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# How institutions shape individual motives for efficiency and equity: Evidence from distribution experiments\*

Stefan Ambec,<sup>†</sup> Alexis Garapin,<sup>‡</sup> Laurent Muller,<sup>§</sup> and Bilel Rahali<sup>¶</sup>

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## Abstract

We investigate how institutions can shape differently the expression for efficiency and equity. We run four variants of the triple dictator game and the trust game in a within-subject design that enables to plot individual patterns. A veil of ignorance, a positional fee and information about others' behaviors are successively introduced to the two standard games. Alongside those treatments, we also control for individual preferences towards risk and other regarding preferences. Results show that while individuals demonstrate consistency in their preferences, the prospect of transfers in the trust game and the veil of ignorance increases efficiency and equity. Second, the option to choose their position as investor at some cost attracts the less cooperative players: they pay to be investor and keep more for themselves. Third, subjects who modify their investment decision after learning the average investment in their group tend to move closer to the average.

**Key Words:** Trust game, triple dictator game, fairness, efficiency, social dilemma, equity.

**JEL classification:** C72, C90, D03, D63.

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<sup>†</sup>INRA, Toulouse School of Economics, [stefan.ambec@inra.fr](mailto:stefan.ambec@inra.fr)

<sup>‡</sup>University of Grenoble Alpes (GAEL), [alexis.garapin@univ-grenoble-alpes.fr](mailto:alexis.garapin@univ-grenoble-alpes.fr)

<sup>§</sup>INRA, University of Grenoble Alpes (GAEL), [laurent.muller@inra.fr](mailto:laurent.muller@inra.fr)

<sup>¶</sup>University of Grenoble Alpes (GAEL), [bilel.rahali@univ-grenoble-alpes.fr](mailto:bilel.rahali@univ-grenoble-alpes.fr)

# 1 Introduction

The trade off between equity and efficiency is a central principle in Economics. Examples include environmental policies (when exploiting a resource generates adverse effect on the local people), fiscal policies (when taxing is regressive or when transfer payments discourage people to work), growth (when the relationship between economic performance and income equality is negative) and so on (see Okun, 2015 for many examples). Welfare improvement and equity may thus be conflictual in some situations, which force individuals to trade-off not only between individual and social welfare, but also between efficiency and equity. In this paper, we investigate in an experiment how institutions may shape individual motives for this trade off between efficiency and equity<sup>1</sup>.

A large body of experiments in Economics has investigated the trade off between efficiency and equity at the individual level in simple bargaining and distribution game settings. In an experiment involving one-shot dictator games, Engelmann and Strobel (2004) find evidence that efficiency motives (defined as the surplus maximization) as well as Rawlsian motives for helping the least well-off dominate motives induced by inequity aversion *à la* Fehr and Schmidt (1999).<sup>2</sup> In variations of the trust game, Charness and Rabin (2002) observe that few subjects sacrifice total payoffs for equalizing payoffs. Furthermore, subjects choose Pareto-damaging behavior more often when it increases inequality than when it reduces inequality. Cappelen et al. (2007) assess people's ideal of fairness in dictator game experiments preceded by a production phase: the money to be shared relies on investments by both players with heterogeneous returns. They observe a majority of strict egalitarian behaviors, though subjects make trade offs between self-interest and fairness. In a trust game experiment that varies the investment rate as well as the binding degree of the proposer's offer (no explicit sharing intention, sharing intention with a cheap talk message, sharing intention with enforcement), Pfaff et al. (2018) observe that enforced contracts increase both efficiency and equity levels. In an experiment using modified dictator games that vary the subjects' endowments and the prices of giving, Fisman et al. (2007) find a strong correlation between the equity-efficiency trade-offs that subjects make and their social preferences.

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<sup>1</sup>By institutions we mean all the rules that determine the interactions between agents.

<sup>2</sup>This result was however criticized by Fehr et al. (2006) who claimed that Engelmann and Strobel (2004)'s experiment was biased by a subject pool effect.

In a distribution game experiment with decisions that concern Pareto optimality, Beckman et al. (2002) examine the role of positional bias, including envy and malice. They compare one treatment in which the positions in the income distribution are known and fixed to another in which these positions are unknown. Their experiment shows evidence that subjects' choices are closer to efficiency in the latter treatment, when they play behind a veil of ignorance. Iriberry and Rey-Biel (2011) consider the influence of role uncertainty in modified dictator games, using games with role certainty as benchmarks. They observe that costly surplus creating actions are significantly more frequent and selfish behaviors less frequent where there is role uncertainty. In their distribution game where a social planner decides the income of two other subjects according to different budgets and prices of equality<sup>3</sup>, Hong et al. (2015) find evidence for a wide heterogeneity of preferences for equality and efficiency, although the majority of subjects weakly preferred efficiency over equality.

However, as pointed out by Bolton and Ockenfels (2006), the literature has not been enough concerned about how treatments can shape differently the expression of preferences for fairness and for efficiency. Our paper bridges this gap by designing a within-subject experiment that allows to measure how individual motives for efficiency and equity evolve from one treatment to another. We depart from the aforementioned literature in three aspects. First, we combine the triple dictator game with the trust game in a single experiment. Implementing both games offers a richer design to study the efficiency-equity trade-off: Contrary to the dictator game, efficiency and equity are both achievable if the investor trusts the receiver and if the receiver is trustworthy. The main parameters between the games are kept constant. Second, we test three treatments with the same subject for each of the two games. Some of our treatments have been investigated separately in previous papers but not together with the same subjects. For instance, paying a fee to obtain a position in the game has been implemented in an ultimatum game in Shachat and Swarthout (2013). Finally, we elicit risk and other-regarding preferences, as both may be underlying attitudes behind efficiency and equity motives in those games (see e.g. Houser et al., 2010 and Kanagaretman et al., 2009).

Our experiment is based on variations of the triple dictator game (Ashraf et al., 2006) and

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<sup>3</sup>This "price of equality" is an inefficiency measure for player B's ability relative to A's, in converting allocations into his or her own income.

the trust game (Berg et al. 1995). In these games, there are two players: the *investor*, who plays first and receives the full endowment at the start of the game, and the *receiver*. In the triple dictator game, maximizing own payoffs requires the investor to keep all the endowment. As the money invested is tripled, maximizing total payoffs means that everything is sent to the receiver, which leads to a very unequal outcome. Equal payoffs can be achieved when the investor invests one-quarter of her endowment. By allowing the receiver to transfer back in the so-called trust game, trade-off decisions are shared between players: while the investor still decides upon the total payoff, the receiver is allowed to redistribute anything she receives. As a result, both efficiency and equity can be achieved if the investor trusts and if the receiver is trustworthy. Equalizing payoffs by investing one-quarter of the endowment is still an option for the investor. By doing so, equalizing needs no trust but is costly.

To assess the impact of institutions on subjects' motivations for efficiency and equity, we run four variants of the two games in a within-subject experiment. Subjects first play the standard triple dictator game. This treatment acts as our benchmark and allow us to determine univocally three types of players: own-payoff maximizers, egalitarians and sum-payoff maximizers. They then play the standard trust game using the strategy method. In the second treatment, we assess subjects' behavior behind a veil of ignorance on their position in the games (investor or receiver). Subjects play both positions. They choose both the investment and the back payment without knowing whether they will be paid as an investor or a receiver. We expect them to be more egalitarian consistently to Rawls's view on fairness. In the third treatment, we assess how subjects behave when they can choose their position at some cost rather than being assigned randomly. We expect them to keep a higher share of total payoffs for themselves if they think they 'deserve' to be rewarded from getting their position in the game. As Chavas and Coggins (2003) point out, equity should also relate to conditions resulting from circumstances over which individuals can be held responsible. This view is in line with the concept of fairness based on responsibility (Fleurbaey, 2008): people should be rewarded for their own investment and compensated for what is beyond their control. In the fourth treatment, we assess the impact on investment of information about others' decisions. Subjects are informed on the average investment made in the benchmark treatment before they play. The average decision might act as a descriptive investment norm that could influence the subject's perception regarding the

trade-off between efficiency and equity (see e.g. Ostrom and Walker 1991 in a common-pool resource games). We expect them to modify their behavior close to the norm<sup>4</sup>. Like Blanco et al. (2011) who also run a within-subjects experiment, we are able to monitor how subjects in general and our three types in particular modify their behavior across treatments.

Alongside those treatments, we control for individual preferences towards risk and other regarding preferences. First, we implement the standard risk test (Holt and Laury 2002). Risk aversion could explain why subjects do not invest in trust games, and hence give up on efficiency, to avoid the possibility of receiving nothing in return. Dictator and trust games may also involve social preferences (see Cooper and Kagel (2016), for a survey). Thus, second, like Offerman et al. (1996) and Kanagareman et al. (2009), we rely on the so-called *ring test* (Liebrand, 1984) to measure subjects' pro-social behavior.

Our main findings are as follows. Our institutions do not shape intrinsic motives. Individuals demonstrate surprising consistency in their preferences. Nevertheless, institutions are able to increase efficiency and equity by unifying opposing interests: transfers in the trust game and the veil of ignorance allow players to achieve efficient, profitable and equitable outcomes at the same time. Other results comprise the following. First, we find usual evidence that when investors move from a dictator to an ultimatum, they become strategic: they invest more because they expect reciprocity from the receiver. Second, the results show treatment effects. Compared to our baseline treatments, investors significantly increase their investments when they can choose for others. Behind a veil of ignorance, a large majority equalizes payoffs, regardless of their preference for efficiency and equity in the baseline treatment. Third, the possibility to pay for one's position has a sorting effect. Paying to be an investor is chosen by the least cooperative individuals in the baseline treatment. Fourth, the majority of investors do not change their level of investment when they are informed of the average level of investment in the baseline treatment. Those who change do so towards the average investment. Finally, the results show that investment behavior is driven by other regarding preferences and not by risk considerations.

The remainder of the article is structured as follows. We introduce the game and the hy-

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<sup>4</sup>By learning the average level of investment, the investor can either increase her/his utility by conforming to the norm (Cialdini and Goldstein, 2004) or adjust her/his behavior according to the newly learned degree of cooperation of others (conditional cooperation, reciprocity).

potheses to be assessed in the experiment in Section 2. Section 3 describes the experiment. The results are analyzed in Section 4. Section 5 concludes.

## 2 Experimental design

### 2.1 Games

The investor  $I$  decides to invest  $x$  euros of her 8 euros endowment. The investment of  $x$  euros is multiplied by 3 and assigned to the receiver  $R$  who gets  $3x$ . In the *triple dictator game* (DG),  $I$  simply keeps  $8 - x$ . In the *trust game* (TG),  $R$  can transfer back to  $I$  part of the  $3x$  euros produced through a non-negative transfer  $t \leq 3x$ . Consequently, the monetary payoffs with the investment  $x$  and the transfer  $t$  are  $8 - x + t$  for  $I$  and  $3x - t$  for  $R$ . The transfer  $t$  divides up the total welfare defined as the sum of payoffs:  $8 - x + t + 3x - t = 8 + 2x$ .

We are interested in 3 game issues: the non-cooperative, the efficient and the egalitarian ones. First, the non-cooperative solution is the Subgame Perfect Nash equilibrium of the games. It consists in investing nothing  $x = 0$  in both games and transferring back nothing  $t = 0$  in TG whatever the investment made by the investor. While it guaranties a payoff of 8 for  $I$ , it minimizes  $R$ 's payoff and the sum of payoffs. This strategy is therefore unequal and the least efficient. Second, investing  $x = 8$  is on the contrary the most efficient strategy as it maximizes the sum of payoffs. This outcome is also unequal in the dictator game as  $R$  obtains all and  $I$  nothing. In the trust game, the back payment  $t$  allows this strategy to be compatible with equal payoffs if  $R$  transfers back half of the surplus created, 24, which is  $t = 12$ . Third, investing  $x = 2$  equalizes payoffs without any transfers. The sum of payoffs is lower than with the all-investment strategy  $x = 8$ .

To sum-up, the equalization of payoffs can be achieved with the efficient solution  $x = 8$  in TG but not in DG. It is therefore compatible with efficiency in TG but not in DG. Subjects can manage to implement the efficient and egalitarian solution in TG if they control both decisions  $x$  and  $t$  like in the veil treatment, or if  $I$  trusts  $R$  and  $R$  is trustworthy in the other treatment.

## 2.2 Treatments

(1) *Baseline treatments* (Basic and Basic-t). Each subject plays successively DG and TG. They play under the strategy method in the trust game (Selten, 1967). Each subject makes her choices as investor and as receiver: an investment  $x$  in both games and a transfer  $t$  for each level of investment received  $x$  in TG. At the end of the experiment, a random mechanism matches the subject with another and determines its role for payment.<sup>5</sup>

(2) *Veil of ignorance treatments* (Veil and Veil-t). DG and TG are played behind the veil of ignorance. Each subject acts as a "(veiled) stakeholder" (called *Decision Maker* in the experiment) that decides on both the investment and the transfer for each level of investment without knowing what her role will be. At the end of the experiment, subjects are randomly matched with another subject. An additional draw chooses which of the two subjects will be the Decision Maker. If the player is drawn as the Decision Maker, then her decision is automatically enforced and imposed to both players, whatever her role.<sup>6</sup>

(3) *Fee treatments* (Fee and Fee-t). Before each game, subjects have the possibility to pay a fee of 2 euros in order to increase their chance of obtaining their preferred role (they can pay either to be investor or receiver). A subject who paid for a particular position is certain to be attributed that position if the other subject she is matched with has not paid for the same position. If both subjects paid and asked for the same position, this position would be assigned randomly with equal probability. The same goes if neither of them was willing to pay the fee for a position.

(4) *Information treatment* (Info and Info-t). Subjects replay Basic and Basic-t after having been informed about the average investment and transfer chosen initially in Basic and in Basic-t.

## 2.3 Hypotheses

**Hypothesis 1** *Investing  $x = 2$  is more often played in the dictator game than in the trust game and investing  $x = 8$  is more often played in the trust game than in the dictator.*

As already mentioned, the sum of payoffs is maximized by investing  $x = 8$  in both DG and

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<sup>5</sup>Engelmann and Strobel (2004) and Iriberry and Rey-Biel (2011) also used this design for their dictator games.

<sup>6</sup>Note that the veil of ignorance differs from role uncertainty as defined by Iriberry and Rey-Biel (2011) because of this capacity of deciding. In our veil treatment, subject have full control of both decisions in the trust game.

TG. This is always unequal in the DG: the receiver  $R$  obtains all and the investor  $I$  nothing. The only way to be egalitarian in the DG is to invest  $x = 2$  and thus to opt for an inefficient outcome. Efficiency and equity are compatible in the TG as  $R$  can share the surplus through the back payment.

**Hypothesis 2** *Investing  $x = 2$  is more often played in Veil than in Basic, and investing  $x = 8$  and transferring back half of the payoff is more often played in Veil-t than in Basic-t.*

Behind the veil of ignorance, subjects control all decisions, and thus adopt their preferred solution when solving the equity versus efficiency trade-off. A Rawlsian or risk-averse subject would try to equalize payoffs as much as possible. He or she would therefore go for the egalitarian solution  $x = 2$  in the dictator game, and the efficient and egalitarian solution in the trust game, that is the investment  $x = 8$  and back-payment  $t = 3x/2$  that equalizes payoffs. We therefore expect subjects to be more egalitarian in both problems and to invest efficiently in the TG.

**Hypothesis 3** *Investment is lower in Fee and Fee-t than in Basic and Basic-t.*

Paying for a position can change subject's perception of fairness. They might think that they should get a reward for what they paid for. They would then keep a higher share of welfare when they decide how much to give to the other by investing less.

**Hypothesis 4** *Subjects invest in Info and Info-t at a level that is closer to the average compared to their investment in Basic and Basic-t.*

Information about average investment in baseline treatment may be perceived as a descriptive norm for own decisions. If subjects are influenced by the norm, they should revise their investment decisions in Info and Info-t closer to the average observed in Basic and Basic-t.

In a final hypothesis that encompasses all the previous ones, we examine behaviors at the individual level. Within-subject design allows us to examine the consistency of individuals' motives across treatments. With no possible transfer from  $R$ , Basic perfectly disentangles  $I$ 's motives and therefore serves as a good reference base for classifying individuals into types:  $I$  is a own-payoff maximizer when investing  $x = 0$  in Basic, an egalitarian when investing  $x = 2$  and a sum-payoff maximizer when investing  $x = 8$ .

**Hypothesis 5** *Individual preferences for the trade-off between own-payoff, equity and efficiency are shaped by institutions.*

Table 1 displays the investment predictions according to each type across treatments. We propose three behavioral types (own payoff maximizers, egalitarians and sum-payoff maximizers) that are determined according the level of investment in the benchmark treatment (Basic).  $I$  should theoretically invest the same amount in Basic as in Fee and Info. However, as we saw in hypotheses 3 and 4,  $I$  may slightly change her preferences after paying for one position in Fee or observing the others in Info. In Veil, risk-neutral own-payoff maximizers should invest  $x = 8$  (and hope to be drawn as a receiver). Egalitarian and sum-payoff maximizers should still invest 2 and 8 in Veil (hypothesis 2). In the case of transfers, the level of investment depends on  $I$ 's belief about  $R$ 's decision. If  $I$  believes that  $R$  will not transfer any amount (as in table 1),  $I$  should invest in Basic-t exactly the same amount as in Basic. If  $I$  believes that there is a chance that  $R$  will transfer a significant share of the investment, own-payoff maximizers and egalitarians may increase their level of investment (Hypothesis 1). Again, paying for a position in Fee-t and observing others in Info-t may slightly change individuals' preferences (hypotheses 3 and 4). Finally, Veil-t unites the motives: Our three types of players best serve their interests by investing  $x = 8$ .

Table 1: Investment predictions according to types in Basic when investors anticipate no transfer from the receiver.

	$x=0$	$x=2$	$x=8$
	(own-payoff maximizer)	(egalitarian)	sum-payoff maximizer
Fee	$x=0$	$x=2$	$x=8$
Info	$x=0$	$x=2$	$x=8$
Veil	$x=8$	$x=2$	$x=8$
Basic-t	$x=0$	$x=2$	$x=8$
Fee-t	$x=0$	$x=2$	$x=8$
Info-t	$x=0$	$x=2$	$x=8$
Veil-t	$x=8$	$x=8$	$x=8$

In the first column (own-payoff maximizer) are the Subgame Nash Equilibria.

## 2.4 Experimental procedure

The experiment was divided into three parts: (i) the two games played in different treatments, (ii) the risk aversion test, and (iii) the social preference test. It was conducted using a within-study procedure: each subject was involved in each part successively. We randomized the order of the three parts in case of needing to control the order effect (see Table 4 in appendix A for the precise orderings). All parts of the experiment involved a monetary incentive and were computerized. Subjects did not know their payoff until it was over. They had no information feedback from one part to another.

The main part of the experiment consisted of the two games played successively in the different treatments detailed previously. DG was played first, then TG.<sup>7</sup> Participants always started with

<sup>7</sup>We keep this same order of the games throughout the experiment. According to the existing literature, we simply expect that subjects will invest more money in the TG than in DG. This result seems robust to different designs, as observed by Cox (2004) and Etang et al. (2011) in a between-subjects design, and by Ashraf et al. (2006) in a within-subjects design with a different order between the two games. We have favored comparability between individuals (each does the same task) rather than already known game effects. Another reason why we keep this order is that varying the order of the games themselves would have required a huge number of sessions

Basic and Basic-t and then successively took part in Veil, Veil-t, Fee, Fee-t, Info and Info-t. In order to control risk preferences, subjects performed the Holt and Laury risk test (Holt and Laury 2002). This test is a menu of 10 paired lottery choices (sets of two options, one of which has to be chosen by the subject), designed to make inferences about risk preferences under various payment conditions. The subjects can choose the safe option (A) when the probability of obtaining the higher payoff is small, and then cross over to the risky option (B) without ever going back to A. The number of safe choices made by the subjects (before the switch to B) determines their risk attitude. As for social preferences, subjects performed the "ring test" (Liebrand, 1984). The ring test measures individuals' value orientations along a spectrum ranging from altruistic to aggressive. Subjects were asked to make binary choices between 24 (own, other) combinations of payoffs. The data collected from the 24 responses generated a motivational vector for each participant. This vector was calculated by adding up all the allocations opted for. The vector was then mapped back into an original circle (the 24 pairs of outcomes are evenly distributed in this circle) thanks to its conversion into an angle of social value. Following Liebrand (1984), this angle was then used to characterize the subject with one of five categories.<sup>8</sup>

We conducted 12 experimental sessions with a total of 180 subjects. Subjects were undergraduates coming from different departments of the university and from engineering schools, with no background in game theory. The experiment proceeded as follows. As they arrived in the laboratory, subjects received a personal code both to preserve their anonymity and to log into the software dedicated to the experiment. Subjects were told that they would be paid in cash at the end of the experiment. In our experiment, the average payoff was about 30 euros, including a participation fee of 5 euros. Each experimental session lasted about 2 hours. At the beginning of each part, participants could read the instructions on their own computer screens while the facilitators read them aloud. Their understanding of the instructions was checked using a simple quiz and then by running through the corrections with the group as a whole. At the beginning of

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and subjects.

<sup>8</sup>The angle  $\theta$  of a subject's motivational vector is the inverse tangent of the other/own ratio calculated from that subject's motivational vector. For instance, for egoistic (only concerned about their own payoff),  $-67.5^\circ < \theta < 22.5^\circ$ , for cooperative (concerned about the sum of both their own and the other's payoff),  $22.5^\circ < \theta < 67.5^\circ$ . Other categories are : aggressive (concerned only to minimize the other's earnings), competitive (concerned about the difference between their own and the other's payoff) and altruistic (only concerned about the other's payoff).

the experiment, subjects were told that the session would be divided into several parts and that all those parts were to involve a monetary incentive. They were also told that the payoffs they would get for each part were independent from one another, and that they would be given the amount of these payoffs, and would receive them, only at the end of the experiment. When the games (DG or TG) started, subjects were also told that the game would be played in different versions, and that one version would be drawn randomly and individually for the payoff at the end of the experiment. Subjects played each part of the experiment successively. When the experiment was over, the binding treatment and game (Basic, Basic-t, Veil, etc.) and the role assigned in DG or TG (either the investor or the receiver were randomly drawn<sup>9</sup>), the attribution of the planner’s role in the veil treatments (when required) and, finally, the binding decision in the Holt and Laury test. Draws, results of the three parts, and the corresponding monetary payoffs were displayed on their screen.

### 3 Experimental results

In this section we present the results of our experiment that provide evidence for our behavioral hypotheses. We start with an overview of the results for all treatments, then we proceed with the results for each treatment separately and we conclude with the results that deal with the efficiency-equity trade-off across individuals and institutions.

#### 3.1 Dictator and Trust Games

Average investment is higher under TG compared to DG (Average investment  $x$  are reported in Table 7 in Appendix B). In Figure 1 below, we represent the share of individuals who picked one of the three solutions we are interested in: non cooperative (play  $x = 0$ ), egalitarian ( $x = 2$ ) and efficient ( $x = 8$ ).

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<sup>9</sup>For the fee treatments, we took into account the possible payment of the €2 and followed the rules described in subsection 2.2.

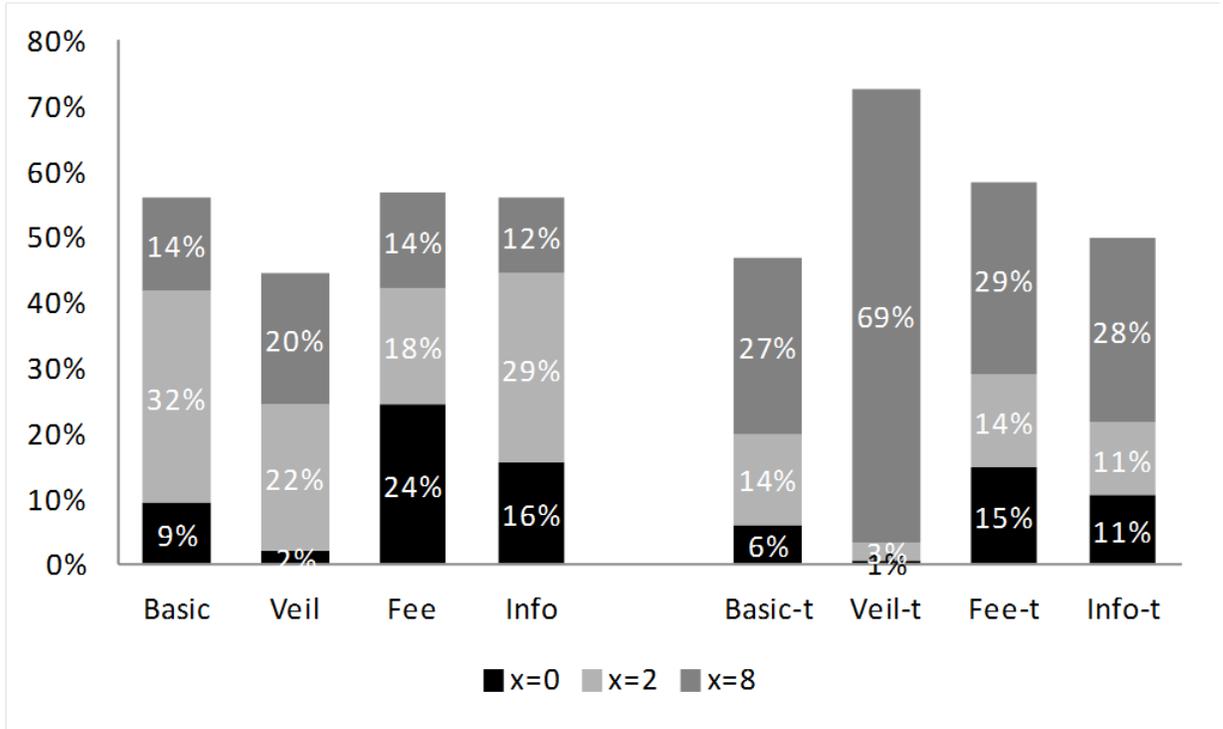


Figure 1: Proportion of non cooperative, egalitarian and efficient investment strategies

The possibility of a payment back to the investor has an effect on their decisions to invest. We can see from Figure 1 that the proportion of  $x > 0$  increased significantly from the dictator game to the trust game: it often more than doubled. On the other hand, fewer subjects opted for the 2 euros investment as it was then no longer the only way of achieving equal payoffs. Both results are consistent with Hypothesis 1.

We estimate investment econometrically under several specifications. The analysis makes use of the within-subject structure of our data by performing mixed effects Logit models to control for individual heterogeneity and repeated observations for each subject. We consider the level of investment  $x$  (Models I, II, III), the dummy  $Y$  ( $Y = 1$  if  $x \in [0; 2; 8]$ ,  $Y = 0$ , else) as a dependent variable (Models IV to VIII); we also look at the behavior in DG and TG separately (Models II, III, VI and VIII). The variable of reference is Basic in tDG games (or Basic-t in TG games). We consider social preferences and risk attitudes as control regressors in all models except in models

III and VI as risk is not supposed to impact  $x$  in the dictator games. Otherwise, controlling for risk aversion in dictator games is mainly motivated by comparability issues between institutions in transfer and no transfer treatments. Social preferences and risk attitudes are measured with respectively the angle of the social value vector of the ring test and the number of safe choices in the Holt and Laury test.<sup>10</sup> Specific data from these two tests are reported in our companion paper Garapin et al. (2015). Results are represented in Table 2 below.

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<sup>10</sup>For these analyses, we kept 141 individuals that all performed the three parts of the experiment (risk test, social value test, the two games). The remaining subjects were withdrawn from the analysis because they made inconsistent choices either in the risk test or in the ring test (25 subjects) and because of a computer bug in the ring test during one session (14 subjects). As subjects take in total 8 investment decisions (8 treatments), we thus obtain  $141 \times 8=1128$  observations, except for models II, III, VI and VIII limited to one game only, DG or TG ( $141 \times 4=564$  observations).

Also note that the different parts of the experiments (RT, RA and DG-TG) were sorted differently in every experimental session (see Table 6 in Appendix A). We therefore also estimated the same models with dummy variables indicating whether RT and RA were played before DG-TG. Results show that RA (respectively RT) significantly decreases (increases) the level of investment  $x$  (See Table 9, Appendix C). Nevertheless, the relative impact of our institutions remains unchanged when controlling for order effects. To further check our results robustness, we also ran the same regression without controlling without controlling for social and risk preferences. Our results remain qualitatively the same

Table 2: Regression results: Investment

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
	x	x	x	x=0	x=2	x=2	x=8	x=8
Social preference	0.0356*** (0.00683)	0.0350*** (0.00683)	0.0322*** (0.00609)	-0.0396*** (0.00976)	-0.0217*** (0.00776)	-0.0215*** (0.00815)	0.0653*** (0.0140)	0.0658*** (0.0155)
Risk	-0.114 (0.0980)	-0.107 (0.108)		0.0910 (0.138)	0.242 (0.158)		0.0544 (0.169)	0.0625 (0.219)
Fee	-0.248 (0.196)		-0.205 (0.178)	3.294*** (0.805)	-1.088*** (0.331)	-1.702*** (0.463)	0.120 (0.436)	
Fee-t	0.979*** (0.247)	-0.149 (0.205)		1.621** (0.806)	-1.879*** (0.465)		2.125*** (0.480)	0.476 (0.383)
Info	-0.305* (0.161)		-0.186 (0.153)	1.773** (0.727)	0.0613 (0.282)	-0.142 (0.348)	-0.682** (0.333)	
Info-t	1.092*** (0.211)	-0.0355 (0.147)		0.600 (0.735)	-2.206*** (0.511)		1.985*** (0.464)	0.321 (0.322)
Veil	0.979*** (0.189)		0.988*** (0.171)	-3.334** (1.476)	-0.513 (0.349)	-0.904** (0.442)	0.856** (0.412)	
Veil-t	3.496*** (0.240)	2.369*** (0.226)		-6.117*** (1.406)	-4.418*** (0.833)		5.781*** (0.650)	4.439*** (0.693)
Basic-t	1.128*** (0.202)			-0.934 (0.633)	-1.590*** (0.436)		1.693*** (0.455)	
Constant	3.631*** (0.652)	4.722*** (0.732)	2.940*** (0.189)	-7.106*** (1.588)	-2.885*** (1.097)	-1.879*** (0.480)	-5.037*** (1.310)	-3.633** (1.613)
Observations	1128	564	644	1128	1128	644	1128	564

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ 

Results are in line with *Hypothesis 1*: The possibility of a back payment in Basic-t has a significant impact on the level of investment with an increase of 15% from Basic to Basic-t (Model

I and Wilcoxon sign-rank tests, reported in Table 8 in Appendix B). While the proportion of efficient investment  $x = 8$  increases (Model VII), fewer subjects opt for the egalitarian  $x = 2$  solution (Model V) as it is then no longer the only way of achieving equal payoffs. At the same time, there is no difference in the rate of non-cooperative solutions  $x = 0$  (Model IV). This could mean that the investment increase between Basic and Basic-t is essentially driven by the egalitarian subjects. This is not statistically confirmed when we look at the individual trajectories (Figure 2). 47% of the non-cooperative players (playing  $x = 0$ ) in Basic invest a positive amount in Basic-t. Similarly, 66% of the egalitarian players in the Basic (playing  $x = 2$ ) increase their investment in Basic-t. These proportions are not significantly different according a Fisher Exact test. 40% of the subjects invest exactly the same amount in Basic and Basic-t. The rest are more likely to increase their investment regardless of their initial level of investment.

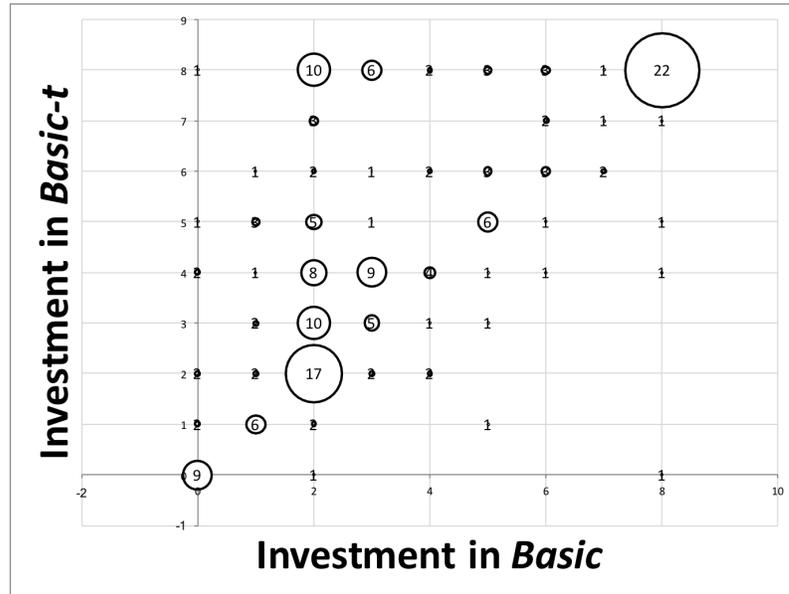


Figure 2: Frequency of players according to their investment in Basic and Basic-t

Finally, risk aversion as measured using the Holt and Laury test, has no significant impact on investment. It does not impact significantly the probability of choosing all investment levels analyzed in Table 2. These results are in line with Houser et al. (2010). Conversely, social preference favors higher investment (Models I, II, III), lower rates of selfish decisions  $x = 0$  (Model IV), lower rates of  $x = 2$  (model V) and higher rates of  $x = 8$  (Model VII). These results

are in line with Kanagaretnam et al. (2009).

### 3.2 Veil treatment

The evidence is mixed regarding Hypothesis 2: while the efficient strategy  $x = 8$  is indeed more frequently played in Veil-t than in Basic-t (Model VIII), the rate of egalitarian strategy  $x = 2$  is significantly lower in Veil than in Basic (Model VI). Investment significantly increases by 30% from Basic to Veil and by 48% from Basic-t and Veil-t (Table 8 in Appendix B). Whatever their initial level of investment in Basic, players switch to the efficient  $x = 8$  solution in Veil-t (Figure 3, left) resulting in 69% of players opting for the efficient solution. Contrary to what was expected in *Hypothesis 2*, efficiency is more attractive for subjects than Maximin strategies. Although 73% of the players who invested  $x = 2$  in Basic keep investing  $x = 2$  in Veil, only 17% of those who played non-cooperatively  $x = 0$  invest  $x = 2$  in Veil. As a matter of fact, 75% of the non-cooperative players in Basic invest more than 2 euros in Veil.

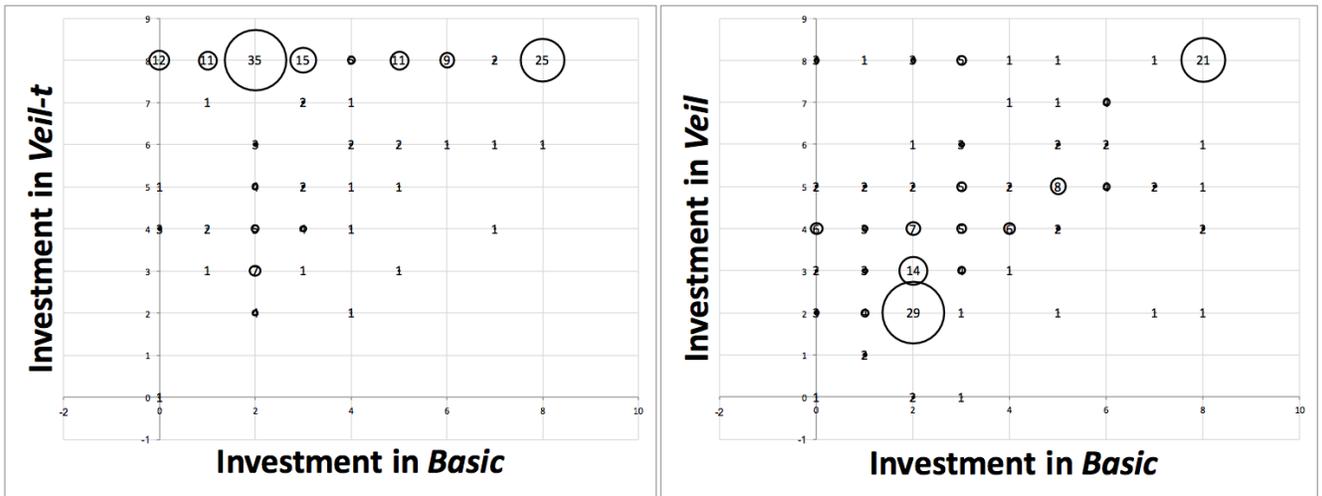


Figure 3: Frequency of players according to their investment respectively in Basic and Veil-t on the left and in Basic and Veil on the right

### 3.3 Fee treatment

Results are consistent with Hypothesis 3 as the opportunity to pay for a position induces more non-cooperative solutions. Although the average investment is not significantly different in Fee

and Basic (Models I, III and Table 8), non-cooperative solutions  $x = 0$  are more frequent in Fee compared to Basic, and in Fee-t compared to Basic-t: 24% of players invest nothing in Fee against 9% in Basic ( $p=0.007$ , Fisher Exact test) and  $x = 0$  is significantly more likely to be played in Fee (Model IV). Same observations can be made about Fee-t and Basic-t: no significant average difference (Table 8) but significantly more  $x = 0$  investment (15% *vs.* 6%,  $p=0.06$ , Fisher Exact test).

We now distinguish individuals according to whether they are willing to pay the fee and, if they are, whether they are willing to pay to be an investor or a receiver. In addition to Fee and Fee-t treatments, we make this analysis also for both Basic and Basic-t as the within subject design makes this possible. To do so, we run six new models (Table 3) that regress the amount invested depending on whether the subject paid to get her/his favorite position (either Investor or Receiver in TG and either Dictator or Receiver in tDG) or not (Neutral). Models IX to XIV consider investment respectively in Basic, Fee, Basic, Fee, Fee-t and Basic-t. In models XI and XII we ran regression without controlling for risk preferences in tDG. Even if participants did not have the opportunity to pay to get their favorite position in Basic and Basic-t, Models IX, X and XIII are useful to see whether those who paid for a position behave differently in Basic and Basic-t treatments when the fee is not available.

Table 3: Tobit regression results: Fee.

	(IX)	(X)	(XI)	(XII)	(XIII)	(XIV)
	Basic	Fee	Basic	Fee	Basic-t	Fee-t
Social preference	0.0401*** (0.00849)	0.0292** (0.0122)	0.0376*** (0.00691)	0.0323*** (0.0105)	0.0403*** (0.00816)	0.0210** (0.0105)
Risk	-0.157 (0.162)	-0.286 (0.203)			-0.0381 (0.154)	-0.447** (0.173)
Fee as dictator	-1.799*** (0.593)	-4.426*** (0.795)	-1.519*** (0.555)	-3.523*** (0.758)		
Fee as receiver	-0.395 (0.472)	1.018* (0.559)	-0.265 (0.435)	1.134** (0.533)		
Fee-t as investor					-1.949** (0.775)	-3.290*** (1.031)
Fee-t as receiver					-0.0698 (0.443)	0.396 (0.535)
Constant	4.197*** (1.132)	4.630*** (1.317)	3.113*** (0.335)	2.597*** (0.444)	4.408*** (1.049)	7.198*** (1.158)
Observations	141	141	161	161	141	141

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Significance based on p-values, we respectively used \*\*\*, \*\* and \* for 1%, 5% and 10% significance levels. Robust clustered standard errors in parentheses.

As depicted in Figure 4, the fee to become an investor sorts out non-cooperative players. Respectively 23% and 18% are willing to pay to be an investor in Fee and Fee-t. Those are less cooperative in general: they invest less in Fee (Model X) and Fee-t (Model XIV) and also in Basic (Models IX and XI) and Basic-t (Model XIII). These results are consistent with previous research on trust games based on individuals willingness to pay to avoid being vulnerable to the target of trust (McEvily et al., 2012). Furthermore, paying a fee also reduces the willingness to invest in DG. Players willing to pay a fee to become investor invest less in Fee than in Basic (2.39 *vs.*

1.22,  $p=0.003$ , signed-rank Wilcoxon test). Although the number of non-investors doubles (from 15% to 30%), players willing to pay a fee to become investors do not decrease their investment in TG (2.95 *vs.* 2.68 in Basic-t and Fee-t,  $p=0.228$ , signed-rank Wilcoxon test).

The results are symmetrical for the players willing to pay to become receivers. They are generally more cooperative compared to players willing to pay to become investors (3.49 *vs.* 2.39 in Basic, 4.89 *vs.* 2.95 in Basic-t, 4.47 *vs.* 1.22 in Fee and 4.80 *vs.* 2.68 in Fee-t) and paying a fee induce more cooperation in DG (3.49 *vs.* 4.47,  $p=0.003$ , signed-rank Wilcoxon test).

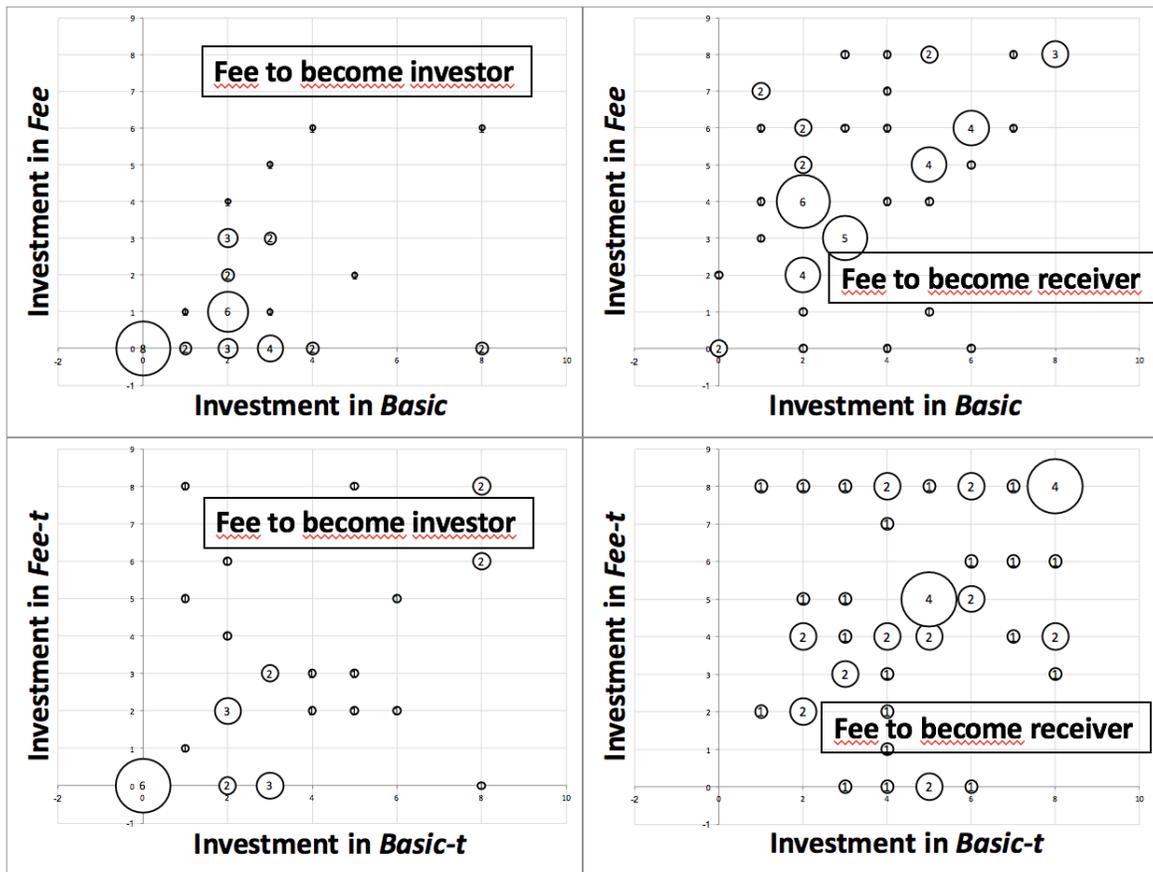


Figure 4: Frequency of players according to their willingness to pay to be either an investor (left) or a receiver (right) and according to their investment respectively in Basic and Fee (top) and in Basic-t and Veil-t (bottom)

### 3.4 Info treatment

Results are overall consistent with Hypothesis 4. Although a slight majority did not change their investment level when informed about the average investment, subjects who did change move towards the average investment.

In Table 4 below we report the number of subjects who increase, decrease or leave unchanged their investment in the info treatment compared to the basic treatment, while investing below, above or at the same level as the average of their group in the basic treatment.

Table 4: Investment decision in Info relative to investment and average investment in Basic.

Dictator Game	Overall	$x_{basic} < \bar{x}_{basic}$	$x_{basic} = \bar{x}_{basic}$	$x_{basic} > \bar{x}_{basic}$
$x_{info} < x_{basic}$	42	8	10	24
$x_{info} = x_{basic}$	96	41	24	31
$x_{info} > x_{basic}$	42	29	8	5
Trust Game	Overall	$x_{basic} < \bar{x}_{basic}$	$x_{basic} = \bar{x}_{basic}$	$x_{basic} > \bar{x}_{basic}$
$x_{info} < x_{basic}$	43	11	8	24
$x_{info} = x_{basic}$	96	33	17	46
$x_{info} > x_{basic}$	41	30	5	6

Only 47% of subjects invested differently in the info treatments. This share is remarkably the same for between the dictator and trust games. Among the subjects who changed their investment decision, 78% of them who invested less than average in Basic increased their investment in Info. Similarly, 82% of the subjects who invested more than average in Basic reduced their investment in Info. A similar feature is observed in the trust game: 73% of the subjects who invested less than average in Basic-t increased their investment in Info-t and 80% of those who invested more reduced their investment.

### 3.5 The Efficiency-Equity trade-off across individuals and institutions

We now look at the investment levels according our three types (own-payoff maximizer, egalitarian and sum-payoff maximizer). Table 5 presents their mean investment across treatments. Except for Veil and Veil-t, own-payoff maximizers systematically invest significantly less than egalitarians

who themselves invest significantly less than sum-payoff maximizers. Sum-payoff maximizers are on average remarkably close to the maximum investment, and thus efficiency, in all treatments with means ranging from 6.50 in Fee to 7.92 in Veil-t. In Fee and Info, own-payoff maximizers and egalitarians are also very close to the predictions (Table 1). If this remain true on average in Fee, it is misleading at the individual level for egalitarians. The majority of egalitarians moves from the  $x=2$  solution by decreasing their investment when they pay a fee to become an investor and increase their investment when they pay a fee to become a receiver (see top charts in figure 4). Thanks to the prospect of a possible transfer back from  $R$  in Basic-t, Fee-t, and Info-t, own-payoff maximizers and egalitarians deviate somewhat from those predictions by investing on average a little more: approximately 1.5 for own-payoff maximizers and 4 for egalitarians. In Veil, own-payoff maximizers invest significantly more than egalitarian (4.12 *vs.* 2.90). This was expected as  $x=8$  maximizes the expected own-payoff and  $x=2$  ensures equal payoffs in Veil. The adoption of maximin strategies may explain the gap between the observed average investment and the predictions for own-payoff maximizers. In Veil-t, investment level does not differ between own-payoff maximizers and egalitarians.

Table 5: Mean investment across treatments according to types in Basic.

Basic	Own-payoff maximizer:		Egalitarian		Sum-payoff maximizer:
	$x=0$ ( $n=17$ )	$x=1$ ( $n=15$ )	$x=2$ ( $n=58$ )	$3 \leq x \leq 7$ ( $n=64$ )	$x=8$ ( $n=26$ )
Fee	0.18 <sup>a</sup>	2.40 <sup>b,c</sup>	2.24 <sup>b</sup>	3.88 <sup>c</sup>	6.50 <sup>d</sup>
Info	0.59 <sup>a</sup>	2.33 <sup>b</sup>	2.26 <sup>b</sup>	3.72 <sup>c</sup>	6.62 <sup>d</sup>
Veil	4.12 <sup>b</sup>	3.27 <sup>a,b</sup>	2.90 <sup>a</sup>	5.09 <sup>c</sup>	7.27 <sup>d</sup>
Basic-t	1.59 <sup>a</sup>	2.73 <sup>b</sup>	4.07 <sup>c</sup>	5.27 <sup>d</sup>	7.38 <sup>e</sup>
Fee-t	1.82 <sup>a</sup>	3.40 <sup>a,b</sup>	3.98 <sup>b</sup>	4.59 <sup>b</sup>	7.08 <sup>c</sup>
Info-t	1.29 <sup>a</sup>	3.27 <sup>b</sup>	4.07 <sup>b</sup>	4.94 <sup>c</sup>	7.50 <sup>d</sup>
Veil-t	6.65 <sup>a</sup>	7.07 <sup>a</sup>	6.33 <sup>a</sup>	6.95 <sup>a</sup>	7.92 <sup>b</sup>

a, b, c, d, e Means per line with the same letter are not significantly different at the 5% level (Wilcoxon Mann-Whitney test)

We end the analysis by assessing the levels of efficiency and equity for each treatment. To do so, we relate investment level to profit equity. In Figure 2, each treatment is presented according to its degree of efficiency (x-axis) and equity (y-axis). Efficiency is quantified by the investment share ( $x/8$ ). As for equity, we compute an equity index  $E$  such as:

$$E = 2 \times \frac{\text{Min}(\pi_I; \pi_R)}{\pi_I + \pi_R} \text{ with } 0 \leq E \leq 1$$

where  $\pi_I$  and  $\pi_R$  are respectively the investor's and receiver's payoffs. If  $E=0$  the share is perfectly unequal and if  $E=1$  the share is perfectly equal.

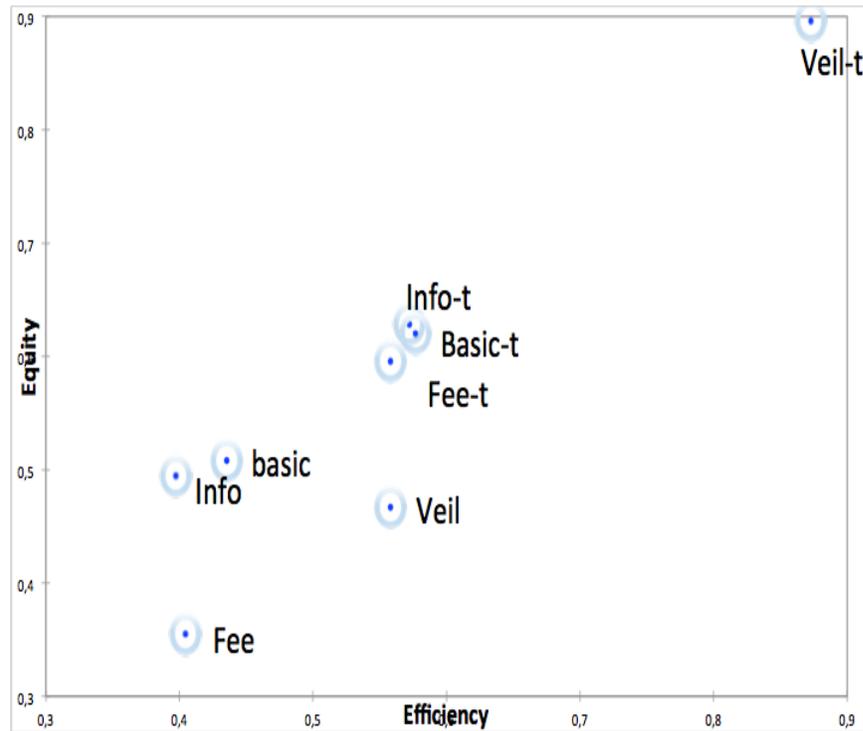


Figure 5: Classification of the treatments according indexes of efficiency and equity.

As expected, trust games perform better in terms of both equity and efficiency than dictator game. When it comes to the dictator game, Fee is clearly the most unequal treatment of all and Veil is by far the most efficient. All trust games treatments have remarkably close scores on both equity and efficiency, except Veil-t who is almost perfect in both dimension with an index close to 1.

## 4 Conclusion

Efficiency and equity are the two main criteria used to assess resource allocation systems. There is a trade-off between efficiency and equity when the activity simultaneously increases productive efficiency and decreases distributive efficiency, or vice versa. The triple dictator game is such an example where fairness and efficiency are mutually exclusive and thus make it possible to disentangle individual motives. This paper examines whether the change in allocation rules has an impact on individual preferences for equity and efficiency. We found that preferences are remarkably consistent across institutions. In order to increase efficiency without compromising equity, institutions must reduce the antagonism between equity and efficiency by allowing transfers from the receiver in trust games or by introducing a veil of ignorance. Descriptive norms do not mitigate the equity-efficiency tradeoff. The introduction of a position fee (to be either the investor or the recipient) even aggravates the efficiency-equity antagonism by leading to more selfish and unequal outcomes.

In details, this article tests several hypotheses. Our first hypothesis is that subjects sacrifice efficiency (defined as total payoff) for equity in the dictator game, where the unique egalitarian outcome is inefficient (when the investor invests 2 units). In the trust game, efficiency and equity are both achievable if the investor trusts the receiver and if the receiver is trustworthy. Subjects seem to follow that path as investors are less likely to invest two units and more likely to invest all units (and thus reach higher efficiency in the trust game than in the dictator game).

Our second hypothesis is that subjects express a preference for equity when they make their decision behind the veil of ignorance. We assume that they are thus incited to even out payoffs as much as possible in both games, as suggested by maximin strategy. The evidence is mixed. In the dictator game where subjects have to choose between being egalitarian or efficient, neither of the two strategies prevail. Subjects express preferences for both. Risk aversion might explain preferences for equality of payoffs rather than for extremely unequal efficient outcomes. Yet, we find that risk attitude measurement using the Holt and Laury test does not determine the choice between the two strategies. In contrast, efficiency and equity are no more conflictual in the trust game. As a result, three quarter of the subjects behave as expected by selecting the efficient and egalitarian solution.

Our third hypothesis is that subjects who pay to get a specific position in the games are less cooperative. Our conjecture is that having to pay the fee changes their perception on what is fair - they may think that they deserve a higher share of welfare when they get their position by paying rather than by chance. It turns out to be true but for another reason than the one we expected. According to a sorting effect, investors are more likely to be non cooperative since non cooperative players are more willing to pay for being investors than others.

Our fourth hypothesis is that once subjects get to know the average investment of their group, they modify their investment decision to bring it closer to this average. Our result provides support for this: while the majority of subjects do not change their investment decision from the basic treatment to the info treatment, those who do change their investment in the predicted direction. However, changes do not affect the overall degree of efficiency and equity.

Our final hypothesis encompasses the previous ones: Motives towards equity and efficiency are shaped by institutions. Our within-subject structure allows us to trace individual behaviors across treatments. Our three types - own-payoff maximizers, egalitarians and sum-payoff maximizers - that are based on behaviors in our benchmark treatment Basic, play remarkably consistently across treatments. We find no evidence that each type univocally changes their objective throughout the experiment. Own-payoff maximizers invest significantly less than egalitarians in all treatments except under the veil of ignorance where own interest and efficiency are convergent. Sum-payoff maximizers always invest significantly more than the two other types. Therefore, institutions do not shape individuals' intrinsic motives with one slight exception. Egalitarians are less inclined to minimize payoff differences when they pay to get a specific position in the triple dictator game. Paying to be an investor decreases their level of investment while paying to be a receiver increases it. As a result, the treatment Fee is the most unequal treatment of all. Giving information about others' level of investment does not overall alter motives for equity and efficiency. In order to drive all individuals towards efficiency and equity, institutions must decrease the trade-offs between maximizing own-payoff and efficiency and equity. Allowing transfers in the trust games and playing under the veil of ignorance are just doing that.

## Appendix

### A Timing of experiment sessions

Order	Nb of Sessions	Nb of observations
RT-RA-DG-TG	3	38
RA-TG-DG-RT	2	28
DG-TG-RT-RA	2	22
DG-TG-RA-RT	2	32
RA-RT-DG-TG	2	32
DG-TG-RA-RT	2	28
Total	13	180

Table 6: Experiment sessions with the order of its different parts (RT: ring test, RA: risk aversion test, DG: dictator game, TG: trust game)

### B Average investment and non-parametric tests on investment

Table 7: Average transfers and returns in TG and DG

Treatments	Basic	Basic-t	Veil	Veil-t	Fee	Fee-t	Info	Info-t
Average investment	3.433 (2.493 )	4.628 (2.619)	4.456 (2.270)	6.872 (1.900)	3.256 (2.777)	4.394 (2.876)	3.256 (2.447)	4.544 (2.700)

Standard errors are in brackets.

Table 8: Multiple comparison between investment in different treatments

Treatments	Basic	Basic-t	Veil	Veil-t	Fee	Fee-t	Info	Info-t
Basic	1	0.000	0.000	0.000	0.367	0.000	0.463	0.000
Basic-t		1	0.431	0.000	0.000	0.171	0.000	0.386
Veil			1	0.000	0.000	0.954	0.000	0.614
Veil-t				1	0.000	0.000	0.000	0.000
Fee					1	0.000	0.921	0.000
Fee-t						1	0.000	0.231
Info							1	0.000
Info-t								1

Wilcoxon Signed Rank test  $p$ -values.

## C Robustness checks: Order effects and risk and social preferences

Table 9: Regression results when controlling for order effects and without controlling for risk and social preferences

	DG and TG	TG	DG	DG and TG	TG	DG
	x	x	x	x	x	x
Social preference	0.0334*** (0.00660)	0.0344*** (0.00683)	0.0304*** (0.00571)			
Risk	-0.151 (0.0983)	-0.131 (0.112)				
Fee	-0.248 (0.196)		-0.205 (0.178)	-0.205 (0.178)		-0.205 (0.178)
Fee-t	0.979*** (0.247)	-0.149 (0.205)		0.994*** (0.222)	-0.130 (0.189)	
Info	-0.305* (0.161)		-0.186 (0.153)	-0.186 (0.153)		-0.186 (0.153)
Info-t	1.092*** (0.211)	-0.0355 (0.147)		1.087*** (0.191)	-0.0373 (0.133)	
Veil	0.979*** (0.189)		0.988*** (0.171)	0.988*** (0.171)		0.988*** (0.171)
Veil-t	3.496*** (0.240)	2.369*** (0.226)		3.435*** (0.220)	2.311*** (0.207)	
Basic-t	1.128*** (0.202)			1.124*** (0.182)		
RA before IG	-0.741** (0.288)	-0.461 (0.329)	-0.892*** (0.294)			
RT before IG	1.021*** (0.270)	0.474 (0.330)	1.323*** (0.285)			
Constant	3.738*** (0.717)	4.871*** (0.816)	2.722*** (0.272)	3.516*** (1.588)	4.640*** (1.097)	3.516*** (0.480)
Observations	1128	564	644	1288	644	644

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

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