across distributions for the choosing player

may result in magnifying the actual importance of the studied alternative components of players' choices, or distort their actual relative roles when the player's own monetary payoff is also determined by the outcome. Though it was a deliberate choice intended to isolate the motives under study from purely individual monetary stakes, it missed a crucial part of the whole interaction between motives. Furthermore, some characteristics of the distributions may be more or less salient, and thus exert more influence on choices, in some matrices, than originally designed, and subjects may also be more or less sensitive to absolute values. Finally, subjects were choosing 'as' Player 2 but did not know whether their choices would be determining the outcome, nor what role they would be playing.

### 2.3 *A renewed case for inequality aversion?*

In their answer to the previous paper, [Bolton and Ockenfels \(2006\)](#), hereafter B&O, introduced a majority rule voting game where three players must indicate their preferences between two distributions. In order to extend the study of the influence of equity on players' choices they also introduced a form of procedural equity in a second condition - 'equal opportunity mode' - where subjects faced role uncertainty, in addition to a 'straight mode' in which subjects knew their own roles before indicating their preferences. The 'equal opportunity mode' features an equivalent of the strategy method where players were asked to mark their preferred distribution conditional on the role that they would be randomly assigned afterwards. This condition allowed them to test the influence of procedural equity on preferences though it left open the question of the general preferences of subjects for one or another distribution.

Table 1 : *Game payoffs* (reproduced from [Bolton and Ockenfels, 2006](#)).

Game	All games	Game I	Game II	Game III
Distribution	A	B	B	B
Player 1	13	19	27	27
Player 2	13	13	1	9
Player 3	13	13	17	9
Total	39	45	45	45

In all treatments, distribution A is an egalitarian distribution which allocates 13 to all three players whereas distribution B is an uneven distribution that yields a higher total payoff to the group. Table 1 above displays the payoffs associated with distribution B in each of the three different games used in the experiment. While the efficiency solution is always distribution B, distribution A bears the equity solution in all three games. The maximin solution is also borne by distribution A in Game II and Game III, both distributions yielding the same minimum payoff in Game I.

We will first focus on the straight mode. Contrary to the settings used in E&S, the distribution chosen had an influence on the monetary payoffs to the players in most cases. In Game II and Game III, all players monetary payoffs are different from distribution A to distribution B, and since the preferences of all players determine the chosen distribution, and are thus reported in the results, the observations on Player 1 choice in Game I are also driven by preferences on the absolute value of the player's own payoff.

The results of Game I provide a sound test of the role of inequality aversion when the difference between monetary payoffs is to the disadvantage of the player. 48% of subjects whose payoffs were the same in the two distributions (Player 2 and Player 3) indeed chose distribution A though distribution B yielded lower payoffs to none of the players.

However, when the monetary payoff to the player varies according to the chosen distribution the shares of players' choices are substantially less balanced. Distribution B was preferred by 75% of the Player 1 subjects in Game I, 67% in Game II and 79% in Game III, and by 63% of Player 3 subjects in Game II. Similarly, distribution A was chosen by 88% of subjects in the three cases where it was more favorable to them than distribution A - Player 2 in Game II, Player 2 and Player 3 in Game III. A large majority of subjects thus chose the distribution in which their monetary payoffs were the highest, with marginal adjustments according to the absolute and relative values of the other players' payoffs in the case of Player 1. The highest variation between Player 1 subjects' choices, for instance, was observed from Game II to Game III, the latter featuring a no more equitable distribution B than the former in both of the above definitions, a higher minimum payoff, but also a more even situation in the sense that Players 2 and 3 get the same payoff instead of Player 3 getting almost all of these two players' shares. A similar outcome is observed with one of the matrices used in E&S, as shown in Table 2. A majority of subjects, in the role of Player 2, chose the least equitable, least collectively profitable distribution C, which dominates the two others in terms of lowest

payoff (maximin) and again provides the most leveled monetary payoffs to the two other players. Subjects may thus also be motivated by impartial equity concerns by which they favor the lowest difference between the other players' payoffs without reference to their own payoff.

*Table 2 : Payoffs and player 2 choices (Treatment R in Engelmann and Strobel, 2004).*

Distribution	A	B	C
Player 1	11	8	5
Player 2	12	12	12
Player 3	2	3	4
Total	25	23	21
Percentage	27 %	20 %	53 %

The 'equal opportunity mode' mostly affected the choice of Player 2 and Player 3 subjects in Game I. The share of these subjects choosing distribution A shrunk from 48% down to 17% when all three subjects in the group had an equal probability to be in each of the three roles. Keeping in mind that in this condition subjects would vote for their preferred distribution for each of the possible roles, the difference can only be attributed to the introduction of procedural equity and thus strongly supports the effect thereof. It also gives another confirmation that preferences can be substantially modified by the very procedure by which subjects express them, as already observed in Shafir and Tversky (1992) and in Frohlich and Oppenheimer (1998) in the case of prisoner's dilemma games.

### **3. A simple distribution game**

#### ***3.1 Refining the settings***

In order to carry the elucidation of the role of distributional concerns in subjects' choices further we ran a majority rule vote experiment which provided complementary results to the observations in E&S and in B&O. First, since the payoff distributions achieved in cooperation games seldom feature perfect equality, as distribution A in B&O does, and since inequality aversion might have a greater influence on choices when it is the case<sup>3</sup>, we used a

<sup>3</sup> Güth et al. (2001), for instance, observed that unbalanced proposals in fixed-allocation ultimatum games



payoff matrix that allocates different amounts to the different player roles in all cases, similarly to E&S - in the two distributions the payoff to the different roles could be strictly ordered. Second, as in B&O and contrary to E&S we included a condition involving role certainty, where players knew which pair of alternative payoffs they were facing. In order to collect subjects' general preferences between the two distributions, we used two conditions in which players did not know which roles they would be attributed and made one choice only to indicate their unique preferred distribution. We did not use the kind of strategy method applied in B&O, where subjects make one choice for each of the possible roles, since it does not address the same kind of preferences, nor the randomization procedure in S&O which similarly did not allow them to assess the general preferences of the subjects.

We ran three sessions involving 18 subjects each, none of them having previously participated in distribution game experiments. They were recruited through ORSEE from the subject pool of the LEES and each participated in one session only. In each condition, we formed different groups of three players, so that each subject would never be matched twice with the same other players. In each session all subjects played for three rounds, under the three different conditions. In order to insure independence between conditions we chose one of the rounds randomly to determine the payoffs for all subjects at the end of the experiment, we did not unveil the round outcome until the end of the last round and we varied the order in which the conditions were presented to subjects using all six possible combinations equally over the three sessions. [Table 3](#) displays the payoff matrix that we used in all conditions. In each group, each subject had to voice their preferred distribution and the payoffs were then determined according to the distribution preferred by two or more subjects.

Table 3 : *Game payoffs*.

Distribution	A	B
Player 1	18	33
Player 2	12	12
Player 3	10	5
Total	40	50

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tend to be chosen and accepted more often if equal distributions is not an available alternative.

### 3.2 *Meeting John Rawls*

We thus used three different conditions where the information about the player's role varied. In addition to the certainty condition (Condition C for 'certainty'), players had also to choose between the same two distributions knowing that each role would be attributed to one player of their group (Condition R for 'risk') and knowing only that themselves as well as the two other players could be in one of the three roles no matter the role attributed to the two other ones (Condition U for 'uncertainty'). This specificity of our design was implemented as an attempt to investigate the necessary conditions of procedural equity, a consideration which stems from the other motivation of our study, the much debated theory of justice proposed by [John Rawls \(1971\)](#). In this perspective, Conditions R and U can indeed be considered as two reduced implementations of the 'veil of ignorance', which is considered by Rawls as the necessary condition for the expression of the collective choice on the principles of justice themselves. In Rawls own words :

"The idea of the original position is to set up a fair procedure so that any principles agreed to will be just. The aim is to use the notion of pure procedural justice as a basis of theory. Somehow we must nullify the effects of specific contingencies which put men at odds and tempt them to exploit social and natural circumstances to their own advantage. Now in order to do this I assume that the parties are situated behind a veil of ignorance. They do not know how the various alternatives will affect their own particular case and they are obliged to evaluate principles solely on the basis of general considerations" ([Rawls, 1971](#), p.136).

Though Rawls is setting out a general, fictitious procedure for society as a whole to choose its principles of justice, the 'original position' implies, among others, that none of the parties, the members of society, knows "his place in society, his class position or social status; nor does he know his fortune in the distribution of natural assets and abilities" (id., p.137). Within the framework of distribution games, the veil of ignorance can thus be translated into limited information conditions where subjects must choose only one of the alternative distributions without knowing what role they will be matched with. Given the broad scope of parties' ignorance of their fate in the original position as described by Rawls, the difference between conditions U and R can be seen as a small step from the most basic form of role uncertainty - where subjects know the group composition and thus the actual distribution of payoffs between the three members of the group - to a situation where subjects are also

prevented from knowing the group composition - how many of each role will be represented.

### 3.3 *Maximin vs. 'efficiency'*

In the original position, behind the veil of ignorance, Rawls argues, it is rational for individuals to opt for the two principles of justice implied by his conception of 'justice as fairness':

"First principle: each person is to have an equal right to the most extensive basic liberty compatible with a similar liberty for others.

Second principle: social and economic inequalities are to be arranged so that they are both (a) reasonably expected to be to everyone's advantage, and (b) attached to positions and offices open to all." (*ibid.*, p.60)

The second principle is then given a more precise content, with the phrase 'everyone's advantage' specified as the 'difference principle' as opposed to the principle of efficiency, so that the new wording states that:

"Social and economic inequalities are to be arranged so that they are both (a) *to the greatest benefit of the least advantaged* and (b) attached to offices and positions open to all under conditions of fair equality of opportunity." (*ibid.*, p. 83, emphasis added)

Further in his essay Rawls introduces the maximin rule as a way to interpret the second principle. The principles themselves are of course presented as impartial views of the contractual structure of society, whereas the maximin rule is presented as a "heuristic device" describing an individual in a situation where they need to make a decision while "faced with several possible circumstances which he may or may not obtain" (*ibid.*, p. 153). In the original position, Rawls argues, individuals would choose according to the maximin rule, for (i) "the situation is one in which a knowledge of likelihoods is impossible, or at best extremely insecure", which is required because the maximin rule "takes no account of the likelihoods of the possible circumstances" (*ibid.*, p. 154), and (ii) the gains associated with the highest of the worst outcomes, which determines the solution, is high enough so that the person does not care about any higher gain given the possibly unacceptable outcomes otherwise faced.

The justification for the second principle, and for the choice of the maximin solution, as it appears, does not rely on equity or self-disinterested considerations. Among other elements

supporting the argument made by Rawls for the difference principle, the rationality of the parties when voicing their choice among alternative principles of justice in the original position is crucial. The motivations behind the choice are clearly based on self-interest, as applied when behind the veil of ignorance:

"The parties do not seek to confer benefits or to impose injuries on one another; they are not moved by affection or rancor. Nor do they try to gain relative to each other; they are not envious or vain. Put in terms of a game, we might say: *they strive for as high an absolute score as possible. They do not wish a high or a low score for their opponents, nor do they seek to maximize or minimize the difference between their successes and those of others.* The idea of a game does not really apply, since the parties are not concerned to win but to get as many points as possible judged by their own system of ends". (*ibid.*, pp. 144-145, emphasis added)

This is a clear formulation of individualism as defined in the social value orientations literature<sup>4</sup>, by which agents are seeking to "maximize their own outcome without any concern for the partner's outcome" (Kollock, 1998). The maximin solution, in this interpretation of the Rawlsian view, is thus not motivated by inequality aversion but by a form of what economic theory often denotes as 'selfishness'.

Rawls further underscores the higher burden put on agents by the utilitarian principle of efficiency, or Hicks optimum, pointing that it "requires a greater identification with the interests of others than the two principles of justice" (*ibid.*, p. 177). The argument follows:

"When the two principles are satisfied, [...] there is a sense defined by the difference principle in which everyone is benefited by social cooperation. [...] When the principle of utility is satisfied, however, there is no such assurance that everyone benefits, [...] thus the scheme will not be stable *unless those who must make sacrifices strongly identify with interests broader than their own*". Looking at the question from the standpoint of the original position, the parties recognize that *it would be highly unwise if not irrational to choose principles which may have consequences so extreme that they could not accept them in practice.* (*ibid.*, pp. 177-178, emphasis added)

Rawls thus makes a strong argument for the maximin to be the most rational choice for selfish players. Though selfishness can indeed be a sufficient condition to choose the maximin distribution in that situation, purely selfish motives might however interact with

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<sup>4</sup> See e.g. Kuhlman and Marshello (1975), McClintock and Liebrand (1988), Van Lange et al. (1992), and Kollock (1998) for a review.

risk-aversion, efficiency or else equity considerations. We will thus consider that none of our two distributions holds a net advantage in terms of pure selfishness.

As in Game II and III in B&O our distribution A is the maximin, the FFC and the ERC solution, whereas distribution B is the efficiency solution. Since the payoff for Player 2 is the same in both distributions, and since we kept the payoffs ordering between players, Player 1 is better off in terms of monetary gain in distribution B while Player 3 is better off in distribution A. This feature allows us to refine the analysis of the weight the various trade-offs between the distributions that are diversely supported by the equity, efficiency and 'monetary selfish' solutions according to the player under consideration.

### 3.4 *Equity vs. 'selfishness'*

With equity aversion on the one side, as an other-regarding preference combination<sup>5</sup> of altruism (reducing favorable difference) and fairness (reducing unfavorable difference) operationalized by either of the definitions of ERC and FFC, selfishness is on the other side the usual label for the alternative motivation. Though it is widely used to define the solution which attributes the highest payoff to the concerned player it is not always clear what it is intended to capture on the motivational side, further than this support to the monetary payoff maximizing choice, when distributional concerns are involved. The outcome associated with the highest payoff for the player may for instance provide a narrower payoff difference for the other players, which would mean a non-selfish driver leading to a seemingly selfish outcome, and in any case players are more generally assumed not to be choosing from an impartial point of view but according to their very own preferences.

Table 4 summarizes the diverse outcomes as predicted by the behavioral drivers so far. Whereas the maximin, the ERC and the FFC predictions can be gathered in the case of this matrix<sup>6</sup>, maximin and efficiency solutions are by definition group properties while solutions based on self-favoring monetary concerns will be attributed to a different distribution according to the player concerned. We denote by 'pure selfish' the choice supported by purely individual motives, pointing to the distribution that provides the highest monetary payoff to

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5 One could incidentally question to what extent these two components might constitute the two sides of the same behavioral driver. The difference is explicitly recognized in FCC, where a specific parameter is used according to the sign of the payoff difference, though the qualitative treatment is the same.

6 It can indeed also be argued that the maximin solution is based on a form of inequality aversion principle, maybe more accurately described as an impartial preference for the least disadvantageous distribution from the point of view of the worst off among the players of the group.

the player. The 'competitive' solution, termed following the 'competitive orientation' mentioned in the social value orientation literature (see e.g. [Kuhlman and Marshello, 1975](#) or [McClintock and Liebrand, 1988](#)), catches the highest total difference between the player's payoff and that of each of the other players.

*Table 4 : Alternative predictions, by player and by distribution.*

<b>Solution</b>	<b>Maximin, ERC, FFC</b>	<b>Pure selfish</b>	<b>Efficiency</b>	<b>Competitive</b>
<b>Player 1</b>	A	B	B	B
<b>Player 2</b>		-		A
<b>Player 3</b>		A		A
<b>All</b>	A	-	B	A

Though we intended to use alternative matrices where the 'equity' solutions would not all support distribution A, we chose to run first these three sessions using only one matrix in order to generate a first set of data where both efficiency and maximin were clearly marked and differentiated from other solutions for most players. This choice allowed us to set aside the potential problems of dependency arising from the order in which the different matrices would be proposed to the subjects, and to adjust future sessions according to the most salient features of the results from this first matrix.

## **4. Results**

### *4.1 Choosing a distribution: points victory for equity*

As shown in [Table 5](#), the outcome of the majority rule was distribution A being chosen by 30 groups out of 54, or 56% of all cases. Both distributions were equally chosen under condition R whereas distribution A collected a one-group and a two-group majority in condition U and condition S respectively. It appears thus that neither of the two distributions is critically more attractive to players than the other, and that neither maximin and equity on the one side nor efficiency on the other side are strong enough drivers to cancel the other, even under uncertainty, especially when players are under diverging tensions from the point of view of the selfish and of the competitive choices, as it is the case in this matrix.

Table 5 : Group choices, by condition.

<b>Condition</b>	<b>S</b>	<b>R</b>	<b>U</b>	<b>Total</b>	<b>Total %</b>
<b>Distr. A</b>	11	9	10	30	56%
<b>Distr. B</b>	7	9	8	24	44%
<b>Total</b>	18	18	18	54	100%

Table 6 displays the outcome of the individual votes, aggregated over the three sessions. The first indication is that distribution A gathered a slight majority of votes in condition S and R (54%), while the outcome was reversed in condition U. All three conditions taken together, the two distributions thus shared subjects' preferences almost evenly, showing that here again no one-sided theoretical prediction would prevail and fully explain the results.

Under condition S, among those who were concerned (Player 1 and Player 3), all subjects but one (97%) chose the 'pure selfish' distribution which allocated them the highest monetary payoff, and which in this matrix and for these players was also the 'competitive' solution. Among them, all subjects in the role of Player 1 chose thus the efficiency solution while those in the role of Player 3 overwhelmingly chose the maximin solution. This observation points to a seemingly predominant role of individual over group outcome considerations where the monetary payoffs to the player are at stake. It appears indeed that in this condition the group outcome was mostly determined by the choices of Player 2 subjects. Two thirds of the latter chose distribution A, which somehow questions the extent of the role of efficiency considerations and, though the null hypothesis of a random choice cannot be rejected (binomial test, p-value = 0.1189), supports the combined dominance of maximin and equity considerations when monetary payoffs are unchanged.

Concerning the effect of role uncertainty, which was introduced as an implementation of Rawl's veil of ignorance, individual choice counts exhibit no difference between condition S and condition R, with the two distributions sharing the votes in the same proportion in both conditions. It thus appears that role uncertainty *per se* is not enough either to deepen or to reverse the relative share of the two distributions and that the veil of ignorance may not be easily operationalized in experimental settings. Interestingly, the numbers were exactly reversed in condition U where subjects faced a higher uncertainty of relative payoffs within

the group and where distribution B was chosen by a few more subjects. This also indicates that procedural equity may play only a marginal role when stakes and procedures do not go beyond monetary payoffs.

*Table 6 : Distribution of votes, by condition and broken down by player for condition S.*

<b>Condition</b>	<b>S</b>				<b>R</b>	<b>U</b>	<b>Total</b>	<b>Total %</b>
<b>Player</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>Total</b>	-	-	<b>All</b>	<b>All</b>
<b>Distr. A</b>	0	12	17	29	29	25	83	51%
<b>Distr. B</b>	18	6	1	25	25	29	79	49%
<b>Total</b>	18	18	18	54	54	54	162	100%

#### *4.2 The hidden effects of risk and uncertainty : intra-player analysis*

Though role uncertainty did not clearly seem to have much influence on players' choices at the aggregate level, looking at the three conditions separately, it is possible to investigate intra-player observations and see whether players consistently made the same choice across conditions so that differences at the aggregate level are only due to marginal switches, or if changing conditions triggered cross-switches by players having made opposite choices.

Table 7 displays for each of the three possible pairs of conditions the number of players who made the corresponding pair of choices. The second and fifth columns indicate consistent choices from one condition to the other while the third and fourth columns correspond to switches in opposite directions.



*Table 7 : Intra-player choices.*

**S vs. R**

<b>Role in S</b>	<b>A-A</b>	<b>A-B</b>	<b>B-A</b>	<b>B-B</b>	<b>Total</b>
<b>Player 1</b>	0	0	9	9	18
<b>Player 2</b>	9	3	0	6	18
<b>Player 3</b>	10	7	1	0	18
<b>Total</b>	19	10	10	15	54

**S vs. U**

<b>Role in S</b>	<b>A-A</b>	<b>A-B</b>	<b>B-A</b>	<b>B-B</b>	<b>Total</b>
<b>Player 1</b>	0	0	11	7	18
<b>Player 2</b>	6	6	0	6	18
<b>Player 3</b>	7	10	1	0	18
<b>Total</b>	13	16	12	13	54

**R vs. U**

<b>Role in S</b>	<b>A-A</b>	<b>A-B</b>	<b>B-A</b>	<b>B-B</b>	<b>Total</b>
<b>Player 1</b>	8	1	3	6	18
<b>Player 2</b>	6	3	0	9	18
<b>Player 3</b>	6	5	2	5	18
<b>Total</b>	20	9	5	20	54

The figures tend to support a greater effect of role uncertainty on individual choices than the aggregated data would indicate. All player roles taken together, 37% of the subjects (20 out of 54) reversed their votes between condition S and condition R, 52% did so between condition S and condition U and 26% between conditions R and U. The first conclusion that can be drawn from these counts is thus that condition U actually triggered a more differentiated effect than condition R compared to the certainty condition. Moreover, the difference between the S/R and the S/U switches is mostly explained by Player 2 and Player 3 subjects switching from distribution A to distribution B, which triggered the reversal of

votes in favor of distribution B observed in condition U, showing that equity and maximin considerations were less relevant in players' choices when the actual relative payoffs were unknown to players at the time of their choices. In that condition, subjects could indeed face an egalitarian distribution yielding any of the three possible payoffs to the three group members.

## 5. Discussion

The above results strongly support that subjects' monetary payoffs play a first order role on their individual choices and further give some indications on outcome indecisiveness when these pure selfish motives are absent. However, some specificities of the design could be addressed.

First, the matrix used in these three sessions does not allow us to fully discriminate between alternative solutions for all player roles, so that our observations cannot all be directly connected to unique determinants. It could be relevant, for instance, to discriminate between the pure selfish and the competitive outcomes, the latter appearing to possibly play a non negligible role in players' choices though it has been somehow ignored previously, both in behavioral theories and experimental settings. Subjects had furthermore to choose between two distributions only, reducing thus their ability to fine tune their distribution choice and implying some framing effect. [Falk et al. \(2003\)](#) found for instance that unequal offers of (8,2) - allocating 8 to the proposer and 2 to the responder - were more often rejected if the alternative was (5,5) than if the alternative was (10,0). It would thus be worth using different payoff matrices, making perfect equality distribution available or varying the relative stakes to the players.

Second, our setting may be prone to the 'complicity effect' observed in [Charness and Rabin \(2002\)](#), [Bolton and Zwick \(1995\)](#), and first mentioned by [Charness \(2000\)](#) as the "responsibility-alleviation effect", a phenomenon which is described as occurring whenever "a shift of responsibility to an external authority dampens internal impulses towards honesty, loyalty, or generosity". In the same paper, Charness states that "in a gift-exchange experiment, we find that subjects respond with more generosity (higher effort) when wages are determined by a random process than when assigned by a third party, indicating that even a slight shift in perceived responsibility for the final payoffs can change behavior". In our

experiment, since the chosen distribution is determined according to the combined votes of the three players in the group, each player may feel less compelled by equity or any other-regarding preferences. The choices of subjects in Player 1 role in condition S, for instance, may thus reflect only weakly their distributional concerns.

Third, though players were presented with the three conditions in all possible orders we could not completely rule out the existence of an ordering effect. Round by round breakdown of players' choices (see Table 8 below) indeed shows that all 6 subjects who were in Player 2 role when condition S was applied in the first round chose distribution A. Though we do not have enough observations to be able to reject the null hypothesis of a random distribution of player choices, a larger set of data could allow one to identify more decisively a possible preference for distribution B for players in that situation.

*Table 8 : Distribution of votes in condition S broken down by round.*

Round	1				2				3				Total
	1	2	3	Total	1	2	3	Total	1	2	3	Total	
Player	1	2	3	Total	1	2	3	Total	1	2	3	Total	
Distr. A	0	6	6	12	0	3	5	8	6	3	0	9	29
Distr. B	6	0	0	6	6	3	1	10	0	3	6	9	25
Total	6	6	6	18	6	6	6	18	6	6	6	18	54

Finally, only reduced versions of the veil of ignorance were operationalized through conditions R and U, for experimental settings can only involve choices between monetary distributions, not the determination of whole principles of justice to be applied to society and determine the broader life conditions of subjects. However, since Rawls explicitly suggested that the maximin rule was a good candidate to approximate the difference principle and even gave a detailed illustration of its application, our attempt to give an experimental account of its effectiveness seems justified. In our two 'Rawlsian' conditions subjects actually knew probabilities and expected payoffs, though calculation was less obvious in condition U (and the result was not given) so that a more accurate test of the maximin rule as described by Rawls could be provided by a new condition where players would actually not be able to calculate expected payoffs, following his argument that "it must be that the situation is one in which a knowledge of likelihoods is impossible, or at best extremely insecure".

## 6. Conclusion

The experiment presented in this paper had a twofold motivation, disentangling distributional concerns at the individual level on the one hand and testing alternative principles guiding collective choices on the other. Our experimental data brought some clear cut results to the former as well as some preliminary indications to the latter.

Under certainty, all players chose the efficient distribution when it was also the one that allocated them the highest payoffs, regardless of equity concerns. Given that both distributions yielded some positive amounts to all players, however, it may be more precise to conclude that inequity aversion had no observable effect on the choices made by these players. It is indeed not to be excluded that distributional considerations may have been taken into account but only to be dominated by the monetary gain for the player, since the relative share of the total outcome in efficient distribution between the highest and the lowest payoff was close to the average offered allocation observed in dictator game experiments. When players' payoffs were not affected by the chosen distribution, efficiency considerations alone were not enough to balance distributional concerns, though our sample was too small to achieve statistical significance on this point.

These observations however support that endogenous cooperation levels may be more related to the repetition of interactions between the same players than to altruism or equity considerations. This would also be more in line with the end effect observed, for instance, in most public good game experiments, which hardly fits inequity aversion models unless one assumes that equity concerns fade away for some reasons, but which occurs precisely as the temporal horizon of the interactions narrows down.

Contrastingly, role uncertainty leads to an almost even distribution of choices between the two alternatives. Again, our data provide support for a mitigated effect of inequity aversion, since the aggregated individual preferences were reversed when subjects also faced some uncertainty on the actual distributive features of the outcome – when more egalitarian distributions were also a possible outcome, in condition U. However, in both conditions, risk aversion was not controlled for and may thus have also interfered with the other preferences.

Finally, at the collective level, preference heterogeneity entails that no decisive conclusion on the choice between the maximin and the efficiency solution emerged from our settings.

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