

# Online Appendix: Concession Bargaining

## An Experimental Comparison of Protocols and Time Horizons

### Contents

A	Experimental instructions	1
B	Control questions	3
C	Results of control questions	3
D	Screenshots of the experiment	4
E	Additional figures and tables	8

### A Experimental instructions

This section gives the experimental instructions translated from German. Paragraphs which differed between protocols and  $T$  are indicated accordingly.

#### General Instructions

*Note: In the interest of a concise text we exclusively use the masculine gender despite describing gender-free aspects.*

Welcome and thank you for taking part in this experiment.

Please read the following instructions carefully. If you have any questions, please raise your hand and one of us will come to help.

Instructions are identical for all participants. The experiment consists of four rounds. Rounds 1 and 2 are identical to each other, as are rounds 3 and 4. You will first receive instructions for rounds 1 and 2 only. In every round you can earn money. How much money you earn depends on your own decisions, decisions made by other participants and a move of chance.

Your total income is the sum of earnings for all rounds. In the experiment, money will be denoted in “points”. Each point will be worth € 0.01. In addition, you will be paid a show-up fee of € 2.50 for having shown up on time plus € 2.50 for participation. You will receive your entire earnings at the end of the experiment anonymously in cash.

At the beginning of the experiment a move of chance will assign one of two roles – A and B – to you. You will interact in this role during the entire experiment. One half of participants will decide in role A and the other half will decide in role B.

In every round one participant A interacts with one participant B. The combination of participants A and B changes at every round, such that no one interacts with someone else more than once.

## Instructions for rounds 1 and 2

### Decisions in each round

Participants A and B can allocate 650 points between each other. To do so, both participants –A and B –must indicate how many points they claim for themselves. Whenever the sum of points claimed by A and B is smaller or equal to 650, we speak of an AGREEMENT. If A and B should not find an agreement at the end of a round, we speak of a disagreement.

#### How to state a claim

Each round consists of at most 3[5] trials. At each trial both participants can state a claim of points to the other participant. This is done by entering the claimed number of points into the appropriate field and by clicking the button “confirm”. Before confirming your entry you can change your decision as often as you wish, but once you have confirmed it your entry is binding.

Both participants submit their claims simultaneously not knowing how many points the other participant claims. Once both have entered and confirmed their claims, the trial ends. Please note that in comparison to the previous trial, you cannot increase your claim. You can either leave your claim unchanged or decrease it by at least 25 points.

#### End of a round and your payment

If both participants found an AGREEMENT at the end of the last trial, then each obtains the number of points he claimed. If both found an agreement before the last trial, then the round ends with this trial and each obtains the number of points he claimed.

If at the end of the last trial both participants remain in DISAGREEMENT, then participant A obtains 25 points and participant B obtains 175 points.

If at any trial after the first one, none of the two participants reduces his claim in comparison to the previous trial, then the interaction ends with this trial. Participant A then obtains 25 and participant B 175 points.

#### At the end of each trial

*Protocol S:* After each trial, participants will neither be informed about how much the other participant claimed, nor whether the round already ended. Only after both participants have submitted their claims FOR ALL TRIALS, each participant will be informed which trial was decisive and how many points the other participant claimed in all trials up to the decisive one.

*Protocol P:* After each trial, participants will not be informed about how much the other participant claimed. They will only be informed about whether there will be another trial. Only after both participants have submitted their claims FOR ALL POSSIBLE TRIALS up to the decisive one, each participant will be informed how many points the other participant claimed in all relevant trials.

*Protocol D:* After each trial, participants will be informed about how many points the other participant claimed and whether there will be another trial before the end of the round.

## Instructions for rounds 3 and 4

### Decisions in each round

The implementation of rounds 3 and 4 is identical to that of rounds 1 and 2 except for the maximal number of trials which changes from 3[5] to 5[3].

## B Control questions

*The control questions were implemented and zTree (Fischbacher, 2007). Participants had to indicate whether a statement was true or false. Whenever a statement was false, all were given the corrected statement.*

Please indicate whether the following statements are TRUE or FALSE:

1. In the first round, A and B are given a maximum of 3 [5] trials to allocate 650 points between each other.
  - If answer was “TRUE”: This is the correct answer.
  - If answer was “FALSE”: Your answer is wrong.
2. If in the first trial A and B altogether claim 500 points then the interaction ends and each participant obtains the amount he claimed.
  - If answer was “TRUE”: This is the correct answer.
  - If answer was “FALSE”: Your answer is wrong.
3. If at the first trial A and B altogether claim 700 points then the interaction ends and each participant obtains the amount he claimed.
  - If answer was “TRUE”: This is wrong. If at any trial prior to the final trial, A and B altogether claim 700 points then there is another trial.
  - If answer was “FALSE”: This is the correct answer.
4. If at the final trial A and B altogether claim 700 points then each participant obtains the amount he claimed.
  - If answer was “TRUE”: This is wrong. If at the final trial A and B altogether claim 700 points then the round ends in disagreement. Participant A receives 25 points and B obtains 175 points.
  - If answer was “FALSE”: This is the correct answer.
5. If at a trial after the first one and before the third [fifth], both participants do not reduce their claim in comparison to the previous trial, then the round continues with another trial.
  - If answer was “TRUE”: This is wrong. If at any trial after the first one both participants do not reduce their claim in comparison to the previous trial, then the round ends in disagreement with A receiving 25 points and B obtaining 175.
  - If answer was “FALSE”: This is the correct answer.

## C Results of control questions

Table C.1 reports the rate of correct answers for each control question. The rate for question 5 is significantly low. This implies that, while reading instructions, subjects had difficulty in understanding the rule of early conflict due to no concessions.

Hence we run the logistic regressions on no concessions and the answer to question 5 in order to check whether subjects did not understand the rule even after completing the control questions. We have two opposing hypothesis:

Table C.1: Rate of correct answers

Q.1	89.9%
Q.2	74.3%
Q.3	97.6%
Q.4	96.2%
Q.5	55.2%

**Hypothesis C.1:** *A subject, who answers Q.5 incorrectly, is more likely to refuse conceding;*  
**Hypothesis C.2:** *A subject, who answers Q.5 incorrectly, is less likely to refuse conceding;*

As shown in Section B, when subjects answer control questions incorrectly, they will see the feedback that reminds them the rule of our experiment again. Hence, we assume that all subjects, whether they answer the question correctly or incorrectly, understand the rule by the time the game begins.

Hypothesis C.1 is the case where subjects, whose answers to Q.5 are wrong, see the feedback, but they still do not understand the rule. Hypothesis C.2 considers another possibility that subjects, who do not understand the rule, answer question 5 at random. If their answers happen to be incorrect, then they see the feedback, otherwise they miss the opportunity to learn the rule again. Thus, subjects with wrong answers eventually the rule better. In either case, not realizing the risk of the early break ups may make subjects refuse to concede more often.

Table C.2 reports the results of logistic regressions on no concession, which correspond to Regressions (1) and (2) of the main text. We have added a new dummy variable for subjects, who answer question 5 wrongly. The variable is insignificant for both types of players, hence we reject hypothesis C.1 and C.2.

Finally, we also checked if players less likely to refuse concession if they experience early breakups (conflict before reaching the final trial  $T$ ) in previous rounds. The dummy variable of the experience of disagreement before reaching the final trial  $T$  in any previous rounds is introduced in the third and fourth columns of Table C.2. If the coefficient is negative, there is a possibility that there are players, who stop no concession because they understand the rule of the early breakups by reading the instructions not by reading the instructions but by experiencing it in the actual game. Of course, there can be an alternative explanation for the negative coefficient: subjects learn how their opponents are stubborn too from the experience of early breakups, then they become less likely to refuse concessions in the next round onwards. Nevertheless, Regressions (C.3) and (C.4) shows that the coefficients are negative but not significant, so we do not find the evidence.

## D Screenshots of the experiment

This section contains the screenshots of three protocols:

- Figure D.1 is the dynamic protocol. When both parties  $i = 1, 2$  simultaneously choose  $d_i^t$ , both  $i$  know all previous demands by other party  $d_{-i}^s$ ,  $s < t$ . The information is provided in the bottom table. In the middle of the screen, the blue rectangular indicates the player's own demand in the current trial. The pale blue is the level of concession from the last trial. The pale red rectangular is the demand by the other player in the last trial.
- Figure D.2 is the positional order protocol. When both parties  $i = 1, 2$  simultaneously choose  $d_i^t$ , both  $i$  are aware of  $d_1^s + d_2^s > 650$  for all previous proposals,  $s < t$ . But both  $i$  do

Table C.2: Logistic regressions on no concession

Regression	(C.1)	(C.2)	(C.3)	(C.4)
	No concession		No concession	
Variables	$c_i = 25$	$c_i = 175$	$c_i = 25$	$c_i = 175$
$T = 5$	0.737*** (0.218)	0.775*** (0.229)	0.725*** (0.221)	0.757*** (0.227)
Protocol P	-0.885** (0.360)	-0.256 (0.364)	-0.902** (0.375)	-0.305 (0.366)
Protocol D	-0.382 (0.348)	-0.309 (0.373)	-0.411 (0.366)	-0.353 (0.375)
Trial	-0.200 (0.123)	-0.191 (0.130)	-0.213* (0.125)	-0.182 (0.129)
$d_i^{t-1} = 325$	2.527*** (0.291)	3.653*** (0.346)	2.548*** (0.298)	3.655*** (0.346)
$325 < d_i^{t-1} \leq 350$	-0.00374 (0.306)	0.660** (0.268)	-0.0233 (0.311)	0.671** (0.267)
$5 \rightarrow 3$	-0.337 (0.290)	-0.647** (0.302)	-0.289 (0.302)	-0.747** (0.297)
Round	-0.0647 (0.0938)	0.199** (0.0991)		
Wrong answer to Q. 5	0.161 (0.294)	0.177 (0.300)		
Experience of early breakups			-0.681* (0.380)	-0.0573 (0.364)
Constant	-1.186** (0.543)	-2.026*** (0.556)	-1.176** (0.479)	-1.364*** (0.452)
Observations	847	847	847	847
Number of subjects	141	141	141	141
Number of groups	36	36	36	36

Notes: See the notes of Table 4 of the main text for the specification of the regression models.

not know all previous demands by other party  $d_{-i}^s$ ,  $s < t$ . Thus the pale red rectangular is hidden.

- Figure D.3 is the static protocol. When both parties  $i = 1, 2$  simultaneously choose  $d_i^t$ , both  $i$  know neither if they are yet to reach an agreement nor all previous demands by other party.

The feedback screen at the end of bargain is the same for all three protocols (see Figure D.4).

Runde 1 von 4		Bitte geben Sie Ihre Punktzahl-Forderung ein.	
Testrunde 2 von 3		<input style="width: 60px; border: 1px solid black;" type="text" value="400"/>	
Sie sind Teilnehmer B.		<b>Eingabe</b>	<b>Bestätigen</b>
<p style="color: blue;">Die Länge des blauen Balkens stellt die Höhe Ihrer Forderung dar.</p> <p style="color: red;">Die Länge des roten Balkens stellt die Höhe der Forderung Ihres Partners dar.</p> <div style="display: flex; align-items: center; margin-top: 10px;"> <div style="background-color: blue; width: 400px; height: 20px; margin-right: 5px;"></div> <div style="background-color: red; width: 375px; height: 20px; margin-right: 5px;"></div> </div> <div style="display: flex; justify-content: space-between; width: 100%; margin-top: 5px;"> <span> ----- 175 ----- </span> <span> ----- 25 ----- </span> </div>			
<b>Testrunde</b>	<b>Ihre Forderung</b>	<b>Forderung Ihres Partners</b>	<b>Summe beider Forderungen</b>
1	425	375	800
<b>Einigung</b>			
Nein			

Figure D.1: Screenshot of the dynamic protocol

Runde 1 von 4		Bitte geben Sie Ihre Punktzahl-Forderung ein.	375
Testrunde 2 von 3			
Sie sind Teilnehmer B.			
		<b>Eingabe</b>	<b>Bestätigen</b>
Die Länge des blauen Balkens stellt die Höhe Ihrer Forderung dar.			
<div> <div>375</div> <div></div> </div>			
<div> <div>175</div> <div></div> <div>25</div> </div>			
<b>Testrunde</b>	<b>Ihre Forderung</b>	<b>Einigung</b>	
1	400	Nein	

Figure D.2: Screenshot of the positional order protocol

Runde 1 von 4		Bitte geben Sie Ihre Punktzahl-Forderung ein.	375
Testrunde 2 von 3			
Sie sind Teilnehmer B.			
		<b>Eingabe</b>	<b>Bestätigen</b>
Die Länge des blauen Balkens stellt die Höhe Ihrer Forderung dar.			
<div> <div>375</div> <div></div> </div>			
<div> <div>175</div> <div></div> <div>25</div> </div>			
<b>Testrunde</b>	<b>Ihre Forderung</b>		
1	400		

Figure D.3: Screenshot of the static protocol

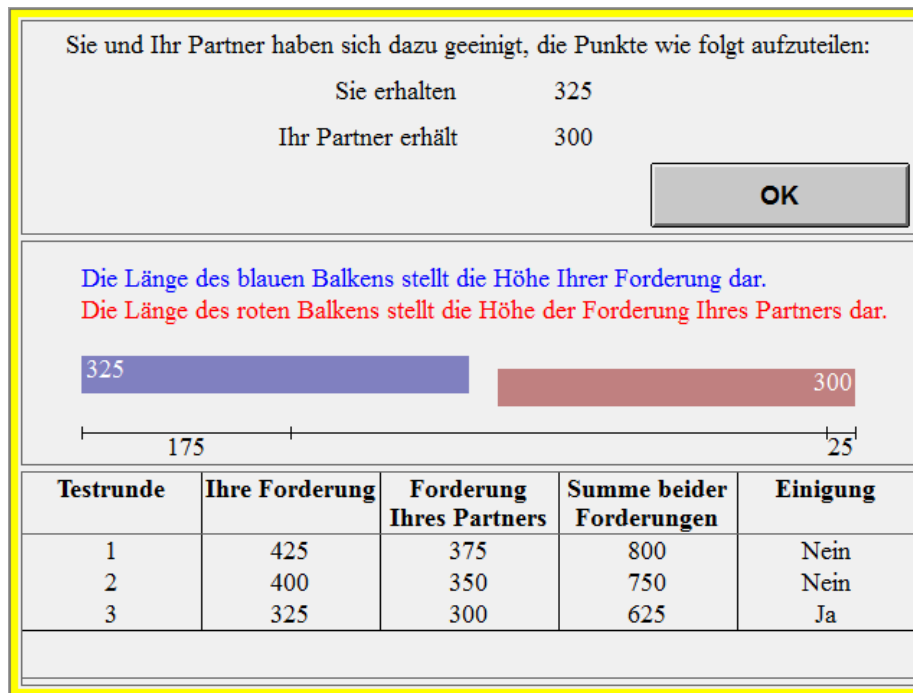


Figure D.4: Screenshot of feedback after bargaining

## E Additional figures and tables

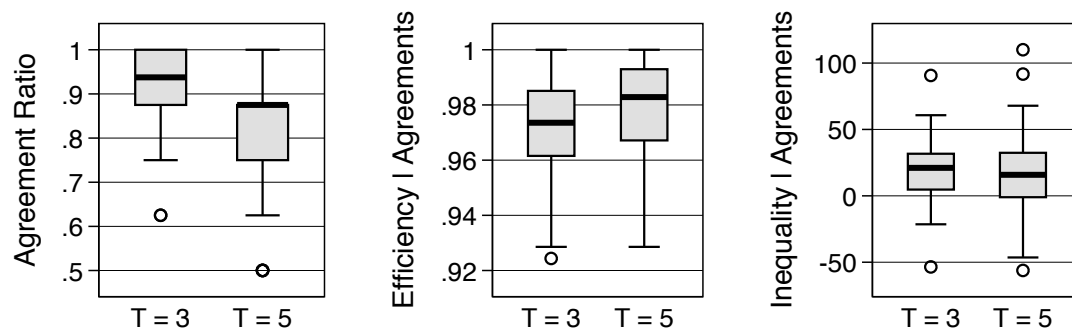


Figure E.1: Agreement ratio, efficiency and inequality by time horizon  $T$

Notes: Each observation is the mean value at the group level.



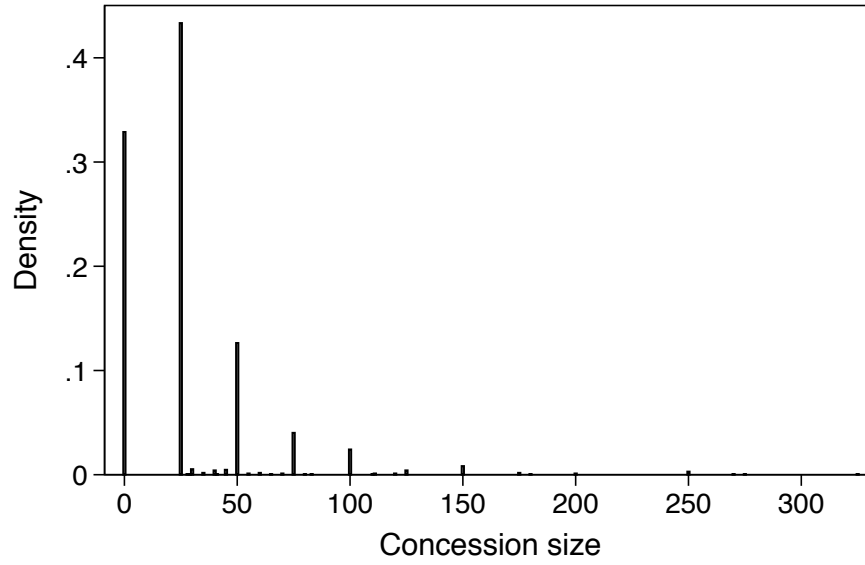


Figure E.2: Histogram of concession sizes

*Notes:* Each observation is the decision per trial per subject for  $t > 1$ . For Protocol S, we exclude the observations of pairs that have finished bargaining.

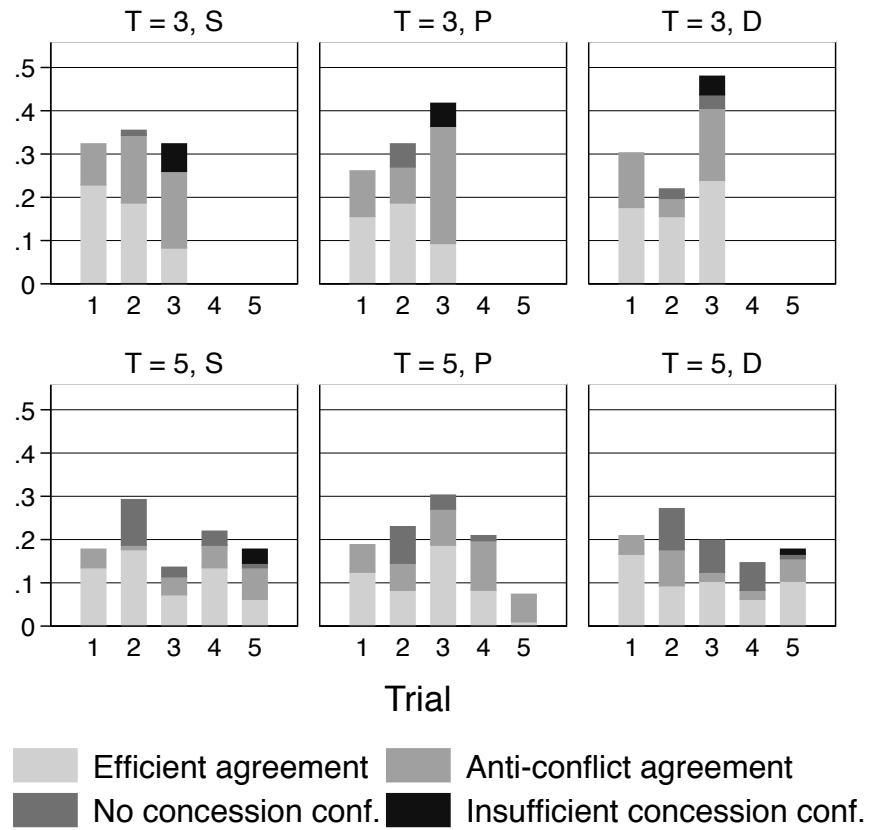


Figure E.3: Types of outcomes

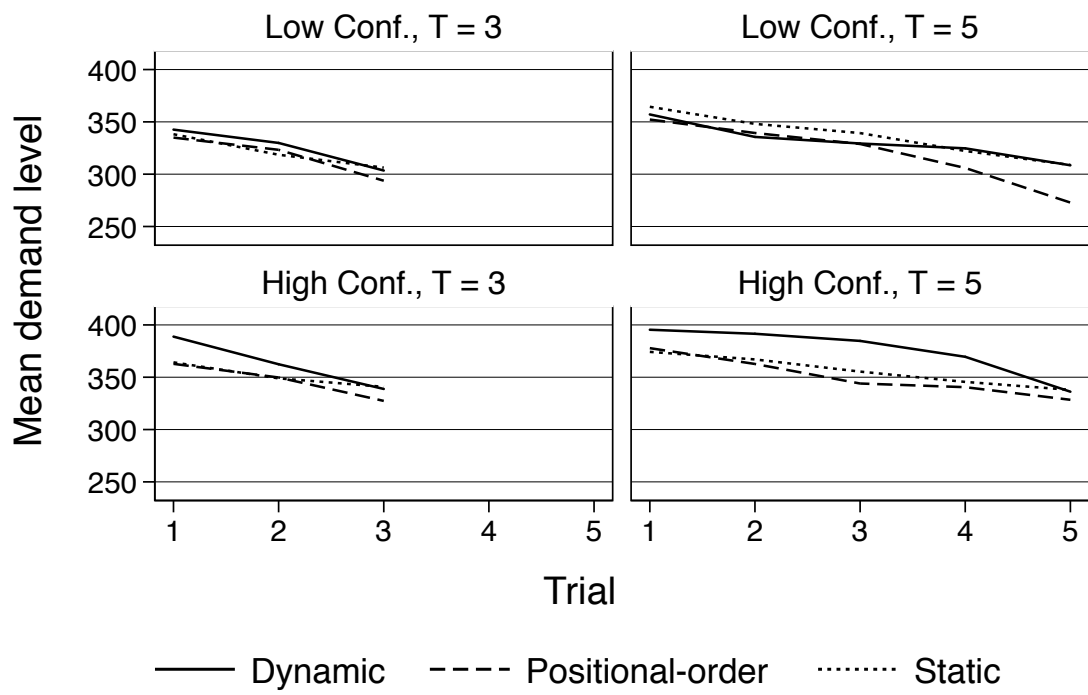


Figure E.4: Mean demand levels by conflict payoff  $c_i$  and time horizon  $T$

*Notes:* For Protocol S, we exclude the observations of pairs that have finished bargaining.

Table E.1: Regressions on agreement, efficiency and inequality

Regression	(E.1)	(E.2)	(E.3)	(E.4)	(E.5)	(E.6)	(E.7)	(E.8)	(E.9)
	Agreement			Efficiency   Agreement			Inequality   Agreement		
Variables	$T = 3$	$T = 5$	Combined	$T = 3$	$T = 5$	Combined	$T = 3$	$T = 5$	Combined
Protocol P	-0.487 (0.877)	0.647 (0.501)	0.237 (0.402)	-0.00346 (0.00745)	-0.00636 (0.00851)	-0.00461 (0.00572)	9.195 (9.938)	23.35 (15.46)	16.70* (8.759)
Protocol D	-0.192 (0.906)	-0.356 (0.449)	-0.319 (0.380)	0.00899 (0.00743)	-0.00694 (0.00881)	0.00168 (0.00581)	8.015 (9.928)	14.85 (15.90)	10.34 (8.865)
$T = 5$			-0.974*** (0.276)			0.00513 (0.00439)			-0.629 (5.540)
5→3	-0.938 (1.256)	0.627 (0.769)	0.136 (0.328)	-0.000794 (0.0136)	-0.0202 (0.0139)	-0.000538 (0.00472)	11.03 (14.33)	-11.77 (19.49)	-8.633 (7.207)
Round	0.258 (0.511)	0.0542 (0.329)	-0.139 (0.121)	0.00701 (0.00609)	-0.00269 (0.00587)	0.00591*** (0.00195)	-3.918 (5.899)	5.379 (7.201)	4.634* (2.455)
Constant	3.965*** (1.317)	1.271 (1.219)	3.031*** (0.531)	0.953*** (0.0110)	0.998*** (0.0220)	0.958*** (0.00699)	16.83 (12.00)	-1.469 (28.57)	2.354 (9.691)
Observations	288	288	576	262	233	495	262	233	495
Number of subjects	144	144	144	139	135	143	139	135	143
Number of groups	36	36	36	36	36	36	36	36	36

*Notes:* Each observation is the outcome per period per subject with the high conflict payoff. The regressions are three-level mixed models with random intercepts at both the session and the subject-within-session levels. Agreement is regressed with a logit model. Efficiency and inequality are regressed with linear models. The dummy variable “5→3” = 1 if  $T = 5$  in the first two rounds, otherwise 0. Standard errors in parentheses. Significance levels: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Table E.2: Sign-rank tests on no concession rate and no concession demand level by time horizon  $T$

		No Concession Rate				No Concession Demand Level				
Conflict		Mean		(n)	p-value	Mean		(n)		p-value
Payoff	Protocol	$T = 3$	$T = 5$			$T = 3$	$T = 5$	$T = 3$	$T = 5$	
25	S	0.3511	0.3775	(12)	0.8139	326.4	326.2	(12)	(12)	0.8427
	P	0.2233	0.3179	(12)	0.3264	325.2	335.7	(10)	(12)	0.1322
	D	0.3932	0.4732	(12)	0.3465	326.9	329.0	(12)	(12)	1.0000
	Combined	0.3225	0.3895	(36)	0.1717	326.2	330.3	(34)	(36)	0.3841
175	S	0.2520	0.4356	(12)	<b>0.0121</b>	349.6	348.4	(11)	(12)	0.3978
	P	0.3073	0.3699	(12)	0.2393	357.5	354.4	(12)	(12)	0.7231
	D	0.2494	0.3706	(12)	<b>0.0309</b>	344.7	374.2	(11)	(11)	0.0827
	Combined	0.2696	0.3921	(36)	<b>0.0006</b>	350.8	358.6	(34)	(35)	0.1855

*Notes:* “No concession rate” means the probability that a player refuses to concede in a trial  $t > 1$ .  $p$ -values are for two-sided sign-rank test. Each observation is at the mean at the group level.

Table E.3: Linear regression on the difference in the demand levels between players with the high and low conflict payoffs

Regression	(E.10)
Variables	$d_{175}^t - d_{25}^t$
$T = 3$	17.20** (7.781)
Protocol P	5.690 (13.60)
Protocol D	26.89** (13.46)
Trial	-2.205 (2.901)
$(T = 3) \times \text{Trial}$	-10.42*** (3.845)
Protocol P $\times$ Trial	0.00579 (4.095)
Protocol D $\times$ Trial	-4.050 (3.941)
5 $\rightarrow$ 3	-0.974 (9.116)
Round	3.972** (1.542)
Constant	9.206 (11.65)
Observations	1,423
Number of subjects	144
Number of groups	36

*Notes:* Each observation is the decision per trial per subject with the high conflict payoff. For Protocol S, we exclude the observations of pairs that have finished bargaining. The regressions are three-level mixed models with random intercepts at both the session and the subject-within-session levels. Standard errors in parentheses. Significance levels: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .