Supplementary Material for
Fairness and Risk in Ultimatum Bargaining

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This appendix contains some analytical details on ex ante and ex post fairness, further details on the experimental design as well as additional tables and more details about the econometric procedure.

S1. Ex Ante and Ex Post Fairness

In this section of the appendix, we provide a more detailed account of the theoretical results presented in the main text. Consider a simple setting in which two agents, A and B, engage in ultimatum bargaining, where A is the proposer and B is the responder. To fix ideas, consider a bilateral trading relationship where Agent A seeks to buy an item from Agent B and where the surplus generated from a trade is 1. Let us assume that there are two states of the world, also denoted A and B for reasons which will become clear, which give rise to different surplus distributions. State A occurs with probability $(1 - z)$, while State B occurs with probability z. Assume also that the prices are state dependent and exogenously given at $p_i \geq 0,\ i \in \{A, B\}$. Without loss of generality, we assume that $p_A < p_B$. In our experiment, we will test an extreme case in which $p_A = 0$ and $p_B = 1$. In this case, it is as if there is a single, indivisible prize that Agent A wins in State A and B in State B.

The timing of the game is as follows:

- Stage 1: Agent A allocates probabilities, z and $(1 - z)$, over the two states.
- Stage 2: Agent B observes the proposed allocation and can accept or reject.
- Stage 3: The state is revealed and payoffs (x, y) are realized as follows,

- If Agent B accepts, then in State A payoffs are $(1 - p_A, p_A)$, and in State B payoffs are $(1 - p_B, p_B)$;
- If Agent B rejects, then there is no trade and the payoffs are $(0,0)$.

Standard game-theoretic arguments predict that Agent B accepts all probability allocations over states in Stage 2, thus in Stage 1 Agent A allocates full probability to her preferred State A.

Consider instead a model of Fehr and Schmidt (1999) aversion to inequitable payoffs from the perspective of Agent B (the perspective of Agent A is symmetric). The utility function is as follows,

$$u_B(x, y) = y - \alpha_B \cdot \max[0, x - y] - \beta_B \cdot \max[0, y - x], \tag{S1}$$

where α_B measures the aversion to disadvantageous inequality and β_B measures the aversion to advantageous inequality. Player types, as defined by their inequity aversion parameters, are common knowledge. To simplify the exposition, let us assume that $\beta_B = 0$, i.e., Agent B has no significant aversion to advantageous inequality.

When outcomes are uncertain, we are concerned not only with the final payoffs x and y, but also preferences over joint payoff distributions implied by the lottery $F(x, y)$. Two approaches are suggested in the literature (e.g. Brock et al., 2013). Either agents evaluate fairness of ex post outcomes by expected utility maximization:

$$w^{EP}(F) = \int u(x, y) dF(x, y), \tag{S2}$$

or they evaluate the fairness of expected outcomes ex ante:

$$w^{EA}(F) = u(E[x], E[y]). \tag{S3}$$

The approaches are not mutually exclusive: a convex combination of the two might best represent preferences (Fudenberg and Levine, 2012).

A. Ex Post Fairness

Let us consider the most relevant case: $p_A < 1/2, p_B \geq 1/2$. That is, Agent A is advantaged in State A and Agent B is advantaged in State B. Agent B's utility from accepting is:

(S4) $$(1-z)[p_A - \alpha_B(1-2p_A)] + zp_B.$$

Thus, Agent B will accept if and only if:

(S5) $$z \geq 1 - \frac{p_B}{p_B + \alpha_B - p_A(1+2\alpha_B)}.$$

Suppose that Agent A proposes an allocation z^*, which will be accepted. Her expected utility is:

(S6) $$(1-z^*)[1-p_A] + z^*[1-p_B-\alpha_A(2p_B-1)].$$

This will be non-negative so long as:

(S7) $$z^* \leq \frac{p_A - 1}{p_A + \alpha_A - p_B(1+2\alpha_A)}.$$

Thus, there will be a subgame perfect equilibrium in which Agent A proposes $z^*$and Agent B accepts if and only if:

(S8) $$z^* = 1 - \frac{p_B}{p_B + \alpha_B - p_A(1+2\alpha_B)} \leq \frac{p_A - 1}{p_A + \alpha_A - p_B(1+2\alpha_A)}.$$

The more Agent B cares about disadvantageous inequality, the less must Agent A care about it for there to be an equilibrium which ends in agreement.

B. Ex Ante Fairness

First note that in our environment, $E[x] = (1-z)(1-p_A) + z(1-p_B)$ and $E[y] = (1-z)p_A + zp_B$. There are two cases to consider.

Case (i). For $(p_A, z): p_B < p_B^{EA}$, so that Agent B is at a disadvantage from an ex ante perspective, Agent B's utility from accepting is:[1]

(S9) $$E[y] - \alpha_B(E[x] - E[y]).$$

Agent B will accept if and only if:

(S10) $$z \geq \frac{\alpha_B - p_A(1+2\alpha_B)}{(p_B - p_A)(1+2\alpha_B)}.$$

Suppose that Agent A proposes an allocation z^*, which will be accepted. Her utility is $E[x]$, which is always non-negative.

Thus, there will be a subgame perfect equilibrium in which Agent A proposes z^* and Agent B accepts if and only if:

(S11) $$z^* = \frac{\alpha_B - p_A(1+2\alpha_B)}{(p_B - p_A)(1+2\alpha_B)} \leq 1.$$

Case (ii). For $(p_A, z): p_B \geq p_B^{EA}$, Agent B will accept any allocation since $E[y] \geq 0$, and Agent B is in an advantaged position relative to Agent A.

Suppose that Agent A proposes an allocation z^*, which will be accepted. Her utility is:

(S12) $$E[x] - \alpha_A(E[y] - E[x]).$$

This will be non-negative so long as:

(S13) $$z^* \leq \frac{p_A(1+2\alpha_A) - 1 - \alpha_A}{(p_A - p_B)(1+2\alpha_A)}.$$

Thus, there will be a subgame perfect equilibrium in which Agent A proposes z^* and Agent B accepts if and only if:

[1] Note that p_B^{EA} is defined as the State B price that achieves ex ante payoff equality, and is given by $p_B^{EA} = p_A + (1/2 - p_A)/z$.

(S14) $$z^* = \frac{p_A(1+2\alpha_A)-1-\alpha_A}{(p_A-p_B)(1+2\alpha_A)} \geq 0.$$

C. Comparison

Let us fix the state prices at the extreme case in which $p_A = 0$ and $p_B = 1$. Agent A obtains all the surplus in State A and Agent B obtains all the surplus in State B. This case makes the trade-offs most salient. Let F be the cumulative distribution function (c.d.f.) of player types having support $[0,\infty)$. Recall that we are assuming complete information.

(i) Under ex ante fairness, for all $\alpha_B \in (0,\infty)$, there exists a proposal $z \in [0, 0.5]$ such that $E[y] - \alpha_B(E[x] - E[y]) > 0$. Thus, ex ante fairness always yields agreement.

(ii) Under ex post fairness, given our assumption on F, for every α_B there exists $\alpha_A^*(\alpha_B)$ such that Agent A is unwilling to make an offer that Agent B would accept. Then, the probability of disagreement is $1 - F(\alpha_A^*(\alpha_B))$. It follows that the expected probability of disagreement is $\int(1 - F(\alpha_A^*(\alpha_B)))f(\alpha_B)d\alpha_B > 0$.

If players evaluate fairness of outcomes ex ante, they are more likely to reach an agreement and there should be no difference in the minimum acceptance thresholds between the standard ultimatum game and the risky ultimatum game that we have described. If players are governed by ex post fairness, then the more Agent B cares about disadvantageous inequality, the less must Agent A care about it for an agreement to emerge in equilibrium. Under this approach, Agent B's minimum acceptance threshold is higher in the risky ultimatum game than in the standard ultimatum game for any positive degree of inequity aversion.

S3. Additional Details on Experimental Design

Attrition is a significant challenge for interactive experiments conducted online (see Arechar et al., 2018, for a discussion). To address this problem, we used on-screen timers on each decision page and informed subjects that failure to decide in time would result in their removal from the experiment without payment. We kept the task instructions as concise as possible and not role-specific. Any subject could opt to leave the study (and claim a notional bonus of $0.25) if asked to wait more than five minutes for a match to arrive. Since HITs on AMT move down the advertisement list over time, entry rates decline. To mitigate this and so reduce wait times, we only invited subjects to join the experiment within 25 minutes of posting the HIT. Recruitment rates were high, and subjects usually entered within 10 minutes of posting.[2] On average, the experiment took 15 minutes to complete.

To improve the likelihood that participants completed the tasks carefully, we set the required number of previous approved HITs at greater than 100, and the approval rating on these HITs at greater than 95% (see Peer et al., 2014, on the benefits of recruiting workers with high approval rating for data quality). We also provided decision support tables that summarized the payoffs (and for the Lottery UG also the likelihoods) associated with each action (screenshots are presented in a later section). To prevent retakes, we granted a custom qualification to each subject on entering the experiment (regardless of completion). To reduce the possibility of variable cultural norms influencing bargaining behaviour, we also restricted subject location to the United States.[3]

[2] Full details of the recruitment procedure are contained in the pre-registration document at the AEA RCT registry.

[3] In the post-experiment questionnaire, 90% of subjects reported (North) American nationality.

S4. Inconsistent responder choices in strategy method treatments

TABLE S.I—OBSERVED CHOICE SEQUENCES FOR INCONSISTENT RESPONSES

Standard UG (N = 8)	\$0	\$1	\$2	\$3	\$4	\$5	\$6				
	0	0	1	0	1	1	1				
	0	0	1	0	1	1	1				
	1	1	0	1	1	0	0				
	0	1	0	1	1	1	1				
	0	0	1	0	1	1	1				
	0	0	1	0	1	1	1				
	0	1	1	1	1	0	1				
	0	1	1	1	1	0	1				
Lottery UG (N = 3)	0	10	20	30	40	50	60	70	80	90	100
	1	0	1	1	0	0	1	0	0	1	1
	1	0	0	1	1	0	1	1	1	0	1
	1	0	0	1	1	0	1	1	1	0	1

Notes: Table columns present the acceptance decision (coded as 1 for accept and 0 for reject) for all possible level 1 offers in each task. N denotes the number of observations.

S5. Structural estimation of responder strategy sequences

In this section of the appendix, we structurally estimate the posterior probabilities that a responder strategy sequence in the Risk-SM treatment falls into either the ex ante or ex post fairness type. We assume that the utility of responder i from payoff y to him/herself and payoff x to his/her matched proposer is given by:

$$u_i = y - \alpha_i \cdot \max\{x - y, 0\}, \tag{S15}$$

which corresponds to the linear inequity averse preferences of Fehr and Schmidt (1999).[4] When there is uncertainty about the final payoff distribution, implied by the lottery $F(x, y)$, evaluation of utility is either by expected utility maximization (S2), or as the utility of expected outcomes (S3).

[4] Initially, we also included the advantageous inequality aversion parameter β_i in the structural estimation model. We found no evidence that this parameter was significantly different from zero, however, and so in the interests of parsimony we removed this parameter from the model.

To construct the posteriors, we first calculate the degree of inequality aversion implied by the Lottery UG, separately based on the ex post $(\alpha^L_{i,ep})$ and ex ante $(\alpha^L_{i,ea})$ assumptions in (S2) and (S3), respectively. We then estimate a mixture model on responder strategy sequences from the Standard UG.

To permit decision errors, we add idiosyncratic and independent error terms ϵ_{ij} and assume that the difference between any two error terms follows a logistic distribution, with noise-to-signal ratio parameter λ.[5] This parameter drives the sub-optimality of responder acceptance decisions. Thus, the responder accepts any offer j in the Standard UG when $u_{ij} + \lambda\epsilon_{ij} > 0$.

Given the logistic error structure, the probability that responder i accepts offer j conditional on α^L_i is:

(S16)
$$P_{ij}(\alpha^L_i) = \frac{1}{1+\exp(-u_{ij}/\lambda)}.$$

For each of the 45 responders in the Risk-SM treatment, we observe a sequence of seven level 1 decisions for the Standard UG task, where $d_{ij} = 1$ denotes acceptance and $d_{ij} = 0$ rejection by responder i of offer j. For 39 of these 45 responders, we also observe a sequence of nine level 2 decisions. One responder reported a threshold of zero for both ultimatum game tasks and so is excluded from the analysis. This yields a total of 659 observations and $T_i \in \{7,16\}$ decisions per responder.

The two fairness types are represented in the model by the mixing proportions p_{ep} and p_{ea}. The marginal likelihood of the strategy sequence of responder i is:

[5] The results of the estimation are robust to using the alternative Fechner error specification.

(S17)

$$L_i = p_{ep}\prod_{j=1}^{T_i}\left[P_{ij}(\alpha_{i,ep}^{L})\right]^{d_{ij}}\left[1-P_{ij}(\alpha_{i,ep}^{L})\right]^{1-d_{ij}} + p_{ea}\prod_{j=1}^{T_i}\left[P_{ij}(\alpha_{i,ea}^{L})\right]^{d_{ij}}\left[1-P_{ij}(\alpha_{i,ea}^{L})\right]^{1-d_{ij}}.$$

Based on equation (S17), the sample log-likelihood is given by:

(S18)
$$Log\ L = \sum_{i=1}^{44}\log(L_i),$$

on maximization of which we obtain likelihood estimates for the rationality parameter λ and one of the two mixing proportions (from which the other is calculated using the delta method).

The estimation was conducted in Stata 16, using the d0 estimator to account for the panel structure of the data. A starting value for the mixing proportion was obtained from the classification of types in Section III.A of the main text. The results of this estimation are presented in Table S.II. The proportion of ex post fairness types is estimated to be 51.9%, which lies in the middle of the 40 to 60% range estimated using the non-parametric and least squares methods.

TABLE S.II —MAXIMUM LIKELIHOOD ESTIMATES FROM MIXTURE MODEL APPLIED TO RESPONDER DATA IN RISK-SM

Rationality Parameter		
λ	1.963	(0.172)
Mixing proportions		
p_{ep}	0.519	0.0946
p_{ea}	0.481	0.0946
Number of Observations	659	
Log-likelihood	-284.749	

Note: Asymptotic standard errors in parentheses. Data is from responder strategy sequences in the Risk-SM treatment.

Posterior probabilities for the two types can be calculated as:

$$
\text{(S19)} \qquad
\begin{aligned}
P(i = ep \mid d_{i1}, ..., d_{iT_i}) &= \frac{p_{ep} \prod_{j=1}^{T_i} \left[P_{ij}(\alpha_{i,ep}^{L}) \right]^{d_{ij}} \left[1 - P_{ij}(\alpha_{i,ep}^{L}) \right]^{1-d_{ij}}}{L_i}; \\
P(i = ea \mid d_{i1}, ..., d_{iT_i}) &= \frac{p_{ea} \prod_{j=1}^{T_i} \left[P_{ij}(\alpha_{i,ea}^{L}) \right]^{d_{ij}} \left[1 - P_{ij}(\alpha_{i,ea}^{L}) \right]^{1-d_{ij}}}{L_i}.
\end{aligned}
$$

In Figure S1, we present a histogram of posterior probabilities of being classified as an ex post fairness type, split according to responders' non-parametric strategy comparisons between the Standard and Lottery UG. The posterior estimates are consistent with the more crude classifications in the main text. Responders who tend to report a higher acceptance threshold in the Lottery UG, tend to have a larger posterior probability of being classified as an ex post type, with a discrepancy of roughly 20% of responders who are mis-classified as an ex ante type. Those responders who report an equal threshold in the two UG tasks are unambiguously classified as an ex ante type. Unlike with the crude classifications, we can now additionally infer that those responders who report a lower threshold in the Lottery UG are not well-classified by either fairness model, as the theory predicts.

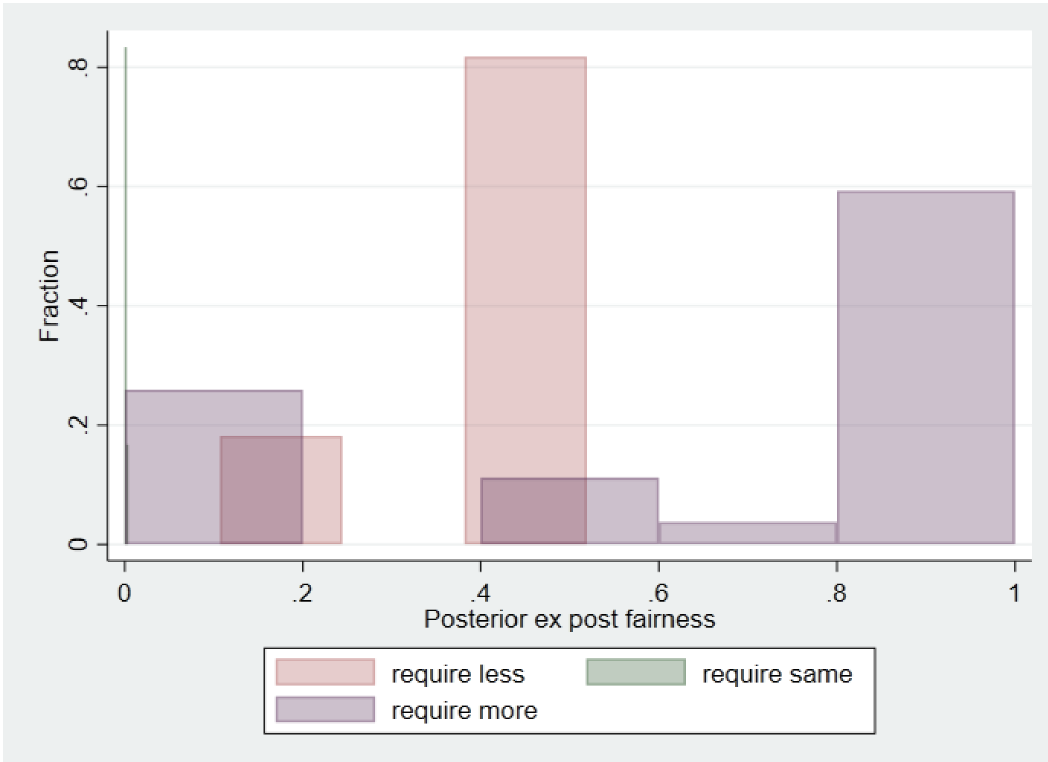


FIGURE S1. POSTERIOR PROBABILITIES OF FAIRNESS TYPES BY RESPONDER STRATEGY COMPARISON IN RISK-SM

Notes: The posterior probabilities are estimated from the mixture model based on the equations in (S7). The responder strategy comparisons are taken from the raw classification of types presented in Section III.A of the main text. Require more (less) [same] indicates the responder reported a higher (lower) [equal] acceptance threshold in the Lottery UG as compared to the Standard UG. Data is from responder strategy sequences in the Risk-SM treatment.

S6. Logit regression of intent hypothesis

Relates to Section III.B of the main text.

TABLE S.III —LOGIT REGRESSIONS FOR ACCEPTANCE DECISION IN INTENT TREATMENTS

Variable	(1)		(2) – Intent-SM Only	
Amount Offered (%)	0.0055	(0.0027)	0.0059	(0.0028)
Indicator for Intent-SM	0.1757	(0.0935)		
Minimum Acceptance Threshold			-0.0091	(0.0028)
Number of Observations	108		69	

Note: The dependent variable is a 0/1 indicator for whether the responder accepted upon losing the lottery. The table reports estimated marginal effects with standard errors in parentheses.

S7. AMT recruitment outcomes, subject pool characteristics and randomization check

We recruited 1,029 subjects on the Amazon Mechanical Turk (AMT) platform in May and June 2020. For transparency, in Table S.IV we report the full breakdown of recruitment outcomes. Figure S2 displays the description of the HIT on AMT as seen by subjects.

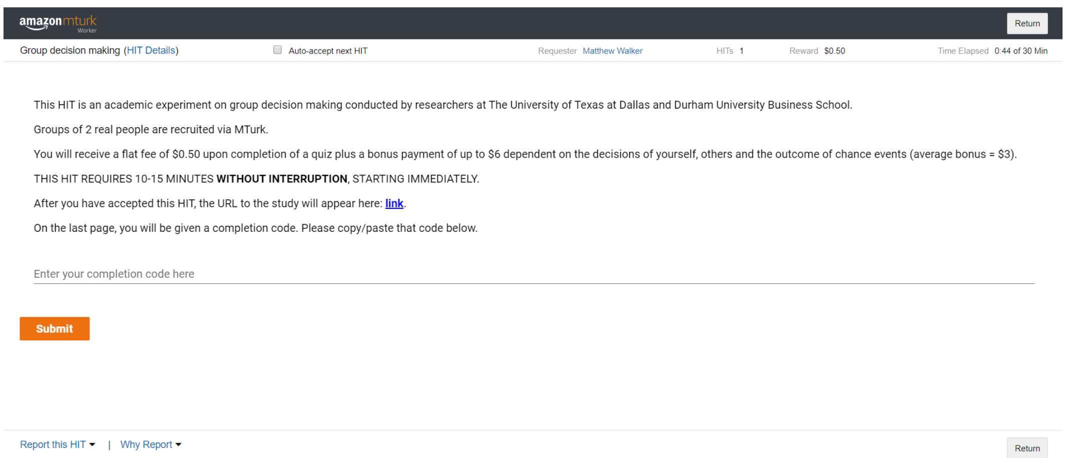


FIGURE S2. AMT RECRUITMENT SCREEN.

In total, 503 recruits successfully completed the experiment. As noted in the main text, 10 of these subjects displayed inconsistent behaviour in either the Risk-SM or Intent-SM treatment and so were excluded from the analysis in accordance with the pre-registration protocol. This left us with a final sample size of 493 subjects across the four treatments.

Non-completes can be classified into one of six categories: failed the Standard or Lottery UG comprehension quiz; opted to leave the study after waiting more than five minutes for a match to arrive (and claim a notional bonus of $0.25 in addition to the participation fee); timed out in one of the tasks; or dropped out for some unobserved reason.

TABLE S.IV —MTURK RECRUITMENT OUTCOMES

	Completes	Non-completes				
Treatment		Fail quiz Standard UG	Fail quiz Lottery UG	Leave after >5 mins wait	Timeout	Dropout
Risk-DR	112	22	12	11	2	32
Risk-SM	94	29	14	11	5	37
Intent-DR	156	33	22	24	5	62
Intent-SM	141	57	45	15	5	83

Note: To obtain the final sample size of 493, exclude 5 completes in the Risk-SM treatment and 5 completes in the Intent-SM treatment who displayed inconsistent behavior, pre-defined as switching from accept to reject, or reject to accept, more than twice in an ordered list of proposals.

Below we summarize characteristics of our sample, based on information elicited from the post-experiment questionnaire. The summary statistics are calculated based on the full sample of 493 consistent completes.

Age: Interval variable. Years.

Mean 36.52, Median 34, Standard deviation 10.62, Minimum 20, Maximum 74

Gender: Categorical variable.

Male 60.21%; Female 38.76%; Other 0.21%; Prefer not to Say 0.82%.

Nationality: Categorical variable:

Central and Eastern Asia 1.63%; Central and Western Africa 0.20%; Central, South America and the Caribbean 1.02%; Europe (excl. UK) 4.07%; Middle East and North Africa 0.20%; North America 91.06%; South-East Asia 1.22%; Southern Asia 0.41%; UK 0.20%.

Employment Status: Categorical variable:

Full-time employed 68.43%; Part-time employed 7.13%; Self-employed 9.16%; Unemployed 9.78%; Retired 1.83%; Student 2.65%; Other 1.02%.

COVID-19 Impact: Categorical variable:

Laid off 5.48%; Pay cut and/or reduction in hours 16.63%; Work from home 39.96%; No impact 35.90%; Positive impact 2.03%.

Risk Index: Based on two questions from Dohmen et al. (2011). Likert scale from 0 “Completely unwilling to take risks” to 10 “Completely willing to take risks”.

1) Are you generally a person who is fully willing to take risks or do you try to avoid taking risks?

Mean 4.51, Median 4, Standard deviation 2.69, Minimum 0, Maximum 10

2) How would you rate your willingness to take risks in financial matters?

Mean 4.26, Median 4, Standard deviation 2.69, Minimum 0, Maximum 10

Competitiveness Index: Based on question from Buser et al. (2020). Likert scale from 0 “Not competitive at all” to 10 “Very competitive”. How competitive do you consider yourself to be?

Mean 5.50, Median 6, Standard deviation 2.70, Minimum 0, Maximum 10

We also conducted a randomization check on age and a dummy for being female. The results are presented in Table S.V. We observe no significant differences between treatments (for age, $p > 0.20$ for all 6 comparisons based on pairwise t-tests with p-values adjusted using Bonferroni correction; for female, $p = 0.756$ based on Pearson's Chi-squared test).

TABLE S.V —TREATMENT RANDOMIZATION CHECK

Treatment	Age	Female
Risk-DR	35.05 (9.86)	0.39 (0.49)
Risk-SM	36.33 (10.34)	0.37 (0.49)
Intent-DR	37.85 (11.18)	0.35 (0.48)
Intent-SM	36.34 (10.70)	0.41 (0.49)

Note: Mean (SD) values in table.

S8. Experimental instructions and decision screens

The experimental instructions and comprehension quiz for each treatment and ultimatum game task are presented in Figures S3 to S8. Each box corresponds to a separate screen. Note the instructions below are for sessions in which the Standard UG was presented first (minor changes for the alternate order are self-evident).

Instructions

This experiment consists of two parts. Below are the instructions for Part 1. You will receive instructions for Part 2 once Part 1 is over. In addition to your flat fee of $0.5, you will be paid your earnings from one of the two parts. Which part you are paid for is chosen by the experimental software at random (with equal chance), after both parts are completed.

On the next screen, you will complete a short quiz to check your understanding of the instructions. You must answer the quiz questions correctly to proceed with the experiment.

Your Task

You will be randomly matched with another participant. You will not know the identity of your match and your match may differ between the two parts of the experiment.

One of you or your match will be the Proposer. The other the Responder. This is determined at random (with equal chance).

Each pair has $6 to split between the Proposer and the Responder.

The **Proposer** must decide how much of the $6 to offer to his/her matched Responder. Proposals can be in increments of $0.1.

The **Responder** will observe the Proposer's offer and either accept or reject this proposal.

- If the Responder **accepts**, then if the Proposer offers $X to the Responder, the Proposer will earn $(6 - X) and the Responder will earn $X.
- If the Responder **rejects**, then both the Proposer and Responder will earn $0.

Please make your decision within the **time limit** shown on your screen.

Please click the button below if you understood the instructions.

I have read and understood the instructions. Continue!

Quiz

You have three attempts to answer the questions below. You may recap the task at the bottom of this page.

Remember that each pair has $6 to divide between the Proposer and the Responder.

Suppose the Proposer offers $4 to the Responder and the Responder accepts the proposal.

1. How much does the Proposer earn (in $)?

2. How much does the Responder earn (in $)?

3. If the Responder had rejected, both Proposer and Responder would have earned $0. Please click to acknowledge.

I acknowledge

Submit

FIGURE S3. EXPERIMENTAL INSTRUCTIONS AND COMPREHENSION QUIZ —RISK-DR AND INTENT-DR (STANDARD UG)

Instructions

Part 1 of this experiment is over. A second and final part will now follow. Below are the instructions for Part 2.

On the next screen, you will complete a short quiz to check your understanding of the instructions. You must answer the quiz questions correctly to proceed with the experiment.

Your Task

You will be randomly matched with another participant. You will not know the identity of your match and your match may differ between the two parts of the experiment.

One of you or your match will be the Proposer. The other the Responder. You will maintain the same role as in Part 1.

Each pair has 100 lottery tickets, numbered from 1, 2, ..., 99, 100, to split between the Proposer and the Responder.

The **Proposer** must decide how many tickets to offer to his/her matched Responder.

If the Proposer offers **x** tickets to his/her matched Responder, then the Responder will have tickets **1, 2, ..., x**, while the Proposer will have tickets **x+1, x+2, ..., 100**.

The **Responder** will observe the Proposer's offer and either accept or reject the proposal.

- If the Responder **accepts**, then the experimental software will randomly draw **(with equal chance)** a number between 1 and 100. The person who has the number drawn by the computer will earn $6, while the other person will earn $0.
- If the Responder **rejects**, then both the Proposer and Responder will earn $0.

Please make your decision within the **time limit** shown on your screen.

Please click the button below if you understood the instructions.

I have read and understood the instructions. Continue!

Quiz

You have three attempts to answer the questions below. You may recap the task at the bottom of this page.

Remember the person who has the winning lottery ticket will earn $6, while the other person will earn $0.

Suppose the Proposer offers 60 lottery tickets to the Responder, the Responder accepts the proposal, and the computer randomly draws a ticket number held by the Responder.

1. How much does the Proposer earn (in $)?

2. How much does the Responder earn (in $)?

3. If the Responder had rejected, both Proposer and Responder would have earned $0. Please click to acknowledge.

I acknowledge

Submit

FIGURE S4. EXPERIMENTAL INSTRUCTIONS AND COMPREHENSION QUIZ —RISK-DR (LOTTERY UG).

Instructions

Part 1 of this experiment is over. A second and final part will now follow. Below are the instructions for Part 2.

On the next screen, you will complete a short quiz to check your understanding of the instructions. You must answer the quiz questions correctly to proceed with the experiment.

Your Task

You will be randomly matched with another participant. You will not know the identity of your match and your match may differ between the two parts of the experiment.

One of you or your match will be the Proposer. The other the Responder. You will maintain the same role as in Part 1.

Each pair has 100 lottery tickets, numbered from 1, 2, ..., 99, 100, to split between the Proposer and the Responder.

The **Proposer** must decide how many tickets to offer to his/her matched Responder.

If the Proposer offers **x** tickets to his/her matched Responder, then the Responder will have tickets **1, 2, ..., x**, while the Proposer will have tickets **x+1, x+2, ..., 100**.

The experimental software will then randomly draw **(with equal chance)** a number between 1 and 100.

The **Responder** will observe the Proposer's offer and who has the ticket number drawn by the computer.

The Responder can either accept or reject the proposal **(knowing what the outcome of the random draw is)**.

- If the Responder **accepts**, then the person with the number drawn by the computer will earn $6; the other person will earn $0.
- If the Responder **rejects**, then both the Proposer and Responder will earn $0.

Please make your decision within the **time limit** shown on your screen.

Please click the button below if you understood the instructions.

I have read and understood the instructions. Continue!

Quiz

You have three attempts to answer the questions below. You may recap the task at the bottom of this page.

Remember the person who has the winning lottery ticket will earn $6, while the other person will earn $0.

Suppose the Proposer offers 60 lottery tickets to the Responder, the computer randomly draws a ticket number held by the Responder, and the Responder accepts the proposal.

1. How much does the Proposer earn (in $)?

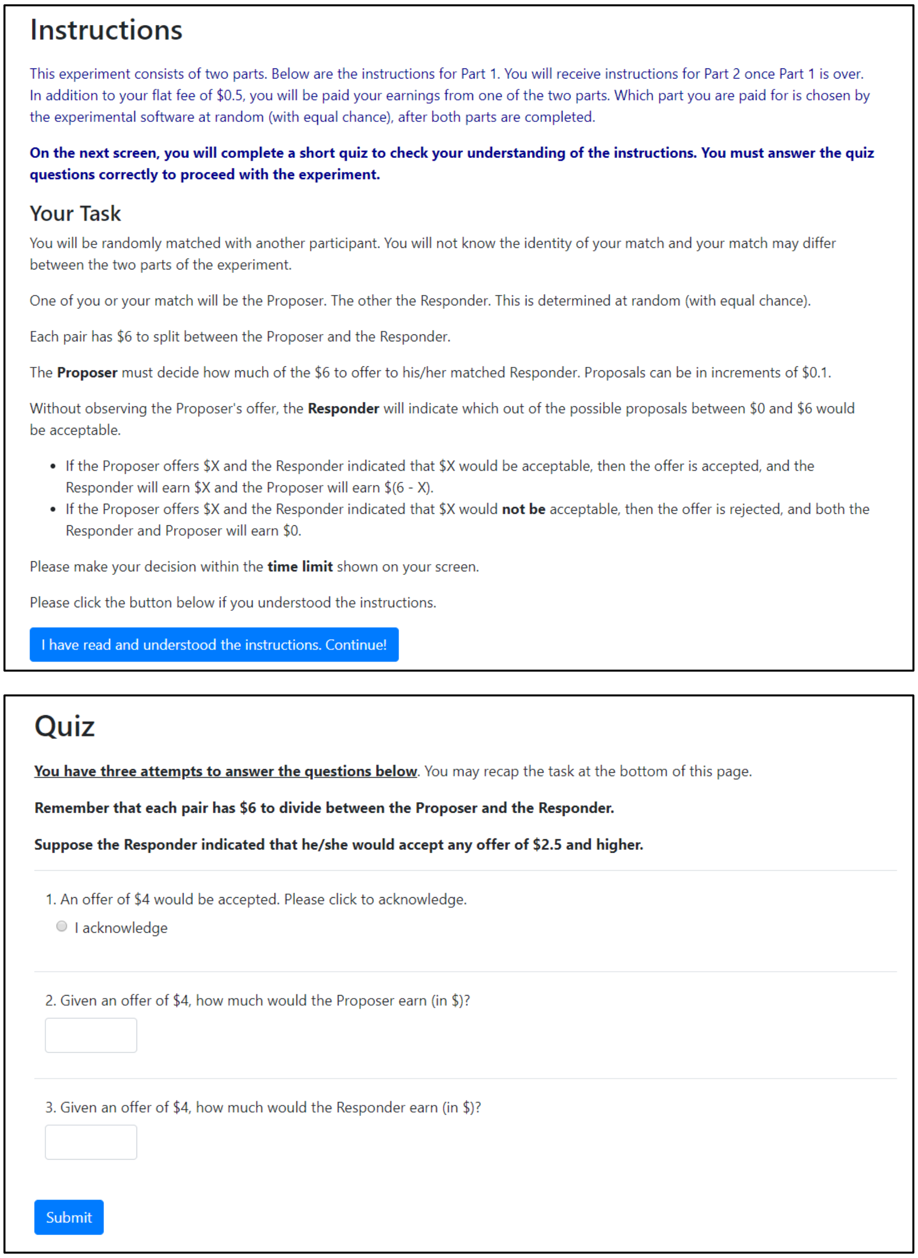
2. How much does the Responder earn (in $)?

3. If the Responder had rejected, both Proposer and Responder would have earned $0. Please click to acknowledge.

I acknowledge

Submit

FIGURE S5. EXPERIMENTAL INSTRUCTIONS AND COMPREHENSION QUIZ —INTENT-DR (LOTTERY UG).



Instructions

This experiment consists of two parts. Below are the instructions for Part 1. You will receive instructions for Part 2 once Part 1 is over. In addition to your flat fee of $0.5, you will be paid your earnings from one of the two parts. Which part you are paid for is chosen by the experimental software at random (with equal chance), after both parts are completed.

On the next screen, you will complete a short quiz to check your understanding of the instructions. You must answer the quiz questions correctly to proceed with the experiment.

Your Task

You will be randomly matched with another participant. You will not know the identity of your match and your match may differ between the two parts of the experiment.

One of you or your match will be the Proposer. The other the Responder. This is determined at random (with equal chance).

Each pair has $6 to split between the Proposer and the Responder.

The **Proposer** must decide how much of the $6 to offer to his/her matched Responder. Proposals can be in increments of $0.1.

Without observing the Proposer's offer, the **Responder** will indicate which out of the possible proposals between $0 and $6 would be acceptable.

- If the Proposer offers $X and the Responder indicated that $X would be acceptable, then the offer is accepted, and the Responder will earn $X and the Proposer will earn $(6 - X).
- If the Proposer offers $X and the Responder indicated that $X would **not be** acceptable, then the offer is rejected, and both the Responder and Proposer will earn $0.

Please make your decision within the **time limit** shown on your screen.

Please click the button below if you understood the instructions.

I have read and understood the instructions. Continue!

Quiz

You have three attempts to answer the questions below. You may recap the task at the bottom of this page.

Remember that each pair has $6 to divide between the Proposer and the Responder.

Suppose the Responder indicated that he/she would accept any offer of $2.5 and higher.

1. An offer of $4 would be accepted. Please click to acknowledge.
   I acknowledge

2. Given an offer of $4, how much would the Proposer earn (in $)?

3. Given an offer of $4, how much would the Responder earn (in $)?

Submit

FIGURE S6. EXPERIMENTAL INSTRUCTIONS AND COMPREHENSION QUIZ —RISK-SM AND INTENT-SM (STANDARD UG).

Instructions

Part 1 of this experiment is over. A second and final part will now follow. Below are the instructions for Part 2.

On the next screen, you will complete a short quiz to check your understanding of the instructions. You must answer the quiz questions correctly to proceed with the experiment.

Your Task

You will be randomly matched with another participant. You will not know the identity of your match and your match may differ between the two parts of the experiment.

One of you or your match will be the Proposer. The other the Responder. You will maintain the same role as in Part 1.

Each pair has 100 lottery tickets, numbered from 1, 2, ..., 99, 100, to split between the Proposer and the Responder.

The **Proposer** must decide how many tickets to offer to his/her matched Responder.

If the Proposer offers **x** tickets to his/her matched Responder, then the Responder will have tickets **1, 2, ..., x**, while the Proposer will have tickets **x+1, x+2, ..., 100**.

Without observing the Proposer's offer, the **Responder** will indicate which out of the possible proposals between 0 and 100 tickets would be acceptable.

- If the Proposer offers X tickets and the Responder indicated that X tickets would be acceptable, then the offer is accepted, and the experimental software will randomly draw **(with equal chance)** a number between 1 and 100. The person who has the ticket number drawn by the computer will earn $6, while the other person will earn $0.
- If the Proposer offers X tickets and the Responder indicated that X tickets would **not be** acceptable, then the offer is rejected, and both the Responder and Proposer will earn $0.

Please make your decision within the **time limit** shown on your screen.

Please click the button below if you understood the instructions.

I have read and understood the instructions. Continue!

Quiz

You have three attempts to answer the questions below. You may recap the task at the bottom of this page.

Remember the person who has the winning lottery ticket will earn $6, while the other person will earn $0.

Suppose the Responder indicated that he/she would accept any offer of 40 lottery tickets and higher.

1. An offer of 60 tickets would be accepted. Please click to acknowledge.

○ I acknowledge

Suppose the computer randomly draws a ticket number held by the Responder.

2. How much would the Proposer earn (in $)?

3. How much would the Responder earn (in $)?

Submit

FIGURE S7. EXPERIMENTAL INSTRUCTIONS AND COMPREHENSION QUIZ —RISK-SM (LOTTERY UG).

Instructions

Part 1 of this experiment is over. A second and final part will now follow. Below are the instructions for Part 2.

On the next screen, you will complete a short quiz to check your understanding of the instructions. You must answer the quiz questions correctly to proceed with the experiment.

Your Task

You will be randomly matched with another participant. You will not know the identity of your match and your match may differ between the two parts of the experiment.

One of you or your match will be the Proposer. The other the Responder. You will maintain the same role as in Part 1.

Each pair has 100 lottery tickets, numbered from 1, 2, ..., 99, 100, to split between the Proposer and the Responder.

The **Proposer** must decide how many tickets to offer to his/her matched Responder.

If the Proposer offers **x** tickets to his/her matched Responder, then the Responder will have tickets **1, 2, ..., x**, while the Proposer will have tickets **x+1, x+2, ..., 100**.

The experimental software will randomly draw **(with equal chance)** a number between 1 and 100.

The **Responder** will observe the Proposer's offer before the random draw takes place and be asked to indicate whether the offer would be acceptable for two possible outcomes:

1. The *Responder is revealed to have the lottery ticket drawn* by the computer.
2. The *Proposer is revealed to have the lottery ticket drawn* by the computer.

The person with the lottery ticket drawn by the computer will earn $6 and the other person will earn $0, but only if the Responder indicated the offer be **accepted** for the realized outcome.

If the Responder indicated the offer be **rejected** for the realized outcome, then both the Proposer and Responder earn $0.

Please make your decision within the **time limit** shown on your screen.

Please click the button below if you understood the instructions.

I have read and understood the instructions. Continue!

Quiz

You have three attempts to answer the questions below. You may recap the task at the bottom of this page.

Remember the person who has the winning lottery ticket would earn $6, while the other person would earn $0.

Suppose the Proposer offers 60 lottery tickets to the Responder, the computer randomly draws a ticket number held by the Responder, and the Responder indicated that he/she would accept the offer for this outcome.

1. How much does the Proposer earn (in $)?

2. How much does the Responder earn (in $)?

3. If the computer had randomly drawn a ticket number held by the Proposer, and the Responder had indicated that he/she would reject the offer for this outcome, both Proposer and Responder would have earned $0. Please acknowledge.

○ I acknowledge

Submit

FIGURE S8. EXPERIMENTAL INSTRUCTIONS AND COMPREHENSION QUIZ —INTENT-SM (LOTTERY UG).

Example decision screens for the proposer and responder in each treatment and task are presented in Figures S9 to S14.

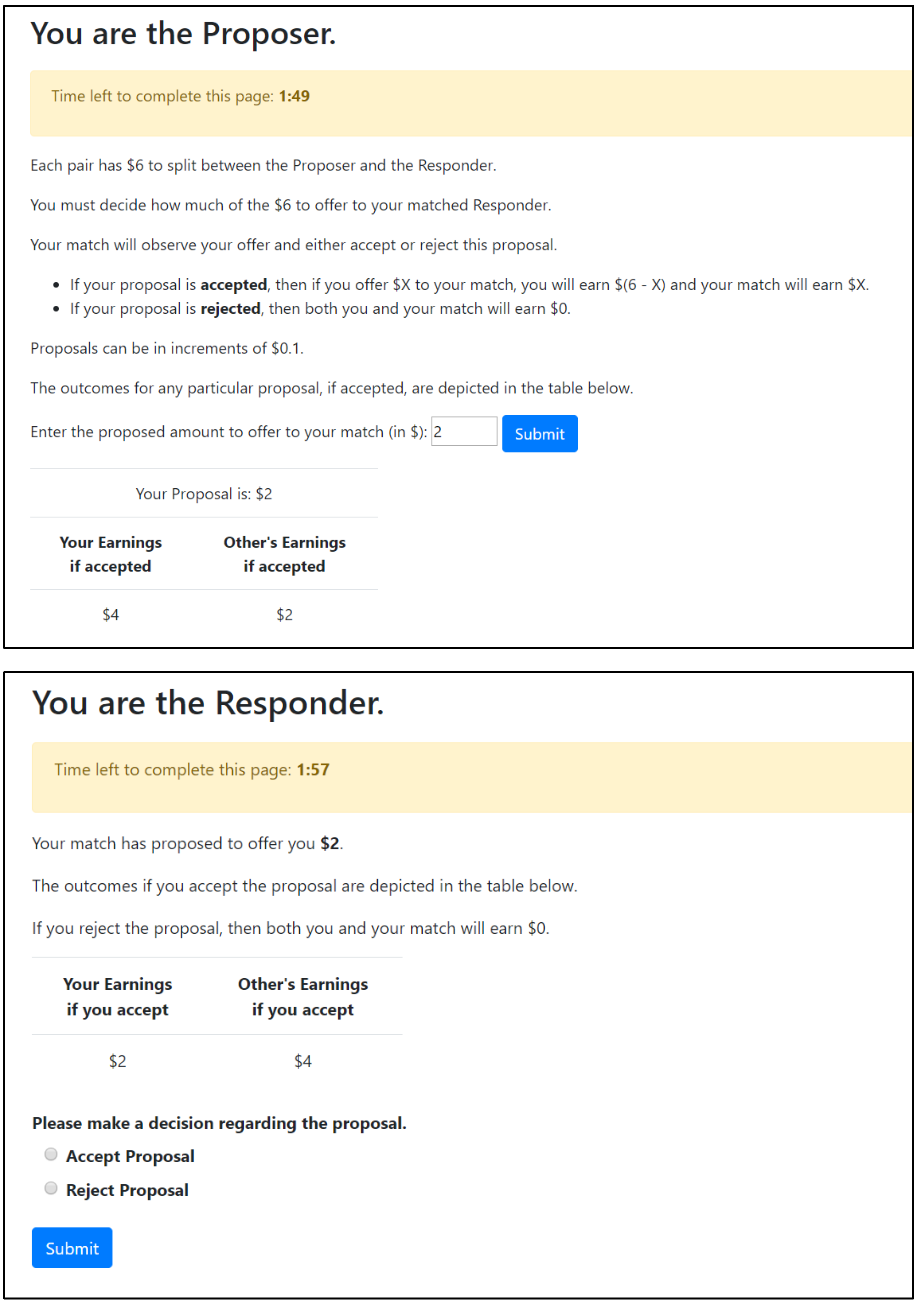


FIGURE S9. DECISION SCREENS —RISK-DR AND INTENT-DR (STANDARD UG).

You are the Proposer.

Time left to complete this page: **0:21**

Each pair has 100 lottery tickets, numbered from 1, 2, ..., 99, 100, to split between the Proposer and the Responder.

You must decide how many tickets to offer to your matched Responder.

If you offer **x** tickets, then he/she will have tickets **1, 2, ..., x**, while you will have tickets **x+1, x+2, ..., 100**.

Your match will observe your offer and either accept or reject this proposal.

- If your proposal is **accepted**, then the experimental software will randomly draw **(with equal chance)** a number between 1 and 100. The person who has the number drawn by the computer will earn $6, while the other person will earn $0.
- If your proposal is **rejected**, then both you and your match will earn $0.

The possible outcomes and their likelihoods (for any particular proposal) are depicted in the table below.

Enter the proposed number of tickets to offer your match: 20 Submit

Your Proposal is: 20

Likelihood of Each Possible Outcome

		Other's Earnings if accepted	
		$6	**$0**
Your Earnings if accepted	**$6**	0%	80%
	$0	20%	0%

You are the Responder.

Time left to complete this page: **1:56**

Your match has proposed to offer you **20** tickets.

Thus, you have tickets **1, 2, ..., 20** and your match has tickets **21, 22, ..., 100**.

If you accept the proposal, then the experimental software will randomly draw **(with equal chance)** a number between 1 and 100. The person who has the ticket number drawn by the computer will earn $6, while the other person will earn $0.

If you reject the proposal, then both you and your match will earn $0.

The possible outcomes, if you accept the proposal, and their likelihoods are depicted in the table below.

Likelihood of Each Possible Outcome

		Other's Earnings if you accept	
		$6	**$0**
Your Earnings if you accept	**$6**	0%	20%
	$0	80%	0%

Please make a decision regarding the proposal.

- **Accept Proposal**
- **Reject Proposal**

Submit

FIGURE S10. DECISION SCREENS —RISK-DR (LOTTERY UG).

You are the Proposer.

Time left to complete this page: **1:48**

Each pair has 100 lottery tickets, numbered from 1, 2, ..., 99, 100, to split between the Proposer and the Responder.

You must decide how many tickets to offer to your matched Responder.

If you offer **x** tickets, then he/she will have tickets **1, 2, ..., x**, while you will have tickets **x+1, x+2, ..., 100**.

The experimental software will then randomly draw **(with equal chance)** a number between 1 and 100.

Your match will observe your offer and who has the ticket number drawn by the computer

Your match can either accept or reject your proposal **(knowing what the outcome of the random draw is)**.

- If your proposal is **accepted**, the person with the number drawn by the computer will earn $6; the other person will earn $0.
- If your proposal is **rejected**, both you and your match will earn $0.

The possible outcomes and their likelihoods (for any particular proposal) are depicted in the table below.

Enter the proposed number of tickets to offer your match: 20 Submit

Your Proposal is: 20

Likelihood of Each Possible Outcome

		Other's Earnings if accepted	
		$6	**$0**
Your Earnings if accepted	**$6**	0%	80%
	$0	20%	0%

You are the Responder.

Time left to complete this page: **1:56**

Your match has proposed to offer you **20** tickets.

Thus, you have tickets **1, 2, ..., 20** and your match has tickets **21, 22, ..., 100**.

The experimental software randomly drew (with equal chance) the following number: **44**

Your match has this ticket number.

The outcomes if you accept the proposal are depicted in the table below.

If you reject the proposal, then both you and your match will earn $0.

Your Earnings if accept	**Other's Earnings if accept**
$0	$6

Please make a decision regarding the proposal.

- **Accept Proposal**
- **Reject Proposal**

Submit

FIGURE S11. DECISION SCREENS —INTENT-DR (LOTTERY UG).

You are the Proposer.

Time left to complete this page: **0:07**

Each pair has $6 to split between the Proposer and the Responder.

You must decide how much of the $6 to offer to your matched Responder.

Without observing your offer, your match will indicate which out of the possible proposals between $0 and $6 is acceptable.

- If you offer $X and your match indicated that $X would be acceptable, then the offer is accepted, and your match will earn $X and you will earn $(6 - X).
- If you offer $X and your match indicated that $X would **not be** acceptable, then the offer is rejected, and both you and your match will earn $0.

Proposals can be in increments of $0.1.

The outcomes for any particular proposal, if accepted, are depicted in the table below.

Enter the proposed amount to offer to your match (in $): 2 Submit

Your Proposal is: $2	
Your Earnings if accepted	**Other's Earnings if accepted**
$4	$2

You are the Responder.

Time left to complete this page: **1:43**

Your match is deciding how much of the $6 to offer to you.

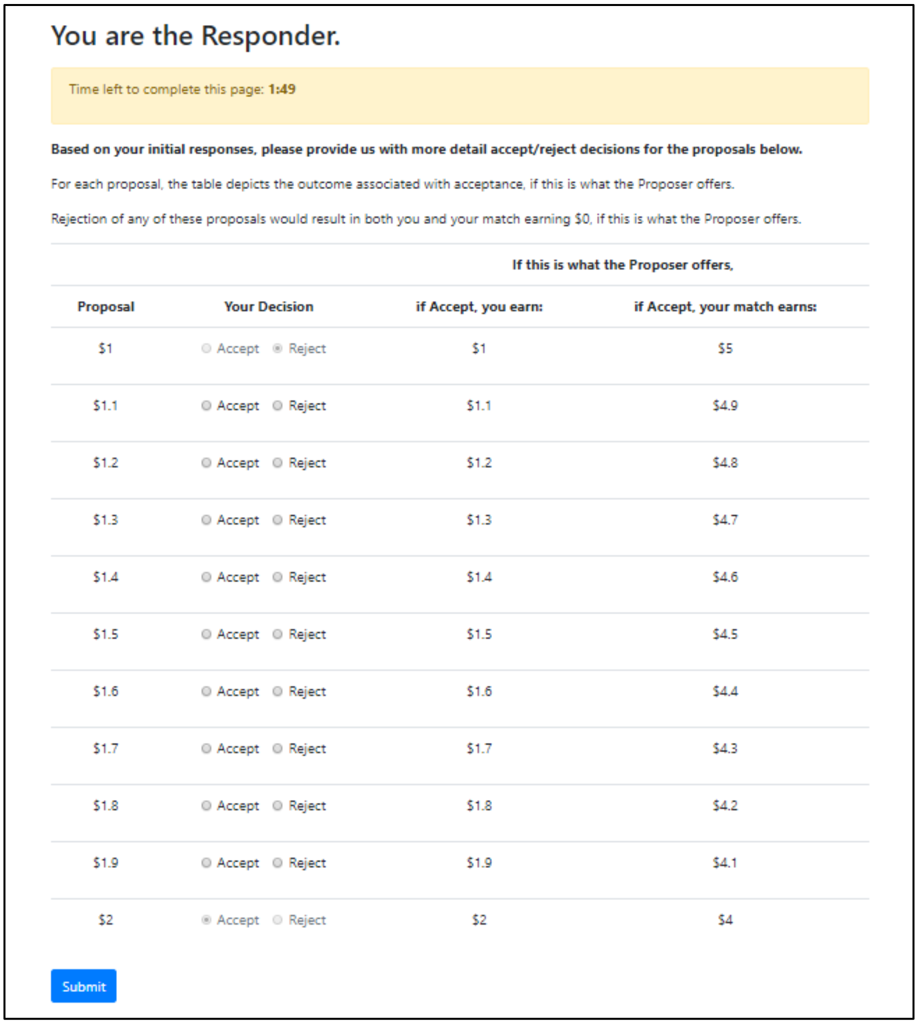
Please indicate which out of the proposals below you would accept or reject.

For each proposal, the table depicts the outcome associated with acceptance, if this is what the Proposer offers.

Rejection of any of these proposals would result in both you and your match earning $0, if this is what the Proposer offers.

		If this is what the Proposer offers,	
Proposal	**Your Decision**	**if Accept, you earn:**	**if Accept, your match earns:**
$0	Accept Reject	$0	$6
$1	Accept Reject	$1	$5
$2	Accept Reject	$2	$4
$3	Accept Reject	$3	$3
$4	Accept Reject	$4	$2
$5	Accept Reject	$5	$1
$6	Accept Reject	$6	$0

Submit



You are the Responder.

Time left to complete this page: **1:49**

Based on your initial responses, please provide us with more detail accept/reject decisions for the proposals below.

For each proposal, the table depicts the outcome associated with acceptance, if this is what the Proposer offers.

Rejection of any of these proposals would result in both you and your match earning $0, if this is what the Proposer offers.

		If this is what the Proposer offers,	
Proposal	**Your Decision**	**if Accept, you earn:**	**if Accept, your match earns:**
$1	Accept Reject	$1	$5
$1.1	Accept Reject	$1.1	$4.9
$1.2	Accept Reject	$1.2	$4.8
$1.3	Accept Reject	$1.3	$4.7
$1.4	Accept Reject	$1.4	$4.6
$1.5	Accept Reject	$1.5	$4.5
$1.6	Accept Reject	$1.6	$4.4
$1.7	Accept Reject	$1.7	$4.3
$1.8	Accept Reject	$1.8	$4.2
$1.9	Accept Reject	$1.9	$4.1
$2	Accept Reject	$2	$4

Submit

FIGURE S12. DECISION SCREENS —RISK-SM AND INTENT-SM (STANDARD UG).

You are the Proposer.

Time left to complete this page: **1:19**

Each pair has 100 lottery tickets, numbered from 1, 2, ..., 99, 100, to split between the Proposer and the Responder.

You must decide how many tickets to offer to your matched Responder.

If you offer **x** tickets, then he/she will have tickets **1, 2, ..., x**, while you will have tickets **x+1, x+2, ..., 100**.

Without observing your offer, your match will indicate which out of the possible proposals between 0 and 100 tickets would be acceptable.

- If you offer X tickets and your match indicated that X tickets would be acceptable, then the offer is accepted, and the experimental software will randomly draw **(with equal chance)** a number between 1 and 100. The person who has the ticket number drawn by the computer will earn $6, while the other person will earn $0.
- If you offer X tickets and your match indicated that X tickets would **not be** acceptable, then the offer is rejected, and both you and your match will earn $0.

The possible outcomes and their likelihoods (for any particular proposal) are depicted in the table below.

Enter the proposed number of tickets to offer your match: 20 Submit

Your Proposal is: 20

Likelihood of Each Possible Outcome

		Other's Earnings if accepted	
		$6	**$0**
Your Earnings if accepted	**$6**	0%	80%
	$0	20%	0%

You are the Responder.

Time left to complete this page: **0:48**

Your match is deciding how many lottery tickets to offer you.

Please indicate which out of the proposals below you would accept or reject.

The possible outcomes and their likelihoods, if you accept the proposal and this is what the Proposer offers, are depicted below.

Rejection of any of these proposals would result in both you and your match earning $0, if this is what the Proposer offers.

		If this is what the Proposer offers,	
Proposal	**Your Decision**	**if Accept, you earn:**	**if Accept, your match earns:**
0	○ Accept ◉ Reject	$0 for sure	$6 for sure
10	○ Accept ◉ Reject	$0 with 90% chance $6 with 10% chance	$6 with 90% chance $0 with 10% chance
20	○ Accept ◉ Reject	$0 with 80% chance $6 with 20% chance	$6 with 80% chance $0 with 20% chance
30	○ Accept ◉ Reject	$0 with 70% chance $6 with 30% chance	$6 with 70% chance $0 with 30% chance
40	◉ Accept ○ Reject	$0 with 60% chance $6 with 40% chance	$6 with 60% chance $0 with 40% chance
50	◉ Accept ○ Reject	$0 with 50% chance $6 with 50% chance	$6 with 50% chance $0 with 50% chance
60	◉ Accept ○ Reject	$0 with 40% chance $6 with 60% chance	$6 with 40% chance $0 with 60% chance
70	◉ Accept ○ Reject	$0 with 30% chance $6 with 70% chance	$6 with 30% chance $0 with 70% chance
80	◉ Accept ○ Reject	$0 with 20% chance $6 with 80% chance	$6 with 20% chance $0 with 80% chance
90	◉ Accept ○ Reject	$0 with 10% chance $6 with 90% chance	$6 with 10% chance $0 with 90% chance
100	◉ Accept ○ Reject	$6 for sure	$0 for sure

Submit

You are the Responder.

Time left to complete this page: **1:22**

Based on your initial responses, please provide us with more detail accept/reject decisions for the proposals below.

The possible outcomes and their likelihoods, if you accept the proposal and this is what the Proposer offers, are depicted below.

Rejection of any of these proposals would result in both you and your match earning $0, if this is what the Proposer offers.

		If this is what the Proposer offers,	
Proposal	**Your Decision**	**if Accept, you earn:**	**if Accept, your match earns:**
30	○ Accept ◉ Reject	$0 with 70% chance $6 with 30% chance	$6 with 70% chance $0 with 30% chance
31	○ Accept ○ Reject	$0 with 69% chance $6 with 31% chance	$6 with 69% chance $0 with 31% chance
32	○ Accept ○ Reject	$0 with 68% chance $6 with 32% chance	$6 with 68% chance $0 with 32% chance
33	○ Accept ○ Reject	$0 with 67% chance $6 with 33% chance	$6 with 67% chance $0 with 33% chance
34	○ Accept ○ Reject	$0 with 66% chance $6 with 34% chance	$6 with 66% chance $0 with 34% chance
35	○ Accept ○ Reject	$0 with 65% chance $6 with 35% chance	$6 with 65% chance $0 with 35% chance
36	○ Accept ○ Reject	$0 with 64% chance $6 with 36% chance	$6 with 64% chance $0 with 36% chance
37	○ Accept ○ Reject	$0 with 63% chance $6 with 37% chance	$6 with 63% chance $0 with 37% chance
38	○ Accept ○ Reject	$0 with 62% chance $6 with 38% chance	$6 with 62% chance $0 with 38% chance
39	○ Accept ○ Reject	$0 with 61% chance $6 with 39% chance	$6 with 61% chance $0 with 39% chance
40	◉ Accept ○ Reject	$0 with 60% chance $6 with 40% chance	$6 with 60% chance $0 with 40% chance

Submit

FIGURE S13. DECISION SCREENS —RISK-SM (LOTTERY UG).

You are the Proposer.

Time left to complete this page: **1:26**

Each pair has 100 lottery tickets, numbered from 1, 2, ..., 99, 100, to split between the Proposer and the Responder.

You must decide how many tickets to offer to your matched Responder.

If you offer **x** tickets, then he/she will have tickets **1, 2, ..., x**, while you will have tickets **x+1, x+2, ..., 100**.

The experimental software will randomly draw **(with equal chance)** a number between 1 and 100.

Your match will observe your offer before the random draw takes place and be asked to indicate whether the offer would be acceptable for two possible outcomes:

1. **Your match** is revealed to have the lottery ticket drawn by the computer.
2. **You** are revealed to have the lottery ticket drawn by the computer.

The person with the lottery ticket drawn by the computer will earn $6 and the other person will earn $0, but only if your match indicated the offer be **accepted** for the realized outcome.

If your match indicated the offer be **rejected** for the realized outcome, then both you and your match earn $0.

The possible outcomes and their likelihoods (for any particular proposal) are depicted in the table below.

Enter the proposed number of tickets to offer your match: 33 Submit

Your Proposal is: 33

Likelihood of Each Possible Outcome

		Other's Earnings if accepted	
		$6	**$0**
Your Earnings if accepted	**$6**	0%	67%
	$0	33%	0%

You are the Responder.

Time left to complete this page: **1:43**

Your match has proposed to offer you **33** tickets.

Thus, you have tickets **1, 2, ..., 33** and your match has tickets **34, 35, ..., 100**.

The experimental software will randomly draw (with equal chance) a number between 1 and 100.

Based on your match's offer, there is a 33% chance that the computer will draw one of YOUR lottery tickets and a 67% chance that the computer will draw one of YOUR MATCH'S lottery tickets

The person with the lottery ticket drawn by the computer will earn $6 and the other person will earn $0, but only if you indicate the offer be **accepted** for the realized outcome.

If you indicate the offer be **rejected** for the realized outcome, then both you and your match earn $0.

Please now indicate whether the offer is acceptable for two possible outcomes:

1. If it is revealed that the computer draws one of YOUR lottery tickets (if accept: you earn $6, your match earns $0):
   - ○ Accept Proposal
   - ○ Reject Proposal

2. If it is revealed that the computer draws one of YOUR MATCH'S lottery tickets (if accept: you earn $0, your match earns $6).
   - ○ Accept Proposal
   - ○ Reject Proposal

Submit

FIGURE S14. DECISION SCREENS —INTENT-SM (LOTTERY UG).

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