

# The Pluralism of Fairness Ideals: An Experimental Approach

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*A core question in the contemporary debate on distributive justice is how to understand fairness in situations involving production. Important theories of distributive justice, such as strict egalitarianism, liberal egalitarianism, and libertarianism, provide different answers to this question. This paper presents the results from a dictator game where the distribution phase is preceded by a production phase. Each player's contribution is a result of a freely chosen investment level and an exogenously given rate of return. We estimate simultaneously the prevalence of three principles of distributive justice among the players and the distribution of the weight they attach to fairness. (JEL D63)*

Many people are motivated by fairness considerations and are willing to sacrifice pecuniary gains in order to avoid large deviations from what they consider a fair solution. This type of behavior has been extensively documented in laboratory experiments with games such as the ultimatum game and the dictator game (Colin F. Camerer 2003). However, while these games show us that a substantial fraction of the players are motivated by fairness considerations, they do not provide much information on the pluralism of fairness ideals present in society. In the standard versions of the ultimatum game and the dictator game, the money to be distributed by the players is “manna from heaven,” and it seems rather uncontroversial to assume that people view the fair solution to be an equal distribution in these cases.

The core question, however, in both the modern political debate on distributive justice and in normative theoretical reasoning, is how to understand fairness in more complex situations involving production. Three fairness ideals are prominent in this debate. *Strict egalitarianism* argues that all inequalities should be equalized even in cases involving production. *Libertarianism*, on the other hand, claims that the fair solution is to give each person what he or she produces. *Liberal egalitarianism* can be viewed as an intermediate position because it holds that only inequalities that arise from factors under individual control should be accepted.

What is the prevalence of these fairness ideals in society? This question is not easily answered, because in actual behavior, fairness considerations are usually balanced against self-interest considerations. Consequently, differences in observed behavior may have two sources. People may differ both in the importance they assign to fairness considerations and with respect to what they consider to be a fair distribution. As a result, the most common ways to elicit data on the prevalence of different fairness ideals have been to use surveys or experiments where the proposer is not a stakeholder, thereby avoiding any self-serving bias (see James Konow 2003 for an overview of this literature). However, these approaches have the weakness that the participants do not have to demonstrate any willingness to act on the endorsed fairness ideals, and consequently the results can be very sensitive to framing effects.

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The aim of this paper is to show how one may estimate simultaneously the prevalence of different fairness ideals and the weight people attach to fairness considerations in an experiment where participants have a stake in the outcome. We study a dictator game in which the distribution phase is preceded by a production phase (Todd F. Cherry, Peter Frykblom, and Jason E. Shogren 2002; James Konow 2000). The players differ with respect to factors under their control and factors outside their control, and therefore different fairness ideals provide different answers to the question of what is a fair distribution of the total income produced. Given a simple random utility model in which people make a trade-off between pecuniary gains and fairness considerations when distributing the income produced, we estimate the share of the population motivated by each of the three fairness ideals and the distribution of the weight people attach to fairness considerations.

The following section describes the basic model in more detail, including the fairness ideals. Section II provides a discussion of the experimental design, and the results are reported in Section III. Section IV contains a discussion of related literature and some concluding comments.

### I. The Model

We study a situation in which individuals differ in both their investment,  $q_i$ , and their rate of return to the investment,  $a_i$ . The income generated by individual  $i$  in the production phase is  $x_i = a_i q_i$ . The distribution phase will always be in a two-person setting, where we refer to the individuals as person 1 and person 2. The total income to be distributed is given by  $X(\mathbf{a}, \mathbf{q}) = x_1(a_1, q_1) + x_2(a_2, q_2)$ , where  $\mathbf{a} = (a_1, a_2)$  and  $\mathbf{q} = (q_1, q_2)$ . Each individual is to propose an amount of income  $y$  for himself or herself and  $X - y$  for his or her opponent.

#### A. Individual Motivation: Income and Fairness

We assume that individuals are motivated by a desire for both income and fairness. A fairness ideal,  $m^{k(i)}(\mathbf{a}, \mathbf{q})$ , specifies the amount that individual  $i$  holds to be his or her fair income. In

addition, we assume that the marginal disutility of deviating from the fairness ideal is increasing in the size of the deviation from the fair distribution. More formally, we assume that person  $i$  is maximizing the following utility function when proposing a distribution:

$$(1) \quad V_i(y; \mathbf{a}, \mathbf{q}) = \gamma y - \beta_i \frac{(y - m^{k(i)}(\mathbf{a}, \mathbf{q}))^2}{2X(\mathbf{a}, \mathbf{q})},$$

where the parameters  $\gamma > 0$  and  $\beta_i \geq 0$  determine the weight individual  $i$  attaches to income and to fairness considerations.<sup>1</sup>

Given an interior solution, the optimal proposal,  $y^*$ , is

$$(2) \quad y^* = m^{k(i)}(\mathbf{a}, \mathbf{q}) + \gamma X(\mathbf{a}, \mathbf{q})/\beta_i.$$

It follows immediately that the optimal proposal depends on both the fairness ideal endorsed by the individual and the importance assigned to fairness considerations. A player with  $\beta_i = 0$  would always keep all the money for himself or herself.

#### B. The Fairness Ideals

We assume that an individual endorses either strict egalitarianism, libertarianism, or liberal egalitarianism. Each of these fairness ideals satisfies the no-waste condition, and thus we can index the fair distribution such that  $m^k$  and  $X - m^k$  represent the amounts that fairness ideal  $k$  assigns to person 1 and person 2, respectively.

According to the strict egalitarian fairness ideal, total income should always be distributed equally among the individuals (see, for example, Kai Nielsen 1985). Thus, both inequalities owing to differences in investment and those owing to differences in the rate of return should be eliminated:

<sup>1</sup> There are a number of other interesting models of social preferences in the literature (see, among others, Ernst Fehr and Klaus M. Schmidt 1999; Gary E. Bolton and Axel Ockenfels 2000; Gary Charness and Matthew Rabin 2002; and Dirk Engelmann and Martin Strobel 2004, for tests of these models). Many of the differences between these models and our model are not relevant, however, given the design of our experiment. Our analysis is robust to alternative specifications of the loss function, including measuring deviations from the fairness ideal in absolute terms or in relative terms.

$$(3) \quad m^{SE}(\mathbf{a}, \mathbf{q}) = X(\mathbf{a}, \mathbf{q})/2.$$

The strict egalitarian view is closely related to the inequality aversion models in the experimental literature, which assume that people dislike unequal outcomes (Fehr and Schmidt 1999).

The libertarian fairness ideal is at the opposite extreme of strict egalitarianism, and does not assign any value to equality. According to libertarianism, the fair distribution is simply to give each person exactly what he or she produces (Robert Nozick 1974), which implies that the fair share for person 1 is given by

$$(4) \quad m^L(\mathbf{a}, \mathbf{q}) = a_1 q_1.$$

The libertarian solution justifies an unequal distribution of income, owing to both different investments and different rates of return.

Liberal egalitarianism, on the other hand, defends the view that people should be held responsible only for their choices (John E. Roemer 1998). A reasonable interpretation of this fairness ideal in the present context is to view the fair distribution as giving each person a share of the total income equal to his or her share of the total investment, which implies that person 1 should get

$$(5) \quad m^{LE}(\mathbf{a}, \mathbf{q}) = \frac{q_1}{q_1 + q_2} X(\mathbf{a}, \mathbf{q}).$$

This principle is equivalent to what has been described as the accountability principle (James Konow 1996, 2000). It implies that if two persons make the same choice, the fair solution is to give them the same income.

Even though these fairness ideals provide different solutions to the distributional problem, it is important to note that, on average, they instruct individuals to offer the same amount to the other person. In any particular game and for any fairness ideal  $k$ , the fair solution would be for person 1 to offer  $X - m^k$  to person 2 and for person 2 to offer  $m^k$  to person 1, which implies that the average fair offer in the game is  $X/2$ . Hence, it is not possible to extract any information about the prevalence of the various fairness ideals from the size of the average offer. In order to establish such information, we need to study how each individual's offer depends

on the distribution of investments and rates of return.

## II. Experimental Design

Our experiment was a one-shot dictator game with production, where production depended on both factors within and factors beyond individual control. At the beginning of the experiment, each participant was given credits equal to 300 Norwegian kroner (NOK), approximately 50 US dollars. They were given complete information about how the production phase and the distribution phase would proceed and about how the outcome of the experiment would be determined. Then, each participant was randomly assigned a low or a high rate of return. Participants with a low rate of return would double the value of any investment they made, whereas those who were assigned a high rate of return would quadruple their investment.

In the production phase, the participants were asked to decide how much they wanted to invest in two different one-shot games. Before they made their investment decision, they were informed that they would be paired with players with different rates of return. Their choice alternatives were limited to 0, 100, and 200 NOK, and the total amount invested in the two games could not exceed the initial credit they received. The design with two games was chosen to expose the participants to different distributional situations in the distribution phase. Any money they chose not to invest was added to their total earnings from the experiment, and thus they faced a genuine choice of investment.

In each distributional situation in the distribution phase, they were given information about the other participant's rate of return, how much he or she had invested in this particular game, and his or her produced income. They were then asked to propose a distribution of the total income produced. The participants were not informed about the outcome of the first game before the second game was completed, i.e., they considered two one-shot games simultaneously. For each participant, one of the two proposals (the participant's own or that of the opponent) in one of the two games was randomly selected to determine the final outcome. The total earnings from the experiment were the final outcome plus the amount of

money not invested. Given that we assume that people's fairness ideals are defined on final outcomes, the chosen elicitation procedure is incentive-compatible.

At the end of the experiment, each participant was assigned a code and instructed to mail this code and his or her bank account number to the accounting division of the Institute for Research in Economics and Business Administration. Independently, the research team mailed a list with the codes and total payment to the accounting division, which then disbursed the earnings directly to the participants' bank accounts. This procedure ensured that neither the participants nor the research team were in a position to identify how much each participant earned in the experiment.<sup>2</sup>

The participants in the experiment were all recruited among the first-year students at the Norwegian School of Economics and Business Administration. In the invitation, they were told that they would initially receive 300 NOK to use in an experiment that would last about 40 minutes and that their total earnings from the experiment would depend on their choices. They were not informed about the purpose of the experiment. The hourly opportunity cost for most of these students would be about 100 NOK, whereas the average payment was 447 NOK. Each student was permitted to participate only once. We had one session with 20 participants, one session with 12, and four sessions with 16, comprising a total of 96 participants. The participants were in the same computer lab during a session, but all communication was anonymous and was conducted through a Web-based interface.

In the distribution phase, the paired players could differ with respect to both their rate of return and their investment, which implies that there were four different classes of distributional situations. First, there were situations where the players were identical with respect to both their rate of return and their investment. The three fairness ideals then imply the same fair distribution, namely that both players get an equal share of the total income. Hence, the prevalence of different fairness ideals cannot

influence the distribution of offers made in this class of situations. Second, there were situations where the players had the same rate of return but differed in their investment level. This would make the liberal egalitarian and the libertarian fairness ideal coincide, whereas strict egalitarianism would imply a different view of the fair distribution. Third, there were situations where the players had made the same investment but differed in their rate of return. Only libertarians considered an unequal distribution fair in this class of situations. Finally, there were situations where the players differed along both dimensions. If both players invested in these situations and the player with the high rate of return was the player with the low investment, then strict egalitarianism and libertarianism imply the same fair distribution. Otherwise, the fairness ideals generally differ in this class of situations. The data are almost balanced with respect to the four classes of distributional situations: there were 44 occurrences of the first class, 50 of the second, 54 of the third, and 42 of the last.<sup>3</sup>

### III. Results

We begin by presenting some descriptive statistics before formulating and estimating a random utility model. Finally, we consider the possibility of "moral wriggling" by the participants.

#### A. Descriptive Statistics

One participant (with a low rate of return) invested only 100 NOK and ten participants (four with a high rate of return and six with a low rate of return) invested 200 NOK. The remaining 85 participants invested the full endowment of 300 NOK, evenly distributed between investing (200, 100) and (100, 200). The fact that some participants did not invest the full endowment indicates that they perceived the investment as a genuine choice. As most did invest the full amount, however, the variation in

<sup>2</sup> Complete instructions are available at [http://www.e-aer.org/data/june07/20050838\\_app.pdf](http://www.e-aer.org/data/june07/20050838_app.pdf).

<sup>3</sup> There are 190, not 192, distributional situations in our dataset, because a single incidence of a software problem caused a pair of participants to enter invalid data in one distributional situation. This pair was excluded from all further analysis.

TABLE 1—DESCRIPTIVE STATISTICS OF OFFERS MADE TO OPPONENT

	Offer	
	Share	Amount (in NOK)
Mean	0.271	229
Median	0.292	200
Standard deviation	0.219	219
Minimum	0	0
Maximum	0.75	800

choices in the production phase introduces no important bias in our analysis of the distribution phase.<sup>4</sup>

Table 1 summarizes the main features of the offers made. The average offer to the opponent was 27.1 percent (which amounts to 229 NOK), whereas the median offer was 29.2 percent. This is slightly higher than what is commonly observed in standard dictator games without production (Camerer 2003). There are marked steps in the distribution. In fact, out of 190 proposed distributions, 184 were of even 100 NOK amounts. The remaining six proposals were of even 50 NOK amounts. While 31 percent of the offers left the opponent with nothing, some offered substantial amounts; 27 percent of the offers were exactly 50–50.

### B. Empirical Model

We adapt the model to bring it into line with two features in the experimental data. First, given that all participants chose numbers that are multiples of 50, we restrict the choice of  $y$  to the set  $\mathcal{Y}(\mathbf{a}, \mathbf{q}) = \{0, 50, 100, \dots, X(\mathbf{a}, \mathbf{q})\}$ . Second, we introduce random variation that is idiosyncratic to each choice.<sup>5</sup> Given the utility function  $V$  defined in (1), we introduce the following random utility model:

$$(6) \quad U_i(y; \cdot) = V_i(y; \cdot) + \varepsilon_{iy}.$$

<sup>4</sup> Our analysis is robust to excluding the 11 individuals who did not invest the full amount from the sample.

<sup>5</sup> Two individuals made choices that were inconsistent with the utility function in (1), given the ideals specified in (3)–(5), which implies that we have to allow for some smoothing of choices in the empirical model.

We assume that the  $\varepsilon_{iy}$ 's are i.i.d. extreme value distributed, and that individuals choose  $y^*$  such that  $U_i(y^*; \cdot) \geq U_i(y; \cdot)$  for all  $y$  in  $\mathcal{Y}$ .<sup>6</sup>

The model we propose has a mixed logit structure where each person is characterized by a type of fairness ideal,  $k(i)$ , as well as the parameter  $\beta_i$  determining the importance a person assigns to fairness considerations. We cannot classify individuals by  $(k(i), \beta_i)$ , but we estimate the distribution of these characteristics.<sup>7</sup> The distribution of fairness ideals is discrete in nature, and we approximate the distribution of  $\beta$  by a log-normal distribution, such that  $\log \beta \sim N(\zeta, \sigma^2)$ . As the fairness ideal and the importance a person assigns to fairness considerations are unobserved by us, these must be integrated out for the unconditional choice probabilities as functions of the observed variables. We provide the likelihood function in the Appendix.

Formal proofs of identification are difficult to provide in our setting, where there is a large (but discrete) set of outcomes. Repeated observations, however, and the fact that we exposed individuals to different distributional situations, provide information about the prevalence of fairness ideals and the distribution of  $\beta$ .

### C. Structural Estimates

In Table 2, we present the estimates of the structural model. Column 1 presents the structural estimates with all the fairness ideals; columns 2 to 4 exclude one of the fairness ideals in turn. In all columns, the estimate for each of the fairness ideals is the share of the participants who are motivated by this particular fairness ideal. There are large effects on the log likelihood of excluding any of the fairness ideals. Specification 1, in which we have 43.5 percent strict egalitarians, 38.1 percent liberal egalitar-

<sup>6</sup> The random utility structure in our empirical model is similar to the one in James Andreoni, Marco Castillo, and Rogan Petrie (2004), but our model is estimated on the full population and we do not estimate individual-specific utility functions.

<sup>7</sup> Of 96 individuals, 75 offered less than what is implied by all fairness ideals, which explains why classification of individuals would not provide much information on the prevalence of the different fairness ideals.

TABLE 2—ESTIMATES OF THE STRUCTURAL MODEL

	Specification			
	1	2	3	4
$\lambda^{SE}$ , share strict egalitarian	0.435 (0.090)		0.674 (0.085)	0.513 (0.097)
$\lambda^{LE}$ , share liberal egalitarian	0.381 (0.088)	0.725 (0.085)		0.487 (0.097)
$\lambda^L$ , share libertarian	0.184 (0.066)	0.275 (0.085)	0.326 (0.085)	
$\gamma$ , marginal utility of money	28.359 (3.589)	16.437 (1.739)	18.189 (2.174)	22.464 (2.793)
$\zeta$ , mean of $\log(\beta)$	5.385 (0.349)	4.171 (0.412)	4.304 (0.459)	4.585 (0.365)
$\sigma$ , standard deviation of $\log(\beta)$	3.371 (0.530)	3.155 (0.507)	3.148 (0.498)	2.897 (0.448)
Log likelihood	-337.584	-367.958	-366.969	-350.736

Note: Standard errors, calculated using the outer product of the gradient (Ernst R. Berndt et al., 1974), are shown in parentheses. Money is scaled in units of 1,000 NOK. One estimate of the population shares and its standard error is calculated residually in each specification.

ians, and 18.4 percent libertarians, is our preferred specification.<sup>8</sup>

Based on these estimates, we make four observations. First, there is considerable pluralism in the fairness ideals that motivate the participants, even in rather simple distributional situations involving a homogeneous group of students. Second, the share of libertarians is smaller than some might expect at a business school.<sup>9</sup> Third, the majority of the participants (the liberal egalitarians and the libertarians) care about the investment made by the opponent when they decide how much to offer. This implies that fairness considerations cannot be reduced to income inequality aversion in these distributional situations. Fourth, the estimated share of strict egalitarians is larger than the share of offers that are 50–50. This is mainly

due to people making trade-offs between self-interest and fairness.

The distribution of the parameter  $\beta$  determines the importance that people attach to fairness considerations, whereas the parameter  $\gamma$  determines the weight given to deterministic utility relative to the smoothing implied from the extreme value distributed  $\varepsilon$ 's.<sup>10</sup> To assist understanding of our estimated parameters, we provide Figure 1. This figure takes as the point of departure a distributional situation where the total income produced is 1,000 and the fairness ideal endorsed by a hypothetical individual justifies an equal split. Then, we provide, for every inner decile of the distribution of  $\beta$ , the deterministic utility and the implied choice probabilities (plotted as solid bars) for this hypothetical individual. By way of illustration, consider the case where  $CDF(\beta) = 0.5$ . The deterministic part of the utility function reaches its maximum when the individual offers 350 NOK, and thus neither fairness nor self-interest dominates. The smoothing implies, however, that there is a positive but small probability of observing such a person offering more than what is considered just by the fairness ideal he or she endorses.

The general impression from Figure 1 is that the population can be divided into three main

<sup>8</sup> In the online Appendix, available at [http://www.e-aer.org/june07/20050835\\_app.pdf](http://www.e-aer.org/june07/20050835_app.pdf), we provide further specification tests. We have experimented with alternative formulations of the strict egalitarian and the liberal egalitarian fairness ideals, with generalizations of the distribution of  $\beta$ , with alternative specifications of the loss term in (1), and with excluding those who do not invest the full 300 NOK amount. Our findings are robust to these changes in the sense that the estimated population shares of the different fairness ideals do not differ by more than a few percentage points.

<sup>9</sup> Business students may not be fully representative of society at large due to a selection effect (see Bruno S. Frey and Stephan Maier 2005).

<sup>10</sup> The model is normalized by the constant variance of  $\varepsilon_i$ , which is  $\pi^2/6$ .

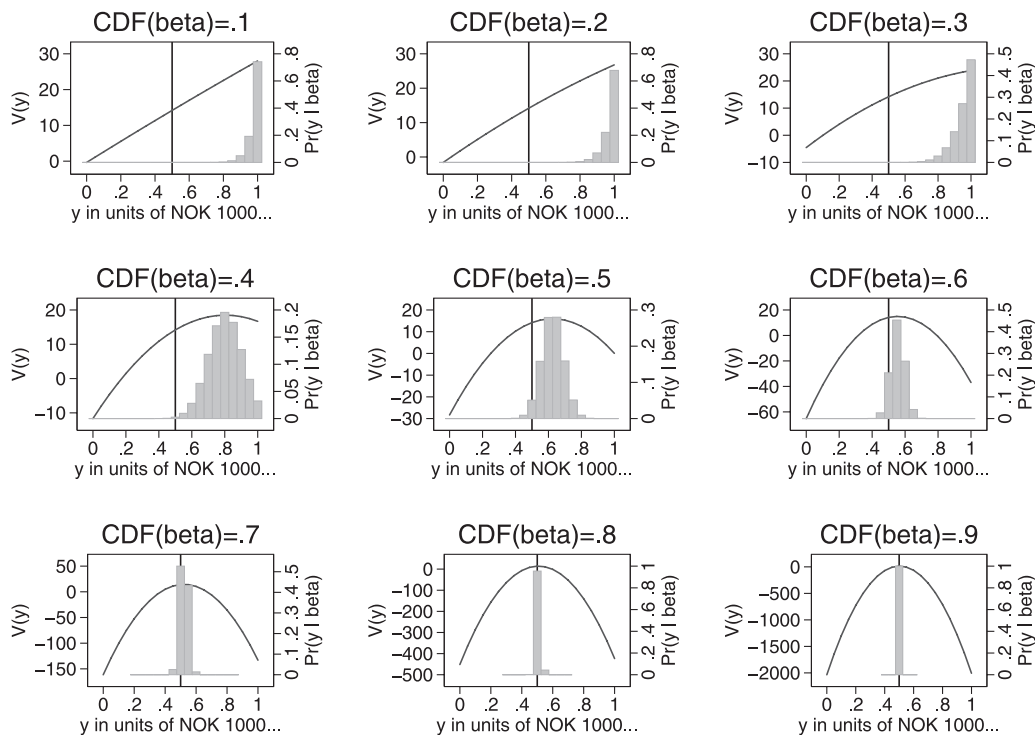


FIGURE 1. IMPLIED CHOICE PROBABILITIES

Notes: Implied choice probabilities are plotted as solid bars for an individual with  $m = 0.5$  and deterministic utility,  $V(y)$ . They are calculated at the deciles of the estimated  $\beta$  distribution using the estimates in the preferred specification 1 in Table 2.

groups. About 35 percent of the participants assign so little importance to fairness considerations that they have no interior maximum in their choice problem. Therefore, the most common choice among them is to offer the opponent nothing. Thirty percent of the participants choose an intermediate solution, whereas 35 percent of the participants act mostly in line with their view of fairness.

To see how well our estimates predict the actual distribution of offers, we simulate a distribution of offers for the distributional situations in the experiment. As we can see from Figure 2, there is a close fit. In particular, we note that we fit the large mass at the two most distinct points in the distribution (offers of 0 and of 50 percent). At the ends of the support, the smoothing can operate only one way, and hence we slightly underpredict the number of proposals that offer nothing, and slightly overpredict the number of very high offers. This is to be

expected given the random utility structure of the model.

#### D. True Pluralism or Moral Wriggling?

We have assumed that individuals have a fairness ideal that is independent of the distributional situation in which they find themselves. Alternative approaches emphasize “moral wriggling” (Jason Dana, Roberto A. Weber, and Jason Xi Kuang forthcoming) or self-serving bias (David M. Messick and Keith Sentis 1983).

Moral wriggling is the idea that individuals may use ambiguity in the distributional situation to further their own pecuniary self-interest at the expense of fairness. In our setting, a natural application of this idea is to allow for the possibility that people opportunistically choose the fairness ideal that benefits them most in any particular distributional situation. Such moral

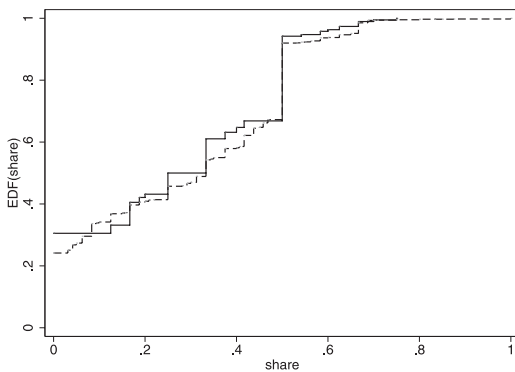


FIGURE 2. EMPIRICAL DISTRIBUTION FUNCTION OF OFFERS MADE AND PREDICTIONS FROM THE ESTIMATED MODEL

*Notes:* Offers are calculated as shares of total income produced. The solid line represents our experimental data, whereas the dashed line represents predictions made from the estimates in specification 1 in Table 2. Predictions are made at the distributional situations in our dataset (using 500 simulated samples).

wriggling is applicable only in distributional situations with some inequality in either the rate of return or the investment (ambiguous situations); otherwise, all fairness ideals imply equal shares (nonambiguous situations). Choosing a fairness ideal opportunistically would, on average, justify increasing one's own share of the total income from 50 to 59.3 percent in the ambiguous situations.<sup>11</sup> Therefore, a simple test of the idea of moral wriggling is to see whether the participants consistently ask for a larger share in these situations. We observe that there is indeed a difference (0.71 in the nonambiguous situations and 0.73 in the ambiguous situations), but this difference is small and not statistically significant ( $p = 0.28$ , one-sided  $t$ -test).<sup>12</sup> We have also used the estimated model

<sup>11</sup> The average share that can be justified in the ambiguous situations if the participants were to choose their fairness ideal opportunistically is given by  $(1/146) \sum_s \max_k m^k(\mathbf{a}_s, \mathbf{q}_s) / X(\mathbf{a}_s, \mathbf{q}_s)$ , where the summation is over the 146 ambiguous situations and the maximization over the set  $\{SE, LE, L\}$ .

<sup>12</sup> A referee pointed out that if there were an asymmetric effect of censoring in situations where the fairness ideal does not prescribe an equal split, then in the absence of moral wriggling the ambiguous situations should yield lower demands than the nonambiguous ones. Therefore, the small difference in the opposite direction might be much stronger evidence for moral wriggling than what we claim.

to predict the distribution of offers for each of the two classes of distributional situations. If there were substantial moral wriggling, the data should fit the predictions much worse when broken down this way. However, we have found no such systematic difference in fit. A Kolmogorov-Smirnov test of the hypothesis that the data are generated from the model has  $p = 0.59$  in the nonambiguous situations ( $n = 44$ ),  $p = 0.22$  in the ambiguous situations ( $n = 146$ ), and  $p = 0.31$  in the pooled data. We conclude from this that while we cannot rule out that some individuals exploit such scope for moral wriggling, there is little reason to suspect this is pervasive to a degree that would invalidate our analysis.

Another concern would be that there is a self-serving bias in the sense that participants, given their rate of return, endorse the fairness ideal that most benefits themselves (Messick and Sentis 1983). In order to study this question, we have compared the predicted distribution of offers to data for low-rate-of-return and high-rate-of-return individuals separately. If self-serving bias were a substantial problem, the fit of the data for each of the two groups should not be as good as for the pooled data. This is not the case, however. The experimental data are close to the predictions of the estimated model for both low-rate-of-return and high-rate-of-return individuals. A Kolmogorov-Smirnov test of the hypothesis that the data are generated from the model has  $p = 0.55$  in situations where the proposer has a low rate of return and  $p = 0.18$  in situations where he or she has a high rate of return.

#### IV. Concluding Remarks

Our analysis relates to the interesting studies of Konow (2000) and of Norman Frohlich, Joe Oppenheimer, and Anja Kurki (2004), who also apply versions of the dictator game with production in order to analyze the role of fairness considerations in individual choices. In line

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In our study, however, there is no tendency for demands to be more constrained by total income produced in the ambiguous situations than in the nonambiguous situations. (In both cases, about 30 percent of the participants demand all of the income produced.)

with our findings, both studies report that the distinction between factors within individual control and factors beyond individual control matters for many people. At the same time, there are important differences between these studies and ours.

The focus of Konow (2000) is to examine the extent to which fairness considerations can be explained by a single fairness ideal, namely the liberal egalitarian principle. In contrast, our aim has been to examine the prevalence of different fairness ideals among the participants, including liberal egalitarianism as one possibility.

Frohlich et al. (2004) share our focus on the pluralism of fairness ideals, and they also find substantial heterogeneity in their group of participants. They study this issue in an environment where it is not possible to distinguish libertarians from liberal egalitarians. More importantly, their linear utility function does not allow for any choice that is intermediate between a fairness ideal and pecuniary self-interest, and therefore they are unable to distinguish clearly between a fairness ideal and the weight people attach to fairness considerations. Even though fully parametric modelling is restrictive, in the sense that we maintain assumptions about unobservables, it is only by estimating a parametric model of social preferences that we are able to examine such trade-offs.<sup>13</sup>

The main aim of our study has been to show how we can estimate simultaneously the degree of heterogeneity in fairness ideals and in the weight people attach to fairness considerations. It turns out that both kinds of heterogeneity matter in explaining individual behavior in our experiment, but we believe that this is also true more generally. Value pluralism is a characteristic feature of modern societies, and therefore it could potentially constitute an important ingredient in the explanation of economic phenomena.

#### APPENDIX: THE LIKELIHOOD FUNCTION

We assume that  $\beta$  is log-normally distributed, parameterized such that  $\log(\beta) \sim N(\zeta, \sigma^2)$ . We

denote the density of  $\beta$  by  $f(\beta; \zeta, \sigma)$ . A distributional situation  $j$  for an individual  $i$  can be characterized by the vectors  $\mathbf{a}_{ij}$  and  $\mathbf{q}_{ij}$ . In order to take into account the fact that individuals make repeated choices, it is necessary to introduce the notation  $J_i$  for the number of choices individual  $i$  makes. If we let  $\lambda^k$  be the population share of individuals motivated by fairness ideal  $k$ , where  $k \in \{SE, LE, L\}$ , the likelihood of an individual  $i$  of type  $k$  making a proposal  $y_{ij}$  from the set of feasible proposals  $\mathcal{Y}_{ij}$  given a parameter vector  $\boldsymbol{\theta} = (\lambda^{SE}, \lambda^{LE}, \lambda^L, \gamma, \zeta, \sigma)$  is

$$L_{ik}(\boldsymbol{\theta}) = \int_0^\infty \left( \prod_{j=1}^{J_i} \frac{e^{V^k(y_{ij}; \mathbf{a}_{ij}, \mathbf{q}_{ij}, \beta, \gamma)}}{\sum_{s \in \mathcal{Y}_{ij}} e^{V^k(s; \mathbf{a}_{ij}, \mathbf{q}_{ij}, \beta, \gamma)}} \right) f(\beta; \zeta, \sigma) d\beta.$$

David Revelt and Kenneth Train (1998) call this a “mixed logit with repeated choices.” The total likelihood, integrating over the distribution of unobserved moral type, is a finite mixture over the type distribution determined by the discrete distribution induced by  $\boldsymbol{\lambda}$ ,

$$L_i(\boldsymbol{\theta}) = \sum_{k \in \{SE, LE, L\}} \lambda^k L_{ik}(\boldsymbol{\theta}).$$

The estimation is a simulated maximum likelihood procedure, with 250 random draws with antithetics for the numerical integration over the  $f(\beta; \cdot)$  density. The estimation is performed with FmOpt, a library of efficient routines for finite mixture models (Christopher Ferrall 2005).

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<sup>13</sup> The application of fully parametric modelling to experimental data has been suggested by Charles F. Manski (2002); other examples of this approach include James Andreoni and John Miller (2002) and Charles Bellemare, Sabine Kröger, and Arthur van Soest (2005).

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