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Inequality Aversion, Efficiency, and Maximin Preferences in Simple Distribution Experiments*

Dirk Engelmann† and Martin Strobel‡

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Abstract

We present simple one-shot distribution experiments comparing the relative importance of efficiency, maximin preferences and inequality aversion, as well as the relative performance of the fairness theories by Bolton and Ockenfels (2000) and Fehr and Schmidt (1999). While the Fehr and Schmidt model performs better in a direct comparison, this appears to be due to being in line with maximin preferences. More importantly, we find that the influence of both efficiency and maximin preferences is stronger than that of inequality aversion. We discuss potential implications our results might have for the interpretation of other experiments.

Keywords: social preferences, efficiency, inequality aversion, maximin preferences, altruism, experiments.

JEL classification: D63, D64, C99.

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1 Introduction

Among the recent attempts to explain anomalous behavior observed in economic experiments, models based on inequality aversion have received special attention. The attractiveness of these models is based on their ability to rationalize a number of well known anomalies with just two motives, maximization of own payoff and inequality aversion. The latter is understood as disutility arising from differences between the own payoff and others' payoffs.

The aim of this paper is on the one hand to compare the relative importance of inequality aversion, concerns for efficiency and maximin preferences in simple distribution experiments. On the other hand, we compare the relative performance of two similar theories based on inequality aversion: Bolton and Ockenfels' (2000) "Theory of Equity, Reciprocity and Competition" (henceforth ERC) and Fehr and Schmidt's (1999) "Theory of Fairness, Competition, and Cooperation" (henceforth F&S).

Our original approach to compare ERC and F&S recognized the potential importance of efficiency[1] and thus controlled for it. However, we expected this to be a comparably minor effect. It turned out, that this was not the case (see the analysis of treatments F and E in section 4). This finding inspired further experiments to test for the robustness of this result and to investigate to what extent inequality aversion is dominated by efficiency concerns or maximin preferences, which are understood as a desire to maximize the minimal payoff in the group. In particular, these new treatments allow us to compare the explanatory power of the models based on inequality aversion to the model by Charness and Rabin (forthcoming, henceforth C&R), that is based on efficiency concerns and maximin preferences and was inspired by results in similar experiments.

Our results suggest that efficiency concerns and maximin preferences are important in this class of simple distribution experiments. While this does not necessarily imply that they are equally important in other classes of games, common interpretations of several games may well be confounded by these motives. It appears that this may have been given too little attention in the past (see section 6 for a discussion). To illustrate that ignoring efficiency and maximin preferences may be problematic, consider the following example. Let person 2 choose from the allocations A and B among persons 1,2, and 3.

Allocation	A	B
Person 1	9	8
Person 2	8	8
Person 3	4	8
Total	21	24

[1] Efficiency is here simply understood as the sum of payoffs, not in the sense of Pareto-efficiency.

If person 2 is inequality averse, i.e. dislikes differences between the payoffs of the three subjects, she clearly prefers B over A. But B is also the preferred choice for person 2 if she is driven by efficiency concerns, i.e. a desire to maximize the total payoff of all subjects or by maximin preferences, i.e. a desire to maximize the minimal payoff of all subjects. Thus deriving any conclusions from a choice of B concerning the importance of inequality aversion is confounded by efficiency concerns and maximin preferences. One cannot tell whether person 2 wants to redistribute money from the rich to the poor because she dislikes inequality, because she cares for efficiency, or because she cares particularly for the poorest. Now add a third allocation C, so that person 2 chooses from the following allocations.

Allocation	A	B	C
Person 1	9	8	11
Person 2	8	8	10
Person 3	4	8	9
Total	21	24	30

If person 2 chooses allocation B now, this is a clear indication that she is inequality averse, since she is even giving up own payoff to reduce inequality and both efficiency concerns and maximin preferences suggest a choice of C. The latter, in turn, could not be considered evidence for either efficiency concerns or maximin preferences, since the same result is suggested by pure selfishness.

In our experiments, we disentangle efficiency concerns, maximin preferences and inequality aversion to compare their relative importance. In order to exclude, as far as possible, motives like reciprocity, we chose degenerate games like the one above that were completely reduced to the question of distribution. All a subject had to do was to choose one of three allocations of money between herself and two other subjects. Since both ERC and F&S are formulated on the basis of distributions only, these games seem to us the most neutral playground to compare their predictive accuracy.

In contrast to previous experiments, in several of our treatments ERC and F&S predict choices of allocations that are at the opposite ends of the choice set. In these treatments, F&S does better in general. However, this effect appears to result from F&S being in line with maximin preferences in this situation. When F&S predicts an allocation that is Pareto-dominated, it does very poorly. Across all treatments, a conditional logistic regression reveals that both efficiency and maximin preferences are indispensable for a complete explanation of our results, whereas inequality aversion does not significantly add to the explanation.

Other fairness theories could be applied to our setting as well. Our experiments, however, are not suited to test theories that explicitly take intentions into account (e.g. Rabin, 1993, Dufwenberg and Kirchsteiger, 2000, Falk and Fischbacher, 1999) since this would require assumptions about beliefs concerning the choices of subjects with whom one might be matched. The same holds for the full C&R model but we can shed some light on the basic model, relying on selfishness plus quasi-maximin preferences (maximizing a weighted sum of total and minimal payoff).

In section 2 we outline the difference between ERC and F&S that we focus on in the comparison. Section 3 presents our experimental procedures, followed by the experimental results in sections 4 and 5 as well as a discussion in section 6. Section 7 concludes.

2 Inequality Measures in ERC and F&S

The difference between the inequality measures in ERC and F&S is represented in the motivation or utility function. The motivation function of ERC is given by $v_i(y_i, \sigma_i)$, with y_i denoting the own payoff and σ_i the share of the total payoff, and v_i for given y_i being maximal if $\sigma_i = \frac{1}{n}$, n being the number of players. F&S assumes a utility function $U_i(x) = x_i - \alpha_i \frac{1}{n-1} \sum_{j \neq i} \max\{x_j - x_i, 0\} - \beta_i \frac{1}{n-1} \sum_{j \neq i} \max\{x_i - x_j, 0\}$ with $\alpha_i \geq \beta_i \geq 0$, $\beta_i < 1$ and x_i the payoff of subject i.

Hence ERC assumes that subjects like the average payoff to be as close as possible to their own payoff while F&S assumes that subjects dislike a payoff difference to any other individual. According to ERC, therefore a subject would be equally happy if all subjects received the same payoff or if some were rich and some were poor as long as she received the average payoff, while according to F&S she would clearly prefer that all subjects get the same. In a real life situation F&S predicts that the middle class would tax the upper class to subsidize the poor, while in an ERC world the middle class would be content with the distribution. Our taxation games mimic such a situation.

3 Experimental Procedures

We conducted thirteen experimental treatments in three sessions. These sessions were all conducted as classroom experiments at the end of a lecture during the first weeks of introductory economics courses at Humboldt-Universität zu Berlin. 136 participants took part in the first session in 1998, 68 in both treatments E and F. 240 participants took part in the second session in 2000, 30 for each of the next eight treatments. In the third session in 2001, 210 participants took part, 90 in both treatments Ex* and P*, and 30 in treatment Ey. We had determined a number of seats corresponding to the desired number of participants in advance. We asked students to either take one of these seats or to leave the class room. After all seats had been taken and all other students had left the classroom, each participant received a decision sheet with the instructions and a questionnaire. We used the questionnaires to gather some biographical data and to check whether the participants understood the task completely. The total procedure took about 20 minutes. Participants were paid in class the following week. They were identified by codes that were noted both on the decision sheets and on attached identification sheets that the participants kept. They received the payment in a sealed envelope in exchange for the identification sheet. These procedures implied anonymity with respect to the other participants.

The decision sheet contained three different allocations of money between three persons, of which they had to choose one. They were informed that we would randomly form groups of three later on and would also assign the three roles randomly, hence subjects faced role uncertainty. Only the choice of the participant selected as person 2 mattered.[2] Treatments Ex* and P*, that serve as control treatments for possible influences of the role uncertainty, assigned fixed roles in advance, but kept the random ex-post formation of groups. To avoid influence by computation errors we also noted the average payoffs of persons 1 and 3 and the total payoff for each allocation in the decision sheet.[3] Sample instructions can be found in appendix A. The precise allocations and the resulting predictions of the different theories will be presented along with the results for the individual treatments.

4 Experimental Results

4.1 Taxation Games

Details and Predictions

In line with our motivation that according to F&S the middle-class would like to tax the upper class to subsidize the poor, while it would be content with the distribution according to ERC, we call one class of our experimental games taxation games. In these games the decision maker (person 2) receives an intermediate payoff and can redistribute payoff between person 1, who receives a higher payoff, and person 3, who receives a lower payoff. These are our original treatments F and E as well as treatments

[2] In other words, we used (a reduced form of) the strategy method. Apart from generating three times the data, it secured that all participants were considered to be equally entitled to the money since they had all performed the same task. It also prevented that we had to pay participants for doing nothing. Careful readers might have noticed that it is impossible to divide 68 subjects into groups of 3 in treatments E and F. We used one subject per treatment a second time as a dummy subject to fill a group, without paying twice. Hence the decision of two of our subjects either mattered for two groups (if the dummy subject was person 2) or mattered only for one other person (if the dummy was not person 2). We chose this procedure since in recruiting the subjects in the classroom, we focused on having equal subtreatments sizes, i.e. multiples of four. This slight dishonesty was avoided in the other treatments since keeping the same number of subjects for each of the six subtreatments per treatment implied multiples of three for each main treatment.

[3] Noting the average payoff implies that ERC was getting a pretty fair shot, since it made the allocation that is optimal according to ERC easy to recognize.

Fx and Ex. Their crucial property is, that the allocation that minimizes the difference between the payoffs of person 2 and each of the other persons, maximizes the difference between the payoff of person 2 and the average payoff and vice versa. Thus ERC and F&S predict choices of opposite allocations. Since both theories include self-interest, we kept the payoff of person 2 constant over all allocations to insure disjoint predictions. Compared to treatments F and E, in Fx and Ex the relative payoff of person 2 differs much more between the allocations and is exactly $\frac{1}{3}$ in the ERC prediction to make the deviations from the optimum according to ERC more salient. The allocations for treatments F, E, Fx and Ex are presented in Table 1 along with the average payoff of persons 1 and 3, the relative payoff of person 2, and the total payoff. We also marked which allocation is predicted by ERC and F&S and which allocation maximizes the minimal or the total payoff, as well as the actual choices.

Our treatments differed by the effect the choice of an allocation had on the total payoff. In treatments F and Fx the allocation predicted by F&S maximizes the total payoff (and that is why they are called treatments F and Fx). In treatments E and Ex the choice predicted by ERC maximizes total payoff. Thus, in the treatments taken together, we have controlled for a possible effect of concerns for efficiency in favor of any of the two theories.[4] Neither ERC, nor F&S, efficiency or maximin preferences predict that the intermediate allocation will ever be chosen.

In all taxation games the F&S prediction coincides with the maximin allocation. Thus one might object, that we should have controlled not only for the effect of efficiency, but also for the influence of maximin preferences. While both F&S and ERC can, however, equally well be in line with and contrary to efficiency, the same holds only for ERC with respect to maximin preferences. F&S is contrary to maximin preferences only if increasing the difference to the poorest payoff is the price for a reduction of other payoff differences that are larger or disadvantageous (as is the case in our other treatments). Thus it is an inherent difference of the two models and not an artifact of our design that F&S is rather in line with maximin preferences.

Each of the treatments E and F was also divided into two subtreatments that only differed by the order in which the allocations were presented on the decision sheet.[5] All other treatments were divided into six subtreatments, one for each permutation of the allocations.

[4] The preferable way to prevent results being confounded by efficiency would have been that all allocations yielded the same total payoff. If the own payoff is fixed, however, ERC implies indifference between all allocations if the average and thus the total payoff of the other subjects is the same.

[5] This was done to avoid the conceivable influence of a preference for the center or right allocation. The allocation with intermediate payoffs was always presented on the left, since it was the allocation we were not really interested in and thus did not consider it a problem that it might have been advantaged or disadvantaged by the position. Our later approach to use all six permutations is certainly superior.

Treatment	F			E			Fx			Ex		
Allocation	A	B	C	A	B	C	A	B	C	A	B	C
Person 1	8.2	8.8	9.4	9.4	8.4	7.4	17	18	19	21	17	13
Person 2	5.6	5.6	5.6	6.4	6.4	6.4	10	10	10	12	12	12
Person 3	4.6	3.6	2.6	2.6	3.2	3.8	9	5	1	3	4	5
Total	18.4	18	17.6	18.4	18	17.6	36	33	30	36	33	30
Average 1, 3	6.4	6.2	6	6	5.8	5.6	13	11.5	10	12	10.5	9
Relative 2	.304	.311	.318	.348	.356	.364	.278	.303	.333	.333	.364	.4
Efficient	A			A			A			A		
ERC pred.			C	A					C	A		
F&S pred.	A					C	A					C
Maximin	A					C	A					C
Choices (abs.)	57	7	4	27	16	25	26	2	2	12	5	13
Choices (%)	83.8	10.3	5.9	39.7	23.5	36.7	86.7	6.7	6.7	40	16.7	43.3
Choices (sub.1)	29	3	2	14	8	12						
Choices (sub.2)	28	4	2	13	8	13						

Table 1: Allocations (in DM), predictions by ERC and F&S, maximin and efficient allocations, and decisions for the taxation games

Results

The results for treatments E and F (including the subtreatments in the last two rows) as well as for Fx and Ex are presented in Table 1. In both treatments F and E there is virtually no difference between the two subtreatments ($\chi^2_2 = .08$, $p > .96$ for treatment E and $\chi^2_2 = .16$, $p > .92$ for treatment F).[6] While there is certainly some randomness in our data due to the random allocation of subjects to treatments, the virtual absence of differences between the subtreatments suggests that our data are far from being completely random.

The results for treatment F are very clear. 83.8% of subjects chose the allocation leading to a maximization of utility according to F&S and also to a maximization of total payoff. On the other hand, only 5.9% chose the allocation predicted by ERC, and 10.3% the intermediate allocation. The three allocations were not chosen with equal probability ($p_{ABC} < .001$), in particular the F&S allocation was chosen significantly more often than the ERC allocation ($p_{AC} < .001$).[7]

[6] Hence we can conclude that the results are not driven by a preference for either the middle or the right column and we pool the data from the respective subtreatments. For the other treatments we do not report results for the subtreatments, since the number of subjects in each of the subtreatments was only five, and since we completely controlled for possible preferences for certain positions by using all permutations of the allocations.

[7] In the following p_{ABC} will always denote the level of significance for a multinomial test of the hypothesis that all allocations are chosen with the same probability, whereas p_{XY} will denote the level of significance for a (two-sided) binomial test of the hypothesis that allocations X and Y are chosen with the same probability taking the number of choices for the third allocation as given.

For treatment E the results are more dispersed. While 39.7% of subjects chose the allocation predicted by ERC (and efficiency), 36.7% decided according to the prediction by F&S and maximin preferences, while 23.5% chose the intermediate allocation.[8] The hypothesis that all three allocations were chosen with equal probability cannot be rejected ($p_{ABC} > .2$). Specifically, there is no significant difference between the probabilities with which the two extreme allocations were chosen.

Since the two treatments balance the influence of efficiency concerns, we also study the pooled data. There, 60.2% of subjects chose the allocation predicted by F&S, whereas 22.8% decided in line with ERC and 16.9% chose the intermediate allocation ($p_{ABC} < .001$, $p_{F\&S,ERC} < .001$).

Of the 136 choices in both treatments, 61.8% are in line with the maximization of total payoffs while 21.3% minimize it. A binomial test shows that this difference is significant ($p < .001$). Hence contradicting the assumption made by both ERC and F&S that efficiency does not matter we find a clear influence. Furthermore, the distribution of decisions clearly differs between treatments E and F ($\chi^2_2 = 29.44$, $p < .001$). Since the crucial difference between E and F is the role of efficiency, we see this as substantial evidence that efficiency matters.

The results for treatments Fx and Ex almost exactly match the results of treatments F and E. In treatment Fx 86.7% decided according to the F&S prediction and 6.7% both for the ERC prediction and the intermediate allocation. Again all allocations were not chosen with the same probability ($p_{ABC} < .001$) and the F&S allocation was chosen significantly more often than the ERC allocation ($p_{AC} < .001$). In treatment Ex the F&S prediction has a marginal advantage over the ERC allocation (43.3% vs. 40%), with a non-negligible fraction of 16.7% deciding for the intermediate allocation. The differences are not significant ($p_{ABC} > .133$, $p_{AC} = 1$). In both treatments pooled significantly more subjects chose the F&S allocation than the ERC allocation ($p < .001$) and significantly more subjects maximized than minimized efficiency ($p < .003$). Again, the distribution of choices differs significantly between treatments Ex and Fx ($\chi^2_2 = 14.51$, $p < .001$).

In treatments Fx and Ex the difference between the relative share of person 2 and the optimum according to ERC is much more salient than in treatments F and E. Since the results changed only marginally (and not in favor of ERC, distributions are far from significantly different: $\chi^2_2 = .69$, $p > .7$ for Ex vs. E and $\chi^2_2 = .34$, $p > .84$ for Fx vs. F), we conclude that the poor performance of ERC in our original treatments cannot be attributed to non-salient differences in relative payoffs. Arguably, these are still not huge, but if non-salience was the issue, than the performance of ERC should improve at least somewhat compared to E and F.

[8]The explanation that some of these subjects provided in the questionnaires indicates that they were looking for a compromise between efficiency and fairness.

Explaining their decisions in treatments E and F, 18 subjects explicitly referred to fairness. Of these 18 subjects, 17 chose according to F&S, including 8 subjects who also referred to the maximal total payoff. The remaining subject chose the intermediate allocation. Of 12 subjects who stated the reason for their decisions was maximization of total payoff (without explicit reference to fairness), 8 were in treatment F and thus chose the allocation predicted by F&S, the other 4 in treatment E chose according to ERC. Only one subject referred to relative payoffs in the explanation, but contrary to ERC, this subject stated that he wanted to maximize his own share. In treatments Ex and Fx all 15 subjects who explicitly referred to fairness chose the F&S allocation. Efficiency concerns were mentioned by 16 subjects, and 6 indicated maximin preferences. Thus among the subjects who explicitly mentioned fairness as a motivation, F&S did much better than ERC and a substantial part of subjects explicitly stated efficiency concerns.

Thus we conclude for the taxation games, that F&S outperforms ERC and that efficiency clearly influences choices. Since the F&S prediction is always the maximin allocation, a substantial part of the data are consistent with maximin preferences. Furthermore, since most of the choices which are not in line with maximin preferences are efficient (the ERC allocation in treatments E and Ex), quasi-maximin preferences (i.e. maximization of a weighted sum of the total and the minimal payoff as in C&R) are consistent with about 85% of the data, if one allows for heterogeneity of subjects. However, this may not be too surprising, given that quasi-maximin preferences are consistent with both extreme allocations in treatments E and Ex.

4.2 Envy Games

Details and Predictions

Treatments F and E demonstrated a major influence of efficiency. This inspired us to subject both theories of inequality aversion to a more severe test, in which they predict decisions that are Pareto-dominated. This situation is represented by treatment N, where the payoff to person 2 is again intermediate and kept constant. In this treatment F&S predicts a choice of C, which is Pareto-dominated by the ERC prediction B, which is in turn Pareto-dominated by allocation A (see Table 2 which is structured in the same way as Table 1). We call these games envy games, because envy could lead the middle-class to take money from the poor, only to be able to take more from the rich.[9]

We also used this treatment as a baseline to test the robustness of our results with

[9] We do not claim that the motivation that leads subjects to behave in that way is in fact envy, which corresponds to the α-component of F&S. It only seems a likely influence in this class of games. Hence our choice of name. Another possible motivation would be competitiveness or spite, i.e. a desire to lower all other subjects' payoffs relative to the own payoff, which corresponds to the α-component of F&S plus the inverse of the β-component. Levine (1998) presents a fairness theory that explicitly takes spite into account.

Treatment	N			Nx			Ny			Nyi		
Allocation	A	B	C	A	B	C	A	B	C	A	B	C
Person 1	16	13	10	16	13	10	16	13	10	16	13	10
Person 2	8	8	8	9	8	7	7	8	9	7.5	8	8.5
Person 3	5	3	1	5	3	1	5	3	1	5	3	1
Total	29	24	19	30	24	18	28	24	20	28.5	24	19.5
Average 1, 3	10.5	8	5.5	10.5	8	5.5	10.5	8	5.5	10.5	8	5.5
Relative 2	.276	.333	.421	.3	.333	.389	.25	.333	.45	.263	.333	.436
Efficient	A			A			A			A		
ERC pred.		B		A or	B			B or	C		B or	C
F&S pred.			C	A	or	C			C			C
Maximin	A			A			A			A		
Choices (abs.)	21	8	1	25	4	1	23	4	3	18	5	7
Choices (%)	70	26.7	3.3	83.3	13.3	3.3	76.7	13.3	10	60	16.7	23.3

Table 2: Allocations (in DM), predictions by ERC and F&S, maximin and efficient allocations, and decisions for the envy games

regard to the monetary incentives for person 2. To test whether subjects were willing to give up own payoff for their desire to increase efficiency or to reduce inequality, we let the payoff of person 2 vary across allocations in the treatments Nx, Ny, and Nyi (see Table 2). Since both F&S and ERC also take maximization of own payoff into account, their predictions depend on the weight assigned to selfishness relative to inequality aversion. In treatment Nx, ERC predicts a choice of A (which strictly Pareto-dominates B and C) or B, whereas F&S predicts a choice of A or C. In treatments Ny and Nyi ERC predicts a choice of B or C, whereas F&S predicts a choice of C, while A is efficient (though no longer Pareto-dominant). We do not intend to measure precisely the value subjects attach to either efficiency or equality with these treatments. The primary purpose is to test whether our results in the other treatments might be artifacts of the irrelevance of the choice for the own payoff.

Results

In treatment N, 70% chose the Pareto-efficient allocation (which is consistent with quasi-maximin preferences), 26.7% the ERC allocation and only 3.3% the F&S allocation ($p_{ABC} < .001$). Hence ERC clearly outperforms F&S, but with the aid of Pareto-dominance ($p_{BC} < .04$).[10]

In treatment Nx we added 1 DM for person 2 in allocation A and subtracted 1 DM in allocation C. As expected, this increased the number of choices for the Pareto-dominant allocation A (83.3%) and decreased that for allocation B (13.3%), with again

[10] Fehr and Schmidt (1999) do not claim that all subjects are inequality averse, but only a substantial fraction. (On the basis of ultimatum games they estimate this fraction to be about 70%.) One out of 30, however, is hardly a substantial fraction.

3.3% for allocation C ($p_{ABC} < .001$, $p_{BC} > .3$). In treatment Ny (Nyi), we subtracted 1 DM (.5 DM) in allocation A and added 1 DM (.5 DM) in allocation C. As expected, this increased the number of choices of allocation C somewhat, to 10% (23.3%). However, with 76.7% (60%), again the majority chose allocation A, whereas also the choices for allocation B are reduced to 13.3% (16.7%) (Ny: $p_{ABC} < .001$, $p_{AB} < .001$, $p_{AC} < .001$, Nyi: $p_{ABC} < .011$, $p_{AB} < .011$, $p_{AC} < .044$). Thus the results in these treatments are qualitatively well in line with the constant-own-payoff treatment N with deviations as expected by standard economic theory overall.[11] This result suggests that our results in the other treatments are not plain artifacts of the constancy of the decision maker's payoff. Overall there is an effect of small variations in the own payoff (and in an expected way) but it is minor.[12] Hence the relative importance of the different motives does not seem to change fundamentally if concerns for the own payoff become an issue. In contrast, the own payoff seems to be just another factor of non-negligible but non-dominating importance.

Note that Ny and Nyi are the only treatments where F&S makes a unique prediction (C) for all subjects, including those which are not inequality averse, since the own payoff is maximal and inequality minimal. But this prediction only covers one sixth of decisions in both treatments ($p_{AC} < .001$ for Ny and Nyi aggregated).

We conclude for the envy games that F&S performs poorly in the face of Pareto-dominance and that ERC does somewhat better but not well, whereas the basic C&R model does very well. In addition the envy games provide an example that the predictive power of F&S can in some cases substantially be improved by abstracting from the linear form. For example, if the disutility is assumed to be quadratic in inequality instead of linear, F&S could also explain choices of allocation B. Of course, this comes at some cost (e.g. not being neutral to scaling), but they might be outweighed by the benefits. In addition, if the restriction $\beta \leq \alpha$ is relaxed, then F&S can be consistent with choices of A. Hence the results in the envy games cannot be seen as evidence against inequality aversion in any possible form.

The envy games emphasize the importance of efficiency if it comes in the strong form of Pareto-dominance. Even then, however, it does not capture all choices and thus there is a potential role for other motives like inequality aversion (in particular of

[11] The effect should be larger in treatment Ny than in Nyi and the number of choices for A should not increase in Ny. These deviations, however, can be attributed to randomness in the data, that naturally follows from the random allocation of the subjects to the treatments. No pair of distributions is significantly different at the 5% level (N vs. Nx: $\chi^2_2 = 1.68$, $p > .43$, N vs. Ny: $\chi^2_2 = 2.42$, $p > .29$, N vs. Nyi: $\chi^2_2 = 5.42$, $p > .06$, Ny vs. Nyi: $\chi^2_2 = 2.32$, $p > .31$, Nx vs. Ny: $\chi^2_2 = 1.08$, $p > .58$, Nx vs. Nyi: $\chi^2_2 = 5.75$, $p > .05$, N vs. Ny and Nyi pooled: $\chi^2_2 = 4.36$, $p > .11$.)

[12] Note that in Ny 76.7% of subjects give up 22% of their own payoff, apparently to satisfy quasi-maximin preferences. While this share corresponds to only a relatively small absolute amount of money, it is often considered strong evidence against self-interest if subjects are willing to give up 20 or 25% of their payoff to achieve, for example, equality.

the ERC kind).[13] Maximin preferences are in line with efficiency, so the results provide (weak) support for their importance.

In the questionnaires references to (Pareto-) efficiency are more prominent in treatment Nx (21 subjects) than in N (11) or Ny and Nyi (15 in total). In all envy games together fewer subjects mention fairness (7) than maximin preferences (11) and selfishness (13). One subject states preferences in line with ERC.

4.3 Rich and Poor Games

Details and Predictions

In the preceding eight treatments person 2 always obtained an intermediate payoff. Our treatments R and P study situations where the decision maker receives either the highest payoff (i.e. is "rich", treatment R, hence "rich game") or the lowest payoff (i.e. is "poor", treatment P, hence "poor game"), which is again constant (see Table 3). Since F&S aggregates over all persons richer or poorer than oneself, it predicts the same as ERC in these situations. So these treatments do not allow to distinguish between F&S and ERC. They allow, however, to contrast efficiency, maximin preferences and inequality aversion and in particular more general forms of inequality aversion. In treatment R person 2 receives the highest payoff and can choose for the other subjects payoffs that are relatively equal (C) or that are maximal in sum (A). Both F&S and ERC predict a choice of the efficient allocation A, whereas maximin preferences predict C. In contrast, in treatment P person 2 receives the lowest payoff. Inequality aversion predicts a choice of the least efficient allocation C. The important aspect of treatment P is that the minimal payoff is constant, so that maximin preferences cannot influence the results. Hence this treatment allows us to contrast efficiency and inequality aversion in a frame neutral to maximin preferences.

We also study at this point our last treatment Ey. This treatment is identical to Ex except that the allocator's payoff is 9 instead of 12. Although Ey has the basic structure of the taxation games (the allocator with an intermediate payoff can increase the poorest subject's payoff at the expense of the richest or vice versa), it does not share the crucial property of the taxation games that allowed a comparison of F&S and ERC. Since the allocator's payoff is lower than in Ex, the preferred outcome according to ERC is shifted from A to C. Not only ERC and F&S, but also maximin and hence all fairness motives under consideration predict the choice of the least efficient

[13] As was suggested by a referee, our results in treatment N do not necessarily imply that 30% of subjects are inequality averse rather than motivated by efficiency or maximin. The pattern of observed proportions declining with the efficiency and maximin rank of the allocations well fits a random utility version of quasi-maximin preferences. Error rates nearly this high have been estimated from retest reliabilities in two-alternative lottery choice tasks (see e.g. Ballinger and Wilcox, 1997) and in our treatments the error rates might be higher since they involve the choice among three alternatives.

Treatment	R			P			Ey		
Allocation	A	B	C	A	B	C	A	B	C
Person 1	11	8	5	14	11	8	21	17	13
Person 2	12	12	12	4	4	4	9	9	9
Person 3	2	3	4	5	6	7	3	4	5
Total	25	23	21	23	21	19	33	30	27
Average 1, 3	6.5	5.5	4.5	9.5	8.5	7.5	12	10.5	9
Relative 2	.48	.522	.571	.174	.19	.211	.273	.3	.333
Efficient	A			A			A		
ERC pred.	A					C			C
F&S pred.	A					C			C
Maximin			C	A	B or	C			C
Choices (abs.)	8	6	16	18	2	10	12	7	11
Choices (%)	26.7	20	53.3	60	6.7	33.3	40	23.3	36.7

Table 3: Allocations (in DM), predictions by ERC and F&S, maximin and efficient allocations, and decisions for the rich and poor games, as well as for treatment Ey

allocation. Therefore, this treatment serves the same purpose as the poor game, namely the comparison of efficiency concerns and fairness motives.

Results

At a first glance, the results in treatments R and P may appear as a puzzle. The results in the taxation and envy games seem to indicate that both efficiency and (to a lesser extent) inequality aversion are important determinants of behavior. Now in treatment R where both ERC and F&S predict the efficient allocation A, only 26.7% of the choices were in accordance, whereas 53.3% of the subjects chose C ($p_{ABC} < .08$, $p_{AC} > .15$). In contrast, in treatment P, where both ERC and F&S predict allocation C, 60% of the subjects chose the efficient allocation A ($p_{ABC} < .001$, $p_{AC} > .18$), i.e. far more subjects chose the efficient allocation when it is not minimizing inequality compared to the case when it does ($p < .08$). (The distribution of choices differs significantly between R and P, $\chi^2_2 = 7.23$, $p < .03$.)

In treatment R a choice of C is consistent with non-self centered inequality aversion since the difference between persons 1 and 3 is minimal, although their average difference to person 2 is maximal,[14] with competitiveness, and some non-linear versions of F&S. These motives, however, all predict allocation C in treatment P, as do F&S and ERC, but only 33.3% chose this allocation. This implies that they do not provide an explanation for the discrepancy.[15]

[14] In the questionnaires some subjects referred to a fair division of money between persons 1 and 3.

[15] The results in treatments P and R can be reconciled with competitiveness if subjects see themselves in competition with the person whose payoff is closest to the own. This implies minimizing the payoff difference to the second poorest person in treatment P (thus a choice A) and maximizing the difference

We consider the crucial difference between treatments R and P to be the role of maximin preferences. In treatment R the minimal payoff is maximized in allocation C,[16] which was chosen by the majority of subjects, whereas in treatment P the minimal payoff is constant, so maximin preferences have no influence. Hence the comparison of treatments R and P indicates that maximin preferences are important.

The results of treatment Ey that allows us to differentiate between efficiency and all the fairness motives show roughly a tie between the efficient allocation A (40%) and the least efficient, but supposedly fair allocation C (36.7%). These results are well in line with treatment P, since the lower number of efficient choices and the marginally higher number of choices for C are consistent with a positive influence of maximin preferences. From this comparison, though, this influence seems rather weak. Furthermore, maximin does worse in comparison to efficiency than in treatment R. A possible explanation in addition to pure randomness (distributions are far from significantly different, $\chi^2_2 = 1.8, p > .4$) is that the trade-off between efficiency and the minimal payoff is more favorable to maximin in R than in Ey. Thus the difference is consistent with reasonable parameter distributions in the C&R model.

The fundamental difference between the treatments Ey and Ex is the ERC prediction. The results are essentially identical, which indicates that ERC is irrelevant in this context.[17]

Treatments Ey and P provide evidence against a primary importance of inequality aversion in general form, not just the specific formulations of F&S and ERC. According to the axiomatic characterization of F&S provided by Neilson (2002), a choice of C in treatment R only contradicts a combination of inequality aversion and linearity.[18] A choice of A in treatments N, Ny, and Nyi contradicts a combination of inequality aversion and positional asymmetry (which is reflected by the condition $\alpha \geq \beta$). In

to the second richest person in treatment R (thus a choice C). None of the existing fairness theories considers such a motivation.

[16] Nine of ten subjects who mentioned fairness chose C, while only two subjects explicitly indicated maximin preferences.

[17] Since the number of choices for allocation C is even slightly lower in Ey than in Ex, the results suggest a marginal negative influence of ERC. Randomness, however, seems a more plausible explanation, since the distributions are far from significantly different ($\chi^2_2 = .5$, $p > .77$).

[18] Note, however, that a choice of C in treatment R is only consistent with unrealistically extreme forms of inequality aversion. Even if the disutility was cubic in the payoff difference, B would still be preferred over C. Hence R not only contradicts a combination of inequality aversion and linearity of the utility function, but inequality aversion and anything but extreme concavity. Sufficiently extreme forms like disutility that is exponential in the payoff difference have absurd implications, namely that subjects who pay non-trivial amounts to reduce a small inequality, would pay almost infinite amounts to reduce a large inequality by just a bit, e.g. they would be willing to pay more than 2000 times as much to reduce a payoff difference from 16.1 to 16 than they would pay to reduce a payoff difference of 6 to 0. Hence it appears much more plausible, that instead of the magnitude of the inequality, the relative position of the other players is more important, but this amounts to maximin preferences.

contrast, in treatments P and Ey, a choice of A is inconsistent with the inequality aversion property alone[19] as well as with non-self centered inequality aversion and ERC. In both treatments fewer subjects chose the allocation predicted by all versions of inequality aversion than the efficient allocation, although the former is also consistent with competitiveness and in Ey even with maximin preferences, motives that appear to be of substantial importance in games of this type.[20]

Treatment P also shows the limits of quasi-maximin preferences, since for any positive weight on efficiency quasi-maximin preferences imply a choice of A, which was chosen by only 60% of the subjects. A third of the subjects instead seems to be guided by either inequality aversion or by competitiveness.

4.4 Control Treatments for the Role Uncertainty

It is conceivable that the role uncertainty that subjects faced in the preceding treatments might have enhanced their concerns for efficiency since they were clearly confronted with the possibility to end up in any of the three roles and this might have increased their concern for the well-being of the subjects in the other roles. It also might have increased in particular the concern for the subject with the lowest payoff and hence increased the role of maximin preferences.[21] While we did not believe that these potential effects were substantial, we have conducted control treatments for Ex and P without role uncertainty. We chose these treatments because we considered treatments most informative where a substantial deviation in the direction of both more and fewer efficient choices would have been possible and because treatment P had provided the clearest evidence against inequality aversion. Treatment P allows us to study the isolated effect on efficiency, treatment Ex possible effects on both efficiency and maximin preferences. In the control treatments, subjects knew in advance their role. Only subjects in the role of person 2 were asked to choose an allocation and they knew that their choice would be implemented. To generate 30 observations we hence

[19] The results in P would be consistent with inequality aversion if the utility function was highly convex in the inequality, but this property is just the opposite of what is necessary to reconcile results in R and the basic dictator game with inequality aversion. Choices for A in Ey are even inconsistent with this form of inequality aversion.

[20] Charness and Grosskopf (2001) also study pure distribution experiments and they find between 20% and 34% of subjects that appear to be driven by either inequality aversion or competitiveness. About 10% can clearly be attributed to competitive preferences in a similar decision task, which leaves only about 10 to 20% of the decisions indicating inequality aversion. Falk et al. (2000a) find even 19% competitive subjects in a three-person prisoner's dilemma and in an ultimatum game where the responder always obtains the higher payoff.

[21] On the other hand, the role uncertainty could also enhance the role of inequality aversion since this method underlines that all players are a-priori in the same situation, so that no one deserves more or less than the others.

Treatment	Ex			Ex*			P			P*		
Allocation	A	B	C	A	B	C	A	B	C	A	B	C
Person 1	21	17	13	21	17	13	14	11	8	14	11	8
Person 2	12	12	12	12	12	12	4	4	4	4	4	4
Person 3	3	4	5	3	4	5	5	6	7	5	6	7
Total	36	33	30	36	33	30	23	21	19	23	21	19
Average 1, 3	12	10.5	9	12	10.5	9	9.5	8.5	7.5	9.5	8.5	7.5
Relative 2	.333	.364	.4	.333	.364	.4	.174	.19	.211	.174	.19	.211
Efficient	A			A			A			A		
ERC pred.	A			A					C			C
F&S pred.			C			C			C			C
Maximin			C			C	A	B or	C	A	B or	C
Choices (abs.)	12	5	13	10	3	17	18	2	10	15	3	12
Choices (%)	40	16.7	43.3	33.3	10	56.7	60	6.7	33.3	50	10	40

Table 4: Allocations (in DM), predictions by ERC and F&S, maximin and efficient allocations and decisions for treatments Ex, Ex*, P, and P*

needed 90 subjects in both control treatments, which we label Ex* and P*. Subjects in the roles of persons 1 and 3 were asked how they would have chosen if they had been assigned the role of person 2 and also about their expectation of the choice of person 2.

The details and predictions for Ex* are identical to those for Ex and those for P* are identical to those for P, of course. The results are presented in Table 4. To ease the comparison, we also repeat the results of treatments Ex and P.

Compared to the treatments with role uncertainty, in both treatments without role uncertainty the number of choices for the efficient allocation decreases by one sixth (from 60% in P to 50% in P* and from 40% in Ex to 33.3% in Ex*). Although this is in line with the hypothesis that role uncertainty favors efficiency, the difference is small and far from significant (Ex vs. Ex*: $\chi^2_2 = 1.22$, $p > .54$, P vs. P*: $\chi^2_2 = .65$, $p > .72$) and it can hence be attributed to random effects. In treatment P* still more subjects chose the efficient allocation than the inequality minimizing allocation. Since the difference between the original and the control treatments is virtually identical in both treatments, there is also no indication that the role uncertainty increased the focus on maximin preferences (if anything, the data point in the opposite direction). Overall, the control treatments do not provide any indication that our results might be primarily driven by the role uncertainty method we applied. Charness and Rabin (2001) conducted control treatments for 11 games to test whether the role reversal they employed in Charness and Rabin (forthcoming) has an efficiency or maximin enhancing effect. They do not find significant or substantial effects either. Also Charness and Grosskopf (2001) use role uncertainty in one of their studies, but not in the other. While they do not use exactly the same games, the results do not indicate an important effect of role uncertainty. Since these experiments are similar to ours, this further supports that our results are not driven by the role uncertainty.

In both treatments, none of the distributions of expectations or hypothetical decisions of either persons 1 or 3 differs significantly from the actual choices of persons 2 ($\chi^2_2 < 3.1$, $p > .21$ for all pairwise comparisons).

5 The Relative Importance of the Different Motives

In order to better understand the relative influences of the different motives we pool the data and estimate a conditional logit model (our situation is captured by Mc Fadden's choice model, see e.g. Maddala, 1983).

For every allocation j, $j \in \{A, B, C\}$ that person i can choose from we define the following explanatory variables, with x_{jk} the payoff to person k in allocation j:[22]

$$\begin{aligned}
Eff_{ij} &= \sum_{k=1}^{3} x_{jk} \\
MM_{ij} &= \min\{x_{jk}, k = 1, 2, 3\} \\
Self_{ij} &= x_{j2} \\
FS\alpha_{ij} &= -\frac{1}{2}\sum_{k \neq 2} \max\{x_{jk} - x_{j2}, 0\} \\
FS\beta_{ij} &= -\frac{1}{2}\sum_{k \neq 2} \max\{x_{j2} - x_{jk}, 0\} \\
ERC_{ij} &= -100\left|\frac{1}{3} - \frac{x_{j2}}{Eff_{ij}}\right| \text{ and let} \\
V_{ij} &= \gamma_1 Eff_{ij} + \gamma_2 MM_{ij} + \gamma_3 Self_{ij} + \gamma_4 FS\alpha_{ij} + \gamma_5 FS\beta_{ij} + \gamma_6 ERC_{ij}
\end{aligned}$$

Then according to the conditional logit model the probability that person i chooses allocation j is given by

$$P_{ij} = \frac{\exp(V_{ij})}{\sum_{g \in \{A,B,C\}} \exp(V_{ig})}.$$

Since we only have one decision per subject, we cannot take into account any individual differences. Hence with this approach we estimate the preferences of an 'average subject' and all heterogeneity is incorporated in the error.

Considering the α and β components of F&S separately has the advantage that it allows us to investigate for both components individually whether they explain any

[22] We choose the negative of the inequality as measured by F&S and ERC because this implies that estimating an odds ratio >1 amounts to an influence in line with F&S or ERC.

of the variance. This, however, causes a collinearity problem because in all of our treatments[23]

$$FS\alpha = FS\beta - \frac{1}{2}Eff + \frac{3}{2}Self.$$

We follow two approaches to overcome this problem. In the first approach we exclude $Self$, because we are not primarily interested in the role of self-interest and, as shown by runs including $Self$, it has a positive but insignificant influence. In the second approach, we include a strict version of F&S, $FSstrict = FS\alpha + FS\beta$, that is we replace the separate components by an aggregate measure of inequality, that assumes equal weights assigned to disadvantageous and advantageous inequality. We also conducted another run excluding MM.

We estimate the model on the basis of three different sets of treatments. First we use all treatments (except for the control treatments Ex* and P*, because they were run with a different procedure). In the second approach, we exclude treatments E and F, because they are structurally identical to Ex and Fx and there were also more subjects in these treatments, which biases the results in giving too much weight to these treatments. Third, we exclude treatments E, F, and Ey, in order to only pool data from treatments that were run in one session and hence under exactly identical conditions. The results are reported in Table 5 along with the results of likelihood-ratio tests of hypotheses that certain subsets of the motives are irrelevant.[24]

If we include both components of F&S separately we find that both efficiency and maximin preferences have a clear significant influence and maximin more so than efficiency.[25] In contrast, neither component of F&S has significant impact, with the α component having a positive impact and the β component a negative. This would be consistent with some subjects wanting to reduce richer subjects' payoffs, but the motivation to increase poorer subjects' payoffs is entirely captured by the maximin motive. A positive effect of the α component and a negative effect of the β component are consistent with competitive preferences. Competitiveness can be expressed either as a combination of the α component and the inverse of the β component or as a combination of selfishness and the inverse of efficiency. Since we cannot include competitiveness in the model due to this collinearity, this implies that any decisions that are in fact driven by competitiveness will lead to an increase of the coefficient for the α component and a decrease of the coefficient for the β component in the first test (consistent with the results found). In the following tests such decisions will lead to a decrease of the coefficient for efficiency and an increase of the coefficient for selfishness.

[23] Overcoming this problem would require including games with more than three players.

[24] We chose to report odds ratios instead of parameter estimates since they allow for an easier interpretation. The odds ratio denotes the factor by which the odds $(P_{ij}/(1 - P_{ij}))$ are multiplied if the corresponding independent variable increases by one unit.

[25] Note that the odds ratios are in general not directly comparable because the variables are partly scaled in different ways.

	All Treatments		excluding E, F		excluding E, F, and Ey	
	Odds Ratio	sign. p	Odds Ratio	sign. p	Odds Ratio	sign p
$\gamma_1(Eff)$	1.232	<.02	1.189	<.03	1.202	<.02
$\gamma_2(MM)$	1.492	<.001	1.412	<.001	1.366	<.01
$\gamma_4(FS\alpha)$	1.245	>.16	1.136	>.39	1.119	>.44
$\gamma_5(FS\beta)$	.816	>.28	.820	>.27	.820	>.27
$\gamma_6(ERC)$	.953	>.07	.955	>.08	.944	>.06
L-R $\gamma_4 = \gamma_5 = 0$		>.31		>.47		>.50
L-R $\gamma_4 = \gamma_5 = \gamma_6 = 0$		>.10		>.11		>.09
$\gamma_1(Eff)$	1.109	<.03	1.096	<.05	1.112	<.04
$\gamma_2(MM)$	1.492	<.001	1.412	<.001	1.366	<.01
$\gamma_3(SELF)$	1.373	>.14	1.277	>.23	1.263	>.25
$\gamma_4(FSstrict)$	1.007	>.93	.965	>.70	.958	>.65
$\gamma_6(ERC)$	.953	>.07	.955	>.08	.944	>.06
L-R $\gamma_4 = \gamma_6 = 0$		>.15		>.10		>.08
$\gamma_1(Eff)$	1.286	<.001	1.250	<.001	1.258	<.001
$\gamma_3(SELF)$	1.032	>.86	1.018	>.91	1.035	>.84
$\gamma_4(FSstrict)$	1.351	<.001	1.239	<.001	1.143	>.05
$\gamma_6(ERC)$	.898	<.001	.910	<.001	.891	<.001

Table 5: Estimated odds ratios for the conditional logit model and results of likelihood-ratio tests

The ERC motive has a negative, marginally significant impact. Likelihood ratio tests reveal that both F&S components together do not explain additional variance ($p > .3$) and that F&S and ERC jointly add only marginally to the explanation ($p > .09$). (Note that if one considers this as indicating that they explain a significant part of the variance, their joint impact is negative.)

Including $FSstrict$ and $Self$ instead of the separate F&S components also yields clear results. We find significant positive impacts of efficiency and maximin preferences, virtual irrelevance of the F&S motive (this is not affected if we use different weights for the α and β component) and a marginally significant negative impact of the ERC motive. A Likelihood ratio test again reveals that F&S and ERC jointly do not add significantly to the explained variance.

An important insight is provided by the last test. Here, we exclude the maximin motive. Apart from a highly significant positive impact of efficiency, we now also find a highly significant positive effect of $FSstrict$ and a highly significant negative impact of the ERC motive. This means that if we ignore the maximin motive, F&S appears to be a much better model of distributional preferences than ERC. But if we include maximin preferences, this advantage virtually disappears. This provides a deeper understanding why F&S clearly outperforms ERC in the taxation games, but does poorly in the other games. The superior performance of F&S in the taxation games seems to result from being in line with maximin there, but not from being a more accurate model of behavior in general. Note again, however, that it is not an artifact of our design that F&S is rather in line with maximin than ERC, but a natural consequence of the different formulations.

As can be seen from Table 5, all results are remarkably robust to the exclusion of treatments E and F and also the exclusion of Ey.

6 Discussion

Our results indicate that efficiency and maximin preferences are important motives in simple distribution games, and that interpretations of experimental results in favor of e.g. a particular form of inequality aversion might be confounded by them. This problem could potentially extend beyond the class of games and the motives that we study.[26] In this section we discuss examples where the common interpretation of results could be confounded, but also the limits of the explanatory power of efficiency concerns and maximin preferences in these games. We also point out what might be a crucial aspect of our experiments that could lead to an increased importance of efficiency and maximin. Furthermore, we discuss other experiments that distinguish between inequality aversion and other motives and that show additional short-comings of F&S and ERC that our experiments were not designed to investigate.

In the gift-exchange game (Fehr et al., 1993, Fehr et al., 1997), concerns for efficiency are consistent with above equilibrium effort levels of workers, as well as above equilibrium wages in the original version of the game. They cannot, however, explain important phenomena in the gift-exchange game like the positive relation between wages and effort or above equilibrium wages in the modified "weak reciprocity treatment" in Fehr et al. (1997). In particular, workers hardly ever choose effort levels that make them worse off than the employer, although this would increase efficiency. Hence there seems to be a fairness constraint that is rarely violated. The presence of such a fairness constraint, however, does not necessarily imply that workers are motivated by inequality aversion. Our experiments suggest an important role of efficiency and maximin preferences. For the worker, efficiency concerns demand a maximal effort, selfishness demands a minimal effort, but maximin demands an increase in effort if the employer is worse off and a decrease in effort if the worker is worse off. If maximin preferences plus efficiency concerns are stronger than selfishness, but selfishness plus maximin are stronger than efficiency concerns, this implies an effort level where employer and worker payoffs are equal. Hence the fairness constraint may result from an interaction of selfishness, efficiency concerns and maximin preferences (i.e. quasi-maximin preferences) as well as from inequality aversion. Put differently, in this situation the interaction of these motives can imply inequality minimization, so it is not

[26] Charness and Rabin (forthcoming) present a similar argument.

possible to discern whether workers are motivated by inequality aversion, or whether inequality minimizing actions result in this situation (but not necessarily others) from other, underlying, motives. Therefore, it cannot be concluded from the experiments whether the motive driving the above equilibrium wages is reciprocity (as claimed in Fehr et al., 1993 and Fehr et al., 1997), inequality aversion (as claimed by Fehr and Schmidt, 1999, and Bolton and Ockenfels, 2000) or quasi-maximin preferences.

The gift-exchange experiments also point to another important issue, the distinction between a reciprocity motive (or generally motives dependent on perceived intentions) and motives based solely on the distribution. While the above mentioned experiments do not allow this distinction, the experiments by Charness (2000, 2001) do. He compares treatments in which the wage was determined by the employer, a chance event, or a third party. He finds little evidence for positive reciprocity, but clear evidence for negative reciprocity. Interestingly, he finds that for low wages, where the worker is disadvantaged for any effort levels, 0 out of 41 workers choose an above minimum effort in the employer treatment, whereas 11 out of 47 do so in the other treatments. Furthermore, in only 2 (out of 182 possible) cases in the employer treatment workers choose the maximal effort level when this leaves them with the lower payoff, but in 10 (out of 160 possible) cases in the random treatment.[27] Hence the fairness constraint seems to be partially driven by reciprocity. We will come back to this issue of distributional motives versus intentions based motives below.

In the trust or investment game (Berg et al., 1995, Ortmann et al., 2000) first movers who send money to second movers could be motivated by trust or by efficiency concerns, while due to the lack of efficiency gains, second movers returning money (which they do only to a limited extent in the experiments) cannot be attributed to efficiency concerns. In a similar experiment Van Huyck et al. (1995) show that the investment increases with the achievable efficiency gains (so at least there is interaction with efficiency). Again an important question is whether subjects act out of purely distributional concerns or whether perceived intentions matter. Cox (2000) provides an approach to distinguish between trust and reciprocity on the one hand and other regarding preferences (i.e. distributional concerns) on the other hand. He compares an investment game with the dictator games derived from a decomposition of the investment games into the purely distributional decisions. He finds evidence for both trust and reciprocity, but distributional concerns appear to be more important.[28] That 63% of senders send money in the decomposed game, where receivers can't send money back is in sharp contrast to inequality aversion since both start with equal endowments,

[27] Effort levels that leave the worker in disadvantage are much less frequent in the third party treatment than in the random treatment. Hence it appears that workers also react with lower effort levels if they feel unfairly treated by a third party as opposed to after an unfavorable chance event.

[28] This is in line with a similar approach by Kritikos and Bolle (1999) who find evidence for positive reciprocity, but in contrast to results by Bolton et al. (1998), who do not find evidence for reciprocity.

but it is consistent with efficiency concerns. Indeed, since selfishness and maximin preferences appear to be important motives in pure distribution games, but predict nothing to be sent, this is rather strong evidence for efficiency concerns.

The moonlighting game (Abbink et al., 2000) extends the investment game by allowing first movers to take money from second movers and second movers to (costly) punish first movers. Falk et al. (2000b) compare second mover decisions in this game and the degenerate game where first mover choices were replaced by a chance move. They find that perceived intentions matter for both punishment and reward. But they also find that 5 out of 23 second movers "punish" chance moves that put them at a disadvantage, in sharp contrast to efficiency concerns, but in line with inequality aversion.[29] This share is, however, also consistent with the 19% competitive subjects identified in Falk et al. (2000a).

In the centipede game, passing, in particular at the last stage, where it cannot be motivated by expectations of being rewarded, violates inequality aversion.[30] McKelvey and Palfrey (1992) find shares of 15% (in a 6 move game) to 31% (in a 4 move game) of pass decisions in the last stage. They classify players who always pass as altruists (and estimate a 5% share of altruists), whereas one cannot distinguish between concerns for efficiency (or maximin) and altruism in the centipede game. The striking aspect of the centipede game appears to us the inefficiency of the Nash equilibrium, which suggests that efficiency concerns are at least a very plausible explanation for deviations.

This points to another issue, the distinction between efficiency concerns and altruism. Altruism and efficiency concerns are difficult to disentangle. The distinction appears to be more on the level of the cognitive process. We would see the cognitive focus of altruism to be the other individuals in the group and in particular their individual well-being, whereas the cognitive focus of efficiency concerns is the whole group and its well-being is represented by a single number, the total payoff. An important implication of this difference is that a decision maker guided by efficiency concerns and making a choice that yields a certain total payoff to a group should not be influenced by the size of this group, whereas he should choose a higher total payoff if more people are included if he is guided by altruism (and his utility function is concave in each other person's payoff as it is commonly assumed in models of altruism). Thus a fixed sacrifice effect as found by Selten and Ockenfels (1998), where subjects who win a lottery donate the same total amount to two subjects not winning as to one subject not winning,

[29] Offerman (forthcoming) also studies a game where the second mover can punish and reward both helpful and hurtful choices by the first mover. Comparing treatments with random and deliberate choices by the first mover, he finds that intentionality has only a mild, insignificant effect on reactions to helpful choices, but a dramatic effect on reactions to hurtful choices.

[30] An exception would be extreme aversion towards advantageous inequality coupled with virtual indifference towards disadvantageous inequality, which, however, appears to be nothing but a complicated way to describe maximin preferences.

cannot be reconciled with altruism but does not contradict efficiency concerns.[31]

Donations that do not increase efficiency as in the basic dictator game (e.g. Forsythe et al., 1994) can be interpreted as evidence for altruism. They are, however, also consistent with maximin preferences, which can be seen as a particular form of altruism with an extremely limited focus. Kritikos and Bolle (1999) claim that altruism is an important motive. They concede that an important determinant of altruism is the intensity of efficiency gains. They do not, however, consider efficiency concerns as a motive in itself. In Kritikos and Bolle (2001) they present results from dictator games that are better in line with efficiency concerns than with inequality aversion. By stating that "the norm to which altruistic players adhere is efficiency", they equate altruism with efficiency concerns.

In the ultimatum game (Güth et al., 1982) the decision of the proposer does not directly affect efficiency but an efficiency maximizing choice depends on his expectations of the responder's behavior. If the proposer assumes that the probability of acceptance increases in the offer (up to an equal split), he should offer an equal split to maximize expected efficiency. While it seems conceivable that rejections of unequal offers are driven by pure distributional concerns, in particular inequality aversion, experimental results by Blount (1995) and Falk et al. (2000a) suggest that instead the driving force is indeed negative reciprocity. In Blount's (1995) experiments acceptance thresholds are substantially lower if proposals in the ultimatum game are not made by the first player but by a random move and, dependent on the framing, they can also be significantly lower if the proposals are made by an independent third party.[32] Falk et al. (2000a) study ultimatum games with reduced choice sets. They find that rejection rates for a suggested (8-2) split are dramatically higher if the alternative available proposal was an equal split (5-5) (44%) than when it was an even more unequal split (10-0) (9%) or the proposer had no choice (he could "choose" between an (8-2) split and an (8-2) split) (18%). Thus the responder's perception of the proposer's intentions are responsible for a larger share of rejections than the payoff inequality. The 18% of subjects who reject the (8-2) proposal when the proposer had no choice could be seen as evidence for inequality aversion. Falk et al. (2000a), however, also observe 19% rejections in an ultimatum game where the rejection increases the payoff advantage of the responder and 19% of players in a three-person prisoner's dilemma who defect and punish. Both these results appear only consistent with competitiveness. Hence the 18% rejections in

[31] Since the size of the pie cannot be affected, efficiency is simply not an issue here and does not provide an explanation for the phenomenon, as inequality aversion does not either.

[32] Similarly to Charness (2001), the results for the third-party treatment are in between the interested party and random treatments. It appears that subjects who get angry about proposals by the third party, behave less cooperatively. This effect is significantly reduced if the second movers' awareness of their decisions' effect on first movers is increased. Hence it appears that this anger is not intentionally directed against the first mover.

the game where proposers had no choice do not indicate that any rejection has to be attributed to inequality aversion.

Kagel et al. (1996) study ultimatum games where proposals are made in chips and these have different values for proposers and responders. While pure efficiency concerns would lead to an allocation of all chips to the player with the higher conversion rate, the results tend towards the equal money split. Hence the equality constraint appears to be important in this game as well, but as in the gift-exchange game, it can be derived from maximin preferences and selfishness. There is also clear evidence for selfishness, since proposers stick to an equal chip split if responders are unaware that they have the lower conversion rate and thus receive a lower payoff. Furthermore, perceived intentions are important because rejection rates are significantly higher if it is common knowledge that the proposers have the higher conversion rates and hence that an equal chip proposal is to the advantage of the proposer than if this is only known to the responder. Efficiency concerns appear to be dominated by a combination of selfishness, maximin and intentions (and possibly inequality aversion). On the other hand, they do not seem to be entirely irrelevant, because when conversion rates are common knowledge, there are no proposals that give the higher money payoff to the responder when he has the lower conversion rate, but a substantial part of the proposals (25% in the last two periods) give the higher money payoff to the responder when he has the higher conversion rate (and thus violating selfishness, maximin preferences, and inequality aversion).

It seems that efficiency reducing behavior like rejections in the ultimatum game are driven by the question whether there is an acceptable reason for what might be perceived as an unfair allocation. A randomly generated proposal, the absence of a less unequal alternative, and the proposer's unawareness of the inequality of the proposal appear to be acceptable reasons for the responder, whereas an unequal proposal consciously made by the first mover who could have made an equal proposal is not. While the standard ultimatum game seems to be in favor of inequality aversion as opposed to efficiency and maximin, considered together with Blount (1995), Kagel et al. (1996) and Falk et al. (2000a) it is completely consistent with a model based on efficiency, maximin preferences, selfishness, competitiveness, and perceived intentions.[33] In contrast, the whole story is only consistent with a model based on inequality aversion, selfishness, competitiveness and intentions if the role of inequality aversion is relatively weak compared to intentions and competitiveness.

Kagel and Wolfe (2001) test implications of inequality aversion in variations of the three-person ultimatum game by Güth and van Damme (1998). They vary the amount

[33] Of course, efficiency and maximin preferences cannot explain why proposals are rejected in the ultimatum game (but maximin correctly predicts which proposals are more likely to be rejected). The point is that what needs to be added, intentions and competitiveness, also have to be included in a model based on inequality aversion to give a complete explanation.

the third player receives in case the second player rejects. If rejections were motivated by inequality aversion, they should sharply decline with that amount. The results however, suggest at best an extremely weak relation in that direction. The results in the second experiment in Kagel and Wolfe (2001) also cast some doubt on the relevance of efficiency and in particular of maximin preferences. In this experiment the third person actually loses money if the second mover rejects the proposal. Efficiency and maximin imply that this should reduce the rejection rate, but it does so only marginally. The authors interpret the inconsistence of their results with the inequality aversion models as an indication that subjects perceive the reference group as different from what is assumed in the models or that they all (including C&R) fail to sufficiently take into account the importance of the role of intentions.

As the above examples show, not taking into account the important role of perceived intentions is a serious short-coming of both ERC and F&S. It also limits the reach of the basic C&R model. Falk and Fischbacher (1999) present a model that is based on F&S but incorporates intentions. The full C&R model incorporates intentions in a form the authors call concern withdrawal. We did not intend to study the role of intentions, but in contrast designed potential influences of perceived intentions out of our experiment to study the relative importance of different distributional concerns in a framework unconfounded by intentions.

It appears that there are three important questions that have to be addressed if we want to understand social preferences. First, if only distributional preferences matter, which are most important? Our experiments suggest that efficiency concerns and maximin preferences are more important than inequality aversion in this case. The experiments in Charness and Rabin (forthcoming, 2001), and Charness and Grosskopf (2001) allow a comparison of different distributional motives in games with little or no interaction. Consistent with our results and the C&R model, they find only little evidence for inequality aversion, but substantial evidence for quasi-maximin preferences (and some for competitiveness). Fehr and Schmidt (2001) review further evidence that efficiency concerns are important in dictator game situations.

Second, it is important to understand the relative importance of perceived intentions compared to distributional motives. This appears to depend on the game. While the impact of perceived intentions seems to be of only minor magnitude, though still significant, in the investment game (Cox, 2000), it appears to be rather dramatic in the ultimatum game (Blount, 1995, Falk et al., 2000a) and the moonlighting game (Falk et al., 2000b).[34] Fehr and Schmidt (2001) conclude that quasi-maximin preferences

[34] The hypothesis that intentions matter fails in Deck (2001). The implication is that second movers would cooperate more in an exchange game (which is a simplified investment game) than in an insurance game, that differs by not allowing mutual profits. The results are in the opposite direction. Furthermore, cooperation is more frequent in the exchange game if it is played in normal form, contrary to the prediction.

and inequality aversion are more important than intentions for kind actions,[35] whereas intentions seems to play an important role for payoff reducing behavior.[36]

The third question is more subtle and our experiments highlight its importance, although they are not designed to answer it. The question is, whether interaction in itself changes the relative importance of different distributional motives. The results in our and other pure distribution games imply an important role of efficiency and maximin preferences and basically no importance of inequality aversion, which appears to be at odds with some results in strategic games (e.g. Kagel et al., 1996). The, so far open, question is whether this is exclusively due to the role of intentions or whether the absence of strategic considerations shifts the focus to different distributional concerns.[37] The approach by Cox (2000) is in general a method to study this question, but in the game he considers it is not possible to disentangle reciprocity from changes of the distributional preferences due to interaction alone. The impunity treatment of the ultimatum game (in case of an unfair offer responders can only reject their own share) studied by Bolton and Zwick (1995) yields some evidence. Proposers had the choice between an equal and one unequal offer (that differed between periods). Except for one equal offer in the first and the second period, all offers in all ten periods were to the disadvantage of the responder. This is in contrast to positive offers made in the dictator game in Forsythe et al. (1994), so one might conclude that the pure fact, that the responder had any choice at all changed the perception of the proposer of the game to be more competitive and foster self-interest as opposed to other motives like maximin preferences or inequality aversion. As Bolton and Zwick (1995) point out, however, in their impunity treatment proposers were, due to the restricted choice set, forced to give away at least 1/4 of the total pie over the periods and this is not substantially different from the average amounts sent in the dictator game. While this is still in conflict with 21% proposers giving away at least an equal share in Forsythe et al. (1994), this discrepancy appears too weak to draw clear conclusions, in particular because there were only ten proposers in the impunity treatment. Charness and Rabin (2001) call the effect that second movers are less generous when first movers had a choice complicity effect. The latter paper offers evidence for this effect in four simple games. In these games, 22% of the second movers' choices are favorable to first movers. This compares to 35% favorable choices in the corresponding dictator games obtained by eliminating the first mover's choice. There are more favorable choices in all four cases in the dictator games, although a first mover choice of entry was favorable to the second mover in three of the games (and neutral in the other). This effect was

[35] Falk et al. (2000b), however, find that intentions are also important for payoff increasing behavior.

[36] This could again be interpreted that subjects care for efficiency, since they need a good reason to reduce efficiency. An exception are the 10-20% competitive subjects consistently found who reduce other's payoffs independent of perceived intentions.

[37] See Fehr and Schmidt (2001) for a similar discussion.

reversed when first movers could express a preference over the second movers' choices, suggesting that preference expression per se is perceived to constitute a choice. Hence it appears that subjects make more selfish choices when they can attribute part of the responsibility to the other player.[38] There are fewer choices in line with inequality aversion in the dictator version in two of the four games and more in one. Hence the effect on the relative importance of inequality aversion and quasi-maximin appears unclear. Selfishness appears to be more important, all other motives less so.

Some further experiments allow a comparison of different approaches to inequality aversion and how they relate to efficiency concerns and maximin preferences. Bolton and Ockenfels (1998) show that the results of three-person ultimatum experiments by Güth and van Damme (1998) are well in line with ERC. On the other hand, violations of the crucial properties that they show to be consistent with ERC require extreme parameters in F&S, e.g. a rejection of a proposal of a third of the total pie for the responder would require $\alpha + \beta > 2$, which Fehr and Schmidt (1999) estimate to be the case for only 10% of players in standard ultimatum games. Allocating a positive amount to the third player requires $\beta > \frac{2}{3}$ for the proposer, which does not occur according to the parameter estimates of Fehr and Schmidt (1999) and a rejection based on a low payoff for the third player requires even $\beta > 2$. Hence the results of Güth and van Damme (1998) are only weak evidence against F&S. Riedl and Vyrastekova (2002) study an ultimatum game with two responders who can both reject the proposal, and vary the effects of a rejection on the other responder. They find only one out of 44 responders with a pattern consistent with ERC and even none consistent with F&S, but 6 that are consistent with the basic C&R model (they do not apply the full C&R model and the basic model produces identical predictions as selfishness). Frechette et al. (2002) study the Baron-Ferejohn bargaining model of legislative behavior. They find that voting behavior to a large extent relies on the "fair share" as acceptance threshold, consistent with ERC, but that there is also some evidence that shares just below the "fair share" are more likely to be rejected if the overall distribution is more unequal. Concerns for the minimal payoff appear to be largely irrelevant. Proposals become more biased in favor of the proposer over time. In one treatment equal split proposals virtually disappear by period 13 (out of 25), in contrast to ERC, F&S, and maximin preferences.

In a three-person prisoner's dilemma game with punishment opportunities, Falk et al. (2000a) interpret their results as favoring the F&S measure of inequality over the ERC measure. This interpretation is problematic, however, since the F&S prediction (punishment of defectors) is in line with the prediction based on intentionality, while the ERC prediction (punishment of cooperators) exactly opposes it. As argued above,

[38] Charness (2000) discusses responsibility alleviation, a related effect where subjects appear to be more selfish when they can attribute some of the responsibility to a third party, and reviews evidence.

both theories are defective in ignoring intentions and so since F&S is in line with, arguably more appropriate, intentions-based theories, the conclusion that F&S employs the better measure of inequality may just be an artifact of the design.[39] Güth et al. (forthcoming) find that concerns for efficiency are insufficient to overcome an equal payoff fairness constraint in a dictator game. They find, however, a substantial share (6 of 21) of efficiency-guided subjects in a mutual gift-giving game, where a fairness constraint depends on the expectation of the other player's choices and is hence not salient.

7 Conclusion

Bolton (1998) suggests three building blocks to explain behavior in games: motivation, learning and strategic reasoning. In the present experiments we have completely isolated distributional preferences from issues such as learning, intentions and strategic reasoning, because distributions are given the central role in F&S and ERC. We are thus able to provide a pure test both for the comparison of ERC and F&S and for the relative importance of inequality aversion, efficiency and maximin preferences as components of the motivation block. It turns out that inequality aversion does not seem to be a major part in a complete explanation in this setting.

Both an analysis of the individual treatments and a conditional logit analysis of the pooled data show that a combination of efficiency concerns, maximin preferences and selfishness (which amounts to the basic C&R model) is virtually sufficient to explain the data. F&S and ERC do not account for additional variance. In contrast, F&S and ERC are not sufficient to explain our data. Both efficiency and maximin do account for extra variance. This is consistent with results for similar simple distribution games in Charness and Rabin (forthcoming) and Charness and Grosskopf (2001).[40]

[39] In addition they study one ultimatum game, where responders can destroy only 90% of the pie and one where responders cannot reduce inequality. In the first case, the rejection rate is 1/3 lower than in the control treatment (standard ultimatum game), in the second case 2/3. They conclude from these results, that the F&S inequality measure is a better explanation than the ERC measure. Punishment, however, is much more effective in the first game than in the second, so that the differences between treatments can also be explained by intention-based punishment if responders care about the relative price of punishment.

[40] Our results are also consistent with the purely distributional model by Cox et al. (2002). This model is based on altruism that is concave in the others' payoff and also assigns a higher weight to subjects that receive a lower payoff than those with a higher payoff. This model differs from C&R by the non-linearity and that special attention is given not only to the lowest payoff but to all payoffs lower than the own. In our experiments this model is consistent with all the choices that are consistent with C&R, but also with inefficient choices in the poor game. Our experiments, however, do not provide a very good test of this model, because it is consistent with all choices in too many treatments. It is only inconsistent with inefficient choices in F, Fx, N, and Nx, of which we observe only very few. A

The taxation games, which we consider the most neutral playground for the comparison of F&S and ERC, show a better performance of F&S than of ERC, but also an important influence of efficiency. The rich and poor games very vividly illustrate that maximin preferences have a major influence, and that efficiency matters more than inequality. On the other hand they show as well that there are limits to quasi-maximin preferences. The results in treatments P and Ey are of particular importance, because they are inconsistent with general forms of inequality aversion and not just the specific formulations of ERC and F&S. The comparison of treatments Ex and Ey also suggests that ERC is largely irrelevant in this class of games. The envy games show that inequality aversion does poorly when it yields predictions that are Pareto-dominated, but also that even Pareto-dominance is not completely ruling out other motives like inequality aversion or competitiveness.

Our analysis of the pooled data reveals that the superior performance of F&S over ERC in the taxation games appears to be driven by the fact that F&S is in line with maximin preferences. If maximin preferences are not included, than the probability that an allocation is chosen increases significantly if it is in line with F&S, but it does not, if maximin is explicitly included. Hence the results cannot be interpreted in a way that more subjects have F&S preferences than ERC preferences but that F&S takes into account that subjects (other things being equal) care about the minimal payoff in the group. It appears as a limitation of ERC that it does not do so.

Our experiments highlight further limitations of F&S and ERC. Neither theory takes account of efficiency concerns, nor do they explicitly consider intentions (a matter that we deliberately designed out of our experiments). That the latter is a clear deficit is pointed out, for example, by the experiments of Blount (1995), Falk et al. (2000a, 2000b) and Kagel and Wolfe (2001). It seems to us, that in plain distribution situations simple motives like efficiency concerns and maximin preferences guide subjects' choices. In strategic situations, however, perceived intentions come into play, and which motives are most important may well depend on the structure of the game.

We concede that the degenerate games we study are of a special kind. Theories of inequality aversion may work better in environments where strategic interaction, perceived intentions and learning matter. Hence at the current stage, our results do not discard inequality aversion as a motive in general. And, to clarify this, we do not discard fairness motives. Of course, maximin is a fairness motive. Both F&S and ERC are, however, exclusively formulated on the basis of distributions and interaction and intentions should rather appear as confounding factors. We conclude, that theories that are based on distributions should, in general, carefully clarify under which conditions they are appropriate. Inequality aversion may do better in situations involving

similar model is studied by Andreoni and Miller (2002) and they show that it fits the data of dictator games well.

perceived intentions, because in these games reciprocity may coincide with inequality aversion and hence the latter may serve as a black box model of the former, as Fehr and Schmidt (1999) suggest. This, however, may be an artifact of the classes of games that have been the focus of experimental research so far (in particular those where a player who treats another player unfairly has a higher payoff, as in the ultimatum game).[41]

Our games can be considered special in three respects. First, in most treatments the allocator's payoff is not affected. Second, there is role uncertainty and this might increase the role of efficiency concerns and maximin preferences. Third, there is no strategic interaction.

Concerning the first issue, our treatments Nx, Ny, and Nyi show no significant (and in particular no unexpected) impact of small deviations of the allocator's payoff over the allocations. Hence they provide no indication that the existence of monetary incentives changes the relative importance of inequality aversion, efficiency and maximin preferences. Therefore, our results cannot be attributed to the constancy of the decision maker's payoff alone. While large incentives would most likely change the decisions, we do not see why they should change the relative importance of the different motives.

As to the role uncertainty, our control treatments do not provide an indication that this method has a substantial effect and we can at least clearly refute the claim that our results are entirely driven by this method. This conclusion is supported by the results of Charness and Rabin (2001) and Charness and Grosskopf (2001).

The remaining issue is the absence of strategic interaction in our experiments. It is conceivable, that apart from matters like reciprocity the fact alone that there is strategic interaction might possibly change the importance of different distributional motives. Since it is difficult to disentangle this possible effect from the effects of perceived intentions, to the best of our knowledge there is yet no persuasive evidence on this matter. It is a matter of substantial importance, because if the relative importance of different distributional preferences depends on the presence and the nature of the strategic interaction, then the whole approach to test distributional preferences in one strategic situation to understand the results in another, appears to be problematic. There are, however, also important situations, which may well not be perceived as strategic interaction, and for these our results are thus more directly applicable. An example would be voting in large groups.

The effect that the games we study are essentially non-strategic might be moderated by the role uncertainty we employed in the experiments. Although a subject's decision will only be relevant when chosen as the allocator and there is no outcome of the random group formation process that has two subjects affecting each other, at the time of the decision the subjects are all in a symmetric situation and make choices

[41] See Charness and Rabin (forthcoming) for a similar discussion.

that can affect the others. Hence at that time subjects might perceive the situation as interactive since they mutually influence their expected payoffs.

As long as there is no conclusive evidence that the relevance of our results is entirely confined to non-interactive situations, they also have some general implications. Given the importance of efficiency concerns and maximin preferences, we believe that in interpreting experimental results one should keep these motives in mind as alternative explanations. They are consistent with many results that are readily interpreted as evidence for different kinds of fairness concerns. Deviations from pure selfishness have been interpreted that subjects are better people (i.e. more altruistic or fair), but maybe they are just better economists. It is surprising that for economists the goal in designing economic mechanisms is to maximize efficiency, while as experimentalists, when designing economic experiments, they tend to ignore that subjects might share this goal.

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A Instructions

[These are sample instructions for treatment Fx (subtreatment Fx1). The instructions for all other treatments were parallel, except for that in treatments F and E the person with the lowest payoff was called person 1 and that with the highest payoff person 3.

Subjects in the control treatments P* and Ex* were assigned roles in advance and received correspondingly adjusted instructions.]

Instructions [page 1]

Thank you for participating in our experiment. With low effort you will earn between 1.- DM and 19.- DM. Please read these instructions carefully. If there is anything that you do not understand, please raise your hand. An experimenter will then come to you and clarify the problem.
Your tasks in this experiment consist of a simple decision in the first part and the completion of the questionnaire in the second part.

> **Part 1:**
>
> Together with two other participants whom we randomly select, you will form a group. You will not get to know anything concerning the identity of these other participants. In the same way, others cannot identify you and your decisions.
>
> As for the formation of the groups, we will later randomly assign you one of three roles (person 1, person 2 or person 3).
>
> On the decision sheet (see next page), you will find three possible payment columns (A, B, C). Person 2 will decide, which of the three payment columns will be realized for all three group members.
>
> **Your Task:**
>
> On the decision sheet choose that payment column which you as person 2 prefer for the group and mark it with a cross.
>
> Later on we will collect the decision sheets and will randomly assign the roles of person 1, 2, and 3 among you and the other group members. To determine the payments in your group, the decision of person 2 will be applied. In case you are assigned the role of person 1 or person 3, your decision will thus be irrelevant. In case you are assigned the role of person 2, however, the column that you have selected will determine the payments of all three persons in your group.

Part 2:

Your Task:

Please complete the accompanying questionnaire.

Thanks again for your participation in this experiment. Please detach now this first page with the instructions and your participant number. It is your proof of participation. The payment will take place in cash next week following the lecture. If you are not present then, you can collect your payment until [...] in office [...]
Keep the sheet with your participant number and bring it along for the payment. Without it we cannot pay you any money.

Decision Sheet [page 2]

Please mark the column that you prefer in case you get assigned the role of person 2.

Payment column	A	B	C
Person 1	19 DM	18 DM	17 DM
Person 2	10 DM	10 DM	10 DM
Person 3	1 DM	5 DM	9 DM
Your Decision	☐	☐	☐
Average 1 and 3	10 DM	11.50 DM	13 DM
Total 1,2,3	30 DM	33 DM	36 DM

We would appreciate it if you stated a reason for your decision.

____

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____

[Part 2 (pages 3 and 4) consisted of questions concerning biographical data and the personality questionnaire developed by Brandstätter (1988)].