Online Appendix for
“Contracting under Asymmetric Information and Externalities: An Experimental Study”

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A.1 Proof of Proposition 1

Part (i) has already been shown in the analysis preceding Proposition 1. Now consider part (ii), where $-v_L < w < -v_L/(1-p)$ holds. In order to characterize the best attainable outcome, consider a (fictitious) benevolent mechanism designer who wants to maximize the expected total surplus. The designer must find a mechanism q_H, t_H, q_L, t_L that maximizes

$$pq_H(v_H + w) + (1-p)q_L(v_L + w)$$

subject to the constraints

$$q_H v_H + t_H \geq q_L v_H + t_L, \qquad (IC_H)$$
$$q_L v_L + t_L \geq q_H v_L + t_H, \qquad (IC_L)$$
$$q_H v_H + t_H \geq v_H, \qquad (PC_H^A)$$
$$q_L v_L + t_L \geq 0, \qquad (PC_L^A)$$
$$p(q_H w - t_H) + (1-p)(q_L w - t_L) \geq pw. \qquad (PC^B)$$

Observe that the constraints (IC_L) and (IC_H) imply the monotonicity constraint $q_H \geq q_L$, because $v_H > v_L$ holds by assumption. We first solve a relaxed problem in which the constraints (IC_L) and (PC_H^A) are ignored. It will turn out that the solution to the relaxed problem satisfies the omitted constraints, so it is also the solution to the original problem.

Note that in the solution to the relaxed problem $q_H = 1$ must hold, since $v_H + w > 0$. Moreover, note that constraint (PC_L^A) must be binding in the solution (otherwise we could decrease t_L and thereby relax the remaining two constraints), so $t_L = -q_L v_L$. Constraint (IC_H) must also be binding, since otherwise we could decrease t_H and relax constraint (PC^B). Hence, $t_H = q_L(v_H - v_L) - v_H$. Since $v_L + w > 0$, we want to make q_L as large as possible, so also (PC^B) will be binding and hence

$$q_L = \frac{pv_H}{pv_H - v_L - (1-p)w}.$$

It is straightforward to check that the solution indeed satisfies the omitted constraints (IC_L) and (PC_H^A). □

A.2 Estimation strategy and regressions

A.2.1 Estimation strategy

The key variable of interest is the implementation decision. To gain a deeper understanding about the underlying mechanisms, we also analyze the offers, the reaction to specific offers, and the resulting payoffs. In the free-form treatments, we investigate chat content and the offers from both players.

We use a mixture of non-parametric tests and regression models that allow us to control for potential mitigating factors. Note that all non-parametric tests are based on matching group averages instead of individual observations to ensure the independence of the observations. We apply Kruskal-Wallice equal population rank tests and Dunn's tests with a Benjamini-Hochberg adjustment to test for treatment differences. We apply Wilcoxon matched-pairs signed-rank tests to compare differences within treatments.

We apply random-effects logit regressions with the implementation decision as the dependent variable to control for potential mitigating factors in the bad state. Given the low variance in the implementation decision in the good state, a regression analysis is only feasible in the bad state. The robust standard errors are clustered on session levels and we use a series of regressions where we stepwise introduce controls. We start our analysis with the full sample and introduce two dummy variables and an interaction term to control for the impact of the bargaining procedure and the size of the externality (cf. Table 4). The variable "Large extern." is one if a subject participated in the UG-24 or the FF-24 treatment and zero otherwise. The variable "Free-form (FF)" is one if subjects participated in the FF-14 or the FF-24 treatment and zero otherwise. By introducing the interaction between both, we obtain a fully saturated model allowing us to compute all treatment comparisons. We then add controls for demographic information (gender and age) and information on the matching group and the round. Next, we insert controls for prosocial preferences, risk attitude, reciprocity, or honesty-humility in the regressions. Note that if we control for individual and social preferences, we cannot include all of them in one model due to a significant correlation between the measures.[1]

In a second step, we need to split the dataset into UG-treatments and FF-treatments to add controls for the offers and the chat content. We introduce the variable "Offer > 9" which is one if the respective binding offer is strictly higher than 9 and zero otherwise. In addition, in the FF-treatments we add controls for the number of offers by each player. As a robustness check, we also report the results of the regressions if we treat the offer as a linear variable in the Supplementary Material in Tables S2 and S4.

In addition to analyzing the key variable of interest, the implementation decision,

[1]See Section S1 in the Supplementary Material for further details.

we also study the impact of the treatments on the offers made. We use a series of random-effects tobit regressions and report the results in Tables A3, A5, and A6. Whereas only player B can submit an offer in the UG-treatments, both players can submit their offers in the FF-treatments. In the FF-treatments we use the final offer as the dependent variable and control for the state because it might be revealed to both players. In addition, we add the aforementioned controls for individual or social preferences and demographics. Given that not all players submitted offers, this reduces the number of observations. For the analysis of the chat content, please refer to Section A.3.

A.2.2 Non-parametric tests and regressions

	UG-14 vs. UG-24	FF-14 vs. FF-24	UG-14 vs. FF-14	UG-24 vs. FF-24	KW test
Implem. frequ.					
bad state	0.045	0.125	0.026	0.077	0.003
good state	0.387	0.389	0.280	0.341	0.397
Agreem. frequ.					
bad state	0.042	0.1307	0.026	0.086	0.004
good state	0.084	0.303	0.343	0.100	0.079
Payoff player A					
bad state	0.037	0.056	0.041	0.032	0.001
good state	0.002	0.041	0.109	0.437	0.001
Payoff player B					
bad state	0.003	0.025	0.131	0.354	0.001
good state	0.082	0.002	0.073	0.457	0.002

Table A1. p-values for treatment comparisons on matching group averages (two-tailed Kruskal-Wallice tests followed by Dunn's tests with a Benjamini-Hochberg adjustment).

	(1)	(2)	(3)	(4)	(5)
Large extern. (UG-24)	2.904***	−0.356	−0.474	−0.512	−0.377
	(0.393)	(1.064)	(1.069)	(1.110)	(1.013)
Offer > 9		6.487***	6.555***	6.504***	6.488***
		(1.116)	(1.117)	(1.171)	(1.013)
Prosocial (SVO)			0.999***		
			(0.358)		
Risk attitude			−0.087	−0.126	
			(0.137)	(0.107)	
Pos. reciprocity				0.339	
				(0.347)	
Neg. reciprocity				0.303	
				(0.240)	
Honesty-Humility					0.559
					(0.632)
Female		−0.585	−0.600	−0.761	−0.786
		(0.983)	(0.943)	(0.968)	(0.825)
Age		0.021	0.018	0.0242	0.017
		(0.026)	(0.024)	(0.031)	(0.027)
Round		0.044	0.040	0.052	0.048
		(0.068)	(0.069)	(0.069)	(0.065)
Matching group		−0.001**	−0.001***	−0.001**	−0.001**
		(0.0004)	(0.0003)	(0.0004)	(0.0004)
Constant	−2.805***	−5.012***	−4.970***	−4.333***	−6.716***
	(0.380)	(1.073)	(1.200)	(1.342)	(2.505)
Observations	320	320	320	320	320
log pseudolikelihood	−154.207	−97.490	−95.952	−96.357	−96.972

Robust standard errors clustered on sessions in parentheses,
*** p<0.01, ** p<0.05, * p<0.1

Table A2. Random-effects logit regression with the implementation decision as the dependent variable for the ultimatum game treatments in the bad state. Note that player B's offer can vary between 0 and 14 in UG-14 and between 0 and 24 in UG-24, so this variable has to be interpreted with caution.

	(1)	(2)	(3)	(4)	(5)
Large extern. (UG-24)	8.120***	8.360***	8.307***	8.169***	8.557***
	(0.813)	(0.821)	(0.820)	(0.821)	(0.820)
Prosocial (SVO)			1.019		
			(0.872)		
Risk attitude			−0.265	−0.263	
			(0.189)	(0.191)	
Pos. reciprocity				0.167	
				(0.406)	
Neg. reciprocity				0.045	
				(0.413)	
Honesty-Humility					1.134
					(0.727)
Female		0.485	0.223	0.164	0.237
		(0.883)	(0.913)	(0.926)	(0.884)
Age		−0.0263	−0.021	−0.029	−0.035
		(0.0586)	(0.058)	(0.059)	(0.058)
Round		0.105**	0.105**	0.105**	0.105**
		(0.0517)	(0.052)	(0.052)	(0.052)
Matching group		−0.00132	−0.001	−0.001	−0.001
		(0.00103)	(0.001)	(0.001)	(0.001)
Constant	1.668***	2.416	3.235	4.209**	−1.186
	(0.583)	(1.578)	(2.068)	(2.012)	(2.791)
Observations	640	640	640	640	640
# left censored obs.	135	135	135	135	135
log likelihood	−1417.814	−1414.644	−1412.960	−1413.554	−1413.442

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table A3. Random-effects tobit regression with the offer of player B as the dependent variable for the ultimatum game treatments.

	(1)	(2)	(3)	(4)	(5)
Large extern. (FF-24)	0.598**	−0.467	−0.520	−0.484	−0.295
	(0.304)	(0.839)	(0.795)	(0.835)	(0.684)
Offer player B > 9		3.171***	3.110***	3.103***	2.915***
		(0.398)	(0.359)	(0.443)	(0.280)
Offer player A > 9		–	–	–	–
# offer player B		−0.422***	−0.416***	−0.423***	−0.405**
		(0.156)	(0.158)	(0.109)	(0.203)
# offer player A		−0.248	−0.266	−0.252	−0.198
		(0.379)	(0.362)	(0.357)	(0.364)
Prosocial (SVO)			0.024		
			(0.245)		
Risk attitude			−0.157	−0.153	
			(0.146)	(0.133)	
Pos. reciprocity				−0.110	
				(0.129)	
Neg. reciprocity				0.094	
				(0.345)	
Honesty-Humility					−1.268***
					(0.275)
Female		−0.377	−0.665	−0.606	−0.068
		(0.494)	(0.627)	(0.771)	(0.484)
Age		0.106*	0.101*	0.105*	0.111**
		(0.060)	(0.058)	(0.057)	(0.049)
Round		0.004	0.001	−0.001	0.039
		(0.096)	(0.095)	(0.101)	(0.098)
Matching group		−0.0004	−0.0004	−0.0004	−0.0004
		(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.235	−1.989	−0.823	−0.984	1.916
	(0.282)	(1.231)	(1.112)	(1.399)	(1.533)
Observations	320	179	179	179	179
log likelihood	−208.436	−91.317	−90.650	−90.450	−87.528

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table A4. Random-effects logit regression with the implementation decision of player A as the dependent variable for the free-form bargaining treatments in the bad state. Note that not all players made offers, which reduces the number of observations. The "Offer player A > 9" has been dropped due to collinearity. The offer can vary between 0 and 14 in FF-14 and between 0 and 24 in FF-24, so the offer variables have to be interpreted with caution.

	(1)	(2)	(3)	(4)	(5)
Large extern. (FF-24)	5.069***	4.823***	4.965***	5.016***	4.921***
	(0.520)	(0.486)	(0.498)	(0.484)	(0.501)
Good state		−2.761***	−2.758***	−2.765***	−2.759***
		(0.335)	(0.335)	(0.335)	(0.335)
# offer player B		0.185	0.165	0.165	0.182
		(0.222)	(0.221)	(0.221)	(0.222)
# offer player A		−0.201	−0.189	−0.187	−0.202
		(0.195)	(0.195)	(0.195)	(0.195)
Prosocial (SVO)			−0.096		
			(0.496)		
Risk attitude			−0.200**	−0.194*	
			(0.099)	(0.100)	
Pos. reciprocity				0.115	
				(0.235)	
Neg. reciprocity				−0.007	
				(0.251)	
Honesty-Humility					0.334
					(0.431)
Female		0.488	0.298	0.332	0.436
		(0.491)	(0.485)	(0.492)	(0.494)
Age		0.0738	0.071	0.066	0.070
		(0.062)	(0.060)	(0.061)	(0.062)
Round		−0.058	−0.062	−0.063	−0.059
		(0.068)	(0.068)	(0.068)	(0.068)
Matching group		0.001	0.001	0.001	0.001
		(0.001)	(0.001)	(0.001)	(0.001)
Constant	7.459***	7.006***	8.247***	8.227***	5.921***
	(0.381)	(1.589)	(1.672)	(1.668)	(2.117)
Observations	346	346	346	346	346
# left censored obs.	5	5	5	5	5
log likelihood	−911.136	−874.515	−872.579	−872.473	−874.214

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table A5. Random-effects tobit regression with the final offer of player B as the dependent variable for the free-form bargaining treatments. Note that not all players made offers, which reduces the number of observations. The demographic control variables are from player B.

	(1)	(2)	(3)	(4)	(5)
Large extern. (FF-24)	3.620***	3.931***	3.936***	3.917***	3.932***
	(0.463)	(0.424)	(0.420)	(0.424)	(0.424)
Good state		−2.863***	−2.884***	−2.875***	−2.868***
		(0.279)	(0.277)	(0.279)	(0.278)
# offer player B		−0.140	−0.149	−0.144	−0.147
		(0.164)	(0.162)	(0.164)	(0.163)
# offer player A		−0.423*	−0.428**	−0.420*	−0.420*
		(0.219)	(0.218)	(0.220)	(0.219)
Prosocial (SVO)			−0.861*		
			(0.461)		
Risk attitude			−0.046	−0.099	
			(0.104)	(0.106)	
Pos. reciprocity				0.097	
				(0.176)	
Neg. reciprocity				0.080	
				(0.245)	
Honesty-Humility					−0.358
					(0.400)
Female		−0.426	−0.391	−0.537	−0.383
		(0.468)	(0.496)	(0.493)	(0.469)
Age		−0.035	−0.030	−0.035	−0.032
		(0.050)	(0.049)	(0.050)	(0.050)
Round		0.050	0.048	0.051	0.050
		(0.057)	(0.057)	(0.057)	(0.057)
Matching group		−0.001	−0.001	−0.001	−0.001
		(0.001)	(0.001)	(0.001)	(0.001)
Constant	10.40***	13.43***	14.37***	13.99***	14.56***
	(0.320)	(1.303)	(1.466)	(1.480)	(1.810)
Observations	267	267	267	267	267
# left censored obs.	0	0	0	0	0
log likelihood	−644.131	−597.802	−595.728	−597.257	−597.399

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table A6. Random-effects tobit regression with the final offer of player A as the dependent variable for the free-form bargaining treatments. Note that not all players made offers, which reduces the number of observations. The demographic control variables are from player A.

A.3 Analysis of the text messages

The text messages were categorized by two research assistants.[2] Both coders read the experimental instructions and received short descriptions of the categories displayed in Table A7. The coders also had the opportunity to ask clarifying questions during the coding process. The results are shown in Table A8.

In FF-14, player A truthfully reveals the bad state in 89% of the cases. In the good state, player A reveals the true state in only 34% of the cases, whereas player A lies and claims that the state is bad in 44% of the cases. In FF-24, the bad state is truthfully revealed by the A-players in 84% of the cases. In the good state, the true state is revealed in only 23% of the cases, whereas in 50% of the cases the A-players claim that the state is bad. Thus, in the good state A-players often try to convince the B-player via the chat that the state is bad, which corresponds to the high opening offers made by A-players. In FF-24, more B-players felt the need to explicitly ask about the state than in FF-14.[3]

During the negotiations, both players frequently make offers in the text messages or suggest how the total surplus should be divided. Player B suggests splitting the revenue equally for a given state very rarely, with the exception of FF-14 assuming a good state (14% of the cases). In both treatments, player A suggests splitting the revenue equally assuming a good state in less than 17% of the cases in which the state is actually good. In contrast, A-players demand an equal split assuming a bad state in approximately half of the cases if the true state is bad, but also in 26% of the cases in FF-14 and 21% of the cases in FF-24 if the state is actually good.

The chat analysis also reveals that A-players are more active in suggesting numerical offers via the text messages. Interestingly, A-players mention trust and honesty in approximately 40% of the cases in both treatments if the state is bad, but only in 19% of the cases in FF-14 and in 14% of the cases in FF-24 if the state is actually good. The lower share of honesty-related messages in the good state indicates some social costs of lying.

Moreover, B-players have concerns and say that they doubt that the state is bad when it is actually bad in 53% (resp., 58%) of the cases in FF-14 (resp., FF-24). In contrast, these percentages are only 36% in FF-14 and 33% in FF-24 if the state is good. However, given that B-players less often receive the information that the state is bad if it is actually good, the relative share of doubt is highest in the good state of treatment FF-14.

The chat analysis further reveals that A-players mention fairness arguments more

[2] The mean numbers of messages vary between 4.54 and 6.48, depending on the role of the player, the state, and the treatment. See Section S.3.3 of the Supplementary Material for a detailed analysis of the numbers of messages and words used by the players.

[3] We also observe that in the bad state B-players send more messages to A-players in FF-24 than in FF-14 (see the Supplementary Material).

often than B-players. In contrast, B-players more often try to haggle and ask for a larger share of the surplus. Additionally, B-players more often mention bad experiences in previous rounds. We also observe that A-players tend to threaten to break off the negotiations more often than B-players.

Variable	**Description**
A_claim_good	A claims that situation is good
A_claim_bad	A claims that situation is bad
A_equalsplitgood	A suggests equal split for good situation (need not be true state)
A_equalsplitbad	A suggests equal split for bad situation (need not be true state)
A_division	A suggests a division
A_num_offer	A writes a numerical offer in the chat
A_accept	A accepts the offer
A_reject	A rejects the offer
A_trust_honesty	A mentions trust, honesty, or similar
A_fairness	A mentions fairness
A_haggle	A tries to haggle, mentions wanting a higher share, or reminds that without the project both players get zero payoff
A_loss	A claims he/she will make a loss with the current offer
A_bad_experience	A mentions bad experience in previous rounds
A_honor	A asks B to honor A's revelation that the situation is good by offering a larger share of the surplus to A
A_break_off	A mentions breaking off the negotiations
B_ask_state	B asks A about situation
B_equalsplitgood	B suggests equal split for good situation
B_equalsplitbad	B suggests equal split for bad situation
B_division	B suggests a division
B_num_offer	B writes a numerical offer in the chat
B_accept	B accepts the offer
B_reject	B rejects the offer
B_doubt	B doubts honesty of A, mentions honesty
B_fairness	B mentions fairness
B_haggle	B tries to haggle, mentions wanting a higher share, or reminds that without the project both players get zero payoff
B_bad_experience	B mentions bad experience in previous rounds
B_break_off	B mentions breaking off the negotiations

Table A7. Overview of the classification categories.

Variable	FF-14, bad	FF-14, good	FF-24, bad	FF-24, good
A_claim_good	0%	33.75%	0%	23.13%
A_claim_bad	88.75%	44.38%	83.13%	50%
A_equalsplitgood	0.63%	14.38%	0%	16.25%
A_equalsplitbad	56.25%	25.63%	47.50%	21.25%
A_division	74.38%	68.13%	76.25%	67.50%
A_num_offer	69.38%	63.13%	70.63%	61.25%
A_accept	6.25%	16.25%	8.75%	11.88%
A_reject	2.50%	0.63%	1.88%	0%
A_trust_honesty	40%	19.38%	40.63%	14.38%
A_fairness	15.63%	13.75%	22.50%	16.25%
A_haggle	0%	0.63%	1.25%	0%
A_loss	21.25%	9.38%	11.88%	6.25%
A_bad_experience	11.25%	10.63%	11.88%	6.25%
A_honor	0%	5.63%	0.63%	0%
A_break_off	23.75%	10.63%	16.88%	4.38%
B_ask_state	35.63%	43.75%	45%	51.88%
B_equalsplitgood	0%	14.38%	0%	0.63%
B_equalsplitbad	3.13%	4.38%	1.25%	1.88%
B_division	41.88%	46.88%	56.25%	44.38%
B_num_offer	41.25%	45%	53.75%	44.38%
B_accept	19.38%	18.75%	12.50%	20.00%
B_reject	1.88%	0.63%	3.75%	1.25%
B_doubt	53.13%	35.63%	57.50%	33.13%
B_fairness	6.88%	9.38%	5.00%	6.25%
B_haggle	22.50%	15.63%	36.25%	21.88%
B_bad_experience	28.75%	21.25%	34.38%	23.13%
B_break_off	4.38%	1.25%	0%	1.25%

Table A8. Classification of the text messages.

	(1)	(2)	(3)	(4)	(5)
Large extern. (FF-24)	−0.603	−0.595	−0.617	−0.668	−0.607
	(0.853)	(0.893)	(0.818)	(0.836)	(0.876)
Offer B > 9	3.129***	3.035***	3.112***	3.288***	3.124***
	(0.376)	(0.356)	(0.430)	(0.417)	(0.456)
Offer A >9	–	–	–	–	–
# message B	−0.018	−0.018	−0.024	−0.001	0.013
	(0.072)	(0.072)	(0.070)	(0.074)	(0.080)
# message A	−0.237***	−0.206**	−0.245***	−0.196**	−0.211**
	(0.087)	(0.084)	(0.075)	(0.093)	(0.096)
A_claim_bad	1.112*				
	(0.638)				
A_equalsplitbad		0.068			
		(0.653)			
A_trust_honesty			0.878*		
			(0.514)		
A_fairness				−1.025**	
				(0.461)	
B_doubt					−0.512
					(0.418)
B_bad_experience					0.394
					(0.637)
Female	−0.346	−0.383	−0.434	−0.536	−0.371
	(0.473)	(0.494)	(0.435)	(0.521)	(0.471)
Age	0.088	0.089	0.084	0.090	0.092
	(0.061)	(0.060)	(0.059)	(0.063)	(0.062)
Round	0.089	0.099	0.077	0.082	0.068
	(0.096)	(0.118)	(0.104)	(0.109)	(0.123)
Matching group	−0.001	−0.001	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	−2.028**	−1.313*	−1.315*	−1.001	−1.107
	(0.798)	(0.754)	(0.703)	(0.689)	(0.699)
Observations	179	179	179	179	179
log pseudolikelihood	−88.504	−89.852	−88.309	−88.461	−89.235

Robust standard errors clustered on session level in parentheses,
*** p<0.01, ** p<0.05, * p<0.1

Table A9. Random-effects logit regression with the implementation decision of player A as the dependent variable for the free-form bargaining treatments in the bad state. The demographic control variables are from player A.

	(1)	(2)	(3)	(4)	(5)
Large extern. (FF-24)	4.385***	4.783***	4.779***	4.764***	4.773***
	(0.433)	(0.474)	(0.480)	(0.480)	(0.506)
Good state	−1.359***	−2.346***	−2.800***	−2.775***	−2.660***
	(0.330)	(0.357)	(0.347)	(0.339)	(0.341)
# offer B	0.195	0.195	0.215	0.207	0.240
	(0.194)	(0.219)	(0.225)	(0.224)	(0.223)
# offer A	−0.283	−0.232	−0.257	−0.256	−0.253
	(0.173)	(0.193)	(0.197)	(0.196)	(0.194)
# message B	0.0867	0.086	0.095	0.095	0.057
	(0.059)	(0.066)	(0.067)	(0.067)	(0.070)
# message A	−0.148**	−0.136**	−0.122*	−0.136**	−0.128*
	(0.058)	(0.065)	(0.068)	(0.068)	(0.066)
A_claim_bad	3.361***				
	(0.341)				
A_equalsplitbad		1.217***			
		(0.356)			
A_trust_honesty			−0.002		
			(0.406)		
A_fairness				0.371	
				(0.417)	
B_doubt					0.765*
					(0.420)
B_bad_experience					0.092
					(0.438)
Female	0.252	0.552	0.559	0.558	0.609
	(0.439)	(0.481)	(0.489)	(0.486)	(0.515)
Age	0.037	0.069	0.075	0.074	0.071
	(0.055)	(0.060)	(0.061)	(0.061)	(0.065)
Round	−0.051	−0.024	−0.037	−0.032	−0.057
	(0.064)	(0.071)	(0.073)	(0.073)	(0.076)
Matching group	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	5.706***	6.757***	7.195***	7.162***	7.154***
	(1.435)	(1.574)	(1.599)	(1.590)	(1.682)
Observations	346	346	346	346	346
# left censored obs.	5	5	5	5	5
log likelihood	−829.794	−866.959	−872.716	−872.320	−870.901

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table A10. Random-effects tobit regression with the final offer of player B as the dependent variable for the free-form bargaining treatments. Note that not all player made offers which reduces the number of observations. The demographic control variables are from player B.

	(1)	(2)	(3)	(4)	(5)
Large extern. (FF-24)	3.884***	4.034***	3.919***	3.890***	3.950***
	(0.369)	(0.376)	(0.427)	(0.425)	(0.422)
Good state	−2.208***	−2.603***	−2.897***	−2.892***	−2.775***
	(0.269)	(0.276)	(0.292)	(0.285)	(0.287)
# offer B	−0.011	−0.053	−0.144	−0.156	−0.116
	(0.151)	(0.160)	(0.166)	(0.166)	(0.166)
# offer A	−0.356*	−0.495**	−0.453**	−0.463**	−0.525**
	(0.200)	(0.212)	(0.222)	(0.222)	(0.225)
# message B	0.036	0.041	0.041	0.041	0.019
	(0.054)	(0.058)	(0.060)	(0.060)	(0.061)
# message A	−0.120*	−0.059	0.002	−0.019	−0.030
	(0.063)	(0.065)	(0.072)	(0.069)	(0.070)
A_claim_bad	2.594***				
	(0.320)				
A_equalsplitbad		1.741***			
		(0.309)			
A_trust_honesty			−0.189		
			(0.342)		
A_fairness				0.560	
				(0.415)	
B_doubt					0.544*
					(0.305)
B_bad_experience					0.046
					(0.349)
Female	−0.554	−0.369	−0.408	−0.406	−0.462
	(0.408)	(0.414)	(0.472)	(0.468)	(0.465)
Age	−0.041	−0.027	−0.033	−0.032	−0.036
	(0.043)	(0.044)	(0.050)	(0.050)	(0.049)
Round	0.050	0.111*	0.041	0.043	0.036
	(0.054)	(0.059)	(0.059)	(0.059)	(0.061)
Matching group	−0.001	−0.001	−0.001	−0.001	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	11.67***	12.05***	13.34***	13.29***	13.42***
	(1.201)	(1.228)	(1.362)	(1.353)	(1.347)
Observations	267	267	267	267	267
# left censored obs.	0	0	0	0	0
log likelihood	−568.112	−582.460	−597.387	−596.630	−595.843

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table A11. Random-effects tobit regression with the final offer of player *A* as the dependent variable for the free-form bargaining treatments. Note that not all player made offers which reduces the number of observations. The demographic control variables are from player *A*.

Supplementary Material for "Contracting under Asymmetric Information and Externalities: An Experimental Study"

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Contents

S.1 Control variables

At the end of the experiment, we elicited various control variables which we describe in detail below. The subjects were informed up-front that after the main part of the experiment short additional parts and a survey would follow. The subjects received the instructions for each part at the beginning of the respective part and the payoffs were added up to the payoff of the main experiment.[1]

First, all subjects participated in an incentivized lottery. The subjects had to decide between a safe and a risky option. If they selected the safe option, they received a fixed amount of money for sure. If they opted for the risky option, they received 2.80 euro with a probability of 1/2 and zero otherwise. We divided the subjects into two groups: The fixed payment for the first group was 60 euro cent, whereas the fixed payment was 80 euro cent for the other group. Thus, the lottery yields to the same payoff structure B-players face in the UG-14 treatment if they decide between offering zero or offering 10 or 11 ECU. We do not further use the lottery results in our analysis, because 90% of the subjects selected the risky option.

In a next step, we implemented a measure of social value orientation (SVO) in our experiment (Murphy et al., 2011).[2] The concept of social value orientation offers insights into the extent to which people care about others. The SVO measure in our experiment consists of six dictator games. In each dictator game, all subjects decide simultaneously about the distribution of a payment between themselves and another matched subject. We made clear that the subjects would be matched with another subject with whom they had never interacted before. After all subjects made their decisions, the computer randomly determined one of the six games for payment. In addition, the computer also determined if the subject was in the active role of the decision maker or not. The results allow us to group subjects into SVO types based on their choices. Overall, we have a share of 65.3% prosocial and 34.4% individualistic subjects.[3] This distribution of types across subjects is in line with previous findings (see e.g. Balliet et al., 2009, or Murphy et al., 2011).

We also elicited the general willingness to take risks on a 11-point likert scale and implemented a short survey on positive and negative reciprocity (Dohmen et al., 2009). In addition, we asked all subjects to answer the subscale for the Honesty-Humility domain from the HEXACO personality inventory (Ashton and Lee, 2009). The HEXACO survey allows to assess six major dimensions of personality. We concentrate on the subscale Honesty-Humility, which contains the facets fairness,

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[1] In the ultimatum game treatments, the control variables were elicited after the strategy-method round (see Section S.2.1 below) was completed.

[2] We implemented the SVO z-tree code by Crosetto et al. (2012) in our program. The dictator games played correspond to the primary items discussed in Murphy et al. (2011).

[3] In addition, there was one competitive subject.

sincerity, modesty, and greed avoidance. People scoring high on this scale are less likely to manipulate other people for personal gain and they are less likely to break rules than people with low scores. They are also less motivated by material gains and feel less self-important compared to people with low scores.

Furthermore, we asked subjects to give us demographic information such as sex and age. The subjects in the free-form bargaining sessions were also asked if they found the chat option helpful.

We use the demographic information as well as information on SVO, risk attitude, reciprocity, and scores on the Honesty-Humility subscale as controls in our econometric analysis. Not surprisingly, we observe correlations between SVO type and Honesty-Humility as well as reciprocity scores (see Table S1). We, therefore, implement these controls in separate econometric analyses to avoid confounding effects.

	Prosocial (SVO)	Honesty-Humility	Positive reciprocity	Negative reciprocity	Risk attitude
Prosocial (SVO)	–	0.227 (0.000)	0.040 (0.481)	−0.097 (0.085)	−0.020 (0.730)
Honesty-Humility	0.227 (0.000)	–	0.161 (0.004)	−0.321 (0.000)	−0.098 (0.079)
Positive reciprocity	0.040 (0.481)	0.161 (0.004)	–	0.001 (0.992)	0.045 (0.418)
Negative reciprocity	−0.097 (0.085)	−0.321 (0.000)	0.001 (0.992)	–	0.075 (0.184)
Risk attitude	−0.020 (0.730)	−0.098 (0.079)	0.045 (0.418)	0.075 (0.184)	–

Table S1. Pairwise correlation matrix for social preferences and risk attitudes over all treatments (p-values are given in parenthesis).

S.2 Ultimatum game

S.2.1 Strategy method

Procedure

In the ultimatum game treatments, after the final round of the main experiment the subjects were informed that an additional round would follow. In this additional round, we employed the strategy method (cf. Selten, 1967) to elicit beliefs of B-players and a response function of A-players.[4] First, all B-players had to state their beliefs about the decision of A-players if the state was bad (resp., good) for all feasible offers ($0 - 14$ in UG-14 and $0 - 24$ in UG-24). Second, all B-players had to state their offer as in the previous rounds, without knowing the realized state. Third, all A-players learned about the realized state and had to record their decision for each feasible offer. Fourth, the payments were calculated by randomly matching the actual offer of player B with player A's corresponding response for the randomly drawn state. Note that the matched subjects were no longer perfect strangers and we have to interpret this data with caution.

Results

The results of the strategy-method round are broadly in line with the behavior in the main part of the experiment. Consider first player A's response in the bad state, which is depicted in the upper panels of Figure S1. In UG-14, only two players accept offers below 10, presumably by mistake. In UG-24, 50% of the A-players reject an offer of 11 and do not implement the project. The majority of these subjects also rejected such an offer in the previous eight rounds of the main experiment at least once. Interestingly, 35% of the A-players do not implement the project if the offer is 12, and one player even does not implement for offers up to 16 (thus accepting only offers that would lead to at least the same payoff for the A-player as for the B-player). Now consider the good state, which is shown in the lower panels of Figure S1. In UG-14, 60% of A-players reject an offer of zero but subsequently implement the project. A small minority rejects offers up to 5 but still implements the project, whereas only one A-player plans to reject and not implement if the offer is below 8. We observe a rather similar pattern for UG-24. If the offer is zero, 25% of the players reject the offer but implement the project, whereas 30% decide against the implementation. We also observe two players that do not implement the project if the offer is below 8.

[4] Due to a technical failure, we did not record the beliefs of B-players and the response of A-players for an offer of 14 in the first session of UG-14. Thus, the number of observations for this particular potential offer is lower.

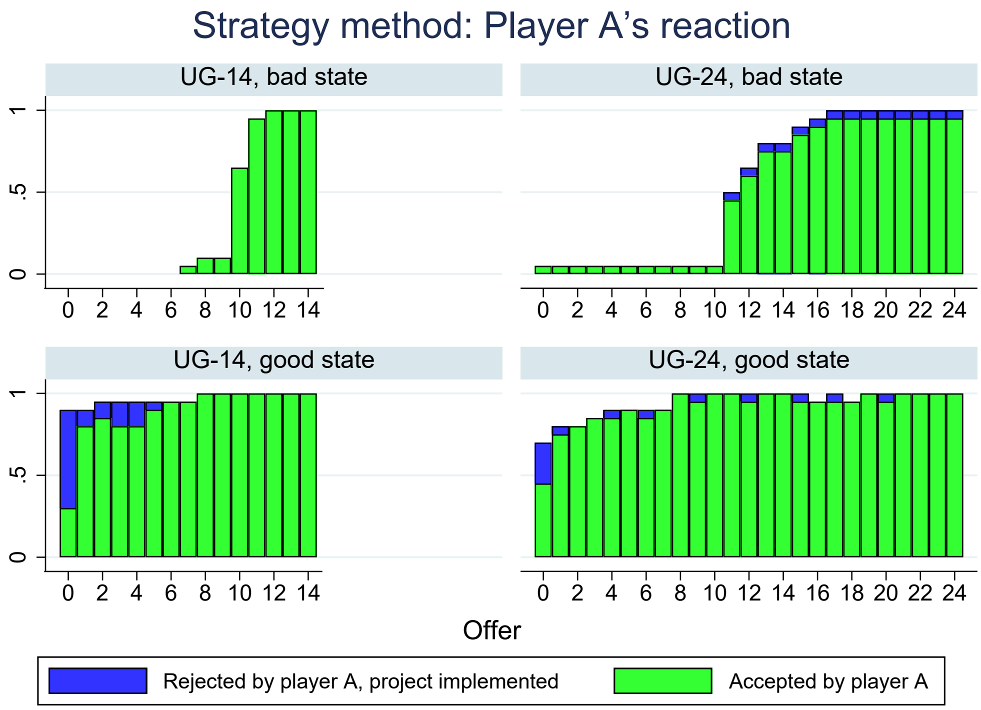

Figure S1. Reaction of player A, elicited in the strategy-method round. Note that the category "Rejected and project not implemented" is given by the space above each bar.

Next, we take a closer look at the stated beliefs of B-players, which are displayed in Figure S2. Consider UG-14 first. 90% of B-players expect A-players to decide against project implementation for offers strictly below 10 in the bad state, whereas 90% of the B-players assume acceptance of offers of 11 or above. Only one B-player believes that A-players will not implement the project regardless of the offer made if the state is good. The majority $(80 - 95\%)$ expects A-players to accept offers strictly larger than zero in the good state. Thus, the majority of B-players has formed beliefs about the behavior of A-players in both states in UG-14 which closely resemble the strategic responses of A-players.

Now consider UG-24. 98% of B-players believe that A-players will not implement the project in the bad state if the offer is strictly below 10, whereas 90% expect acceptance of offers strictly larger than 11. Given this belief it is somewhat surprising that the share of offers below 10 in the main experiment was rather large. However, recall that we elicited the beliefs after the eight rounds of the main experiment, so learning could have taken place. Indeed, only five B-players make an offer below 10 in the last round of the main experiment. 78% of the B-players expect A-players to accept an offer of 11 and only 13% expect the acceptance of an offer of 10 in the bad state, which may be due to the assumption that A-players exhibit inequity aversion. Almost all B-players expect acceptance of offers strictly larger than 10 if the state is good. Interestingly, the beliefs are rather mixed for offers below 10, especially between 1 and 5, which might be due to differing assumptions about player A's inequity concerns. Overall, the beliefs about player-A behavior are rather well adjusted, but the beliefs about behavior in the good state reveal some heterogeneity of B-players' expectations about A-players' behavior.

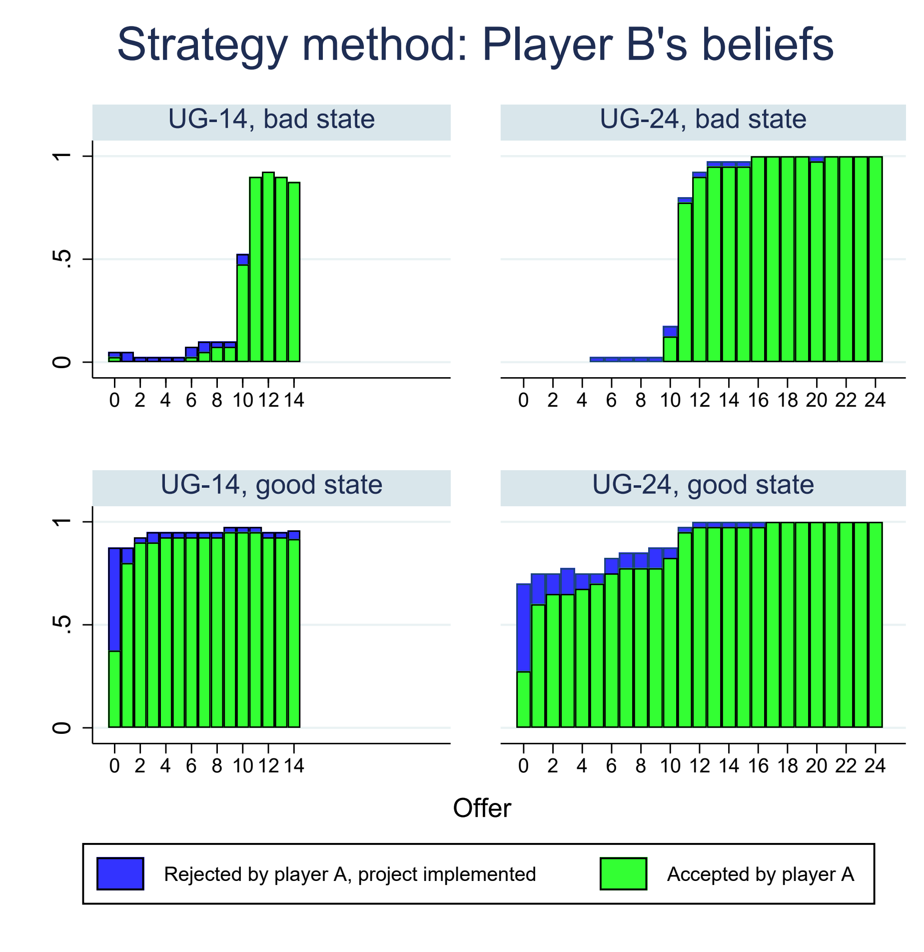

Figure S2. Beliefs of player B, elicited in the strategy-method round. Note that the category "Rejected and project not implemented" is given by the space above each bar.

S.2.2 Additional regressions

Tables S2 and S3 show additional regressions for the ultimatum game treatments. Table S2 reports the results corresponding to Table A2 with the only difference that the offer is treated as a linear variable in models (1) to (4). In models (5) and (6) we execute the regressions for the UG-24 to investigate the impact of social value orientation. Furthermore, we restrict our dataset to offers above 9 in UG-24 in model (6) in Table S2. Note that a dummy variable indicating that the offer was strictly higher than 9 will be omitted in the UG-24 treatment because an offer below 10 predicts failure perfectly. Thus, we use a linear operator to control for the offers made.

Table S3 reports the results of additional tobit regressions with the offer as the dependent variable for the UG-14 and the UG-24 treatment to study learning effects.

	(1)	(2)	(3)	(4)	(5) UG-24	(6) UG-24, Offer > 9
Large extern.	−1.141	−1.338	−1.228	−1.172		
(UG-24)	(1.388)	(1.432)	(1.392)	(1.379)		
Offer	1.144***	1.189***	1.160***	1.156***	5.689***	5.666***
	(0.398)	(0.407)	(0.413)	(0.411)	(1.209)	(1.229)
Prosocial (SVO)		1.458**			2.935**	2.928**
		(0.655)			(1.174)	(1.166)
Risk attitude		−0.0550	−0.126		0.0345	0.0348
		(0.124)	(0.115)		(0.460)	(0.459)
Pos. reciprocity			0.423			
			(0.484)			
Neg. reciprocity			0.332			
			(0.237)			
Honesty-Humility				0.667		
				(0.850)		
Female	−0.715	−0.666	−0.953	−0.963	−3.357*	−3.346*
	(1.058)	(1.004)	(0.989)	(0.908)	(1.855)	(1.860)
Age	0.005	−0.00130	0.00766	−0.00171	0.00678	0.00670
	(0.0230)	(0.0272)	(0.0364)	(0.0319)	(0.0436)	(0.0436)
Round	0.102*	0.097	0.115**	0.111**	0.110	0.110
	(0.0556)	(0.0604)	(0.0543)	(0.0517)	(0.115)	(0.115)
Matching group	−0.0002	−0.0004	−0.0002	−0.0002	−0.00111	−0.00111
	(0.001)	(0.0004)	(0.001)	(0.001)	(0.00113)	(0.00113)
Constant	−10.84***	−11.49***	−10.39***	−12.99***	−61.87***	−61.63***
	(2.980)	(3.784)	(3.246)	(4.684)	(13.25)	(13.45)
Observations	320	320	320	320	160	123
log pseudol.	−84.284	−81.920	−83.210	−83.686	−40.655	−40.651

Robust standard errors clustered on session level in parentheses,
*** p<0.01, ** p<0.05, * p<0.1

Table S2. Random-effects logit regression with the implementation decision as the dependent variable for the ultimatum game treatments in the bad state. Note that player B's offer can vary between 0 and 14 in UG-14 and between 0 and 24 in UG-24, so this variable has to be interpreted with caution. Models (5) and (6) contain data from UG-24 only. In model (6) we further restrict the dataset to observations where player B made an offer strictly above 9 in UG-24.

	(1) UG-14	(2) UG- 24
Female	0.195	1.101
	(1.522)	(1.106)
Age	−0.033	−0.029
	(0.240)	(0.053)
Round	−0.003	0.191***
	(0.084)	(0.066)
Matching group	−0.001	−0.002*
	(0.002)	(0.001)
Constant	2.673	11.03***
	(5.292)	(1.720)
Observations	320	320
# left censored obs.	112	23
log likelihood	−628.751	−780.633

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table S3. Random-effects tobit regression with the offer of player B as the dependent variable for UG-14 and UG-24. We restrict the dataset to observations from UG-14 in model (1) and to observations from UG-24 in model (2).

S.3 Free-form bargaining

S.3.1 Additional regressions

	(1)	(2)	(3)	(4)	(5)
Large ext. (FF-24)	0.598**	−0.856	−1.008	−1.013	−0.624
	(0.304)	(0.904)	(0.797)	(0.686)	(0.913)
Offer player B		0.687***	0.652***	0.651***	0.650***
		(0.170)	(0.126)	(0.146)	(0.153)
Offer player A		−0.383*	−0.321**	−0.320	−0.361***
		(0.203)	(0.163)	(0.231)	(0.081)
# offer player B		−0.583***	−0.568***	−0.567***	−0.578***
		(0.165)	(0.166)	(0.139)	(0.212)
# offer player A		−0.316	−0.301	−0.294	−0.302
		(0.505)	(0.481)	(0.446)	(0.478)
Prosocial (SVO)			−0.110		
			(0.382)		
Risk attitude			−0.188	−0.190	
			(0.187)	(0.180)	
Pos. reciprocity				−0.035	
				(0.206)	
Neg. reciprocity				0.012	
				(0.448)	
Honesty-Humility					−1.740***
					(0.294)
Female		−0.546	−0.846	−0.867	−0.117
		(0.889)	(0.999)	(1.120)	(0.949)
Age		0.161*	0.150*	0.149**	0.168***
		(0.083)	(0.077)	(0.069)	(0.049)
Round		0.009	0.013	0.014	0.041
		(0.132)	(0.123)	(0.126)	(0.122)
Matching group		−0.001	−0.001	−0.001*	−0.001*
		(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.235	−1.625	−0.644	−0.722	3.755
	(0.282)	(2.401)	(2.081)	(2.779)	(2.407)
Observations	320	179	179	179	179
log likelihood	208.436	−82.476	−81.836	−81.836	−78.253

Robust standard errors clustered on session level in parentheses,
*** p<0.01, ** p<0.05, * p<0.1

Table S4. Random-effects logit regression with the implementation decision of player A as the dependent variable for the free-form bargaining treatments in the bad state. Note that not all players made offers, which reduces the number of observations. The offer can vary between 0 and 14 in FF-14 and between 0 and 24 in FF-24, so the offer variables have to be interpreted with caution. Table S4 reports the results corresponding to Table A4 with the only difference that the offers are treated as linear variables.

S.3.2 Offers

Recall that in the free-form bargaining treatments, both players could make offers during the three minutes bargaining phase. Figure S3 shows all offers made during the bargaining phase. Observe that in each state of FF-14 and FF-24, the gap between the fitted values of the offers made by A-players and B-players shrinks over time.

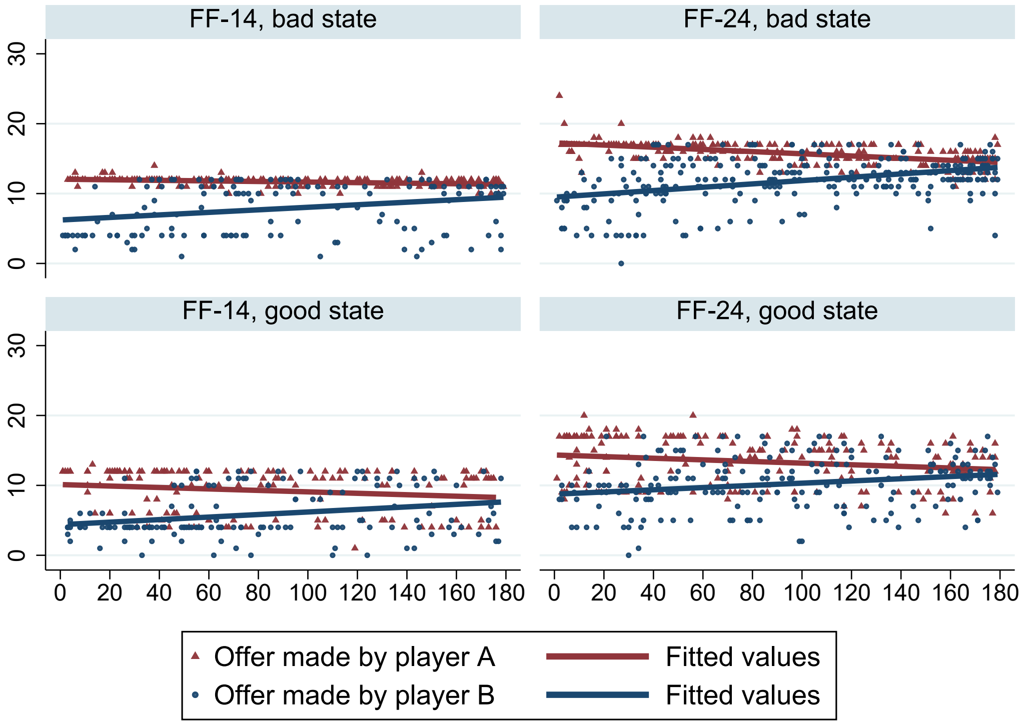

Figure S3. Offers made during the 180 seconds of the bargaining phase in the treatments FF-14 and FF-24, conditional on the state.

Figure S4 depicts the average opening and final offers over all eight rounds. Observe that in each state of FF-14 and FF-24, the average opening offer of player A is in every round larger than the average opening offer of player B. During the negotiations the players make concessions, so the average final offers of the players tend to be closer to each other.

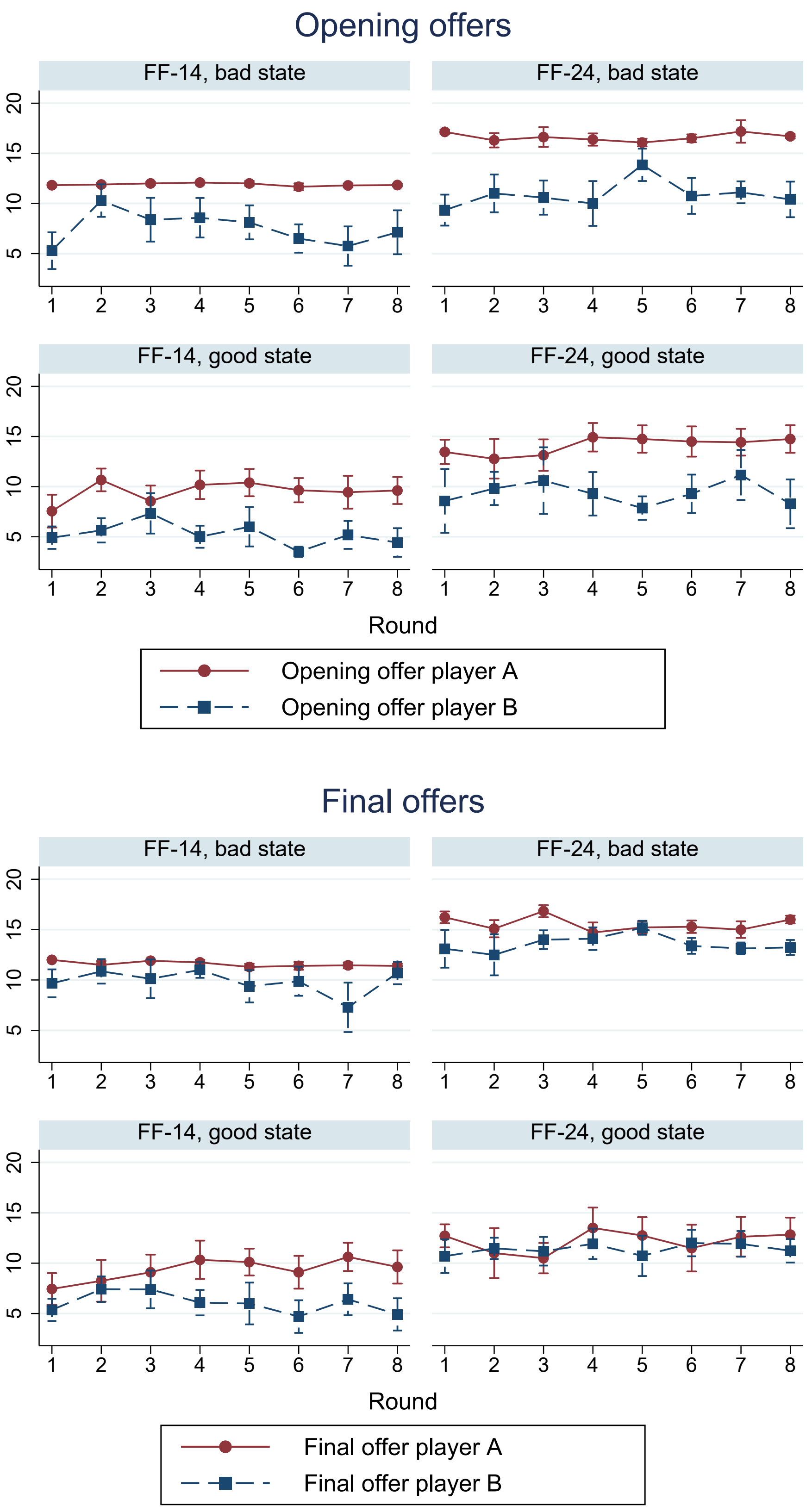

Figure S4. Average opening and final offers in the treatments FF-14 and FF-24, conditional on the state.

S.3.3 Text messages

Table S5 shows how many messages and how many words A-players and B-players used on average during the bargaining phase, conditional on the state of the world. Almost all groups exchanged at least some messages. First, one might have expected that A-players tend to send more messages and words than B-players, because only the A-players know the state of the world. Indeed, in FF-14 in both states the numbers of messages and words used by A-players are larger than those used by B-players. However, the numbers of messages and words used in FF-24 by A-players and B-players is rather balanced. Second, one might also have expected A-players to use more words in the bad state trying to convince the B-players to make or accept a high offer. We observe that A-players indeed use more words in bad situations than in good situations.

	FF-14		FF-24	
	bad	good	bad	good
Mean number of messages by A	6.13	5.29	6.48	4.81
Mean number of messages by B	4.86	4.54	6.06	4.79
Mean number of words by A	34.71	27.84	35.41	22.96
Mean number of words by B	23.01	21.71	31.78	21.98
No messages by A	0%	3%	3%	7%
No messages by B	2%	5%	4%	9%

Table S5. Descriptive statistics regarding the numbers of messages and words.

In the bad state the number of messages and words sent by B-players in FF-24 is significantly larger than in FF-14. Thus, B-players get more active in the bad state of FF-24, indicating that they feel more need to discuss the division of the surplus than in the FF-14 treatment. Indeed, we observe that B-players ask for the state in 45% of the cases in the bad state of FF-24, but only in 36% of the cases in FF-14. Also, the share of B-players complaining about past bad experiences and trying to haggle is higher if the externality is large.

Figure S5 depicts the average number of messages in the eight rounds. We observe a slight tendency to exchange more messages over time, especially in the good state of the world.

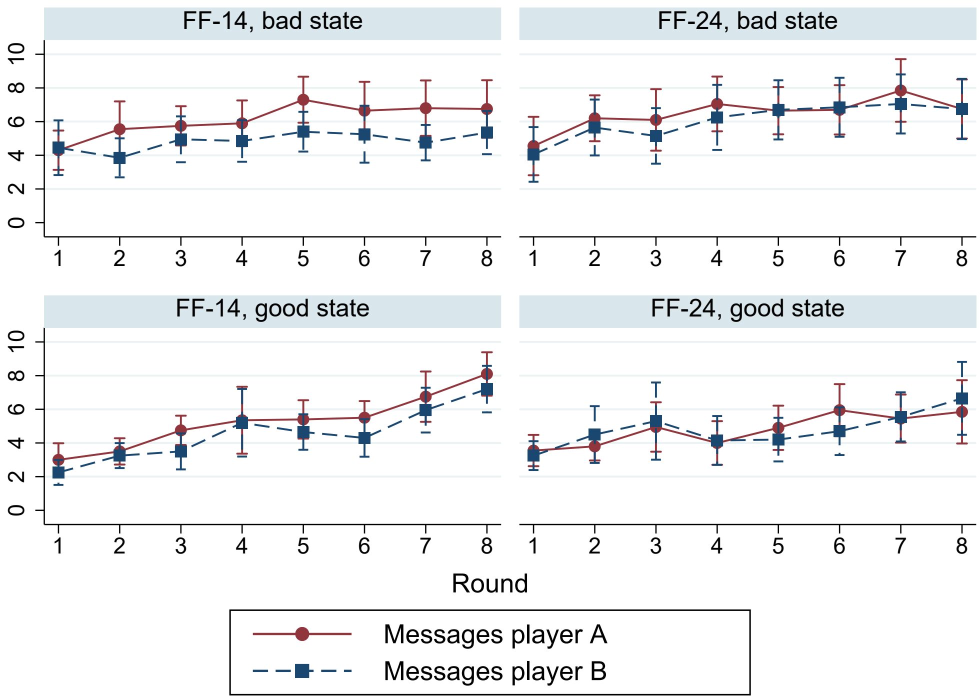

Figure S5. Average number of messages sent in the free-form bargaining treatments, conditional on the state.

S.4 Instructions

In this section, we provide English translations of the instructions for the treatments UG-14 and FF-14. The instructions for the treatments UG-24 and FF-24 are identical, except that "14" is replaced by "24" throughout.[5]

S.4.1 Ultimatum game (UG-14)

Welcome to the experiment!

This experiment consists of a main part with **8 rounds**, three additional short parts, and a questionnaire.

In the main part two participants interact with each other.

One participant is in the role of **Player A**, the other one in the role of **Player B**.

Your role is randomly drawn at the beginning of the experiment. You will be informed about your role at the beginning of the experiment.

You will **keep your role** (Player A or B) over all **8 rounds**.

In each round, one Player A will be matched with one Player B. You will be matched with a **different participant** in each round.

In the main part, we use a currency called ECU. At the end of the experiment, it will be converted in euro. **One euro** equals **5 ECU**.

General procedure

In each round, **Player A** can implement a **project**.

At the beginning of each round, the computer randomly **determines a situation** by a virtual coin flip. With a probability of 50% the current situation is "bad", with a probability of 50% the current situation is "good".

Only Player A learns if the situation drawn by the computer is "bad" or "good".

Player B does not receive any information about the drawn situation.

Depending on the situation (good or bad) the project results in different revenues for Player A if he decides to implement the project.

The revenue in case of a "good" situation is positive for Player A and amounts to 6 ECU, whereas in case of a "bad" situation it is negative and amounts to -10 ECU.

Regardless of the current situation, the project results in **a revenue of 14 ECU** for **Player B if Player A implements the project**. Thus, the current situation has

[5] The original instructions (in German) are available from the authors upon request.

no impact on the revenue of Player B. If Player A does not implement the project, both players receive 0 ECU.

Player A and Player B can **bargain with each other** over the implementation of the project. For this purpose they can agree that a transfer payment will be made between the players.

Bargaining process

Player B offers a payment of X ECU that he is willing to pay to Player A for implementing the project (where X must be an **integer** between 0 and 14).

Possibility 1: Player A accepts the offer

If Player A accepts the offer, the **project will be implemented**. The payoff of Player A in this round is **X ECU + 6 ECU** if the situation is "good", and it is **X ECU - 10 ECU** if the situation is "bad". The payoff of Player B in this round is **14 ECU - X ECU**.

Possibility 2: Player A rejects the offer

If Player A rejects the offer, no payment is made from Player B to Player A. Player A can then freely decide whether or not to implement the project:

• If Player A implements the project, his payoff in this round is **6 ECU** in a "good" situation and **-10 ECU** in a "bad" situation. The payoff of Player B in this round then is **14 ECU**.

• If Player A does not implement the project, both players receive a payoff of 0 ECU in this round.

Sequence of events in a round

Specifically, each round consists of up to three stages and proceeds as follows:

First stage: Player A learns if situation is "good" or "bad"

At the beginning of each round, the computer randomly determines the situation by a virtual coin flip. With a probability of 50% the current situation is "bad", with a probability of 50% the current situation is "good".

Only Player A learns if the situation drawn by the computer is "bad" or "good". Player B does not receive any information about the drawn situation.

Second stage: Bargaining

Player B offers a payment of X ECU to Player A (where X must be an integer between 0 to 14). In order to do this, Player B types his offer into the box "Offer to Player A".

Player A is informed about the offer of Player B and can accept the offer by clicking on the button "Accept Offer". He can reject the offer by clicking on the button "Reject Offer".

• If the players reach an agreement (which is the case if Player A accepts the proposed X from Player B by clicking on the button „Accept Offer"), the project is implemented. Player B pays X ECU to Player A and the round is over.

• If the players do not come to an agreement (which is the case if Player A clicks on the button "Reject Offer"), the third stage is reached.

Third stage: Decision of Player A if no agreement has been reached in the second stage

If no agreement has been reached in the second stage, no transfer payments will be made between the two players. Player A can then freely decide whether or not to implement the project.

Thus, the players' payoffs in a round are as follows:

	Payoff of Player A if situation is "good"	Payoff of Player A if situation is "bad"	Payoff of Player B
Agreement between Player A and Player B	**X ECU + 6 ECU**	**X ECU - 10 ECU**	**14 ECU - X ECU**
No agreement, Player A **implements** the project	**6 ECU**	**-10 ECU**	**14 ECU**
No agreement, Player A **does not** implement the project	**0 ECU**	**0 ECU**	**0 ECU**

Your payoff

At the end of the experiment you will receive the sum of your payoffs of all 8 rounds. Your profit is converted using the rate of 1 euro for 5 ECU and paid to you in cash. You may also receive additional payoffs from the other parts of the experiment.

Please note

Throughout the experiment, all communication is forbidden. Please open your cubicle door if you have a question and we will come to your cubicle. All decisions are anonymous, i.e. no participant learns the identity of another participant who has made a particular decision. You will receive your payoff privately, i.e. no participant learns the payoff of another participant.

Thank you very much for your participation and good luck!

S.4.2 Free-form bargaining (FF-14)

Welcome to the experiment!

This experiment consists of a main part with **8 rounds**, three additional short parts, and a questionnaire.

In the main part two participants interact with each other.

One participant is in the role of **Player A**, the other one in the role of **Player B**.

Your role is randomly drawn at the beginning of the experiment. You will be informed about your role at the beginning of the experiment.

You will **keep your role** (Player A or B) over all **8 rounds**.

In each round, one Player A will be matched with one Player B. You will be matched with a **different participant** in each round.

In the main part, we use a currency called ECU. At the end of the experiment, it will be converted in euro. **One euro** equals **5 ECU**.

General procedure

In each round, **Player A** can implement a **project**.

At the beginning of each round, the computer randomly **determines a situation** by a virtual coin flip. With a probability of 50% the current situation is "bad", with a probability of 50% the current situation is "good".

Only Player A learns if the situation drawn by the computer is "bad" or "good".

Player B does not receive any information about the drawn situation.

Depending on the situation (good or bad) the project results in different revenues for Player A if he decides to implement the project.

The revenue in case of a "good" situation is positive for Player A and amounts to 6 ECU, whereas in case of a "bad" situation it is negative and amounts to -10 ECU.

Regardless of the current situation, the project results in **a revenue of 14 ECU** for **Player B if Player A implements the project**. Thus, the current situation has no impact on the revenue of Player B. If Player A does not implement the project, both players receive 0 ECU.

Player A and Player B can **bargain with each other** over the implementation of the project. For this purpose they can agree that a transfer payment will be made between the players.

Bargaining Process

Player A and Player B can bargain about whether the project is implemented and a transfer payment is made from Player B to Player A. The players have **three**

minutes to bargain via chat. During the three minutes the players can agree on a payment of X ECU (where X must be an **integer** between 0 and 14). The players can send text messages to each other and they can make proposals regarding the payment of X ECU that Player B has to transfer to Player A.

Possibility 1: The players reach an agreement

If the players reach an agreement, the **project is implemented**. The payoff of Player A in this round is **X ECU + 6 ECU** if the situation is "good", and it is **X ECU - 10 ECU** if the situation is "bad". The payoff of Player B in this round is **14 ECU - X ECU**.

Possibility 2: The players do not reach an agreement

If the players do not reach an agreement, no payment is made from Player B to Player A. Player A can then freely decide whether or not to implement the project:

• If Player A implements the project, his payoff in this round is **6 ECU** in a "good" situation and **-10 ECU** in a "bad" situation. The payoff of Player B in this round then is **14 ECU**.

• If Player A does not implement the project, both players receive a payoff of 0 ECU in this round.

Sequence of events in a round

Specifically, each round consists of up to three stages and proceeds as follows:

First stage: Player A learns if situation is "good" or "bad"

At the beginning of each round, the computer randomly determines the situation by a virtual coin flip. With a probability of 50% the current situation is "bad", with a probability of 50% the current situation is "good".

Only Player A learns if the situation drawn by the computer is "bad" or "good". Player B does not receive any information about the drawn situation.

Second stage: Bargaining

The players have three minutes to bargain via chat. During the three minutes the players can agree on a payment of X ECU (where X must be an integer between 0 to 14). The players can send text messages to each other and they can make proposals regarding the payment of X ECU that Player B has to transfer to Player A. Each text message may contain up to 280 characters. The players can exchange as many messages as they like during the three minutes.

To submit a binding offer to another player, players type their offer in the intended box and click on "Send Offer". If a player wants to retract his offer, he leaves the box empty and clicks on "Send Offer". Each player observes the offer of the other player in a separate box. A player can accept an offer made by the other player by clicking on the button “Accept Offer”. The players can submit as many offers to the other player as they like during the three minutes. If a player does not want to continue bargaining and wants to irrevocably break off the negotiations, he can click on the “Break Off” button.

• If the players reach an agreement (which is the case if one player accepts the proposed X from the other player by clicking on the button “Accept Offer”), the project is implemented. Player B pays X ECU to Player A and the round is over.

• If the players do not come to an agreement, the third stage is reached. This happens if

  • three minutes have passed and the players have not reached an agreement on a payment of X ECU, or

  • one player decides to break off the negotiations before the three minutes have passed.

Third stage: Decision of Player A if no agreement has been reached in the second stage

If no agreement has been reached in the second stage, no transfer payments will be made between the two players. Player A can then freely decide whether or not to implement the project.

Thus, the players’ payoffs in a round are as follows:

	Payoff of Player A if situation is “good”	Payoff of Player A if situation is “bad”	Payoff of Player B
Agreement between Player A and Player B	**X ECU + 6 ECU**	**X ECU - 10 ECU**	**14 ECU - X ECU**
No agreement, Player A **implements** the project	**6 ECU**	**-10 ECU**	**14 ECU**
No agreement, Player A **does not** implement the project	**0 ECU**	**0 ECU**	**0 ECU**

Remark

It is forbidden to reveal information about your identity (i.e., name, seat number, clothing, and so on) in the text messages. If such messages are detected, this leads to **exclusion** from the experiment with a total payoff of 0 euro.

Your payoff

At the end of the experiment you will receive the sum of your payoffs of all 8 rounds. Your profit is converted using the rate of 1 euro for 5 ECU and paid to you in cash. You may also receive additional payoffs from the other parts of the experiment.

Please note

Throughout the experiment, all communication is forbidden, apart from communication via the experimental software. Please open your cubicle door if you have a question and we will come to your cubicle. All decisions are anonymous, i.e. no participant learns the identity of another participant who has made a particular decision. You will receive your payoff privately, i.e. no participant learns the payoff of another participant.

Thank you very much for your participation and good luck!

S.5 References

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