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Just Luck: An Experimental Study of Risk-Taking and Fairness[†]

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Choices involving risk significantly affect the distribution of income and wealth in society. This paper reports the results of the first experiment, to our knowledge, to study fairness views about risk-taking, specifically whether such views are based chiefly on ex ante opportunities or on ex post outcomes. We find that, even though many participants focus exclusively on ex ante opportunities, most favor some redistribution ex post. Many participants also make a distinction between ex post inequalities that reflect differences in luck and ex post inequalities that reflect differences in choices. These findings apply to both stakeholders and impartial spectators. (*JEL* D63, D81, H23)

People make choices involving risk in all spheres of life, and the outcomes of these choices fundamentally affect the distribution of income and wealth in society. At the same time, people often disagree about the fair allocation of gains and losses that inevitably result from risky choices. One can distinguish two questions in this regard. First, how should gains and losses be distributed between risk-takers and those who avoid risk? Second, how should gains and losses be distributed between lucky and unlucky risk-takers? Discussions about compensation schemes, health care policies, and the regulation of financial markets suggest that these two questions arise in a wide range of contexts.[1]

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[1] Although we make no claims that our study reflects directly any specific economic or political phenomena, we do believe it does speak to important and commonly shared concerns. For example, arguments advanced in the debates over bailouts of distressed industries in the aftermath of the recent financial crisis provide examples of our two questions and how they are framed in this paper. On the first question concerning risk-takers and risk-avoiders, a group of 192 prominent economists wrote an open letter to Congress arguing that it was unfair for taxpayers, most of whom had not been involved in risky investments, to finance the bailout ("Economists of the

How to deal fairly with risk-taking is often cast in terms of whether to focus on ex ante opportunities or ex post outcomes.[2] The conflict between these two views is most clearly seen when people have equal opportunities. In such cases, the ex ante view, which focuses on initial opportunities, provides a fairness argument for no redistribution of gains and losses from risk-taking. The ex post view, on the other hand, focuses on outcomes, and considers it fair to eliminate all inequalities resulting from risk-taking. Clearly, such fairness considerations need to be balanced against efficiency concerns, but this conflict illustrates how fairness views about risk-taking could significantly impact the support for and, consequently, the design of public policies. Such views are arguably also important for understanding behavior not only in a policy context but also in a wide range of other economic contexts where agents are motivated, at least partially, by fairness considerations.

This paper reports the results from the first experiment, to our knowledge, to study fairness views about risk-taking.[3] The study focuses on cases in which it is costly to avoid risk; thus, we do not consider gambling or other risk-seeking behavior. The experiment consisted of a risk-taking phase followed by a distribution phase. In the risk-taking phase, participants faced a sequence of choices between a risky and a safe alternative, where the value of the safe alternative varied. In the distribution phase, for each risk-taking situation, the participants were anonymously paired with other participants who had faced the same choice, and the earnings of each pair were pooled. In all distributive situations, therefore, there was ex ante equality in opportunities but possibly ex post inequalities in individual earnings. The participants were then informed about the choices and the outcomes of the risk-taking phase for both parties and asked to distribute the total earnings.

This design enables us to focus on our two main questions. First, do people in situations of equal opportunities deviate from the ex ante fairness view and redistribute gains and losses from risk-taking? Second, do people make a distinction between ex post inequalities that reflect differences in luck and ex post inequalities that reflect differences in choices? We also consider an intermediate fairness position, which we refer to as choice egalitarianism. This fairness view holds people

World, Unite!" by Joe Nocera. *New York Times*, September 25, 2008. http://executivesuite.blogs.nytimes.com/2008/09/25/economists-of-the-world-unite/). The second question of lucky and unlucky risk-takers was important in the discussions surrounding the possible establishment of an industry-financed bailout fund, where a key concern was whether or not it was fair that lucky risk-takers partially financed the losses of unlucky risk-takers.

[2] There is also an extensive theoretical literature on the normative question of how to evaluate risky situations. See, among others, Harsanyi (1955); Diamond (1967); Hammond (1981); Fried (2003); Harel, Safra, and Segal (2005); and Fleurbaey (2010).

[3] Various recent experimental and theoretical studies have examined possible trade-offs between the desire to achieve a fair distribution and the desire to avoid risk (Babický 2003; Babický, Ortmann, and Van Koten 2010; Brennan et al. 2008; Brock, Lange, and Ozbay, forthcoming; Krawczyk 2010; Krawczyk and Le Lec 2010; Magdalou, Dubois, and Nguyen-Van 2009; Fudenberg and Levine 2011). The experiments of Zizzo and Oswald (2001) and Daniel John Zizzo (2003, 2004) come closest to our study. In a series of intriguing experiments, subjects first choose how much to invest in a risky gamble, earnings are distributed and then subjects can (and often do) destroy the earnings of other participants. Our study differs in several respects, but, most importantly, we place no restrictions on how the participants choose to distribute the money in the distribution phase and this allows us to focus on the fairness preferences of individuals rather than on envy. Brock, Lange, and Ozbay (forthcoming) is an interesting study showing that the propensity to give in a dictator game decreases if the transfer is risky. Finally, see also Shogren (1992) for an early experimental study of bargaining over ex ante lotteries and ex post rewards.

responsible for their choices but not for their luck.[4] Such a view would endorse ex post redistribution between lucky and unlucky risk-takers but not between risk-takers and participants who choose the safe alternative. The design also allows us to study whether the attractiveness of the ex ante fairness view depends on how costly it is to avoid risks, as captured by the value of the safe alternative. A conjecture in this regard is that the ex ante position would be considered less appealing in cases where the safe alternative is very unattractive, and, as a result, the risky alternative appears virtually unavoidable.

In addition to the "stakeholders" described thus far, who made decisions about risk-taking and redistribution that affected their own earnings, we also randomly assigned some participants to be "spectators" in the experiment. The spectators did not make choices in the risk-taking phase but instead acted as third parties who were paid a fixed fee to allocate the total earnings of other subjects in the distribution phase. Specifically, spectators allocated the pooled earnings of pairs of stakeholders in a randomly selected subsample of the distributive situations. By comparing the behavior of the two groups, one can examine the extent to which the fairness views of stakeholders seem to deviate from the fairness views of impartial spectators. In particular, this allows us to study whether the involvement in the risk-taking phase makes stakeholders assign more importance to choices in the distribution phase. This comparison is also of considerable importance from a methodological point of view. Previous empirical research on the nature of social preferences has relied on both spectator (Charness and Rabin 2002; Engelmann and Strobel 2004; Konow, Saijo, and Akai 2009; Konow 2000, 2009) and stakeholder behavior (Cappelen et al. 2007; Cherry, Frykblom, and Shogren 2002; Engelmann and Strobel 2004; Fehr and Schmidt 1999; Frohlich, Oppenheimer, and Kurki 2004), but this is the first study to examine whether these two approaches generate the same conclusions about social preferences within a given experiment. Finally, it has also been argued that spectator judgments might be particularly relevant for normative analysis and policy evaluation missing (e.g., Konow 2009).

Our analysis provides four main findings. First, we show that, although the ex ante fairness view garners the single largest share of support among the three candidates, most participants favor some ex post redistribution, even when, as here, people had the same ex ante opportunities. Second, we find that, among the participants who redistribute earnings, many make a distinction between ex post inequalities that result from different choices and ex post inequalities that result from differences in luck. Overall, most participants favor not equalizing ex post inequalities that result from different choices, but most also favor equalizing ex post inequalities resulting from differences in luck among risk-takers. Third, we show that the appeal of the ex ante view is independent of how costly it is to avoid exposure to risk. Fourth, even though the choices of stakeholders clearly reflect a selfish motive, we find that stakeholders and spectators act on the same fairness views. Thus, the two approaches support the same set of conclusions about fairness preferences over the gains and losses from risk-taking.

[4] This view has been discussed extensively in the philosophical literature (see Dworkin 1981a, b; Arneson 1989; Lippert-Rasmussen 2001; Fleurbaey 2002; Vallentyne 2002; and Fried 2003).

The paper is organized as follows. Section I presents the experimental design. Section II analyzes the choices of spectators. Section III introduces a model of distributive choice, which we estimate for both spectators and stakeholders, and Section IV concludes.

I. Design and Procedures

We recruited participants among students at the Norwegian School of Economics. A total of 119 subjects participated in 4 sessions that lasted about 40 minutes and that all took place on the same day. Subjects were strongly incentivized in the experiment and earned, on average, 472 Norwegian Kroner (NOK) or about $75, including a 100 NOK show-up fee. The experiment was conducted in a computer lab using a web-based interface and was double-blind; i.e., neither subjects nor experimenters could associate decisions with particular subjects. Moreover, earnings were paid anonymously by wire using payment codes through an independent accounting division, a fact that was communicated to all subjects.

At the beginning of the experiment, participants were randomly assigned to be either stakeholders (78 subjects) or spectators (41 subjects), and they remained in a single role for the duration of the experiment. There were two decision-making phases: a risk-taking phase and a distribution phase. Only stakeholders participated in the risk-taking phase, in which they were asked to choose between a safe alternative and a risky alternative in four different risk-taking situations. In all of the four cases, the risky alternative contained two equally likely outcomes of 800 NOK and 0 NOK. Hence, the expected value of the risky alternative was always 400 NOK. The safe alternative varied across the four situations and took on the values 400 NOK, 300 NOK, 200 NOK, or 25 NOK. The four situations were presented in random order. Before the stakeholders made their choices in the risk-taking phase, they were told that a second phase would follow that concerned the distribution of earnings from the risk-taking phase, but they were not provided with any details of this phase.[5]

Table 1 provides an overview of the choices made by the 78 stakeholders in the risk-taking phase. Only seven participants made choices that reflected potentially risk-loving preferences. Hence, almost all participants were weakly risk averse, but none so risk averse as to choose the safe alternative when it had a value of 25 NOK. Considering the complete set of choices of each stakeholder, we observe that the preferences of all but five obey monotonicity; i.e., a subject who chose the risky alternative for a high value of the safe alternative also did so for lower values of the safe alternative.

In the distribution phase, stakeholders were anonymously and randomly paired with a sequence of eight other stakeholders.[6] For each pair, one of the four situations

[5] We cannot rule out that knowledge about the distribution phase induced strategic risk-taking (Coate 1995) and, possibly, also affected the participants' perceived ownership of the earnings. The fact that we find very similar results for stakeholders and spectators, however, suggests that the timing of information in itself did not affect the propensity to act on a particular fairness view in the distribution phase.

[6] Double-blind anonymity and high stakes should allay concerns that our results are due to audience effects; i.e., effects on the behavior of decision-makers due to their being observed by other subjects or the experimenter (see, e.g., Andreoni and Bernheim 2009). We believe that this is particularly so for which fairness view to follow in the distributive situations, which is the main focus of the present paper.

Table 1—Risk Choices Made by Participants

Value of safe alternative	Risk choice		Total
	Safe alternative	Risky alternative	
25	0	78	78
200	5	73	78
300	28	50	78
400	71	7	78
	104	208	312

Notes: The table reports the choices made by stakeholders in the risk-taking phase. For each value of the safe alternative, the table reports the number of stakeholders choosing the safe alternative and the risky alternative.

from the risk-taking phase was drawn randomly, and the stakeholder was asked to determine how the total earnings of the two stakeholders should be distributed among them. Before they made each choice, the participants were informed about the choices and outcomes of the risk-taking phase for both parties. Thus, there was no uncertainty about the source of inequality in earnings.[7] Moreover, given that this was a one-shot experiment, the participants did not have to consider whether the distributive choices would affect future risk-taking choices. The distributive situations were presented in random order, and after making their decisions, the participants were given a final opportunity to revise any or all of them, if desired. Correspondingly, the spectators made eight distributive choices from a randomly selected subsample of the distributive situations faced by the stakeholders. The spectators were provided with the same information as the stakeholders. In total, we have 530 distributive situations with positive total earnings, 112 distributive situations where one stakeholder chose the risky alternative and the other stakeholder chose the safe alternative, 152 distributive situations where both stakeholders chose the safe alternative, and 266 distributive situations where both chose the risky alternative and at least one of them was lucky. Spectators made choices in 283 distributive situations with positive total earnings. All allocations were restricted to multiples of 25 NOK.

At the beginning of the experiment, stakeholders were told that the computer would randomly choose one of the situations and one of the choices in this situation to determine their final outcome. Spectators received a fixed payment of 350 NOK unrelated to their decisions.

II. Ex Ante or Ex Post?

Table 2 reports some basic descriptive statistics from the distribution phase. We observe that stakeholders give away, on average, 23.5 percent of total earnings. Spectators choose an equal split more often than stakeholders, 55.5 percent versus 24.5 percent of the situations, and stakeholders take everything for themselves in 36.4 percent of the distributive situations. Overall, by comparing the earnings

[7] This rules out the possibility for heterogeneity in beliefs among the participants about the sources of differences in earnings, which has shown to be prevalent and of importance in dictator games where the participants lack information about the earning stage (Ray-Biel, Sheremeta, and Uler 2011).

TABLE 2—DISTRIBUTIVE CHOICES: BASIC DESCRIPTIVE STATISTICS

	Stakeholders	Spectators
Mean share given	0.235	0.507
Median share given	0.125	0.500
Standard deviation share given	0.249	0.261
Share equal split	0.245	0.555
Share all to self	0.364	·
Observations	530	283

Notes: The table reports basic descriptive statistics for both stakeholders and spectators, restricted to situations with positive total earnings. For spectators, share given is defined to be share given to the first person in the pair (randomly determined).

before and after transfers, we observe a reduction in the Gini coefficient from 0.474 to 0.440 for the decisions made by spectators, and an increase in the Gini coefficient from 0.483 to 0.560 for the decisions made by stakeholders.[8] Thus, the presence of the selfish motive for the stakeholders makes them choose differently from the spectators.

To study the distributive choices of spectators in greater detail, we present histograms of share given in different types of situations in panels A–F in Figure 1. We observe in panel A that the most common choice among spectators is to distribute equally among the two participants. This is predominantly the case when there is equality in individual earnings (panel C), but, interestingly, equal splits are also the most common choice when ex post earnings are unequal (panel B). Clearly, therefore, many spectators deviate from the ex ante position in their distributive choices and deem it fair to redistribute earnings ex post.

We also observe that many spectators make a distinction between different sources of ex post inequalities. As shown in Figure 1, spectators choose to equalize earnings in more than 40 percent of the distributive situations where lucky and unlucky risk-takers meet (panel D), whereas this only happens in fewer than 20 percent of the distributive situations in which an unlucky risk-taker is paired with a participant choosing the safe alternative (panel E). Thus, ex post inequalities between participants who have made different choices appear to be acceptable to a larger fraction of spectators than ex post inequalities due to luck (even in cases where people have equal opportunities and risk is avoidable). Finally, we observe that the share of equal splits in distributive situations where a risk-taker meets a participant choosing the safe alternative is independent of whether the risk-taker is lucky or unlucky (panels E and F).

Is deviation from the ex ante position more frequent in situations where it is very costly for the participants to avoid risk? To study this question, we look at the level of redistribution by spectators in situations where lucky risk-takers are paired with unlucky risk-takers. In such situations, the total earnings to be distributed are always 800 NOK; i.e., equal to the individual ex post earnings of the lucky risk-taker. Table 3 shows the share of this amount transferred ex post to the unlucky risk-taker. We observe that the fraction transferred is invariant with respect to the

[8] The corresponding Lorenz curves are shown in Figure A1 in the online Appendix.

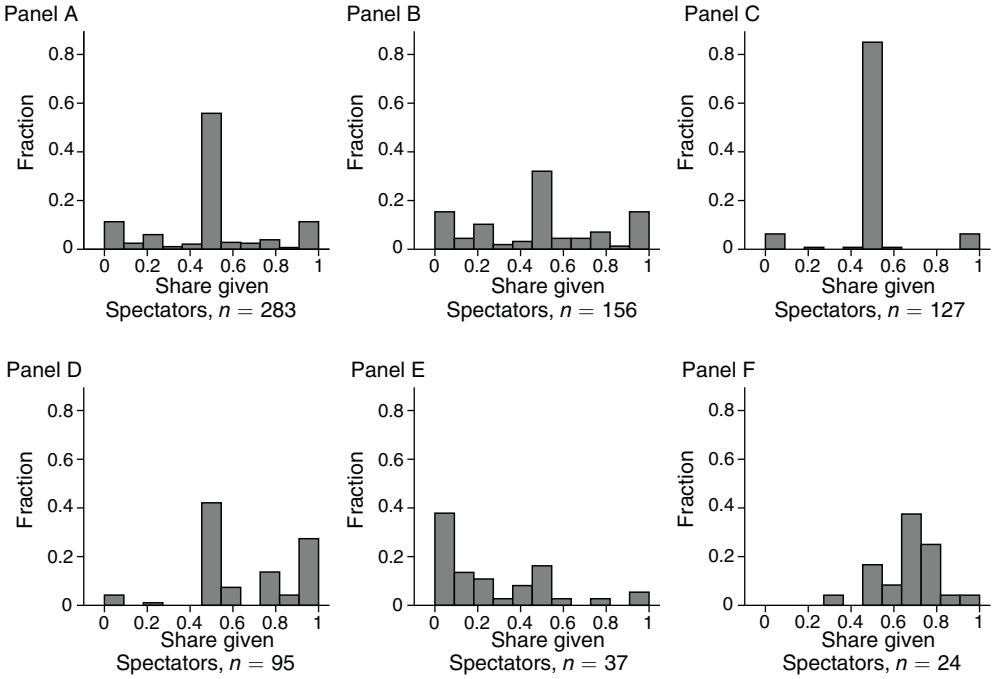

FIGURE 1. HISTOGRAMS OF SHARE GIVEN, SPECTATORS

Notes: Panel A: Distribution of all spectator decisions, share given to the first person in the pair (randomly determined). Panel B: Distribution of spectator decisions where there are unequal ex post earnings, share given to the first person in the pair (randomly determined). Panel C: Distribution of spectator decisions when ex post earnings are equal, share given to the first person in the pair (randomly determined). Panel D: Distribution of spectator decisions when lucky meets unlucky, share given to lucky risk-taker. Panel E: Distribution of spectator decisions when unlucky meets safe, share given to unlucky risk-taker. Panel F: Distribution of spectator decisions when lucky meets safe, share given to lucky risk-taker.

value of the safe alternative: in all three cases, the unlucky risk-taker receives, on average, about one-third of the total earnings.[9] Hence, spectators do not differentiate between situations where risk is almost unavoidable and situations where the cost of avoiding risk is relatively small.

Overall, the data show that 71.7 percent of all distributive choices made by the spectators correspond exactly to the ex ante, ex post, or choice egalitarian fairness views. If we restrict attention to the distributive situations with unequal earnings (156 out of 283), where fairness views may be in conflict, we find that spectator choices are exactly in line with at least one of the fairness views in 60.9 percent of the distributive situations.[10]

To study further the ability of these three fairness views to account for the behavior of spectators, both at the population level and at the individual level, we formulate and estimate a choice model that allows for some random noise in the

[9] In Table A1 in the online Appendix, we show that this result holds if we control for individual fixed effects and only consider individual variation across the alternatives.

[10] In Table A2 in the online Appendix, we report the share of decisions fitting each of the fairness views in the different distributive situations.

TABLE 3—REDISTRIBUTION WHEN A LUCKY RISK-TAKER MEETS AN UNLUCKY RISK-TAKER, SPECTATORS

Value of safe alternative	Average share redistributed
25	0.338 (0.041) $n = 41$
200	0.321 (0.045) $n = 36$
300	0.319 (0.053) $n = 18$

Notes: Share redistributed is defined as share of total earnings transferred to the unlucky risk-taker. Standard errors are in parentheses. There were no distributive situations where the safe alternative was 400 NOK and both participants chose the risky alternative. This results from the random matching procedure used in the distribution phase and the fact that only seven participants chose the risky alternative when the value of the safe alternative was 400 NOK.

decisions. This model also introduces self-interest considerations for stakeholders and allows us to study the extent to which the fairness views of the spectators and the stakeholders differ.

III. A Model of Distributive Choice

We assume that a stakeholder is motivated by own income and fairness when deciding how to distribute the total earnings X generated in the risk-taking phase,

$$V(y; \cdot) = \gamma y - \beta f(|y - F^k|, X), \tag{1}$$

where y is what a stakeholder allocates to him- or herself, and F^k is what a stakeholder considers to be his or her fair income. The cost of acting unfairly is captured by the function $f(|y - F^k|, X)$, where we assume that $f(0, X) = 0$ and that the cost is increasing in the absolute value of the difference between own income and fair income.

In the main analysis, we focus on a version of equation (1) that has been proposed by Cappelen et al. (2007),

$$V(y; \cdot) = \gamma y - \beta(y - F^k)^2/2X. \tag{2}$$

The interior solution y^* is then given by

$$y^* = F^{k(i)} + (\gamma/\beta)X. \tag{3}$$

Hence, a stakeholder takes at least what he or she considers fair, or more, depending on how much weight the decision-maker assigns to fairness.

Stakeholders may differ both in the weight they attach to fairness relative to self-interest (γ/β) and in what they consider to be a fair distribution (F^k). Informed by

our analysis of spectators in Section II, we assume that the individuals endorse the ex post (EP), ex ante (EA), or choice egalitarian (CE) fairness view,

$$F^{EP} = \frac{1}{2}X, \tag{4}$$

$$F^{EA} = x, \tag{5}$$

$$F^{CE} = \begin{cases} \frac{1}{2}X & \text{if } C_i = C_j, \\ x & \text{if } C_i \neq C_j, \end{cases} \tag{6}$$

where x is the decision-maker i's earnings and C_i takes the value 1 if the individual chooses the risky alternative and the value 0 otherwise.[11]

We assume that spectators maximize the same utility function as stakeholders with two exceptions: for spectators, the first term is always zero, and the second term is defined for the spectator's preferences over the income of one of the two stakeholders in the pair. Hence, trivially, the interior solution for a spectator is to choose what he or she considers the fair allocation of the total earnings between the two stakeholders.

A. *Estimates of the Choice Model*

We assume a discrete choice random utility model of the form

$$U(y; \cdot) = V(y; \cdot) + \epsilon_{iy}, \qquad \text{for } y = 0, 25, \ldots, X, \tag{7}$$

where ϵ_{iy} is assumed to be i.i.d. extreme value. For each individual, with a fixed (F^k, β), the choice probabilities then have a simple logit form. We assume that β has a log normal distribution, such that $\log \beta \sim N(\zeta, \sigma^2)$. Note that the random utility model is formulated both for spectators and stakeholders, which means that we allow for noise in the choices of all the participants. More specifically, the estimated β captures the importance of noise relative to fairness considerations for both spectators and stakeholders, whereas γ captures the importance of noise relative to self-interest for stakeholders.

[11] In Sections A5–A8 in the online Appendix, we show that our main findings are robust to other model specifications. First, inspired by Fehr and Schmidt (1999) and Bolton and Ockenfels (2000), we introduce other functional forms in equation (1) that only slightly change the estimation results. Second, we consider a generalized version of equation (2), introducing the possibility of a threshold in the fairness views. The threshold captures the idea that the participants might be concerned with securing everyone at least a minimum level of income, and, therefore, might allow choice egalitarian and ex ante fairness considerations to play a role only above the threshold. The estimated threshold model provides evidence that some participants are motivated by threshold considerations in their distributive choices. Thus, some of the participants who are classified as holding the ex post fairness view might be willing to accept choice egalitarian and ex ante fairness considerations above a certain threshold, whereas some of the participants who are classified as holding the choice egalitarian or ex ante fairness views might consider the ex post fairness view to be appropriate below a certain threshold. The relative importance of the three fairness views, however, largely remains the same when introducing a threshold (Table A6), and the threshold model does not fit the data better than the estimated version of equation (2) (Figure A2 and Figure A3).

Let the vector θ represent all parameters to be estimated. The population share for each of the fairness views is the estimated proportion of the participants motivated by this particular fairness view, λ^{EA}, λ^{CE}, and λ^{EP}. The likelihood contribution of an individual conditional on a fairness view F^k is given by

$$L_i^k(\theta) = \int_0^\infty \left(\prod_{j=1}^{j_i} \frac{e^{V(y_{ij};\, F^k,\, \beta,\, \cdot)}}{\sum_{s \in \mathcal{Y}_{ij}} e^{V(s;\, F^k,\, \beta,\, \cdot)}} \right) dF(\beta; \zeta, \sigma), \tag{8}$$

where $j = 1, \ldots, J_i$ is an index of the choices made by individual i, $\mathcal{Y}_{ij}$ is the choice set $\{0, \ldots, X_{ij}\}$ for individual i in situation j, and y_{ij} is the realized choice in this situation. To calculate the total likelihood contribution of an individual, we weight the conditional likelihood values with the corresponding estimated population shares:

$$L_i(\theta) = \sum_k \lambda^k L_i^k(\theta). \tag{9}$$

Table 4 reports estimates of θ for both stakeholders and spectators. From specification (1), we observe that each of the three fairness views gain support from a substantial population share. The ex ante fairness view appears to be the most frequent among the participants, accounting for the behavior of around 40 percent of the individuals. Still, a majority of the participants endorses ex post redistribution when ex post inequalities reflect differences in luck. Only a minority of about 30 percent endorses equalization of all ex post inequalities.[12]

In specifications (2)–(4), we remove, in turn, one of the fairness views. In each case, we observe a substantial reduction in the likelihood value, which suggests that all three fairness types contribute to an explanation of the observed choice patterns.

The estimates reported in Table 4 also provide strong evidence that spectators and stakeholders express the same fairness preferences in this experiment and that their choices differ only in that the stakeholders are also motivated by self-interest.[13] The estimated population shares are very similar for stakeholders and spectators, and the restriction that they are the same cannot be rejected by a likelihood ratio test ($p = 0.94$).[14] We observe that the estimated ζ is higher for spectators than stakeholders, which means that the random element plays less of a role in explaining the behavior of the median spectator.

B. *How Well Does the Estimated Model Fit the Data?*

To study how well the model fits the data, we use the model to simulate and predict the actual distribution of data in different situations.

[12] In Table A5 in the online Appendix, we show that the estimated population shares change only marginally for alternative specifications of how to include the strictly selfish individuals in the estimations.

[13] This also suggests that the fixed payment to the spectators did not induce an anchoring effect in their distributive choices.

[14] We report the population estimates for the pooled model used in the likelihood ratio test in Table A4 in the online Appendix.

TABLE 4—ESTIMATES OF THE CHOICE MODEL

	1		2		3		4	
Parameter	Stake-holder	Spectator	Stake-holder	Spectator	Stake-holder	Spectator	Stake-holder	Spectator
λ^{EP}	0.274	0.302			0.499	0.501	0.356	0.412
	(0.086)	(0.087)			(0.087)	(0.092)	(0.107)	(0.120)
λ^{CE}	0.315	0.272	0.590	0.545			0.644	0.588
	(0.095)	(0.089)	(0.090)	(0.099)			(0.107)	(0.120)
λ^{EA}	0.411	0.427	0.410	0.455	0.501	0.499		
	(0.091)	(0.091)	(0.090)	(0.099)	(0.087)	(0.092)		
ζ	3.094	6.960	3.012	4.899	3.039	4.984	1.613	3.552
	(0.503)	(0.683)	(0.488)	(0.688)	(0.494)	(0.680)	(0.590)	(0.894)
σ	4.378	4.660	3.910	4.386	4.059	4.226	4.662	5.115
	(0.655)	(0.706)	(0.566)	(0.675)	(0.595)	(0.644)	(0.644)	(0.910)
γ	15.577		13.243		14.525		10.718	
	(0.509)		(0.463)		(0.496)		(0.260)	
log L	−1,200.6	−606.5	−1,239.0	−623.1	−1,254.7	−676.2	−1,305.8	−697.0

Notes: The specifications are estimated separately for spectators and stakeholders, where λ^{EP}, λ^{CE}, and λ^{EA} are the share of individuals with the ex post, choice egalitarian, and ex ante fairness views, respectively. The expectation and the standard deviation of the lognormal β are parameterized such that $\log \beta \sim N(\zeta, \sigma^2)$. The likelihood is maximized using the FmOpt library (Ferrall 2005). One population share and its standard error are calculated residually. Income is scaled in units of 1,000 NOK. Standard errors (in parentheses) are calculated using the BHHH method (Berndt et al. 1974).

As can be seen from Figure 2, the model predictions fit nicely the behavior of both stakeholders and spectators. Thus, the theoretical framework of the present analysis, given by equation (2) and the three fairness views, appears in a robust manner to capture both the underlying fairness motivations of the participants in risk-taking situations and how stakeholders trade off fairness and self-interest considerations.

One possible concern about spectators in experiments is that they might not be sufficiently motivated, since their earnings are not affected by their choices, and that, as a result, their choices might exhibit more noise than among stakeholders. This hypothesis is not borne out in the data from the present experiment, as seen from the estimates and by comparing data and predictions for spectators in Figure 2. The moral incentives created by the distributive situations being real, therefore, appears to have been sufficient to motivate spectators in their distributive choices, which is consistent with evidence from other studies (e.g., Konow 2000; Charness and Rabin 2002; Engelmann and Strobel 2004).

C. *Consistency and Classification at the Individual Level*

In this section we examine how effectively our estimates can be used to classify individuals according to fairness views and how consistent spectators are at the individual level.[15]

[15] In Section A8 in the online Appendix, we also use this classification to show that the fairness views identified in this experiment relate in a systematic manner to the participants' self-reported political views. Specifically, those results suggest that subjects on the right wing of the political spectrum are more likely to favor the ex ante fairness view, whereas a larger share of those on the left wing make choices consistent with the ex post fairness

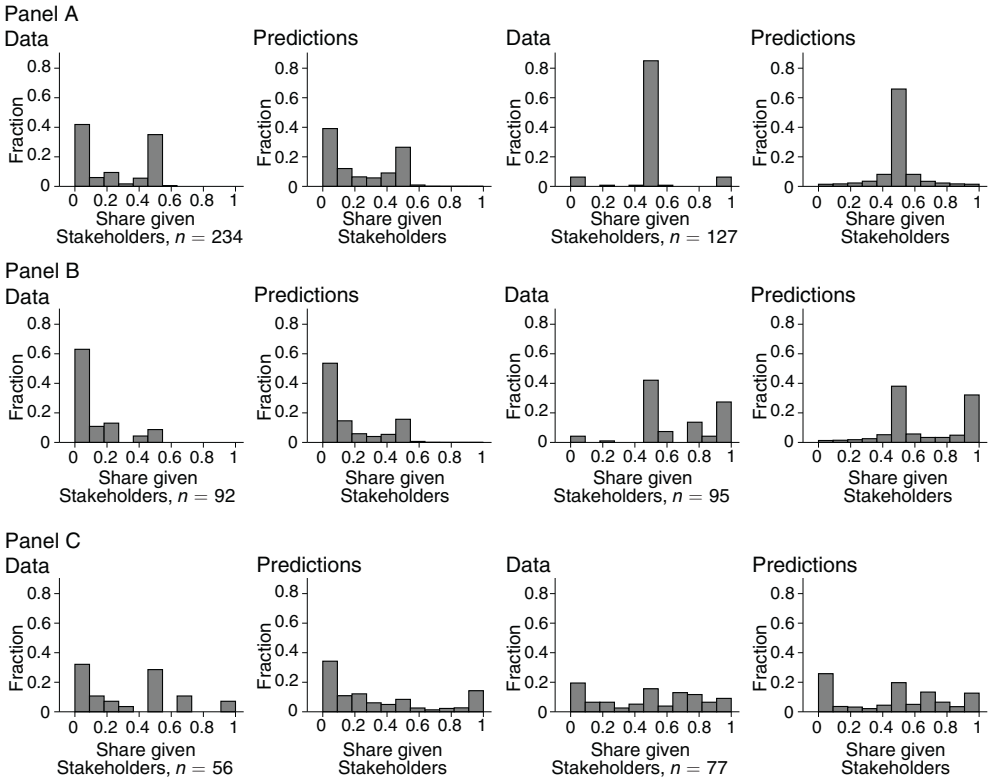

FIGURE 2. ACTUAL AND PREDICTED SHARE GIVEN IN VARIOUS DISTRIBUTIVE SITUATIONS

Notes: Predictions refer to simulations of the model for stakeholders and spectators. The simulations are based on the estimates reported for specification (1) in Table 4. These are calculated with 1,000 replications of each individual and the distributive situations in which he or she is involved. Each replication is randomly assigned a fairness view F^k and β in accordance with the estimates. Panel A: Distribution of decisions when ex post earnings are equal, share given to the other participant (stakeholders)/ to the first person in the pair, randomly determined (spectators). Panel B: Distribution of decisions when lucky meets unlucky, share given to the other participant (stakeholders)/ to the lucky participant (spectators). Panel C: Distribution of decisions when risk-taker meets safe, share given to the other participant (stakeholders)/ to the risk-taking participant (spectators).

We start out by using the estimates reported for specification (1) in Table 4 to identify the ex post likelihood of any specific individual holding a particular fairness view. Given an individual's choices, we apply Bayes' theorem,

$$P(k \mid y, \mathbf{z}) = \frac{P(y \mid k, \mathbf{z})P(k \mid \mathbf{z})}{P(y \mid \mathbf{z})} \qquad \text{for } k \in \{EA, CE, EP\}, \tag{10}$$

where $P(k \mid y, \mathbf{z})$ is the a posteriori probability of having the fairness view k given that the choice y is made in a situation described by the vector $\mathbf{z}$. These probabilities can be calculated by applying equations (8) and (9).[16]

view. We take these results as favorable evidence on the external validity of the fairness preferences identified in this experiment.

[16] The expression $P(y \mid k, \mathbf{z})$ corresponds to $L_i^k(\boldsymbol{\theta})$ as defined in equation (8), $P(k \mid \mathbf{z})$ is the population share λ^k, and $P(y \mid \mathbf{z})$ is the total likelihood contribution $L_i(\boldsymbol{\theta})$ defined in equation (9).

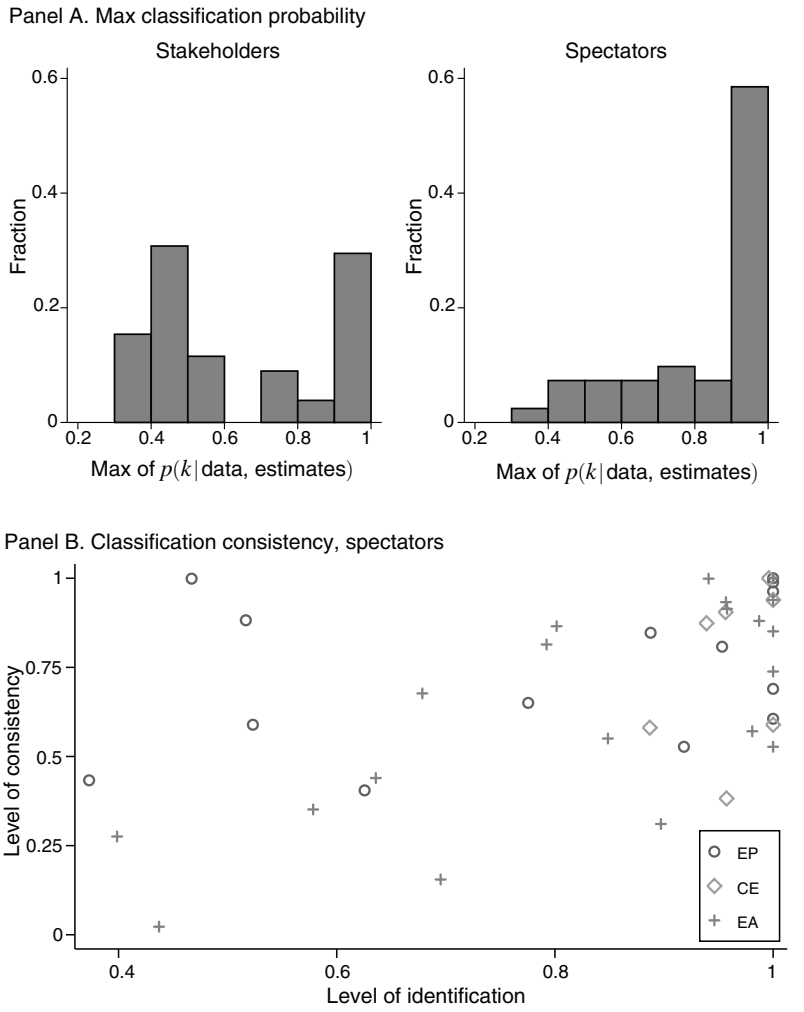

FIGURE 3. IDENTIFICATION OF FAIRNESS VIEWS AT THE INDIVIDUAL LEVEL

Notes: Panel A shows the distribution of the a posteriori probability of the most likely fairness view for each individual, $\max_k\{P(k|y,\mathbf{z})\}$, for stakeholders and spectators. Panel B shows scatter plots of the level of consistency and level of identification for each spectator. Level of consistency is measured by the fraction of decisions consistent with the most likely fairness view of an individual (restricted to distributive situations with positive total earnings) and the level of identification is measured by the a posteriori probability of the individual having this fairness view, $\max_k\{P(k|y,\mathbf{z})\}$. Circle, diamond, and cross indicate that a spectator is identified as having the ex post, choice egalitarian, and ex ante fairness view, respectively. Calculations of a posteriori probabilities are based on the main specification in Table 4.

Figure 3, panel A, shows how well the model identifies fairness views at the individual level by reporting the distribution of the a posteriori probability of the most likely fairness view for each individual. We observe that a large majority of the spectators and a substantial share of the stakeholders are identified very precisely. The fact that the models are less effective in identifying precisely the fairness views of the stakeholders is mainly due to the fact that a substantial share of them took everything for themselves.

We can further study whether spectators choose consistently across distributive situations, where the level of consistency is measured by the fraction of decisions exactly in line with the most likely fairness view of the spectator.[17] Figure 3, panel B, reports a scatter plot for spectators of the fraction of consistent decisions and the a posteriori probability of their most likely fairness view. We observe that most of the spectators are located in the upper right corner of the panel, which means that their fairness view is precisely identified and that they act consistently with their respective fairness classifications.[18]

IV. Concluding Remarks

Our experiment provides initial evidence that many people consider fairness in the context of risk-taking to go beyond equalizing opportunities, but it also reveals considerable disagreement on how to allocate fairly the gains and losses from risk-taking. Many participants endorse the ex ante fairness view, whereas others endorse the ex post fairness view. Nevertheless, if we look separately at the two fairness questions, we find, on each of them, that the majority favors the choice egalitarian distribution. When distributing between lucky and unlucky risk-takers, most participants find it fair to eliminate inequalities. When distributing between risk-takers and those who choose the safe alternative, most participants find inequalities in outcomes justifiable.

One should be careful when drawing general conclusions from a single laboratory experiment, but the findings of this paper could have interesting implications for our understanding of political debates. In the context of the financial crisis, for example, the majority view in the present experiment can be seen as opposing redistribution from those who avoid risk to unlucky investors, but as favoring redistribution between lucky and unlucky investors. Similarly, in the health context, where a key question is who should bear the costs of treatment related to risky lifestyle choices (World Health Organization 2002), the majority view may be seen as supporting the distribution of costs of treatment among all those with risky life styles; for example, by the government taxing products such as cigarettes, alcohol, sugar, and fat, or by insurance companies demanding higher premia from individuals who engage in risky behavior (Cappelen and Norheim 2005).

The current study might also be connected to the design of compensation systems in principal-agent situations, where there is a trade-off between providing effective work incentives to the agents and reducing the agents' exposure to unwanted risk (Sappington 1991). An efficient compensation system would create inequalities between agents who exercise the same level of effort but have different luck. Our results suggest that some view such inequalities as unfair even if the agents had the same ex ante opportunities and had voluntarily entered into the relationship. This perceived unfairness might, in turn, increase the level of compensation needed to

[17] It is not meaningful to examine consistency of this sort for stakeholders given the role of self-interest in their decisions.

[18] We observe a few spectators located in the upper left part of the panels, which means that they are very consistent but not precisely identified. This results from the fact that some spectators faced distributive situations where different fairness views justified the same distribution.

attract agents to the task and affect the optimal structure of the compensation system (Desiraju and Sappington 2007).

The present study highlights the fact that risk-taking raises distinct questions of fairness by focusing on how to deal with risk-taking in a setting of equal opportunities. Important avenues for future research are to study fairness views about risk-taking when initial opportunities are unequal and to explore how such views might depend on culture, institutions, and other contextual factors.

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