Inequality Aversion, Efficiency, and Maximin Preferences in Simple Distribution Experiments: Reply

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Gary E Bolton and Axel Ockenfels (2006, henceforth B&O) as well as Ernst Fehr, Michael Naef, and Klaus M. Schmidt (2006, henceforth FNS) discuss in their comments results of new experiments and implications for the interpretation of our results from Engelmann and Strobel (2004, henceforth E&S). We discuss their results and interpretations below.

I. Reply to Bolton and Ockenfels

B&O present results of classroom experiments on voting games, which they interpret to indicate that experimental subjects have a higher willingness to pay for achieving equality than for increasing efficiency. Hence, they question the robustness of the efficiency motive that significantly contributed to the explanation of our results in E&S.[1] We discuss their evidence and argue that it is inconclusive because B&O consider only the costs that subjects are willing to pay to achieve equality or to increase efficiency. They ignore that the gains in terms of efficiency are much smaller than the gains in terms of equality (or other fairness motives like maximin preferences).

We agree with B&O that to assess the relevance of different distributional motives, one should consider the costs that experimental subjects are willing to incur in order to satisfy them. The experiments by B&O suggest that more subjects are minimizing inequality than are maximizing efficiency and that the former are even paying more for satisfying their fairness concerns than the latter are paying to satisfy their efficiency concerns.

One should consider, however, not only the different costs, but also the different benefits with respect to the different motives. Indeed, the efficiency-maximizing choice always increases efficiency by only DM 6, from DM 39 to DM 45, or a moderate 6/39 $\approx$ 15 percent. In contrast, option A in B&O always yields perfect equality, but option B implies a high degree of inequality in games II and III, with shares ranging from $\frac{1}{45}$ to $\frac{3}{5}$. It therefore comes as no surprise that the subjects who care about equality are willing to pay more than those interested in efficiency, because they get a lot of, indeed perfect, equality for their money, while the efficiency-minded could buy only little efficiency for slightly lower costs (on average about DM 4 versus DM 6). Moreover, in games II and III, the inequality-minimizing choice equals the maximin choice, and by choosing A the minimal payoff in the group is increased substantially in relative terms (by 44 percent in game III and by 1,200 percent in game II, consistent with more persons 1 voting for A in game II), but also in absolute terms in game II (DM 12).

We had already pointed out in E&S that the apparent discrepancy between our treatments Ey and R can be reconciled by the different trade-off between efficiency and maximin preferences. Indeed, in R twice as many subjects prefer an increase in the minimal payoff by DM 2 over an increase in the total payoff by DM 4. Hence, the results in B&O's games II and III, as well as those in E&S, are equally consistent with a model where subjects care about a mixture of efficiency and maximin concerns and make their choice depending on the trade-off between these two motives. Gary Charness and Matthew Rabin (2002) call these preferences quasi-maximin. Indeed, given the small possible

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[1] In E&S, we argue that our results might be more directly applicable to voting in large groups where voting might not be perceived as strategic. This is not necessarily the case for the three-person games studied by B&O.

efficiency gains, we find it quite impressive that 12.5 percent of persons 2 in game II are voting to give up more than 90 percent of their payoff when voting for the efficient outcome.

The only game in B&O that provides clear evidence against quasi-maximin preferences is game I. Almost 50 percent of players 2 and 3, whose payoff is unaffected, decide in line with inequality aversion and not in line with efficiency. While this is clear evidence that many subjects do prefer equality over efficiency if their choice is for free, a slim majority prefers efficiency. The situation these subjects find themselves in is the one closest to the choice situations in E&S, yet inequality aversion does much better here. The explanation we consider most likely is that game I in B&O allows for a perfectly equal distribution instead of just reducing inequality. Perfect equality certainly has a special appeal and can serve as a focal point.[2]

The only subjects who clearly indicate a positive willingness to pay to achieve equality, even if this does not increase the minimal payoff, are persons 1 in game I. These six subjects (25 percent) vote to throw away their money in order to eliminate inequality. This in itself is a deeply puzzling result. In dictator games in general, at most 25 percent of dictators give half of their money to receivers, eliminating the inequality without destroying the money. So 25 percent of subjects burning the whole payoff difference seems to be at odds with previous results.[3]

The discrepancy indicates that there might be something particular about the voting game of B&O. We suspect that some persons 1 consider their vote as cheap "fairman" talk. Note that persons 2 and 3 are in the identical position in game I. Hence, if person 1 believes that the population is very homogeneous with respect to their preferences in game I (which would actually not be a rational expectation) and, hence, persons 2 and 3 vote with high probability for the same allocation, the vote of person 1 is irrelevant. This would allow her to show concerns for equality (or appear not to be greedy) at no cost.

While B&O argue, based on their results, that subjects' willingness to pay for efficiency is low, this is in remarkable contrast to the results by James C. Cox (2004). In dictator-controls for the trust game, he finds that 40 percent of subjects give away at least half of their endowment, although the payoffs are perfectly equal if they give nothing. The results by Cox (2004) can only be explained by efficiency concerns or altruism (which are difficult to disentangle). Hence, while B&O are right to state that efficiency concerns do not contribute to an explanation of responses in the trust game, they appear to play a crucial part in the explanation of first-mover choices.[4]

B&O also present results from five-player allocation experiments that are in sharp contrast to quasi-maximin preferences. These illustrate that quasi-maximin preferences are also a simplification. Reducing other, relatively poor, subjects' payoffs substantially appears to be too high a cost to increase the poorest subject's payoff marginally. In comparable five-person experiments with trade-offs less unfavorable to quasi-maximin preferences (Engelmann and Strobel, 2005) we find a large share of the

[2] While this issue has not been systematically investigated in distribution games, the evidence for ultimatum games by Werner Güth et al. (2001) suggests that perfectly equal distributions have a special appeal.

[3] Indeed, while a dictator who eliminates the payoff difference would have to have only a parameter $\beta > \frac{1}{2}$ in the model by Fehr and Schmidt (1999), these six subjects violate the $\beta < 1$ constraint that Fehr and Schmidt assumed, with the good reason that burning money to reduce inequality appeared implausible to them. In a variant of the dictator game by Mariana Blanco et al. (2006) which allows for a fine measurement of the β parameter, only two of 61 subjects exhibited such an extreme parameter.

[4] Interestingly, one of their own experiments (Bolton et al., 1998) also provides evidence for subjects' considerable willingness to pay for increasing efficiency. In their experiment, one player could sacrifice multiples of 50 Spanish pesetas, which each increased the other player's payoff by 200 pesetas. In one of three variants of this decision problem, payoffs are equal at the maximum sacrifice, so that inequality aversion and efficiency concerns agree. In the other two variants, the first player has a higher payoff than the second player if he sacrifices zero, but a lower payoff at the maximal sacrifice, with perfect equality obtainable at an intermediate sacrifice. Hence, the predictions of inequality aversion and efficiency concerns differ. Among the 142 choices in these two variants, 22 equalize payoffs, whereas in 24 cases subjects sacrifice more, including 17 cases where efficiency is maximized. By design, these subjects sacrifice more than the subjects who eliminate inequality. The remaining choices do not allow for a discrimination between efficiency concerns and inequality aversion, since subjects either choose selfishly (89 choices), or reduce inequality and increase efficiency at the same time, without minimizing equality (7 choices).

data to be consistent with quasi-maximin preferences.[5] The appropriate model for distribution games appears, to us, a model of altruistic preferences that assign higher weights to the payoffs of subjects the lower their relative position (see Engelmann and Strobel, forthcoming).[6] For games with relatively few players, including most three-person games, this coincides with maximin preferences.

To summarize, in our view, the results of B&O do not conclusively show that subjects are willing to pay more for equality than for efficiency, since the achievable efficiency gains are small, whereas inequality can be completely eliminated. Furthermore, in two of their three treatments, inequality aversion and maximin preferences coincide.

Clearly, efficiency concerns are often in conflict with experimental results, in particular if achieving efficiency is very costly (as in Bertrand games) or if it is in conflict with reciprocity (e.g., in the ultimatum game).[7] In E&S we did not advocate efficiency as a good model on its own, but our main point was that it *can* have major impact in some situations and that this should be kept in mind as an important confound (we discuss this in detail in Engelmann and Strobel, 2002). Furthermore, we agree that fairness concerns are relevant, but we argue that fairness is often better captured by maximin preferences than by inequality aversion.

Equality, however, might have an important function as a focal point and as a standard for reciprocity, as in the model by Cox et al. (forthcoming). If equality is an option, deviating from it toward self-interest appears to be seen as unfriendly and might be punished.

To conclude, we agree with B&O that preferences for efficiency depend on many factors, but we advance that so do preferences for equality, and this has not sufficiently been recognized in the literature. In particular, as we argued in E&S, the alleged good performance of the inequality aversion models in organizing experimental data might be driven by a bias in the experimental design choices, since in those experiments where they organize the data well, they agree with reciprocity. The results of B&O concerning the change of acceptability of inequality due to the different modes are very informative in this respect, and we agree that the issue of procedural fairness deserves further research.

II. Reply to Fehr, Naef, and Schmidt

FNS replicate two of our simple distribution games from E&S. They find interesting subject pool effects. While economics students in their sample decide in favor of the efficiency-maximizing allocation even more frequently than in E&S, other subjects choose this allocation significantly less often.[8] They conclude that "E&S overstate the relevance of efficiency motives and understate the relevance of inequity aversion." We consider this to be the central claim of their comment. We argue below that this claim can be substantiated only by an experiment using a representative sample for an appropriate reference population and that the sample of FNS does not satisfy this requirement. Moreover, the results are not consistent across the two games they study.

To evaluate the validity of the central claim of FNS, we have to answer three questions. First, what is a meaningful interpretation of this claim? Second, what could be considered conclusive evidence in support of this claim? And third, do FNS provide such evidence?

A meaningful interpretation of the claim that E&S "overstate" something has to relate to an appropriate reference group, i.e., the findings in

[5] In Engelmann and Strobel (2005), we systematically vary the costs to satisfy different motives in three- and five-player dictator games. When we isolate efficiency concerns, the number of choices in favor of efficiency does indeed decrease when choices become more costly, whereas very few subjects choose in line with B&O-type inequality aversion even if it is free.

[6] Such preferences are also captured by the concave altruistic utility function underlying the model by Cox et al. (forthcoming).

[7] One of B&O's counter arguments against efficiency concerns is that in the gift-exchange game efficiency concerns would predict effort decreasing in the wage, opposite to the pattern found. This argument, however, applies only to a utility function that is linear in both one's own payoff and the total payoff. An increased wage has a large effect on the worker's wage, but only a small effect on the attainable efficiency gains. Thus, the observed pattern is not inconsistent with efficiency concerns if the worker's utility function is concave in his own payoff.

[8] Note that this effect differs from a hypothesis that has repeatedly been investigated in the past (with nonrobust results), namely that economists are more selfish than other subjects (see, e.g., Anthony M. Yezer et al., 1996).

E&S should indicate a larger role for efficiency concerns than in an appropriately defined relevant population. In our view, this relevant population could be either the general population or the group of subjects employed in economics experiments, who are usually university students.[9] Given this interpretation, what should be considered conclusive evidence in support of this claim? We believe that this would be an experiment using games from E&S but a subject sample that is representative of the relevant population, and that in this experiment significantly fewer subjects choose the efficiency maximizing allocation than in E&S.

Do FNS provide such evidence? We see two problems. First, while they provide evidence on several different subject pools, these can hardly be considered representative (for either of the two possible relevant populations). Second, even if we accepted that the noneconomists in Munich and Zurich are "more representative" of the relevant population than the economists in Berlin, the experimental results are inconclusive. For game P, the Munich and Zurich noneconomists indeed choose the efficiency maximizing allocation less frequently than our subjects, and the difference between the distributions of choices is significant ($\chi^2_2 = 12.16$, $p = 0.002$, Munich noneconomists versus E&S, $\chi^2_2 = 8.25$, $p = 0.016$, Zurich noneconomists versus E&S), while the results for the Munich and the Zurich economists are not significantly different from the E&S data ($\chi^2_2 = 1.462$, $p = 0.481$, Munich economists versus E&S, $\chi^2_2 = 1.424$, $p = 0.491$, Zurich economists versus E&S). This is in line with the claim by FNS. For game Ey, however, while the distribution of choices between the Munich economists and the Munich noneconomists differs significantly, as do those of the Zurich economists and Zurich noneconomists, neither the Munich noneconomists nor the Zurich noneconomists differ significantly from the data in E&S ($\chi^2_2 = 3.957$, $p = 0.138$, Munich noneconomists versus E&S, $\chi^2_2 = 2.109$, $p = 0.348$, Zurich noneconomists versus E&S). In contrast, the Munich economists maximize efficiency more frequently than the E&S subjects in game Ey, and this difference is significant ($\chi^2_2 = 6.969$, $p = 0.031$).[10] Thus, it appears that apart from the distinction of economists and noneconomists, there are other important subject pool effects,[11] and these might even differ across games.[12] It may well be that the results of E&S are not representative with respect to the relative importance of efficiency concerns and other motives, and FNS provide some important insights, but we consider the evidence FNS provide insufficient to support their central claim.[13] A reason one might believe that E&S do not overstate the role of efficiency concerns is that they are also crucial for the explanation of other recent distribution experiments that were not run with an economist subject pool, in particular the Berkeley sessions of Charness and Rabin (2002).

Concerning the second part of the claim by FNS that E&S "understate the relevance of inequity aversion," there is an additional problem, because games Ey and P are not suitable to

[9] We note that many of the classical experiments that the inequality aversion models have set out to rationalize have been conducted with economists as subjects. Classic examples for economist subject pools are, e.g., Güth et al. (1982) or Alvin E. Roth et al. (1991). Hence, for the conclusion of E&S that efficiency might be an important confounding factor to be valid in these particular experiments, E&S employ the relevant population.

[10] We note that the E&S data do not differ significantly from the Zurich economists ($\chi^2_2 = 1.587$, $p = 0.452$). But if we pool Zurich and Munich economists, the difference to E&S is significant ($\chi^2_2 = 5.224$, $p = 0.073$), while if we pool Zurich and Munich noneconomists, it is not ($\chi^2_2 = 2.735$, $p = 0.255$). Conducting Fisher's exact test instead of χ^2-tests does not affect significance (at either 5- or 10-percent levels) in any of the comparisons above.

[11] One could, for example, try to explain the difference between Berlin and Munich subjects as a difference between East and West Germans. Furthermore, we note that FNS also point out that there are differences between men and women.

[12] FNS state that "treatment P is particularly important" because "treatment P constitutes a clean test of the relevance of inequity aversion in comparison to the efficiency motive." As we argue below, this test is not as clean as FNS suggest. Furthermore, both games Ey and P isolate efficiency concerns and, hence, they both provide a clean test of efficiency concerns versus various fairness concerns. For the assessment of the importance of efficiency concerns, they are therefore equally important.

[13] We also note that FNS do not use role uncertainty as we did in E&S. We had checked for effects of role uncertainty for two games and had not found significant differences, but the number of efficiency-maximizing choices had been decreased by one-sixth. Furthermore, the subjects in FNS played both games Ey and P, while all of our subjects played only one game. Hence, when comparing the results of E&S and FNS, we are actually considering the joint effect of subject pools and the change in procedures.

provide unambiguous support for inequity aversion.[14] In game Ey, the inequality-minimizing allocation is also the maximin allocation. In game P, a subject who chooses the least efficient allocation could do so because he wants to reduce the disadvantageous inequality, or because he wants to make the poorer of the other two subjects better off. This is a motive contrary to inequality aversion[15] but consistent with altruistic utility functions that exhibit stronger concerns for players who have a relatively lower payoff.[16] We can gather some indirect evidence that both motives matter from a variant of P that we used in Internet experiments reported in Engelmann and Strobel (2005). As for game P, in this game, the decision maker receives the lowest payoff and, compared to the efficient allocation A, allocation B reduces the highest payoff and increases the intermediate payoff. In contrast to game P, this game's allocation C further reduces (compared to allocation B) the highest payoff without affecting the intermediate payoff. Hence, if the decision maker is driven by altruism with particular concern for relatively poor players, he should choose B, while if he wants to reduce disadvantageous inequality, he should choose C. In the experiment, 27 subjects (38 percent) chose A, 19 (27 percent) chose B, and 25 (35 percent) chose C.[17] This suggests that both motives that are consistent with a choice of C in game P matter. As stated above, this evidence is only indirect as the subject pool and the procedures differ, but it should caution against interpreting the choices for C in game P as support for inequality aversion.

As a final and minor issue, we note that we have already discussed in E&S that the results of our conditional logit model are sensitive to the exclusion of certain motives because of the correlation between some of them. FNS correctly point out that, if we drop *Eff*, then $FS\alpha$ becomes significant. The reader should, however, not mistake this as evidence in favor of the inequality-aversion model, because the odds ratio is smaller than one, which means the impact of $FS\alpha$ is in the direction opposite to inequality aversion. In any case, this model is not central to the analysis of E&S.

To summarize, the subject pool effects FNS report on can improve our understanding of the relevance of different distributional motives, which seems to depend on specifics of the game, procedures, subject pools, and probably other factors. This is consistent with the message of E&S, since we did not advocate a general quasi-maximin model. Our aim was to investigate the performance of the inequality aversion models in a neutral setting. Our conclusion from their weak performance was that one should be cautious in applying them because other motives, like efficiency concerns and maximin preferences, *can* be important and should be kept in mind as confounds. If these confounds interact with subject pools, this is reason to worry for the proponents of any general behavioral theory.

Abstracting from specific functional forms, the question of the relative importance of inequality aversion and efficiency concerns boils down to whether subjects are altruistic or envious toward richer subjects. The evidence is mixed, but absent reasons for negative reciprocity, the data appear to us rather in support of altruism.

[14] When we designed the E&S treatments, the aim of games Ey and P was to isolate efficiency concerns opposed to various fairness concerns.

[15] Remember that the decision maker has the lowest payoff in game P.

[16] This amounts to a generalization of quasi-maximin preferences that assign a special weight only to the player with the lowest payoff. Cox and Vjollca Sadiraj (2006) present and test such a model.

[17] Note that aversion toward inequality between the other two players or other more general forms of inequality aversion also predict a choice of C.

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