DFG Research Group 2104
Need-Based Justice and Distribution Procedures

Sharing with the Powerless Third: Other-regarding Preferences in Dynamic Bargaining

Manuel Schwaninger

Working Paper Nr. 2021-02

Date: 2021-11-16

FOR 2104

DFG Research Group 2104 at Helmut Schmidt University Hamburg
https://www.hsu-hh.de/bedarfsgerechtigkeit

Sharing with the Powerless Third:
Other-regarding Preferences in Dynamic Bargaining

Manuel Schwaninger [1]
University of Oldenburg

November 2021 [2]

Abstract

Other-regarding preferences are powerful drivers of human behavior, leading individuals to forgo their own economic gains to share with others. However, when subjects with different levels of other-regarding concern bargain about how to distribute payoffs, it is unclear whether joint bargaining decisions reflect their individual preferences. In this free form bargaining experiment, I examine how other-regarding preferences of two subjects interact and influence negotiated distribution decisions when they allocate payoffs between themselves and a powerless third subject. The data reveals that fairness between the bargainers is more important than fairness towards the third subject; bargainers only allocate payoff shares to third subjects if the other bargainer is willing to allocate the same amount, even if their other-regarding preferences differ strongly from each other when revealed individually. Through the formal analysis, I can link the results to the other-regarding preferences elicited individually and, thereby, provide insights into the interaction of other-regarding preferences in joint decision-making environments.

Keywords

Free-form bargaining, Other-regarding and Social preferences, Third Agent, Unstructured bargaining

JEL-Classification

C78, C92, D64, D9;

---

[1] Manuel Schwaninger, manuel.schwaninger@uni-oldenburg.de (corresponding author).

[2] I gratefully acknowledge funding by the German Forschungsgemeinschaft (DFG, KI 1419/2-1) and the Austrian Wissenschaftsfonds (FWF, I1888-G11). I thank Bernhard Kittel, Stefan Traub, Arnold Neumaier, Jan Sauermann, Fabian Paetzel, Roman Hoffmann, Marina Chugunova and Mrinalini Cariappa for helpful comments and suggestions.

1. Introduction

The last two decades of research on other-regarding preferences indicates that individuals care in many situations about the well-being of others (Cooper & Kagel, 2016; Fehr & Schmidt, 2006). However, more than any other type of preference, other-regarding preferences depend on the presence of other decision-makers. When a decision cannot be clearly ascribed to a single person (Dana et al., 2007), individuals decide in groups (Charness & Sutter, 2012; Kugler et al., 2012) or bargain on the market (Bartling et al., 2015; Kirchler et al., 2016), then concerns for third parties appear to change. In a nutshell, "individual decisions in isolation cannot necessarily be assumed to be good predictors of the decisions made by groups" (Charness & Sutter, 2012, p. 158). Usually, the differences are attributed to psychological effects that cause individuals to increase or decrease their concern for others. In comparison, there is less research on how other-regarding preferences interact and mutually affect joint decisions, especially in unstructured decision-making environments. Though, when the concern for others varies between people, understanding how other-regarding preferences aggregate is key in explaining collective distribution decisions.

The interaction of other-regarding preferences has received little attention for two main reasons. First, despite extensive efforts to model other-regarding preferences, there is no commonly shared conception of how social utility functions are shaped (Cooper & Kagel, 2016). Yet, the aggregation of preferences depends on the shape of the preferences and, as I will show in this paper, predictions can vary drastically conditional on the initial assumptions. Second, bargaining studies typically implement a highly structured bargaining protocol (Karagözoğlu, 2019). These protocols often imply a first-mover advantage, which directs the focus of the analysis to the influence of the structure rather than the influence of other-regarding preferences on the outcome. Also, a high level of structure can restrict the interaction between decision-makers, which minimizes potential interaction effects and eases the analysis. However, despite this advantage, there are numerous situations in which decision-makers interact intensively and bargain in unstructured ways (Camerer, 2003; Luhan et al., 2019). Settling on agreements without going through highly institutionalized procedures can be particularly important when bargainers want to reach a fast and efficient decision, especially between two actors (Camerer et al., 2019; Ingersoll & Roomets, 2020).

In this study, I want to open up the black box between individual and collective distribution decisions to investigate how two active individuals distribute payoffs among themselves and a third, passive individual in a dynamic, free-form bargaining environment. Third parties appear, for example, when political coalitions negotiate a policy or managers negotiate the allocation of workload and they make a decision that affect themselves and third parties, such as the opposition or co-workers. The study implements a free-form bargaining protocol which allows for unrestricted back-and-forth interaction in the form of distribution offers. At the same time, I retain the design feature employed by most structured bargaining experiments to prohibit verbal communication. This enables me to focus on the influence of other-regarding preferences on the bargaining outcome, while controlling for the influence of cheap-talk on bargaining outcomes (Agranov & Tergiman, 2014; Baranski & Kagel, 2015; Croson et al., 2003).

In order to solve the bargaining problem, I derive closed-form solutions by applying other-regarding preferences to the Nash bargaining solution (Birkeland & Tungodden, 2014; Luhan et al., 2019; Nash, 1950). Since I focus on the distributive outcome of the free-form bargaining game, I make use of outcome-based utility functions (Bolton & Ockenfels, 2000; Fehr & Schmidt, 1999). More specifically, I focus on two key features of prominent outcome-based models–the *pairwise* comparison of payoffs as well as the *increasing* penalty of inequality, which I compare against a baseline inequality aversion model. Whereas outcome-based models make similar predictions for a wide range of individual decision problems, the results show that the predictions in the bargaining game are highly sensitive to the assumed utility function. Fitting the bargaining solutions to the observed bargaining behavior, enables me to test which model explains the repeated bargaining behavior best. Additionally, I elicit subjects' distributional preferences in individual decision tasks in two treatments, either before or after the bargaining game. This allows me to compare subjects' estimated other-regarding preferences with their individual distribution decisions.

My main result is that assuming pairwise inequality aversion (Fehr & Schmidt, 1999) explains the bargaining outcomes significantly better than the two alternative models and generic OLS or Tobit models. In principle, decision-makers could forgo payoff shares unilaterally to benefit third subjects. However, when third subjects receive any payoff shares, bargainers retain equal amounts of the payoff in 94 percent of the cases. A substantial share of the decision-makers cares about the third subject; yet, fairness between the bargainers appears to be more important than sharing fairly with the third subject. Therefore, transfers of one and the same subject can vary strongly but consistently during the bargaining game depending on the bargaining partner. If other-regarding subjects are not able to enforce equal transfers, then the third subjects receive no payoff shares, because virtually no bargainer is willing to reduce inequality between themself and the third subject at the expense of an increase in inequality between themself and the other bargainer. The rationale is also apparent when analyzing the dynamic bargaining process, in which subjects hardly ever offer to reduce their own payoffs exclusively to benefit the third subject.

The analysis indicates that the other-regarding preferences estimated from the bargaining game correlate strongly with the revealed other-regarding preferences from the individual decision tasks. Yet, single bargaining agreements are often polarized. In a majority of agreements, third subjects receive none or exactly the equal share of the payoff. The outcome depends on the relative strength of the preferences. Subjects strongly motivated by self-interest are more likely to enforce even two-way splits, while subjects strongly motivated by fairness concerns are more likely to enforce three-way even splits. Moreover, analyzing the dynamics of the bargaining process reveals that the individual other-regarding preferences of the proposer of the final agreement influences the payoff distribution significantly stronger than the preferences of the receiver of the agreed offer. Also, the data confirms the presence of an 'anchor effect'

(Chertkoff & Conley, 1967) and a ‘deadline effect’ (Roth et al., 1988), implying that first offers have a lasting impact on the outcome and most agreements are formed during the last seconds of the negotiations.

The remainder of this paper is structured in the following way: First, I discuss findings of previous experimental studies that include third subjects. Then, I derive predictions for the bargaining problem with the three inequality aversion models. In section 4, I describe the experimental design to compare the predictive quality of the different models. In sections 5 and 6, I explain the procedure to compare the results and present the empirical findings. Finally, I summarize and discuss the findings.

2. Experimental Evidence on Sharing with Third Parties

Third parties appear in several fields of experimental research. A passive third individual was first introduced by Güth and van Damme (1998) in an extended version of the ultimatum game. The ultimatum game gives the proposer significant bargaining power since the responder can only decide to accept or reject the offer. They find that proposers and responder predominantly agree on the three-way even split in early periods, which can be replicated with samples outside the laboratory (Güth et al., 2007). In later periods, when the proposer learns to use their first-mover power, responders of the take-it-or-leave-it offer care mostly about their own relative payoff share and less about the third, which is corroborated by electrophysiological data (Alexopoulos et al., 2012). The results from the structured bargaining experiments led to the conclusion that self-interested bargainers can exploit other-regarding bargainers as long as the latter receive their own fair share defined as their own payoff relative to the average payoff (Bolton & Ockenfels, 1998, 2000, 2008).

In the multilateral bargaining and coalition formation literature third individuals appear outside the coalition. Under simple majority rule, it is ‘coalitionally irrational’ for self-interested actors to allocate more resources to third actors than necessary (Aumann & Maschler, 1961). Hence, self-interested actors are expected to form minimum winning coalitions which distribute payoffs exclusively among the majority. Experimental tests show that multilateral bargaining outcomes are generally more equal than theoretically predicted by the assumption of strict self-interest (Diermeier & Morton, 2005; Fréchette et al., 2003; McKelvey, 1991). However, the use of first-mover or agenda-setting power increases over several periods in structured multilateral bargaining experiments (Agranov & Tergiman, 2014; Miller & Vanberg, 2013). When the bargaining structure is reduced, coalition partners mainly retain equal payoff shares (Sauermann et al., 2021; Schwaninger et al., 2019; Tremewan & Vanberg, 2016). In contrast to the evidence from ultimatum games, coalition members in less structured experiments rarely exploit each other, even when one member is more self-interested than the other. Yet, in the latter studies it is difficult to control for the influence of the third subjects on the bargaining outcome.

Third subjects also appear in dictator games with multiple dictators and one or more recipients. Studies examining the influence of other-regarding preferences on the transfers focus especially on team dictator games, in which payoffs between the dictators are equal by default. Evidence whether teams transfer less than individuals is not robust (Cason & Mui, 1997; Franzen & Pointner, 2014; Luhan et al., 2009). Though, results from Ellman and Pezanis-Christou (2010) suggest that average transfers to third subjects are higher if the decision is based on the average distribution proposal instead of consensus. Utilizing the strategy method, Panchanathan et al. (2013) study independent dictators and find that 13 percent of all subjects condition their transfer on the transfer of another dictator. In fact, 51 percent of all subjects do not react to different amounts of transfers of other dictators, while 36 percent of the decision-makers even compensate for the other dictators' self-interest. Similarly, Gächter et al. (2017) find considerable heterogeneity regarding the influence of others on dictators' sharing behavior. However, when decision-makers know the actual decision of the other dictator, transfers often align. In an additional treatment, Panchanathan et al. (2013) allow dictators to communicate and prevent them from pledging one amount and then transferring a different amount. In this treatment, dictators retain equal payoff shares in 75 percent of the agreements and other outcomes are often close to an even split. Xu et al. (2020) also study transfers in a dictator game, in which the first-mover makes a suggestion about how much the two dictators should transfer. They find that charitable giving is more likely when the first mover suggests donating the same amounts, as compared to cases in which the first mover suggests donating a lower amount than the other subject. Yet, the studies do not clarify how other-regarding preferences interact and affect joint decisions.

Finally, this study contributes to the growing body of unstructured bargaining experiments (Karagözoğlu, 2019). In unstructured bargaining experiments, two bargainers predominantly agree on an equal split (Isoni et al., 2014; Nydegger & Owen, 1974), but can depart from the equal split, when the decision involves entitlements (Gächter & Riedl, 2005), information asymmetries (Camerer et al., 2019), or the equal split is Pareto inefficient (Galeotti et al., 2019). To the best of my knowledge only Ingersoll and Roomets (2020) introduce a third passive subject to an unstructured bargaining experiment. In their experiment, passive subjects take on the role of clients which receive a share of the payoff the agent negotiates for them. They find that a "minimization of differences" solution, closely related to Fehr and Schmidt (1999) model, explains the behavior better compared to the Nash bargaining solution based on self-interested decision-makers. In this study, I combine these two approaches and integrate individuals' inequality aversion directly into the Nash bargaining solution.

3. Cooperative Bargaining Solutions with Inequality Aversion

This study analyzes how two individuals divide payoffs among themselves and a third individual if they bargain in an unrestricted and costless bargaining environment. Building on Birkeland and Tungodden (2014) and similar to Luhan et al. (2019), I make use of the Nash bargaining solution (Nash, 1950) to predict the division, allowing for heterogeneous other-regarding preferences. More concretely, suppose there are $n = 3$ individuals $j = a, b, c$. While individuals $i = a, b$ bargain over the distribution of a bargaining value, v, individual c is excluded from bargaining. The two bargaining individuals can agree on any triple $y = (y_a, y_b, y_c)$ of payoff shares, $y_j \in [0, v]$, which belong to the set of feasible bargaining agreements $Y = \{y : y_a + y_b + y_c \leq v\}$. The disagreement point d is zero, $d = (0, 0, 0)$, which means that individuals receive no payoff if they cannot agree on any offer and that disagreement entails the risk of losing a potential increase of utility. I assume individuals a and b bargain over the payoff shares y_j as if they were solving the following optimization problem,

$$max\ (u_a(y) - u_a(d)) * (u_b(y) - u_b(d)) \text{ subject to } y_a + y_b + y_c = v, \quad (1)$$

where $u_i(y)$ is the utility of individual i, which depends on the distribution of payoffs. If the bargaining set is convex, this bargaining solution is symmetric, independent of scale, independent of irrelevant alternatives, and Pareto efficient (Nash, 1950). When the utility at the disagreement point is zero, i.e. $u_i(d) = 0$, which applies to the utility functions below, Pareto efficiency implies that an individual will not agree to any outcome resulting in a negative individual utility (Birkeland & Tungodden, 2014).

When all individuals aim to maximize their own monetary payoffs, i.e. $u_i(y) = y_i$ and $d_i = 0$, the distribution $y = (v/2, v/2, 0)$ maximizes the Nash product. In this case, individual c introduces only irrelevant alternative distributions and the third individual receives no payoff since the bargaining individuals are strictly self-interested. In contrast, assuming individuals value not only their own payoffs but also the relation of their own payoffs to the payoffs of others, the third individual may receive some payoff shares. The outcome then depends on the specific properties of the utility function of the two bargaining individuals and the relative weights attached to own and others' payoffs.[3]

Here, I examine outcome-based social utility functions that differ with respect to two conceptualizations of inequality aversion, *average* and *pairwise* comparisons as well as *linear* and *increasing* penalties. In the baseline model, subjects compare their own payoff to the average payoff and any penalty of inequality is

[3] An implicit assumption in Nash's bargaining solution is that the bargainers know each other's utility function. Arguably, the distribution preferences are revealed during the bargaining process when bargainers repeatedly make their distribution offers. For a bargaining solution with incomplete information, see Harsanyi and Selten (1972). Latter approach is difficult to combine with common conceptions of other-regarding preferences because types are usually not discrete. Hence, I follow Birkeland and Tungodden's (2014) and Luhan et al.'s (2019) approach here.

discounted linearly (IA). In the second model, inequality is also discounted linearly, but subjects compare their payoff pairwise to other subjects (FS), which mirrors the model suggested by Fehr and Schmidt (1999). In the third model, subjects compare their payoff to the average payoff, but the penalty of inequality increases exponentially with increasing inequality (BO), which coincides with the assumptions suggested by Bolton and Ockenfels (2000). This class of models do not always make the most precise predictions when researchers introduce equality-efficiency trade-offs (Kagel & Wolfe, 2001) or information about intentions, merit, or needs (Cooper & Kagel, 2016; Nicklisch & Paetzel, 2020) to the decision. Yet, when the decision problem abstracts from other factors than the pure distributive outcome, outcome-based models explain a wide range of decisions accurately (Konow & Schwettmann, 2016). In the following, I discuss the impact of the assumptions of the three models on the predicted bargaining solution.

3.1. Inequality aversion (IA)

To solve the optimization problem in (1), I consider each utility function separately, assuming that the utility weight attached to other individuals' payoffs varies across individuals in order to allow for heterogeneity of other-regarding preferences. For the IA model, I assume the utility to be

$$u_i(y) = y_i - \delta_i \left|\frac{n\, y_i - v}{n-1}\right|, 0 \leq \delta_i, \tag{2}$$

where parameter δ_i discounts deviations from the average payoff share. When $n = 3$, this utility function implies individuals maximize their utility in the bargaining game when they receive the full bargaining value, v, if $\delta_i < 2/3$ and transfer $2v/3$ to the other two individuals if $2/3 < \delta_i$. Since this model assumes that individuals only care about the average payoff, they are indifferent how transferred payoff shares are distributed among the two other subjects. Using (2) in (1) and solving for y_c gives:

$$y_c(\delta_a, \delta_b) = \begin{cases} \frac{1}{3}v & if\ \frac{2}{3} < \delta_i\ \forall\ i, \\ 0 & otherwise; \end{cases} \tag{3}$$

Hence, IA predicts the three-way even split, when both players' other-regarding preferences are sufficiently strong, otherwise third individuals are left empty handed. The payoff shares of the bargaining individuals are shown in (A1) in the Supplementary Materials. The results suggest that more self-interested individuals are able to exploit more other-regarding individuals since latter care about their own payoff share relative to the average payoff share, but not about pairwise payoff differences.

3.2. Pairwise inequality aversion (FS)

For the FS model, I assume individuals compare their payoff pairwise to others' payoffs and dislike disadvantageous inequality more than advantageous inequality; that is,

$$u_i(y) = y_i - \alpha_i \sum_{j\neq i} \max\left\{\frac{y_j - y_i}{n-1}, 0\right\} - \beta_i \sum_{j\neq i} \max\left\{\frac{y_i - y_j}{n-1}, 0\right\},\ \beta_i \leq \alpha_i, 0 \leq \beta_i < 1; \tag{4}$$

where parameters α_i and β_i express the disutility from being worse or better-off in payoffs. This model is identical to Fehr and Schmidt's (1999) model and coincides with the IA model if $y_{j\neq i} \leq y_i \forall j$. Individuals exhibiting these preferences maximize their utility in the bargaining game either when $(v, 0, 0)$ or $(v/3, v/3, v/3)$, depending on whether $\beta_i < 2/3$ or $2/3 < \beta_i$ (in the two-player case, $\beta_i \lessgtr 1/2$). The worse-off weight α_i only plays an indirect role as it ensures that an individual also discounts lower payoffs, but never becomes effective due to the assumption $\beta_i \leq \alpha_i$. Using (4) in (1) and solving for y_c gives:

$$y_c(\beta_a, \beta_b) = \begin{cases} \frac{1}{3}v & if \quad \frac{4}{3} \leq \beta_a + \beta_b, \\ \left(\frac{3\beta_a\beta_b - 4(\beta_a+\beta_b)+4}{9\beta_a\beta_b - 6(\beta_a+\beta_b)+4}\right)v & if \quad \frac{3}{4}\beta_a\beta_b + 1 < \beta_a + \beta_b < \frac{4}{3}, \\ 0 & if \quad \beta_a + \beta_b \leq \frac{3}{4}\beta_a\beta_b + 1; \end{cases} \tag{5}$$

Similar to IA, FS has corner solutions at zero and one third of the bargaining value.[4] However, there are two key differences between FS and the previous bargaining solution. First, FS implies that any optimum requires even payoff shares between the bargaining individuals, i.e. $y_a = y_b$. Other-regarding preferences necessary to break this outcome are never realized due to the specific assumptions about the inequality aversion parameters (see, A2 in the Supplementary Materials). Intuitively, the two bargainers will always agree on even payoffs between themselves because the utility gained by reducing the payoff difference to the third individual is always lower than the negative utility gained by increasing the payoff difference to the bargaining partner and the lower utility from the lower payoff share. Thus, FS captures the idea that bargaining individuals are deeply concerned about a fair allocation between themselves and neither self-interested nor other-regarding individuals are able to take advantage of each other.

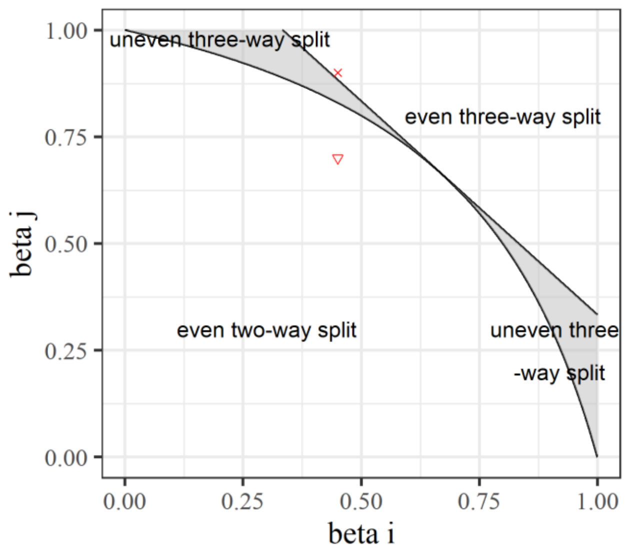
Second, due to the pairwise payoff comparison in FS, other-regarding individuals are sometimes able to enforce their preferred outcome. Suppose the better-off weight of an individual a is $\beta_a = 9/20$. In the bargaining game, this individual prefers to increase their own payoffs over an equal distribution of payoffs. When a bargains with an individual b with $\beta_b = 14/20$, implying a preference for equality, a's preferences are relatively stronger in comparison to b and individual a enforces the even two-way split, which maximizes the payoffs of the bargainers under the condition that $y_a = y_b$ (see triangle in Figure 1). However, if individual b has stronger preferences, say $\beta_b = 18/20$, then the relative influence switches and the bargaining individuals will agree on the three-way even split (see cross in Figure 1). In other words, self-interested preferences do not always drive the bargaining agreement. The more important profit (equality) is for an individual, the closer the outcome is to this individual's distribution preferences since the individual is more reluctant to agree on a more (less) equal distribution. The bargaining individuals only

---

[4] The related utility model of Charness and Rabin (2002) would predict the same outcomes if it makes the same assumptions about the other-regarding parameters as Fehr and Schmidt (1999).

reach a compromise by which they receive an even share and allocate a share between zero and one-third to the third individual when the preferences are similarly weighted. In a majority of cases, however, the Nash product aggregates pairwise inequality averse preferences into the two- or three-way even split.

Figure 1. Predicted agreement depending on FS better-off weights.



3.3. Increasing inequality aversion (BO)

For the BO model, I assume a utility function in which the penalty of inequality aversion increases exponentially when the own payoffs deviate from the average payoff,

$$u_i(y) = y_i - \vartheta_i \left(\frac{n\, y_i - v}{n-1}\right)^2, 0 \leq \vartheta_i, \tag{6}$$

where parameter ϑ_i weights the inequality between own payoffs and mean payoffs. The assumptions about other-regarding preferences proposed by Bolton and Ockenfels (2000) can rationalizes intermediate transfers due to the concave utility function. In this bargaining game and with this specification, individuals maximize their own utility when $y_i = v/3 + 2/9a$. Using (6) in (1) and solving for y_c gives:

$$y_c(\vartheta_a, \vartheta_b) = \begin{cases} \frac{1}{3}v - \frac{2}{9}\left(\frac{1}{\vartheta_a} + \frac{1}{\vartheta_b}\right) & if\ \frac{\vartheta_a + \vartheta_b}{\vartheta_a \vartheta_b} < \frac{3}{2}v, \\ 0 & otherwise; \end{cases} \tag{7}$$

Similar to IA, BO predicts the bargainers transfer positive payoff shares if the disutility of inequality of both players is sufficiently strong, i.e. $\vartheta_a \vartheta_b/(\vartheta_a + \vartheta_b) > 3v/2$. In contrast to IA, the increasing penalty of inequality also rationalize agreements that transfer a payoff share between zero and one third to the third individual. Furthermore, contrasting the FS solution, BO does not predict that bargainers retain even payoff shares (see, A3 in the Supplementary Materials). In sum, the initial assumptions lead to three very different bargaining solutions, which I will discuss further in section 5.

4. Experimental Design

The experiment, designed to emulate the theoretical environment, incentivizes bilateral negotiations in which the participants distribute payoffs between themselves and an uninvolved third subject. In addition, I elicit distribution preferences in an individual choice setting. To control for ordering effects, I vary the sequence of the bargaining game and the individual tasks between subjects. In the *I-B treatment*, participants complete the individual decision tasks before they play the bargaining game; in the *B-I treatment*, they complete the individual tasks after the main experiment.

4.1. Free-form Bargaining

At the start of the bargaining game, two-thirds of the participants are randomly selected to bargain over the distribution of payoffs and one-third of the participants are excluded from the payoff-relevant negotiations. The role assignments remain constant throughout an entire session of the experiment. In each round, two bargainers are matched together with one excluded participant and must bargain over the distribution of 72 points.

To make an offer, a subject has to allocate exactly 72 points between themself, the other bargainer, and the excluded subject who cannot participate in the negotiations.[5] The format of the proposals is restricted to numbers displayed on the computer screen. Further communication is prohibited during the experiment. Subjects are able to send as many offers and counteroffers as they choose at any point during a round. The most recent proposal of the other bargainer can be accepted at any time during the round after the first 30 seconds by clicking on an 'Accept' button. In this sense, bargaining is costless, unrestricted, and not subject to a tightly structured protocol. If the bargainers agree on a distribution of payoffs, the round ends and the payoffs are implemented for all three subjects. The time limit to reach an agreement is two minutes. If no agreement is reached within the time limit, all three subjects receive zero points. When an agreement is reached or the time ends, the subjects are informed about their payoffs and a new round begins.

Each session consists of 24 participants who engage in 20 rounds of negotiations. In the first five rounds, the 16 bargainers are randomly matched in every round. In the last 15 rounds, the 16 subjects are matched so that each bargainer bargains exactly once with all other bargainers. At the end of the session, three rounds are randomly selected and paid out. In the meantime, the 8 excluded subjects also bargain in groups of two, but their outcomes are not relevant for the payoff. Even though I do not use this data, this procedure ensures the roles remain anonymous during the experiment. The subjects are informed about their own role prior to the bargaining game. The roles are constant during the experiment to control for indirect reciprocity.

---

[5] I choose a relatively high number of points to broaden the action space of the subjects and allow for a meaningful variance of outcomes. Participants can use a calculator integrated in the bargaining interface.

4.2. Individual distribution preferences

To compare the bargaining behavior with the decisions of the individual choice task, I elicit the individual distribution preferences in two ways. All subjects complete an extended Equality-Equivalence test (Kerschbamer, 2015; henceforth EET) and a three-person random dictator game.

The *EET* measures preferences for inequality aversion. It is an incentivized task assessing an individual's distributional preferences based on decisions between various distribution alternatives in two blocks. In the disadvantageous inequality block (DIB), subjects face five pairs of allocations and for each pair, they must choose whether they prefer an equal distribution between themselves and another subject (20, 20) or an unequal distribution (20 + x, 30), where $x \in \{-5, -1, 0, 1, 5\}$. In the advantageous inequality block (AIB), they must also choose whether they prefer an equal distribution (20, 20) or the unequal distribution (20 + x, 10), but the payoff share of the other subject is smaller. I can observe when a subject switches from left to right and use this decision as a proxy for the inequality aversion weight. The EET originally includes five items for DIB and AIB. I extend the latter with three additional items, where $x \in \{10, 20, 50\}$, to get a more precise measure of the better-off weight. One decision is randomly chosen per subject and is paid out to the decision-maker and a paired recipient. Hence, each subject earns two payoffs, once as a decision-maker and once as a recipient. The setup ensures that a dictators' recipient is not simultaneously the recipients' dictator, so decisions are not mutually payoff relevant. [6]

The *dictator game* elicits a subject's most preferred distribution between themself and two other subjects. Participants are randomly assigned to groups of three. Each participant must allocate exactly 72 points between themself and two other subjects. At the end of the experiment, one of the three group members is randomly selected as the dictator and their decision is paid out. The group size and stakes are the same as in the bargaining game. In comparison, the number of active decision-makers changes from one to two and the number of passive group members changes from two to one. The three-person dictator game elicits the distribution that a subject aims to enforce during the bargaining game.

All decisions in isolation are anonymous and participants do not receive any information about their payoff from the individual tasks until the end of the experiment. Since the participants are unaware of the final outcomes of the individual tasks, the influence on the bargaining game should be relatively low in the *I-B treatment*. To control for possible ordering or framing effects, I vary the order of the experiment and elicit the individual preferences after the bargaining game in the *B-I treatment*.

---

[6] Since the EET is designed for two players, I included a separately incentivized battery with seven items that distributes the payoff among three subjects. Designed similarly to the EET, these items aim to capture the willingness to share payoff with a third individual, given the payoff of a second individual and a constant sum of payoffs. In this paper, I focus on the decisions in the EET and the dictator game. Attachment 1 in the Supplementary Material shows all implemented choice items.

4.3. Further Measurements

At the end of the experiment, the participants answer a short questionnaire. Since risk preferences are frequently discussed in the bargaining literature, I include a self-reported measure for risk preferences, which is argued to be more predictive of empirical behavior than alternative incentivized measures (Dohmen et al., 2011; Lönnqvist et al., 2015). To gain more information about factors that could influence the bargaining behavior, I included questions about assertiveness, compassion, and trust (Danner et al., 2016; Soto & John, 2017), a self-reported assessment of the bargaining skills, and socio-economic background variables. See Attachment 4 in the Supplementary Material for the full translated questionnaire.

4.4. Procedure

I conducted six sessions with 24 subjects each at the Vienna Center for Experimental Economics in March 2018, resulting in a sample of 144 participants evenly divided between the two treatments. All subjects were university students, on average in their sixth semester, with a median age of 23. The experiment was fully computerized using z-Tree (Fischbacher, 2007) and the participants were recruited using ORSEE (Greiner, 2015). All experimental sessions lasted fewer than two hours. The experimental data is available at the data repository, X-econ (see, Schwaninger, 2020).

The participants were all provided with written instructions. Instructions for the individual tasks and the bargaining game were handed out after each other. Participants knew the experimental session consists of several parts but did not know the content of the future parts before the respective instructions were provided. See the attached Experimental instructions for the instructions in English and German.

At the end of the experiment, the program converted the earned payoff points into Euros and the laboratory assistants paid the participants separately and in private. In sum, the payoff of the participants consisted of three bargaining outcomes (three randomly selected rounds) and three individual decisions (EET, additional items, dictator game). The payoffs between the first and second part (B and I) were evenly weighted and paid roughly the same on average. The participants earned, on average, 29.43 Euros, including 5.71 Euro (40 points) as a show-up fee.

5. Theoretical Comparison of the Bargaining Solutions

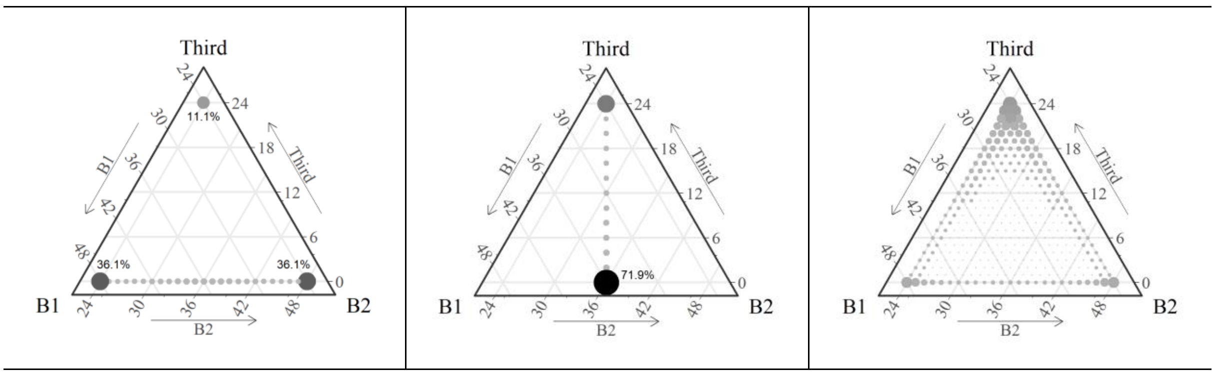
To investigate how subjects' other-regarding preferences interact and influence the bargaining outcomes, I compare the explanatory power of the derived bargaining solutions after calculating the best model fit of each bargaining solution. The comparison is based on the residual vectors, i.e. the remainders of each model that cannot be explained. In this section, I generate random bargaining outcomes and fit the models to the random data to calculate the restrictiveness of each model (Fudenberg et al., 2021), i.e. I compare how flexible they are in comparison to each other.

I start the comparison of the three models by visualizing how the three preference models shape the outcomes. Figure 2 shows the predicted distribution of agreements and transfers to the third individual assuming other-regarding weights between zero and one within each class. The IA model predicts that the bargaining subjects transfer either nothing or one third of the payoff. If the third subject receives no payoff, the payoff shares of the bargaining subjects increase, the lower the other-regarding preferences relative to the other bargainer. The FS model predicts equal payoff shares between the bargaining subjects and that the majority of agreements accumulate at the three-way and two-way even split. The BO model predicts less polarized outcomes since the model assumes that the marginal utility of own payoff is decreasing. The predicted bargaining outcomes are distributed across the whole bargaining space.

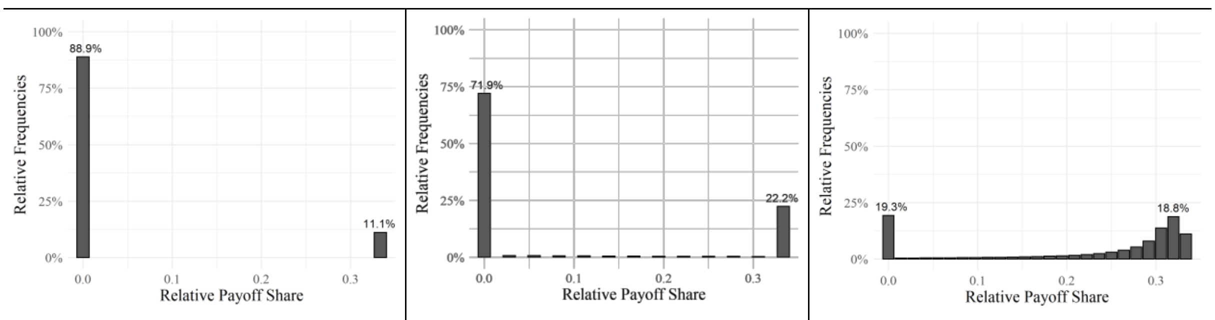
Figure 2. Simulated bargaining outcomes

Inequality aversion (**IA**)	Pairwise Inequality Aversion (**FS**)	Inequality Aversion (**BO**)

Distribution of agreements



Relative payoff shares of the third individual



$\delta_i \in U(0,1)$, $v = 72$;	$\beta_i \in U(0,1)$, $v = 72$;	$\vartheta_i \in U(0,1)^2$, $v = 72$;

Predictions are rounded to the closest feasible distribution in the experiment.

In the following, I focus on the payoff of the third subject. To compare the predictions, I first have to estimate the individual other-regarding preferences that explain the transfer to the third subject best. In the empirical analysis, I base the estimation on round 6 to 20 to control for learning effects in early rounds. Hence, in each session, I observe sixteen individuals, $i = 1, \ldots, 16$, who bargain in fifteen rounds in new pairs ab, where $a \neq b$, over the distribution of $v = 72$ points. This gives me a total of 120 observations per session, with 8 pairs in 15 rounds. For each observation, pair ab can transfer a payoff $y_{c,ab} \in [0,72]$ to the excluded individual c. I estimate the parameters $\tilde{p}_i = \delta_i, \vartheta_i, \beta_i$, of IA, FS, and BO such that the Nash bargaining solution minimizes the sum of squared residuals between the actual and the predicted transfers, i.e. $min \sum_1^{120} \left(y_{c,ab} - y_c(\tilde{p}_a, \tilde{p}_b)\right)^2$.The lower the squared residuals, the better is the explanatory power of the model. Since the total amount of squared residuals is equal in each case, this is equivalent to comparing the R^2 against each other.[7]

To fit the non-smooth functions of the bargaining solutions, I use gradient-free algorithms implemented in the statistical software R. The algorithms of a simulated annealing process (Xiang et al., 2013) and a particle swarm optimizer (Bendtsen, 2012) turned out to provide the best and fastest results for the objective functions.[8] Note that gradient-free algorithms usually do not guarantee that the optimal solution is ever found. Hence, I use the multi-start method to determine the minimum. When fitting the empirical data, I first run 1000 iterations of the simulated annealing process 30 times to find global minima. Then, I assign the 30 results to clusters. If at least one cluster consists of less than three cases, I repeat this process to find potential, additional clusters. Otherwise, I use the particle swarm optimizer to find the local minima of each cluster and to determine the best solution.

Before analyzing the empirical data, I compare how restrictive the three bargaining solutions are in explaining repeated transfers to the third subject. That is, I test how flexible the three models are in organizing any kind of observed transfers consistently. For instance, consider a single observation. The IA model can explain transfers of zero or one third of the bargaining value, whereas the FS and BO model can explain any transfer between zero and one third of the payoff. Hence, the IA model is more restrictive and less flexible than the FS and BO model, because it narrows down the predicted set of behavior to a smaller subset. Given the same predictive power of two models, the model that is more restrictive or less flexible is usually preferred (Fudenberg et al., 2021). While the FS and BO model can explain any transfer between zero and one third of the payoff for a single round, the same is not true for more than one round assuming consistent preferences. Following Fudenberg et al.'s approach, I generate random transfers and compare the average error across the models, normalized by the error of a naive model. I use the predictions of the Nash bargaining solution that is based on self-interest as the naive model.

---

[7] Maximum likelihood estimation (MLE) would provide the same results if I assume normally distributed errors, because MLE also has to rely on gradient-free algorithms to optimize non-smooth objective functions. As I estimate the same number of parameters for each model, I do not need to punish for the parameters and the comparison between AIC, BIC and log likelihood is equivalent to comparing the sum of squared residuals or the R^2.

[8] For a comprehensive list of available algorithms, see https://cran.r-project.org/web/views/Optimization.html.

In line with the empirical experiment, I generate 120 random transfer values between zero and one half of the bargaining value for each simulated session (8 pairs times 15 rounds) and then fit 1000 simulated sessions in total. After fitting the models to the simulated data, the restrictiveness compared to the best available model is .154 for the IA, .037 for the FS and .006 for the BO model. Assuming there exists a model without an error, the restrictiveness is .336 for the IA, .243 for the FS and .220 for the BO model. The results imply that IA is the most restrictive (least flexible), FS is the second most restrictive (second least flexible) and BO is the least restrictive (most flexible) model. However, the averages (95%-quantiles in parenthesis) of the mean residual sum of squares per session are 143.2 (117.6, 169.4), 100.5 (81.5, 120.3), and 94.5 (77.8, 111.9), which suggests that only the IA model is significantly more restrictive than the BO model.

From a statistical point of view, the BO model is most likely to explain the data because it is the most flexible model. Bolton and Ockenfels (2008) also formulate conjectures about the aggregation of other-regarding preferences based on empirical evidence of structured bargaining games. Accordingly, subjects who are strongly motivated by other-regarding preferences aim to obtain an equal share of the payoff and are indifferent on how the remaining payoff is distributed, i.e. they do not care about pairwise payoff differences. Hence, when bargaining with self-interested subjects, they are willing to agree to a distribution in which the latter receives the major shares of the payoff. This prediction is in stark contrast to the bargaining solution derived from the FS model, which predicts equal payoff shares between the bargainers. However, the literature reviewed in section 2 suggests that results from structured bargaining experiments with third, passive individuals have to be generalized to less structured environments with care. For example, more recent evidence suggests that the FS model predicts bargaining outcomes well in an unstructured experiments (Ingersoll & Roomets, 2020). Therefore, I approach the empirical analysis without explicit priors.

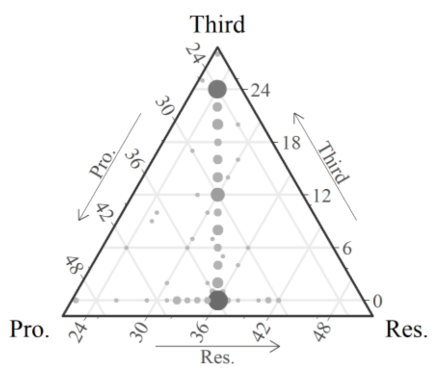
6. Results

Analyzing the data consists of three parts. In the first part, I give a descriptive overview of the observed bargaining outcomes. In the second part, I fit the three different models and test which functional form explains the data most accurately. Thereafter, I compare the estimated other-regarding preferences from the bargaining game with the individual decisions in the EET and the transfers in the dictator game. In the third part, I report on results regarding the bargaining process.

6.1. Bargaining Outcomes

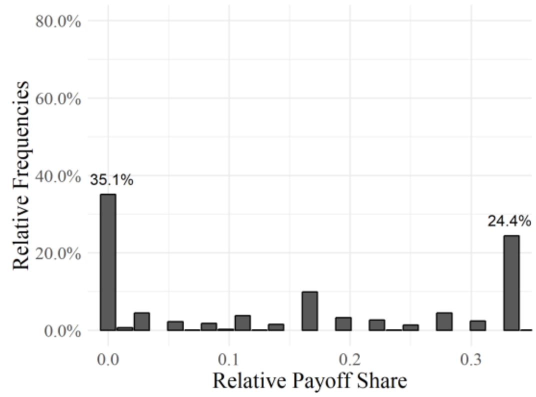
The bargaining data show that in 67.3 percent of the cases, bargainers allocate a payoff share greater than zero to the excluded individual. On average, they transfer 15.8 percent of the payoff. In the initial rounds, the transfers decrease and converge to about 15 percent of the distributable payoff (see, Figure A1 in the Supplementary Materials). To control for the learning effects in the first 5 rounds, I concentrate on rounds 6 to 20 in the following analysis of the data. The transfers do not decrease significantly after round 5 in either treatment (Pearson corr., $p = .59$, $p = .67$). Furthermore, there is no statistical difference between the average transfers in I-B and B-I according to the two-sided Mann-Whitney test (in each round, $p > .10$, with and without a Bonferroni correction). The statistical indifference between the two treatments indicates no significant framing or ordering effects of the individual tasks on the bargaining game.

Figure 3. Distribution of bargaining agreements



The three axes of the ternary plot show the absolute payoff of each individual of the agreement. More frequent agreements are visualized through darker and larger circles.

Figure 4. Distribution of third subjects' payoff



The bar plot shows relative payoff shares transferred to the third subject and how frequently they occurred.

Figure 3 visualizes the distribution of bargaining agreements. The results show that the payoff shares between the bargainers are equal in 90.5 percent of the agreements. More precisely, in 17 out of the 720 negotiations (2.4 percent), the subjects cannot agree on a distribution. In 456 of the 703 negotiations (64.9 percent), the third subject receives more than zero points. In 429 out of these 456 negotiations (94.1 percent), the bargainers agree on even payoffs between themselves. When I distinguish between subjects that propose and subjects that accept the agreed upon offer, the results show that the former obtains on average 42.9 percent and the latter 42.4 percent of the available payoff. The payoff shares between the proposer and the responder are not significantly different (one-sided, paired Wilcoxon test with Bonferroni correction, each round, $p > .10$).[9] The equal payoff shares between the bargainers resembles the predictions of the FS model.

[9] Without Bonferroni correction, $p = .03$, $p = .09$, $p = .09$ in round 12, 15 and 17.

Figure 4 shows the distribution of payoff shares transferred to the third subject. In line with all three inequality aversion models, transfers to third subjects virtually never exceed one-third of the payoff (0.01 percent). In a majority of cases, the bargaining subjects transfer exactly zero (35.1 percent) or 24 (24.4 percent) points, which again shows similarities with the patterns predicted by FS. Another focal point seems to be one-sixth of the payoff (10.0 percent). Transferring 12 points may be attractive since it offers an even compromise between more self-interested and more other-regarding subjects.

6.2. Explaining the transfers to Third Subjects

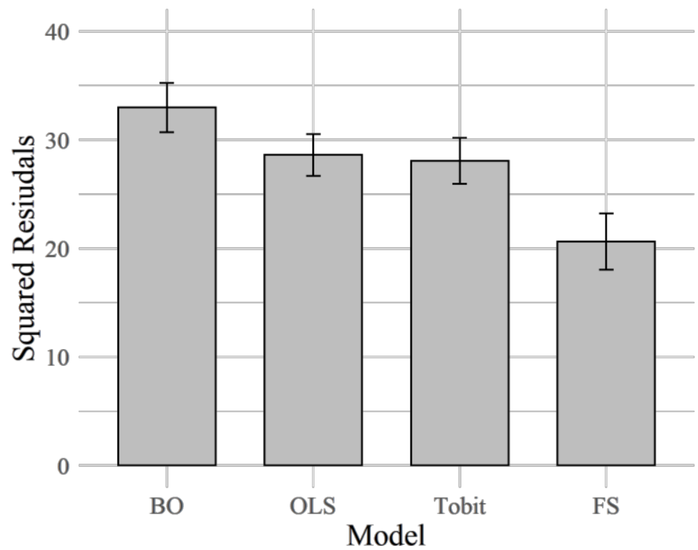
To examine which model explains the transfers to the third subject best, I optimize the other-regarding parameters with respect to the specific functional forms as outlined in section 3 and 5. The lower the squared residuals (SR), the better the explanatory power of a model. After fitting the models, the mean squared residuals of the CD, BO and FS model are SR_{IA} = 90.1, SR_{FS} = 20.6, SR_{BO} = 31.8. Recall that the lower 95-percentile of the mean residuals are 117.6, 81.5, and 77.8 when fitting random data. The model fits of the empirical data are significantly below these thresholds (each Wilcoxon test, $p < 0.01$). Since the models perform better on systematic than on arbitrary data, the results suggest that individuals behave systematically over multiple rounds in the bargaining game. The proportion of the variance (R^2) the IA, FS and BO model can predict is equal to .578, .903, and .846, respectively.

The FS and BO models also perform significantly better than the IA model (paired Wilcoxon tests, $p < 0.01$).[10] Hence, assuming either pairwise or increasing inequality averse utility functions, improves the explanatory power compared to the baseline inequality aversion model. Figure 5 shows how the FS and BO models perform in comparison to each other and to generic regression models. Assuming pairwise inequality aversion improves the explanatory power more than assuming increasing inequality aversion (paired Wilcoxon test, $p < 0.01$). The FS model also performs significantly better than an ordinary least squares model with individual fixed effects (SR = 28.6, paired Wilcoxon test, $p < .01$) or a Tobit model with a lower limit at zero and individual fixed effects (SR = 28.1, paired Wilcoxon test, $p < .01$). To put these results into perspective, calculating the absolute residuals of the FS model and the best alternative, the Tobit model, reduces the mean residual from 3.8 points to 2.3 points (the distributable payoff is 72 points), which improves the average accuracy by 64 percent.

---

[10] I base my statistical tests on the average residual of each individual. The average residual per individual, like the residuals of the bargaining outcomes, are not truly independent observations because the subjects interact with each other during the experiment. However, the dependency is systematic since each subject interacts exactly once with each other subject within a session. If I aggregate the data on the session level, which are independent, the two-tailed paired Wilcoxon tests are still statistically significant when comparing the FS model to the IA and BO models ($p < .01$ and $p = .03$), but the p-value is lower due to the low number of observations.

Figure 5. Squared Residuals across Models



Mean squared residuals and 95%-confidence intervals.

To further investigate the validity of the results, I examine the relationship between the individual other-regarding preferences estimated from the bargaining game and the other-regarding preferences elicited from the individual distribution tasks. Two types of information about the individual preferences are available. The switching points of the two blocks of the EET (DIB and AIB) elicit the advantageous and disadvantageous inequality aversion of the subjects. The median switching point for the bargaining subjects lies at 3 out of 5 in DIB and 5 out of 8 in AIB. Subjects' transfers in the three-player dictator game provide a measure of the distribution preferences. The dictators in the sample allocate on average 17.2 percent of the payoff share to each recipient.[11] Most subjects allocate zero or two thirds (even three-way split) to the recipients. The correlation between the lower transfer in the dictator game and the switching point in AIB is equal to 0.25 ($p = .01$).

Similar to previous studies, I cannot directly predict the bargaining behavior from the other-regarding parameters I estimate from the dictator game nor the EET (Blanco et al., 2011). Yet, the estimated other-regarding parameters of the FS model correlate significantly with the decisions in the AIB (corr. = 0.31, $p < 0.01$) measured by the EET and the transfers in the dictator game (corr. = 0.43, $p < 0.01$). DIB and the FS better-off weights do not correlate ($p = 0.35$), which supports the notion that the worse-off weight plays no role in the bargaining game. Regressions I – IV in Table 1 analyze the relationship closer and controls for

[11] While the bargaining outcomes between the treatments are statistically indifferent, there is weak evidence that the mean transfer in the B-I treatment is higher than in the I-B treatment (Mann-Whitney test, $p = .09$), which means subjects transfer more if they play the dictator game after the bargaining game. The ordering effects may be explained by a willingness to equalize anticipated inequalities from the previous bargaining game. In direct comparison, transfers to excluded individuals are, on average, higher in the individual dictator game than in the bargaining game, independent of the order of the treatments (paired Wilcoxon tests, $p < 0.01$).

fixed effects on the session level. Further controls include observable traits such as gender, age, field of study, experience in experiments, and self-reported characteristics such as risk preferences, bargaining skills, assessment on a political left-right scale, extraversion, and agreeableness.

Table 1. Relation between individual and bargaining behavior

DV:	Estimated other-regarding preferences in the bargaining game			
IVs:	I	II	III	IV
Transfer dictator game	0.006^{***}	0.007^{***}		
	(0.002)	(0.002)		
Switching point AIB			0.041^{***}	0.045^{***}
			(0.014)	(0.015)
Switching point DIB			0.016	0.015
			(0.019)	(0.023)
Controls	No	Yes	No	Yes
Observations	96	96	96	96
R^2	0.154	0.212	0.097	0.142
F Statistic	16.217^{***}	2.149^{**}	4.721^{**}	1.193

Linear models with fixed effects on session level. *** p < .01, ** p < .05, * p < .10.
Subjects choosing a higher switching point in the advantageous (AIB) and disadvantageous inequality block (DIB) of the Equality-Equivalence test are considered more inequality averse.

The results suggest that subjects who transfer higher payoff shares in the dictator game behave more other-regarding during the bargaining game, which means they behave consistently across the individual decision task and the bargaining game. In regression I, the average better-off weight in the bargaining game increases from 0.38 if the individual transfers nothing in the dictator game to 0.68 if the individual transfers the payoffs equally in the dictator game, i.e. transfers 48 points. Furthermore, in line with the theoretical conception, advantageous inequality aversion (AIB) has a statistically significant relationship with the behavior in the bargaining game, while disadvantageous inequality aversion (DIB) has no explanatory power. Subjects that later switch in the AIB, have also stronger other-regarding preferences in the bargaining game. The regression results remain robust if I control for further characteristics, of which none is significant. The control variables remain statistically insignificant if I remove the incentivized other-regarding measures from the regression (see Table A1 in the Supplementary Material).

In sum, the data shows that individual behavior and bargaining behavior are related, which supports the derived functional relationship of the FS model. The strength of this bargaining solution is that it explains seemingly arbitrary behavior. Generally, subjects' transfers to third subjects vary considerably across the different rounds in which they are matched with different bargaining partners. The mean individual range of transfers is equal to 21.3 points, which implies that many of the subjects transfer no points with one bargaining partner and then one-third of the payoff (24 points) with another bargaining partner. The FS model is the only model that predicts equal payoff shares between the bargainers and thereby explains the aggregation process behind the bargaining outcomes.

6.3. Bargaining Dynamics

So far, I have focused on the bargaining outcomes. Yet, the free-form bargaining protocol enables the bargainers to react to offers and negotiate dynamically and, thus, generates a rich data set that can open the black box between individual other-regarding preferences and negotiated distribution outcomes further. In this section, I report on bargaining patterns that can be observed during this interaction.

Table 2. Analysis of the bargaining process

DV:	Negotiated payoff allocated to the third subject		
IVs	I	II	III
Transfer dictator game	0.285^{***}	0.191^{***}	0.188^{***}
(Proposer)	(0.031)	(0.032)	(0.031)
Transfer dictator game	0.090^{***}	0.014	0.001
(Responder)	(0.032)	(0.032)	(0.033)
First offer		0.349^{***}	0.458^{***}
		(0.058)	(0.126)
ID accepted offer			0.033
			(0.362)
First offer x ID accepted offer			-0.021
			(0.019)
Observations	703	524	524
Log Likelihood	-1,988.096	-1,496.084	-1,493.076
Wald Test	207.999^{***}	259.650^{***}	269.073^{***}

Tobit models with fixed effects on session level. Robust standard errors. *** p < .01, ** p < .05, * p < .10. First offer refers to the suggested transfer in the first offer. The ID of the accepted offer accounts for the number of offers that are exchanged before the agreement.

As in previous unstructured experiments, I observe a 'deadline effect' (Roth et al., 1988). A majority of the agreements (52.3 percent) are made just within the last ten seconds of the available bargaining time. When the distribution preferences of the bargainers do not match, instead of seeking a compromise, the bargainers tend to wait until the other subject eventually gives in to prevent losing all payoffs. To illustrate this, I separate the two bargainers into proposer of and responder to the final agreement and analyze their influence on the outcome distribution. Regression I in Table 2 estimates the influence of the proposers' and responders' other-regarding preferences, measured by the dictator game, on the transfer to the third subject, in a Tobit model with session fixed effects and robust standard errors. The results suggest that individual other-regarding preferences of both subjects, proposer and responder of the agreed upon offer, significantly influence the agreement. Yet, a Wald-test that compares the two coefficients indicates that the individual other-regarding preferences elicited from the proposer have a stronger influence on the bargaining outcome than the preferences of the responder ($p < 0.01$).

This finding leads to the question of which subjects are more inclined to give in. To answer this question, I count the number of times each individual is the responder to the final distribution offer and examine the relationship between accepting the final offer and the transfer in the dictator game. Other-regarding preferences appear not to explain the tendency to accept offers (Poisson model with session fixed effects, $p = 0.30$, see Table A4 in the Supplementary Material). The data suggests that neither other-regarding nor self-interested subjects are more likely to give in.

Next, I look closer into the bargaining process. The data indicates that not only are the payoff shares of the bargainers equal in the outcomes, but they are already equal when they propose the offers. From round 6 to 20, the subjects make 720 first offers. In none of these offers does the proposer offer to pay more for the payoff share of the third subject than the other bargainer. In response to received offers, the subjects make, in sum, 2288 counteroffers, of which 890 (38.9 percent) suggest an increase in the payoff share of the third subject. In only 31 (3.5 percent) of these offers do the bargaining subjects propose to reduce their own payoff share more than the payoff share of the other bargainer to pay for the higher transfer to the third actor. Out of these 31 offers, 21 ultimately equalize the payoff shares between the bargainers since the standing offer benefited the proposer of the counteroffer. When subjects suggest increasing the payoff share of the third subject, they primarily suggest reducing their own payoffs equally (57.1 percent) or they suggest that the other bargainer should pay more for the higher transfer to the third actor (39.4 percent). In sum, the bargaining dynamics imply that subjects virtually never want to pay more for the payoff share of the third subject. Equal sharing appears to not only be integral to the bargaining outcomes but also an important motive during the negotiations.

Finally, I investigate the first offers and their influence on the outcome. Beginning with Chertkoff and Conley (1967), several studies find that first offers set an anchor that determines the course of the negotiations. To examine this relationship, I first exclude all 179 agreements in which the first offer is simultaneously the accepted offer since the first offer and the outcome are identical by definition in those cases. Within the remaining subset, I include the payoff share allocated to the third subject in the first offer of this round as an explanatory variable of the final share while keeping the other-regarding preferences of the bargainers as control variables. Regression II in Table 3 suggests that the first offer has a significant impact on the outcome. The anchor effect also remains robust when bargainers negotiate longer, as indicated by Regression III. The latter regression includes a variable that accounts for the number of offers that are exchanged before the final offer is accepted and an interaction effect between this variable and the first offer to measure whether the impact of the first offer declines with an increasing number of offers that are exchanged before the agreement. Testing who is more likely to make first offers reveals that subjects with stronger other-regarding preferences make significantly more first offers (Poisson model with session fixed effects, $p = 0.01$, see Table A5 in the Supplementary Material).

7. Conclusion

Whenever bargainers have to decide on how to allocate payoffs among a group of actors, socially-concerned coalition members may be willing to distribute payoffs to third actors. The question is, what deal can the bargainers make to take third actors into account and who is willing to forgo payoffs to benefit the third actor? In this study, I examine negotiated distribution outcomes in a free-form bargaining experiment to identify the influence of other-regarding preferences on the bargaining outcomes and dynamics.

I find that integrating inequality aversion into the utility functions of the Nash bargaining solution can explain 90.3 percent of the observed variance of the transfers to the third subject. The results suggest that subjects bargain as if they compare their payoff pairwise and maximize the product of their utilities. This explains why the payoff shares are equal between the bargaining partners in more than 90 percent of the agreements. Further, it explains why transfers of some subjects vary considerably across different rounds of the bargaining game. In fact, many subjects do care about how much of the payoff is allocated to the third subject, but they also care about how much the other bargainer contributes to benefit the third subject. Since unilateral transfers would increase inequality between the bargainers and inequality averse individuals do not want others to free-ride on their fairness preferences, transfers to third subjects depend on both bargaining subjects. Hence, the theoretical analysis implies that the observed variance of transfers can be consistent with stable preferences during the bargaining game and allows for linking the bargaining behavior to the individual distribution preferences. In fact, when the estimated other-regarding preferences of the bargaining game increase, subjects are also more likely to transfer higher shares in the dictator game and are also more inequality averse in the Equality-Equivalence test.

In short, individual preferences interact systematically when subjects bargain bilaterally about the distribution of payoffs among themselves and a third subject. The bargaining problem involves two conflicting fairness aspects, and the more self-serving aspect has to be respected first. If there is a conflict between the distributional preferences of the bargainers, the outcome depends on the subject who has stronger preferences. Due to this preference aggregation mechanism, the outcomes tend to become more extreme and, in a majority of cases, the bargainers either share payoffs equally or exclude the third subject completely from any payoffs. Furthermore, the bargaining process reveals that other-regarding subjects are more likely to make first offers. First offers set an anchor, which influence the bargaining outcomes significantly. Similarly, the proposer of the final offer has a stronger influence on the outcome than the responder, but self-interested and other-regarding subjects are as likely to be the proposer.

In a way, the employed free-form bargaining game leads to different interpretations about the influence of other-regarding preferences on bargaining outcomes than existing structured bargaining experiments. Results from the ultimatum game (Güth & van Damme, 1998) lead to the conjecture that responders care about their own relative payoff share and are less concerned about pairwise differences (Bolton &

Ockenfels, 2008). Indeed, when dictators can condition their transfer to a recipient on a second dictator, subjects frequently compensate for low transfers of the second dictator even though this results in disadvantageous inequality. Yet, when they can communicate and interact, the transfers align (Panchanathan et al., 2013). In this study, as well as in other less structured bargaining experiments (Sauermann et al., 2021; Schwaninger et al., 2019; Tremewan & Vanberg, 2016), the possibility of back-and-forth-interaction induces subjects to retain equal payoffs in most agreements. A high level of structure can imply different levels of bargaining power, but it also restricts the interaction between bargainers. Considering that many negotiations in natural environments are not well structured, it appears important to learn more about the influence of the level of interaction on the bargaining outcomes.

In this study, I use well-researched other-regarding preference models, integrate them in the Nash bargaining solution and test them against each other. The employed models focus purely on inequality aversion, but disregard other factors such as risk preferences (Binmore et al., 1986) or diminishing marginal utility of money (Gauriot et al., 2020). Hence, they are potentially subject to an omitted-variable bias and can potentially be improved. However, in case of the best performing bargaining solution, which makes a considerable share of corner predictions, small changes in the curvature might not strongly affect the predicted outcomes because the assumed utility is generically unresponsive. In line with this notion, risk aversion has proven to have a small effect on bargaining outcomes relative to equal focal points (Murnighan et al., 1988). This reasoning leads to the hypothesis that bargaining outcomes are more sensitive to pairwise inequality aversion than other influences on the utility function and offers interesting future research avenues in bilateral as well as multilateral bargaining.

8. References

Agranov, Marina, and Chloe Tergiman. 2014. "Communication in Multilateral Bargaining." *Journal of Public Economics* 118: 75–85.

Alexopoulos, Johanna et al. 2012. "Do We Care about the Powerless Third? An ERP Study of the Three-Person Ultimatum Game." *Frontiers in Human Neuroscience* 6: 59.

Aumann, Robert J., and Michael Maschler. 1961. *The Bargaining Set for Cooperative Games*. Princeton University.

Baranski, Andrzej, and John H Kagel. 2015. "Communication in Legislative Bargaining." *Journal of the Economic Science Association* 1(1): 59–71.

Bartling, Björn, Roberto A. Weber, and Lan Yao. 2015. "Do Markets Erode Social Responsibility?" *The Quarterly Journal of Economics* 130(1): 219–66.

Bendtsen, Claus. 2012. "Pso: Particle Swarm Optimization. R Package Version 1.0.3." *https://CRAN.R-project.org/package=pso*.

Binmore, Ken, Ariel Rubinstein, and Asher Wolinsky. 1986. "The Nash Bargaining Solution in Economic Modelling." *The RAND Journal of Economics* 17(2): 176–88.

Birkeland, Sigbjørn, and Bertil Tungodden. 2014. "Fairness Motivation in Bargaining: A Matter of Principle." *Theory and Decision* 77(1): 125–51.

Blanco, Mariana, Dirk Engelmann, and Hans Theo Normann. 2011. "A Within-Subject Analysis of Other-Regarding Preferences." *Games and Economic Behavior* 72(2): 321–38.

Bolton, Gary E, and Axel Ockenfels. 1998. "Strategy and Equity: An ERC-Analysis of the Güth–van Damme Game." *Journal of Mathematical Psychology* 42(2): 215–26.

Bolton, Gary E., and Axel Ockenfels. 2000. "ERC: A Theory of Equity, Reciprocity, and Competition." *American Economic Review* 90(1): 166–93.

———. 2008. "Chapter 59 Self-Centered Fairness in Games with More Than Two Players." In *Handbook of Experimental Economics Results*, eds. Charles R. Plott and Vernon L. Smith. Elsevier, 531–40.

Camerer, Colin F. 2003. *Behavioral Game Theory: Experiments in Strategic Interaction*. Princeton University Press.

Camerer, Colin F., Gideon Nave, and Alec Smith. 2019. "Dynamic Unstructured Bargaining with Private Information: Theory, Experiment, and Outcome Prediction via Machine Learning." *Management Science* 65(4): 1867–90.

Cason, Timothy N., and Vai-Lam Mui. 1997. "A Laboratory Study of Group Polarisation in the Team Dictator Game." *The Economic Journal* 107(444): 1465–83.

Charness, Gary, and Matthew Rabin. 2002. "Understanding Social Preferences with Simple Tests." *The Quarterly Journal of Economics* 117(3): 817–69.

Charness, Gary, and Matthias Sutter. 2012. "Groups Make Better Self-Interested Decisions." *Journal of Economic Perspectives* 26(3): 157–76.

Chertkoff, Jerome M., and Melinda Conley. 1967. "Opening Offer and Frequency of Concession as Bargaining Strategies." *Journal of Personality and Social Psychology* 7(2, Pt.1): 181–85.

Cooper, David J., and John H. Kagel. 2016. “4. Other-Regarding Preferences: A Selective Survey of Experimental Results.” In *The Handbook of Experimental Economics, Volume 2: The Handbook of Experimental Economics*, eds. John H. Kagel and Alvin E. Roth. Princeton University Press, 217–89.

Croson, Rachel, Terry Boles, and J.Keith Murnighan. 2003. “Cheap Talk in Bargaining Experiments: Lying and Threats in Ultimatum Games.” *Journal of Economic Behavior & Organization* 51(2): 143–59.

Dana, Jason, Roberto A. Weber, and Jason Xi Kuang. 2007. “Exploiting Moral Wiggle Room: Experiments Demonstrating an Illusory Preference for Fairness.” *Economic Theory* 33(1): 67–80.

Danner, Daniel et al. 2016. *Die Deutsche Version Des Big Five Inventory 2 (BFI-2)*. Mannheim: GESIS - Leibniz-Institut für Sozialwissenschaften.

Diermeier, Daniel, and Rebecca Morton. 2005. “Experiments in Majoritarian Bargaining.” In *Social Choice and Strategic Decisions: Essays in Honor of Jeffrey S. Banks*, eds. David Austen-Smith and John Duggan. Berlin, Heidelberg: Springer Berlin Heidelberg, 201–26.

Dohmen, Thomas et al. 2011. “Individual Risk Attitudes: Measurement, Determinants, and Behavioral Consequences.” *Journal of the European Economic Association* 9(3): 522–50.

Ellman, Matthew, and Paul Pezanis-Christou. 2010. “Organizational Structure, Communication, and Group Ethics.” *American Economic Review* 100(5): 2478–91.

Fehr, Ernst, and Klaus M. Schmidt. 1999. “A Theory of Fairness, Competition, and Cooperation*.” *The Quarterly Journal of Economics* 114(3): 817–68.

———. 2006. “Chapter 8 The Economics of Fairness, Reciprocity and Altruism – Experimental Evidence and New Theories.” In *Handbook of the Economics of Giving, Altruism and Reciprocity*, Foundations, eds. Serge-Christophe Kolm and Jean Mercier Ythier. Elsevier, 615–91.

Fischbacher, Urs. 2007. “Z-Tree: Zurich Toolbox for Ready-Made Economic Experiments.” *Experimental Economics* 10(2): 171–78.

Franzen, Axel, and Sonja Pointner. 2014. “Giving According to Preferences: Decision-Making in the Group Dictator Game.” *Soziale Welt* 65(2): 139–52.

Fréchette, Guillaume R., John H. Kagel, and Steven F. Lehrer. 2003. “Bargaining in Legislatures: An Experimental Investigation of Open versus Closed Amendment Rules.” *American Political Science Review* 97(2): 221–32.

Fudenberg, Drew, Wayne Y. Gao, and Annie Liang. 2021. “How Flexible Is That Functional Form? Quantifying the Restrictiveness of Theories.” *Available at SSRN* 3580408.

Gächter, Simon, Leonie Gerhards, and Daniele Nosenzo. 2017. “The Importance of Peers for Compliance with Norms of Fair Sharing.” *European Economic Review* 97: 72–86.

Gächter, Simon, and Arno Riedl. 2005. “Moral Property Rights in Bargaining with Infeasible Claims.” *Management Science* 51(2): 249–63.

Galeotti, Fabio, Maria Montero, and Anders Poulsen. 2019. “Efficiency Versus Equality in Bargaining.” *Journal of the European Economic Association* 17(6): 1941–70.

Gauriot, Romain, Stephanie A. Heger, and Robert Slonim. 2020. “Altruism or Diminishing Marginal Utility?” *Journal of Economic Behavior & Organization* 180: 24–48.

Greiner, Ben. 2015. “Subject Pool Recruitment Procedures: Organizing Experiments with ORSEE.” *Journal of the Economic Science Association* 1(1): 114–25.

Güth, Werner, and Eric van Damme. 1998. “Information, Strategic Behavior, and Fairness in Ultimatum Bargaining: An Experimental Study.” *Journal of Mathematical Psychology* 42(2): 227–47.

Güth, Werner, Carsten Schmidt, and Matthias Sutter. 2007. “Bargaining Outside the Lab – A Newspaper Experiment of a Three-Person Ultimatum Game.” *The Economic Journal* 117(518): 449–69.

Harsanyi, John C., and Reinhard Selten. 1972. “A Generalized Nash Solution for Two-Person Bargaining Games with Incomplete Information.” *Management Science* 18(5): 80–106.

Ingersoll, William Robert, and Alex Roomets. 2020. “Bargaining with a Partially-Incentivized Agent.” *Journal of Economic Behavior & Organization* 171: 96–115.

Isoni, Andrea, Anders Poulsen, Robert Sugden, and Kei Tsutsui. 2014. “Efficiency, Equality, and Labeling: An Experimental Investigation of Focal Points in Explicit Bargaining.” *American Economic Review* 104(10): 3256–87.

Kagel, John H., and Katherine Willey Wolfe. 2001. “Tests of Fairness Models Based on Equity Considerations in a Three-Person Ultimatum Game.” *Experimental Economics* 4(3): 203–19.

Karagözoğlu, Emin. 2019. “On ‘Going Unstructured’ in Bargaining Experiments.” In *The Future of Economic Design: The Continuing Development of a Field as Envisioned by Its Researchers*, eds. Jean-François Laslier, Hervé Moulin, M. Remzi Sanver, and William S. Zwicker. Cham: Springer International Publishing, 295–304.

Kerschbamer, Rudolf. 2015. “The Geometry of Distributional Preferences and a Non-Parametric Identification Approach: The Equality Equivalence Test.” *European Economic Review* 76: 85–103.

Kirchler, Michael, Jürgen Huber, Matthias Stefan, and Matthias Sutter. 2016. “Market Design and Moral Behavior.” *Management Science* 62(9): 2615–25.

Konow, James, and Lars Schwettmann. 2016. “The Economics of Justice.” In *Handbook of Social Justice Theory and Research*, eds. Clara Sabbagh and Manfred Schmitt. New York, NY: Springer New York, 83–106.

Kugler, Tamar, Edgar E. Kausel, and Martin G. Kocher. 2012. “Are Groups More Rational than Individuals? A Review of Interactive Decision Making in Groups.” *WIREs Cognitive Science* 3(4): 471–82.

Lönnqvist, Jan-Erik, Markku Verkasalo, Gari Walkowitz, and Philipp C. Wichardt. 2015. “Measuring Individual Risk Attitudes in the Lab: Task or Ask? An Empirical Comparison.” *Journal of Economic Behavior & Organization* 119: 254–66.

Luhan, Wolfgang J., Martin G. Kocher, and Matthias Sutter. 2009. “Group Polarization in the Team Dictator Game Reconsidered.” *Experimental Economics* 12(1): 26–41.

Luhan, Wolfgang J., Odile Poulsen, and Michael W. M. Roos. 2019. "Money or Morality: Fairness Ideals in Unstructured Bargaining." *Social Choice and Welfare* 53(4): 655–75.

McKelvey, Richard D. 1991. "An Experimental Test of a Stochastic Game Model of Committee Bargaining." In *Laboratory Research in Political Economy*, Ann Arbor: The University of Michigan Press, 139–68.

Miller, Luis, and Christoph Vanberg. 2013. "Decision Costs in Legislative Bargaining: An Experimental Analysis." *Public Choice* 155(3/4): 373–94.

Murnighan, J. Keith, Alvin E. Roth, and Francoise Schoumaker. 1988. "Risk Aversion in Bargaining: An Experimental Study." *Journal of Risk and Uncertainty* 1(1): 101–24.

Nash, John F. 1950. "The Bargaining Problem." *Econometrica* 18(2): 155–62.

Nicklisch, Andreas, and Fabian Paetzel. 2020. "Need-Based Justice and Distribution Procedures: The Perspective of Economics." In *Need-Based Distributive Justice: An Interdisciplinary Perspective*, eds. Stefan Traub and Bernhard Kittel. Cham: Springer International Publishing, 161–89.

Nydegger, R. V., and G. Owen. 1974. "Two-Person Bargaining: An Experimental Test of the Nash Axioms." *International Journal of Game Theory* 3(4): 239–49.

Panchanathan, Karthik, Willem E. Frankenhuis, and Joan B. Silk. 2013. "The Bystander Effect in an N-Person Dictator Game." *Social Dilemmas* 120(2): 285–97.

Roth, Alvin E., J. Keith Murnighan, and Francoise Schoumaker. 1988. "The Deadline Effect in Bargaining: Some Experimental Evidence." *The American Economic Review* 78(4): 806–23.

Sauermann, Jan, Manuel Schwaninger, and Bernhard Kittel. 2021. "Making and Breaking Coalitions: Strategic Sophistication and Prosociality in Majority Decisions." *European Journal of Political Economy*: 102064.

Schwaninger, Manuel. 2020. "Sharing with the Powerless Third. Other-Regarding Preferences in Dynamic Bargaining." *X-econ*.

Schwaninger, Manuel, Sabine Neuhofer, and Bernhard Kittel. 2019. "Offers beyond the Negotiating Dyad: Including the Excluded in a Network Exchange Experiment." *Social Science Research* 79: 258–71.

Soto, Christopher J., and Oliver P. John. 2017. "The next Big Five Inventory (BFI-2): Developing and Assessing a Hierarchical Model with 15 Facets to Enhance Bandwidth, Fidelity, and Predictive Power." *Journal of Personality and Social Psychology* 113(1): 117–43.

Tremewan, James, and Christoph Vanberg. 2016. "The Dynamics of Coalition Formation – A Multilateral Bargaining Experiment with Free Timing of Moves." *Journal of Economic Behavior & Organization* 130: 33–46.

Xiang, Yang, Sylvain Gubian, Brian Suomela, and Julia Hoeng. 2013. "Generalized Simulated Annealing for Global Optimization: The GenSA Package. An Application to Non-Convex Optimization in Finance and Physics." *The R Journal* 5(1): 13–28.

Xu, Qiang et al. 2020. "A Sense of Unfairness Reduces Charitable Giving to a Third-Party: Evidence from Behavioral and Electrophysiological Data." *Neuropsychologia* 142: 107443.

DFG Research Group 2104

– Latest Contributions

Bauer, Alexander Max, Meyer, Frauke, Romann, Jan, Siebel, Mark and Traub, Stefan: Need, Equity, and Accountability: Evidence on Third-Party Distributive Decisions from an Online Experiment. Working Paper Nr. 2020-01. http://bedarfsgerechtigkeit.hsu-hh.de/dropbox/wp/2020-01.pdf

Bauer, Alexander Max: Sated but Thirsty. Towards a Multidimensional Measure of Need-Based Justice. Working Paper Nr. 2018-03. http://bedarfsgerechtigkeit.hsu-hh.de/dropbox/wp/2018-03.pdf

Khadjavi, Menusch and Nicklisch, Andreas: Parent's Ambitions and Children's Competitiveness. Working Paper Nr. 2018-02. http://bedarfsgerechtigkeit.hsu-hh.de/dropbox/wp/2018-02.pdf

Bauer, Alexander Max: Monotonie und Monotoniesensitivität als Desiderata für Maße der Bedarfs-gerechtigkeit. Working Paper Nr. 2018-01. http://bedarfsgerechtigkeit.hsu-hh.de/dropbox/wp/2018-01.pdf

Schramme, Thomas: Mill and Miller: Some thoughts on the methodology of political theory. Working Paper Nr. 2017-25. http://bedarfsgerechtigkeit.hsu-hh.de/dropbox/wp/2017-25.pdf

Kittel, Bernhard, Tepe, Markus and Lutz, Maximilian: Expert Advice in Need-based Allocations. Working Paper Nr. 2017-24. http://bedarfsgerechtigkeit.hsu-hh.de/dropbox/wp/2017-24.pdf

Tepe, Markus and Lutz, Maximilian: The Effect of Voting Procedures on the Acceptance of Redistributive Taxation. Evidence from a Two-Stage Real-Effort Laboratory Experiment. Working Paper Nr. 2017-23. http://bedarfsgerechtigkeit.hsu-hh.de/dropbox/wp/2017-23.pdf

Tepe, Markus and Lutz, Maximilian: Compensation via Redistributive Taxation. Evidence from a Real-Effort Laboratory Experiment with Endogenous Productivities. Working Paper Nr. 2017-22. http://bedarfsgerechtigkeit.hsu-hh.de/dropbox/wp/2017-22.pdf

Kittel, Bernhard, Neuhofer, Sabine, Schwaninger, Manuel and Yang, Guanzhong: Solidarity with Third Players in Exchange Networks: An Intercultural Comparison. Working Paper Nr. 2017-21. http://bedarfsgerechtigkeit.hsu-hh.de/dropbox/wp/2017-21.pdf

Nicklisch, Andreas, Puttermann, Louis and Thöni, Christian: Self-governance in noisy social dilemmas: Experimental evidence on punishment with costly monitoring. Working Paper Nr. 2017-20. http://bedarfsgerechtigkeit.hsu-hh.de/dropbox/wp/2017-20.pdf

Chugunova, Marina, Nicklisch, Andreas and Schnapp, Kai-Uwe: On the effects of transparency and reciprocity on labor supply in the redistribution systems. Working Paper Nr. 2017-19. http://bedarfsgerechtigkeit.hsu-hh.de/dropbox/wp/2017-19.pdf

Chugunova, Marina, Nicklisch, Andreas and Schnapp, Kai-Uwe Redistribution and Production with the Subsistence Income Constraint: a Real-Effort Experiment. Working Paper Nr. 2017-18. http://bedarfsgerechtigkeit.hsu-hh.de/dropbox/wp/2017-18.pdf

FOR 2104

DFG Research Group 2104 at Helmut Schmidt University Hamburg
http://needs-based-justice.hsu-hh.de