This is a previous version of the article published in Journal of Conflict Resolution. 2018, 62(5): 1012-1043. doi:10.1177/0022002716676312

Ultimatum Concession Bargaining: an Experimental Study

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Abstract

Unlike letting the Ultimatum Game be played in the strategy mode with monotonic response strategy, both players, the proposer as well as the responder, are allowed to concede. Proposers would concede by increasing second, third, … binding offers. Similarly, responders concede by decreasing binding acceptance thresholds.

Treatments differ in whether to avoid early conflict at least one party must concede. The other condition varies the number of possible concessions, namely, two versus four. Since accepting every positive (last) offer is weakly undominated, the benchmark outcome is the usual one with the smallest positive offer accepted (at least in last attempt). If concessions are necessary, the responder might prefer larger early acceptance thresholds allowing him to concede. Similarly, a proposer might begin by offering much less than what she is finally willing to concede.

Our experimental findings confirm the hypothesis of more frequent and larger concessions by responder participants for whom the concessions are hypothetical and essentially mean to rely on weakly dominant behavior. According to our data, the need of concessions weakens the power advantage of the proposer. Surprisingly, the longer horizon does not improve the chances of an agreement, even when no concessions are needed.

JEL Classification: C72, C78

Keywords: Bargaining Experiments, Concession Making.

1. Introduction

In his classic book on "the art and science of negotiation" Howard Raiffa (1982) argues that "…*Bargainers are continually asked during negotiations whether they prefer one constellation of outcomes to another … Not only must they decide what they ultimately want, but they also determine what they would be willing to give up in order to achieve their goal*…" (p. 148). In this respect, *concession is the hidden side of bargaining,* since parties must try to conceal -at best- how far would they go in the direction of their counterpart in order to reach an agreement.

Sometimes, these concession dynamics unravel through the sequence of offers and counteroffers that characterize sequential bargaining, whether it takes place in wage settlements (Becker, 1987) or in Maroccan bazars (Lamieri e Bertacchini, 2006). However, dynamic bargaining gives only a partial description of the concession dynamics: when the recipient accepts (or rejects) an offer, the proposer will never knows how far he should have pushed (or pulled) to get a better trade (or to close a deal that eventually broke down).

Put differently, *the concession dynamics is based on counterfactuals,* which are poorly described by the mere observation of the bargaining outcomes. This paper is based on an experiment in which *subjects are explicitly asked for their concession dynamics in the normal form.* This gives us a finer insight into the players' decision process when feedback information in a bargaining process is either unavailable or difficult to get.

To this aim, we follow the methodological approach of Alberti *et al.* (2014) for the context of the Nash Demand Game by enriching the dimensionality of the choice set and, thereby, the possibilities to infer possibly conflicting motives in ultimatum-like bargaining situations (see Güth and Kocher, 2014, for a recent survey). Assuming a normal form -or static- negotiation framework players, proposer and responder, do not choose just one offer, respectively acceptance threshold but, when first attempts fail, can concede by offering more, respectively accepting less in further attempts. For half of the treatments, in line with many bargaining protocols, no concession results in conflict whereas further attempts to find an agreement are possible when at least one party concedes after a failed attempt. For the other half conflict results only when even the last agreement attempt fails.

In collective wage bargaining, a round with no concession by any party would usually imply a strike what might be captured by a decreasing pie size where, however, most bargaining protocols assume alternating offers bargaining (e.g. Ståhl, 1972; Rubinstein, 1982). If the pie size shrinks to 0 after no concession, this would resemble one of our conditions. In international negotiations, like those to fight global warming, parties cannot meet very often (the first Kyoto-protocol dates from 1992, the second from 1997); in case of no concessions one often drops the issue, what corresponds to an "early conflict" in the condition where concessions are

needed. In legally regulated disputes no concession could mean that the judge determines a settlement what could be costly for all parties involved, similar to what will be called here "early conflict".

Compared to usual theoretical and experimental studies of concession bargaining in the tradition of Zeuthen (1930), the main innovative aspect of this paper is the *asymmetric ultimatum framework*. Especially,

- there can be no anti-conflict with both parties demanding and getting together less than available;
- the responder states only what he minimally requires for himself (and, therefore, her decision is only binding with respect to the likelihood of an agreement being reached, not her final payoff in case of agreement), so that each concession brings him closer to the solution strategy;
- the proposer might have to pay dearly for what he concedes.

Does this suggest more concessions by responder than proposer participants? Will conceding responders initially not even accept the equal split? Do proposer participants begin with meager offers, hoping for a "sucker"? Will more experienced participants delay agreement to later attempts and avoid conflict more often? And, finally, will experience effects mainly apply to responder participants? We predict more frequent and larger concessions mainly from participants with greedy first requests and those in the role of responders. Our multidimensional choice format helps to answer the questions raised above and to infer different motives to possibly categorize proposer and responder participants. In addition, we also link behavior to individual characteristics, distilled from the debriefing questionnaire answered after the experiment.

Let us already indicate here some of our findings: if concessions are needed, agreement does not become more likely for the longer horizon; experience renders conflict less probable across all conditions; and proposers are asking for more and conceding less than responders, again across all conditions. We also compare our results with those of *symmetric* concession making (Alberti *et al.* 2014), as well as to the outcomes of usual ultimatum experiments.[1] Across all conditions we confirm a slightly advantage of proposer participants and, as a result of concession ultimatum bargaining, high agreement ratios.

Section 2 introduces the "Concession Ultimatum Game" (CUG), whose solution outcome also predicts exploitation and does not question the large multiplicity of equilibrium outcomes in ultimatum games. Section 3 describes the experimental protocol and the four conditions differing in (no) need of conceding and in the number of concession stages, 2 *vs* 4. Section 4 is devoted to the statistical analysis of our data. Section 5 concludes by comparing our main results to other studies of concession and ultimatum bargaining. Appendices

[1] Restricting ourselves to the comparable data of Binmore *et al.* (2002).

contain supplementary information on the debriefing questionnaire and translated versions of the experimental instructions.

2. The Concession Ultimatum Game (CUG)

Let X and Y denote the proposer, respectively, the responder. The positive monetary amount, p, i.e., the "pie" is what X and Y can share. The proposer chooses an offer profile with for all whereas the responder determines an acceptance profile with for all . The latter, , means that, on trial t, responder Y would accept an offer only if , i.e., the components of are *acceptance thresholds*.

The last attempt, T, is applied when no earlier attempt leads to an agreement and, depending on the condition, when conceding prevents early conflict. More specifically, an agreement is reached in trial when, for all [$\leq T$], it holds that and, again depending on the condition, when at least one party concedes after each round t, and when , i.e. Y accepts via the offer of X in round t^*.

In case of such an agreement, X earns and Y receives , the amount offered to him by X. Thus, any agreement satisfies , i.e. anticonflict in the sense of agreeing to share less than is impossible. If no agreement is reached within the (time) horizon, T, the play ends in *disagreement* with monetary payoff of 0 for both players.

3 Experimental design

3.1. Sessions

We ran 9 sessions at the Laboratory of the Max Planck Institute in Jena. A total of 280 students (8 sessions with 32 participants each plus one session with 24) were recruited among the undergraduate population of Jena University using Orsee (Greiner, 2004). Subjects were provided with a hardcopy of the instructions, which were read aloud by the experimental proctor, the same for all sessions.[2] Some control questions and a dry round preceded the "real" experiment, in which subjects played 30 rounds of two variants of CUG, to be described in the following section.

3.2 Treatments

We analyze within-subjects T=3 and T=5, but vary between subjects the sequence: participants either confront T=3 first, then T=5, the 3→5 sequence, or the reverse 5→3 sequence. The other distinction between

[2] The experiment was programmed and conducted with the software *z-Tree* (Fischbacher, 2007).

- no concessions needed to prevent early conflict, N-condition, or
- not conceding after failed attempt yields negotiation breakdown, C-condition,

is implemented between subjects (152 *vs.* 128 subjects, respectively). Table 1 represents the 2x2 factorial design.

T-sequence	*Concessions needed?*	
	N(o)	**C**
3->5	$N_{3->5}$ (3 , 88)	$C_{3->5}$ (2 , 64)
5->3	$N_{5->3}$ (2 , 64)	$C_{5->3}$ (2 , 64)

Tab. 1. The 2x2 factorial between-subject design. Number of sessions and subjects per treatment within brackets.

We refer to and as *treatments*; to (N, T=3), (N, T=5), (C, T=3) and (C, T=5) as *conditions,* with *T*=3,5 identifying a *T-game*. When facing a given *time horizon*, *T*{3,5}, participants played this T-game for 15 rounds with randomly changing partners and outcome feedback after each round. Varying T only within subjects was based on the conjecture –confirmed by our evidence- that it hardly matters- at least in the latter of the 15 rounds with the same horizon *T*ϵ{3,5}- whether one first encounters the longer or the shorter horizon.[3]

We actually are able to pool the data for some statistical tests. Compared to this we expected and confirmed strong effects of condition *N*, respectively *C* for concession making and bargaining results and have therefore explored those conditions between subjects.

Feedback information has been restricted to outcomes. Specifically, participants were told:

- which, if any, attempt *t=1,…,T* was decisive for yielding an agreement or, if not that, only in the C-treatments, after which failed attempt *t=1, .., T* early conflict was the outcome. In N-treatments conflict results only after a failed last attempt.
- in case of agreement, the accepted offer and how much each partner had earned.

The second phase of 15 rounds was announced afresh after the end of the first phase. Only then, subjects were given the instructions for the second phase.[4]

3.3. Matching

At the beginning of a session, the software would partition the subject pool in *matching groups* of 8 subjects -4 X and 4 Y- with subjects interacting only with participants of the same matching group across the entire

[3] All regressions reported in this paper always include a sequence dummy, which is never significant and, therefore, not reported (but controlled for).

[4] See the Appendix B for a translation of the German instructions.

experiment. Role and matching group assignment was kept constant throughout the session. Across periods, participants were randomly rematched within the same matching group to form pairs of X and Y participants. Participants were not told that random re-matching was restricted to smaller matching groups, to discourage repeated-game effects.

3.4. Feed-back

At the end of each round participants were informed about:

1. Whether an agreement has been reached;
2. If so, at which trial; and if not, in the *C* treatment, which trial led to conflict due to no party conceding.
3. All offers from *X* leading to the result;
4. The monetary earnings of both participants, *X* and *Y*, in that period.

By contrast, *Y*'s acceptance profile was not made public to *X* at any time (to limit the effect of using monotonic response strategies) what anyhow would be unrealistic –an acceptance threshold specifies behavior hypothetically.

3.4. Payment

The monetary pie, *p*, was always € 11. Proposers' and responders' admissible offers/acceptance thresholds *were restricted to integer numbers*, thus excluding, by design, the equal split and imposing a quite substantial minimum size for concessions. In addition to the show-up fee of € 4, participants were paid for two randomly selected rounds for each of the two phases. Subjects were paid in cash privately at the end of the session. An experimental session, including the debriefing questionnaire and the payment phase, lasted approximately 2 hours. On average participants earned € 28 (min €14, max € 37).

3.5. Debriefing

To collect information about the heterogeneity in the subject pool participants answered a debriefing questionnaire at the end of a session. In addition to standard socio-demographic variables (gender, age, field of study, parents' education, family wealth and available income, etc…) the questionnaire also includes two classic psychological tests: *i)* Frederick's (2005) *Cognitive Reflection Test* and *ii)* a 25-item reduced version of the *Big Five personality inventory* (John and Srivastava, 1999), which is designed to elicit five stereotypical psychological traits (see Appendix A for more details). We implemented *ii*) as a control to be used in case of unusual findings and thereby focus mainly on *i*).

3.6. Hypotheses

The rich database, hopefully, will yield clear results concerning the learning direction of the following dimensions:

a) the (non) agreement frequencies;

b) whether agreements converge more to equal splits (evolution of fair play) or meager offers (evolution of rational play);

c) whether the heterogeneity in behavior and outcomes is reduced by experience;

d) whether agreements are more and more delayed;

e) whether dependence on condition becomes weaker across rounds.

Our main hypothesis that greedy first attempts go along with larger concessions and that responders concede more often and larger amounts partly addresses individual heterogeneity and partly the asymmetry of the game, a novel aspect compared to other concession-making studies. Whereas for responder Y a concession means to give up one monotonic acceptance strategy for one which weakly dominates it, proposer X loses when increasing his offer. We thus predict that the burden of conceding is significantly more often shared by Y – than by X – participants.

Another interesting aspect is whether the fairness norm is so strong that at least pairs agreeing on the fifty-fifty split can do so without much delay and haggling. On the other hand, the possibility and partly the need of concessions may induce some participants to begin with rather ambitious claims in order to be later on able to concede. A fair participant, for example, in the proposer role might fear:

"Imagine that I as proposer X immediately offer what, however, due to is rejected. Even if now the responder concedes but not enough to reach an agreement: wouldn't (s)he expect me to concede next? But I can't offer Y more than half of the pie!"

At least in the *C-treatments* such reasoning seems rather likely which is why we predict more ambitious first choices for *C-treatments* than for *N-treatments*.

More basically, conflicting intuitions on how to behave in CUG-experiments might gain momentum in repeated play like:

- the symmetric characteristic function of the CUG suggesting equal sharing;
- the asymmetric power structure not reflected by the symmetric characteristic function but revealed by backward induction reasoning suggesting exploitation of *Y*;
- the basic intuition that concession bargaining asks for haggling hoping to find a "sucker" and
- fairness concerns since roles are randomly assigned and the pie is given to *X* and *Y* like "manna from

heaven" what questions entitlement and exploiting strategic advantages.

If one surprising effect of ultimatum experiment was the motivational complexity of ultimatum bargaining (see the recent survey by Güth and Kocher, 2014), CUG-experiments could enrich this much further.

4. Results

Regarding the 280 participants (177 female, 63.2%; mean age ± SD: 24.3±3 years; age range 19-35 years); mostly, undergraduates from the University of Jena student population (26% from Natural Science, 50% from Social Science and 23% from Humanities), we find no specific correlation between socio-demographic characteristics and treatment assignment.[5]

4.1. Agreement ratios and dynamics

We begin by looking at outcome distributions. Outcomes, basically, depend on whether and, if so, which agreement is reached and, if not, whether this is due to the fact that the time horizon, *T*, has been reached without an agreement or whether, in *C-treatments*, neither party concedes within trials.

Figure 1 replicates Figure 1 in Alberti *et al.* (2014), Panel A, by reporting the "box plots" representing the distribution of acceptance rates across matching groups in the four conditions.[6]

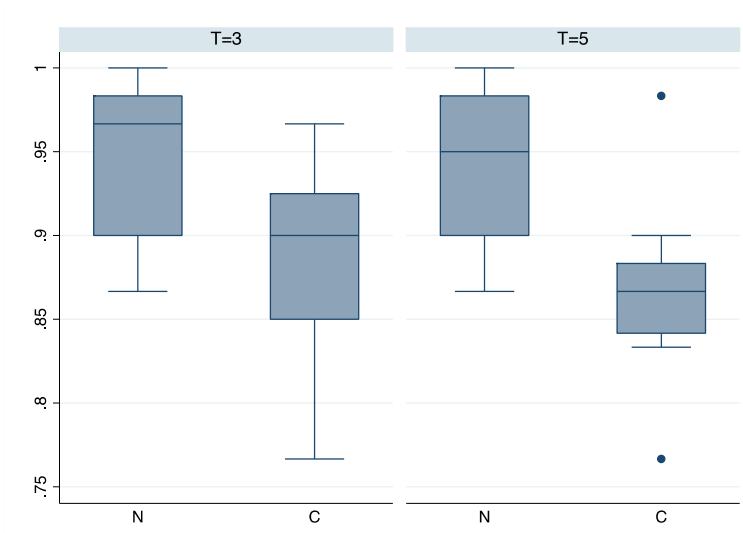


Fig. 1. Box plots of agreement ratios by condition.

Agreements are more frequent in *N* treatments (with negligible differences across horizon, *T*). The different

[5] Correlation tables are not reported here but available upon request.

[6] The boxes show 50% of the total observations (from the 25% to the 75% percentile). Adjacent lines trace the first upper and lower adjacent values, while points denote outliers. The line within the box denotes the median.

results of the C-treatment, are *i)* lower average agreement rates, *ii)* especially for *T*=5. Mann-Whitney non parametric tests on the differences of matching group agreement rate averages confirm

Result 1. *The difference in agreement rates between N and C treatments is always significant (at 5% confidence level), whether or not one conditions on a specific horizon, T. By contrast, the difference in agreement rates between T=3 and T=5 is never significant, regardless on whether or not one conditions on concession protocol, N and C.*

Figure 2 details the disagreement patterns, separately for each condition.

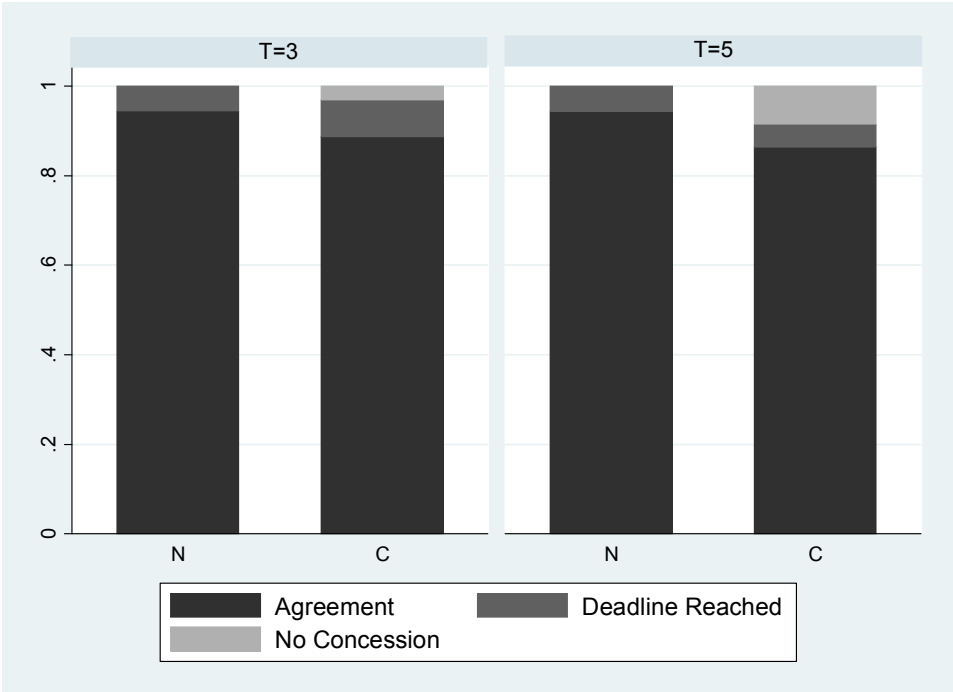


Fig. 2. Agreement shares by condition.

Across all conditions, agreement is by far the most common outcome, over 90% of all observations. Also notice that *i)* the agreement ratio is higher for *N* (left T-columns in Figure 2), while, *ii)* conditional on a given concession rule, time horizons *T* (compare lower and upper panels of Figure 2) do not affect the likelihood of an agreement. Another interesting finding is that, in case of *C*-treatments, "early conflict" for *T*=3 is not more frequent than for *T*=5, in spite of the twice as many possible opportunities for "no concession". Table 2 reports results of testing mean differences in conflict type, –evaluated at matching group level- across time horizons and concession requirements using Mann-Whitney tests,[7] what supports

Result 2. *In the C condition, the way of disagreeing (no concession vs. deadline) crucially depends on the time horizon, with lower (higher) relative frequency of No Concession (Deadline Reached) conflict when T=3 (T=5),*

[7] All test statistics reported in this paper follow exactly the same methodology.

respectively.

	Ratio of No Concession Conflict			Ratio of Deadline Reached Conflict		
	Mean			Mean		
Protocol	*T*=3	*T*=5	*p-value*	T=3	T=5	*p-value*
N	X	X	X	.056	.057	.89
C	.03	.08	.0006	.082	.05	.031
Both	X	X	X	.068	.054	.214

Tab. 2. Testing mean differences in conflict types (Mann-Whitney test, 2-tailed). "X" denotes non-applicable cells.

We now take a closer look at the agreement dynamics *across trials,* that is, within a single round. Figure 3 summarizes the within-trial agreement dynamics by reporting relative frequencies of agreements disaggregated by trials. Here we see that, for both *T*-games, condition C yields a smaller relative frequency of agreements in the first trial . Conditional on an agreement being reached (i.e., excluding observations ending in conflict), average agreement trials $t^*=1,\ldots,T$ are significantly higher in condition C (Mann-Whitney tests reject the null at less than 1% confidence for both $T=3$ and $T=5$).

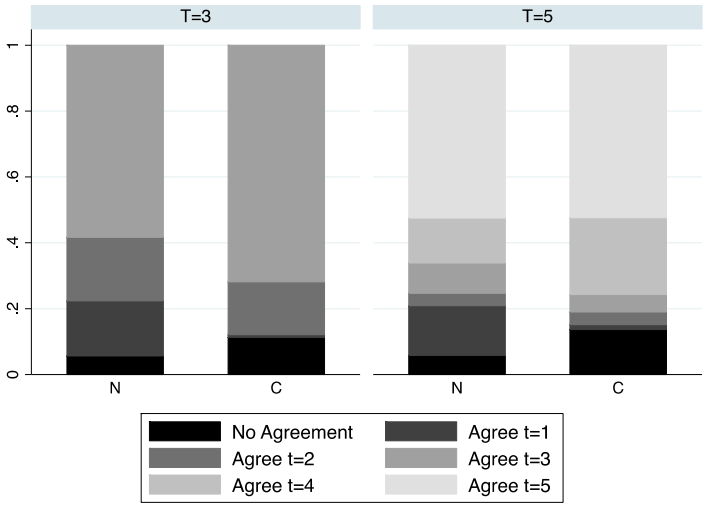


Fig. 3. Agreement dynamics across trials.

Apparently, players anticipate that, in condition C, they will have to concede more often and start off more aggressively.

Result 3. *Conditional on reaching an agreement, the need to concede in order to avoid early conflict significantly increases the number of trials till agreeing.*

We now look at the agreement dynamics across *rounds*. Table 3 reports the estimated coefficients of (ordered)

logit regressions in which we regress the probability of an agreement (in agreement trial, t^*) against a round index, r, and condition dummies.[8]

	ALL DATA		N-condition		C-condition	
	Agreement	Agreement trial t^*	Agreement	Agreement trial t^*	Agreement	Agreement trial t^*
C condition	-0.862***	0.654***				
	(0.177)	(0.204)				
T=5	-0.152	3.240***	-0.0330	2.498***	-0.222	4.784***
	(0.119)	(0.331)	(0.227)	(0.343)	(0.138)	(0.409)
round r	0.0669***	0.0267***	0.0957***	0.0103	0.0507***	0.0600***
	(0.0137)	(0.00761)	(0.0245)	(0.00843)	(0.0164)	(0.0112)
Constant	2.395***		1.963***		1.783***	
	(0.204)		(0.267)		(0.198)	
Obs.	8,400	7,662	4,560	4,300	3,840	3,362

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Tab. 3. Regressions of agreement dynamics.

As Table 3 shows, condition C delays the agreement, and we also observe evidence of learning, as reported in the following

Result 4. *Agreement is more likely in the* N *sessions, and in later rounds.* C *sessions are characterized by later agreements.*

4.2. Inequality

Figure 4 replicates Figure 1 in Alberti *et al.* (2014), Panel B, by reporting the box plots representing the distributions of the relative share for X, conditional of an agreement being reached, in the four conditions.

[8] In the regressions of Table 3 –as well as in all regressions reported in this paper- we controlled for the existence of *order effects*, since both *T*-games where administered within subjects, in different order (see Table 1). In this respect, order effects were never significant and we omit to report them.

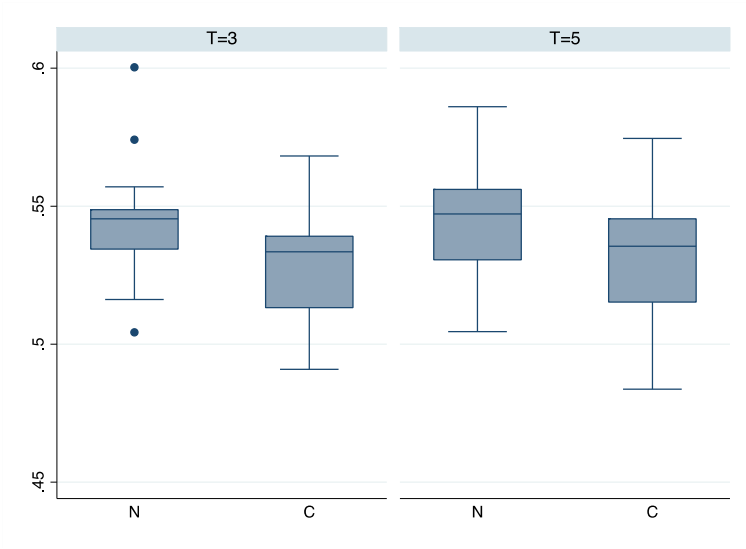


Fig. 4. Distributions of X's relative share, conditional of agreement being reached.

Proposers exploit their bargaining power: the relative pie shares of *X* usually are above half of the pie in all conditions. Thus ultimatum power pays in agreement what, however, is limited and never yields more than 60% of *p*. Comparing across concession protocols, the ultimatum power advantage seems more pronounced in condition *N*: the need to concede mitigates X's ultimatum power and, thereby, raises *Y´*s relative share.

Table 4 reports the estimated coefficients of random-effect tobit regressions in which the dependent variable is , the pie share the proposer gets in case of an agreement being reached in round *r*, as a function of the negotiation round, *r,* and condition dummies. We run three separate regressions: one for all observations, including a concession dummy, then two additional regressions, conditioning on the concession protocols.

	ALL	N	C
VARIABLES	myShare	myShare	myShare
C-condition	-0.0138***		
	(0.00484)		
T=5	0.00230*	0.00170	0.00308
	(0.00125)	(0.00148)	(0.00214)
Round *r*	0.000125	0.000316*	-0.000123
	(0.000145)	(0.000171)	(0.000248)
Constant	0.543***	0.542***	0.531***
	(0.00353)	(0.00340)	(0.00449)
Observations	3,831	2,150	1,681

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Tab. 4. Regressing proposers' relative share in case of agreement, $(p- y_{t^*})/p$ with p=€11.

The estimated coefficients of Table 4 justify

Result 5. *Even when controlling for conditions, the effect of ultimatum power on proposer X´s agreement share is significant. However, in C, the advantage of X is significantly reduced. Inequality does not depend on experience, measured by round (r =1,…,15) nor on sequence, and .*

4.4. Individual behavior

We now look at individual behavior along two complementary dimensions: *initial aggressivness and willingness to concede*. Figure 5 reports mean offers/acceptance thresholds across trials, disaggregated by condition, showing that C parties start off with more aggressive claims and concede more across trials.

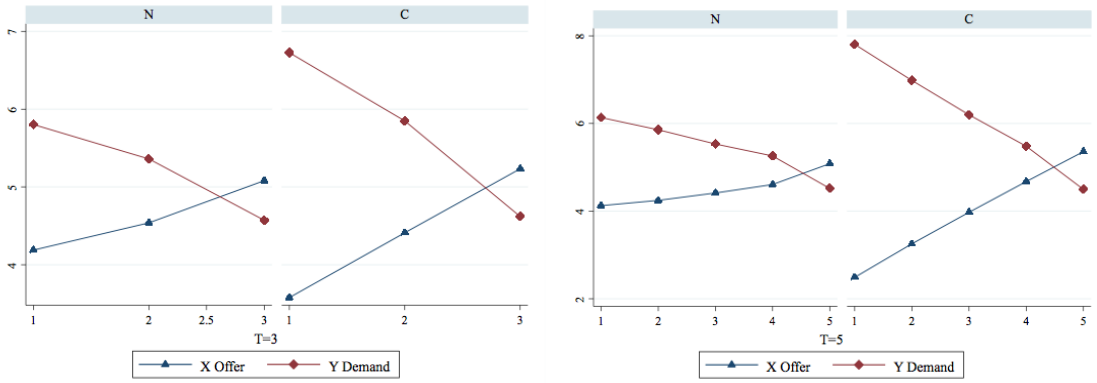


Fig. 5. Mean offers/minimum acceptable offers across trials, disaggregated by treatment

Furthermore, in condition *C* mean offers/thresholds movements follow a nearly linear trend (choices were restricted to integer numbers), whereas in *N* the already smaller gap between claims is more rapidly reduced in the last trial than before.

Mann-Whitney tests always reject the null (always at less than 1% confidence) that *i)* first/last demands are equal across player roles, *ii)* first are equal to last demands and *iii)* across trials, proposers concede as much as responders. Proposers are more aggressive in their claims, both at the first and at the latest trial, and conceding is a consistent pattern, also in *N*, with- as expected- responders conceding more than proposers. In all conditions differences are always statistically significant at 5% confidence level with the exception of *C, T*=5. To summarize, we could largely confirm our theoretical conjectures: concessions are larger in *C* with proposers conceding less than responders (except for *C, T*=5).

Result 6. *Proposers demand more (and concede less) than responders, in all trials. In the C-protocol both parties*

begin with more aggressive claims and concede more.

After discovering that the heterogeneity in first demands and concession rates has a clear treatment -and player role- component, we became also interested in identifying (if any) an *individual component,* once treatment conditions have been controlled for. Figure 6 plots, for each participant, average values of initial demands *(Demand1)* and concessions rates, *deltaDem*, , (for proposers (responders), respectively, by protocol and *T*-game.

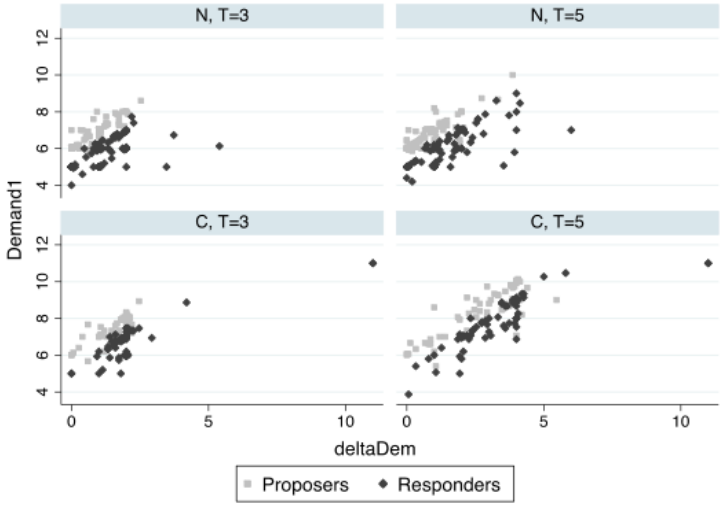


Fig. 6. First demands (Demand1) against concession rates (deltaDem), averaged by subject.

As Figure 6 shows, on average, proposers demand more (and concede less) than responders. Moreover, Figure 6 also shows that initial demands and concession rates are highly correlated: those subjects who initially demand more, are also those who concede more. Put differently, individual behavior is highly heterogeneous, even after controlling for treatment conditions and player role.

Motivated by the evidence of Figure 6, we evaluate, for each subject, mean first demand and concessions across the entire experiment, and evaluate the median of such individual mean values by player roles and *C*-condition. We then partition our subject pool in four groups, depending on whether their initial demand (concession rate) is above the median of their reference group (that is, among subjects with the same role and condition). Since first demands and concession rates are highly correlated, we jointly estimate the probability of belonging to either partition (hiDem1/loDem1, hideltaDem/lodeltaDem) using a bivariate probit regression, where the set of regressors includes proxies of subjects' observed heterogeneity distilled from the questionnaire.

	ALL		Proposers		Responders	
VARS.	hi_Dem1	hi_delta	hi_Dem1	hi_delta	hi_Dem1	hi_delta
female	-0.0249	0.226	0.304	0.529**	-0.371	-0.196
	(0.166)	(0.168)	(0.237)	(0.239)	(0.239)	(0.252)
RSR	**0.0320**	**0.0230**	**0.0440**	**0.0507**	**-0.0212**	**-0.113**
	(0.101)	(0.101)	(0.128)	(0.131)	(0.177)	(0.183)
GPA	0.0357	0.0841	0.0675	0.0914	-0.0153	0.148
	(0.112)	(0.114)	(0.148)	(0.153)	(0.188)	(0.196)
CRT	0.159**	0.202***	0.188*	0.0416	0.128	0.322***
	(0.0687)	(0.0691)	(0.104)	(0.105)	(0.0957)	(0.0992)
BIG5_Agree	-0.735	-1.202	-0.845	-0.752	-0.915	-2.396**
	(0.729)	(0.734)	(0.977)	(1.012)	(1.128)	(1.161)
BIG5_Open	0.595	0.683	0.574	-2.470*	1.159	4.612***
	(0.951)	(0.959)	(1.335)	(1.346)	(1.431)	(1.539)
BIG5_Neuro	-0.234	-1.464*	-0.366	-0.604	-0.154	-2.798**
	(0.867)	(0.873)	(1.374)	(1.391)	(1.178)	(1.256)
Constant	-0.231	0.504	-0.390	1.920	-0.113	-0.416
	(0.847)	(0.854)	(1.195)	(1.233)	(1.262)	(1.256)
Obs.	280	280	140	140	140	140

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

Tab 5. Bivariate probit regressions

Our set of covariates includes:

1. **female:** gender dummy.
2. **RoomSizeRatio:** a standard proxy for household wealth, obtained by dividing the number of rooms of the main residence by the household size.
3. **GradePointAverage:** academic performance.
4. **CRT** score (see Appendix A).
5. **BIG_5_x.** See Appendix A.

The estimates in Table 5 show that the higher the CRT score the larger the likelihood of stating an "aggressive" first demand and of ending up making larger concessions. It also indicates that this behavior might be influenced by some personality traits such as Agreeableness and Conscientiousness and by gender with this latter effect being more prominent for proposers.

The evidence of Figure 6 and Table 5 yields the following

Result 7. *Responders concede more than proposers, even after controlling for the positive (negative) effects that C treatments (large T) have on concession rates. Reflective subjects demand and concede more, irrespective of the role as proposer or responder. Female proposers concede more, while the BIG 5 psychological traits are significant by influencing behavior mainly of responders.*

In our view, Result 7 illustrates nicely that heterogeneity in strategic interactions will not only be caused by heterogeneity in preferences and beliefs but can be due to cognitive skills, specifically it seems that more thoroughly reflecting participants concede more often. We only used the CRT-data although other personality characteristics, e.g. the so called "Big Five", also help to account for the heterogeneity in behavior and, quite in line with our intuition that responders will concede more and more often. We do not pay attention to them as well as to gender since our hypothesis and research question did not focus on such traits. We mainly confirm our intuition that those who rate higher on conscientiousness, i.e. those who are thorough, careful and vigilant, concede more. Similar results has been obtained by Ben-Ner *et al.* (2003) and Ponti and Rodriguez-Lara (2015), who explain Dictator giving by CRT scores and personality traits measures.

5. Comparison across studies

In this section we compare some of our findings (US hereafter) with those of Binmore *et al.* (2002, BIN02) and Alberti *et al.* (2014, ALB14), the former implementing (among other treatments) a straightforward Ultimatum Game with no concessions and the latter implementing (among other treatments), our *C*-game under the Nash Demand Game (with asymmetric outside options) protocol. Two dimensions will be under scrutiny: agreement rates and relative shares in case of agreement. Specifically, our evidence collected in the N (C) condition, will be compared with that of BIN02 (ALB14), respectively.

5.1 Agreement ratios

By analogy with Figure 1, Figure 7 compares the agreement rate distributions across datasets.

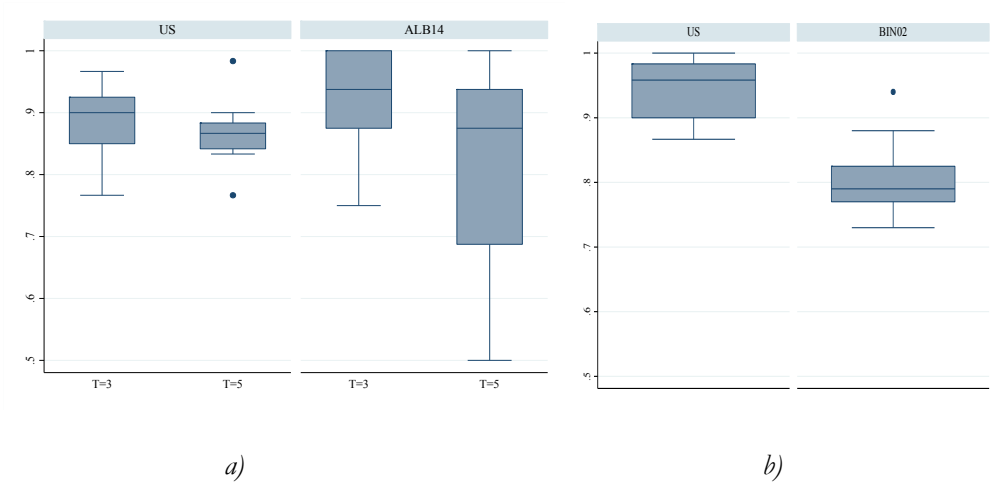


Fig. 7. Agreement ratio by datasets.

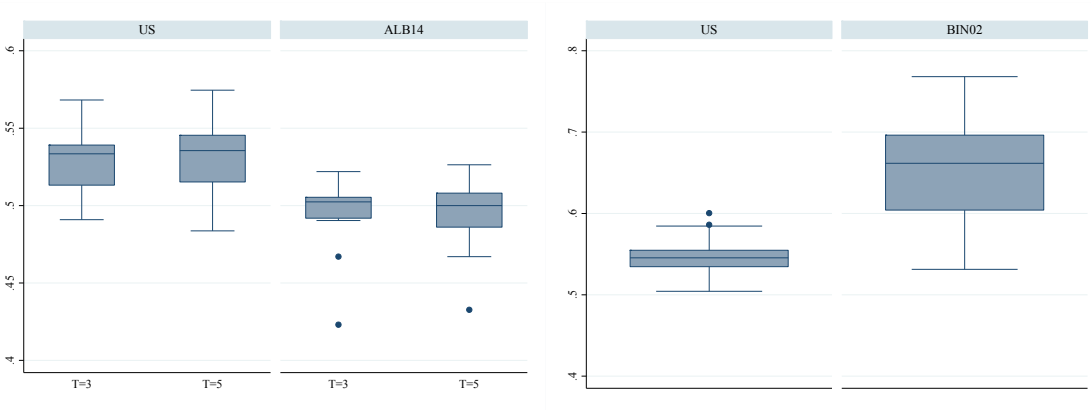
As Table 7 shows, difference in mean agreement rates between our data and those of ALB14 are never significant (though we observe a higher dispersion across matching groups in the latter dataset), whereas BIN02 is characterized by a smaller agreement rate, around 80% -against 91% and 86% overall in our data and those of ALB14, respectively. These differences are always significant at less than 1% confidence, whether we consider the full datasets, or we split it by T-games.

5.2 Inequality

We now move to the comparison of relative inequality across studies (in case of agreement). By analogy with Figure 4, Figure 8 reports the box plots of the distributions of X's relative share in case of agreement. Panel *a)* compares US with ALB14 (condition *C)*; Panel B compares US with BIN02 (condition *N*).

Let's discuss the comparison with ALB14 first. As Figure 8, Panel *a)* shows, the relative share Player 1 gets is (significantly) lower, roughly, just below 50% of the pie. Remember that ALB14 implements a Nash Demand Game, in which, in case of agreement, players receive what they ask. So, here bargaining power can only be measured by the size of the conflict payoff (175 points for player 1 against 25 for player 2, with sharing a total of 650). As Panel *a)* clearly shows, the agreement share does not reflect such a huge difference in the opportunity cost of the agreement, while the 50/50 split seems to act as social norm in ALB14 data: 47% (44%) of the pie is what Player 1 (2) gets in case of agreement.[9]

[9] If we consider the bargaining process in ALB14 over the surplus, once the sum of the conflict payoffs has been subtracted, we see that, in case of agreement, Player 1 (2) gets 29% (58%) of the pie.



a) *b)*

Fig. 8. Inequality in case of agreement by datasets.

Things change dramatically in the comparison with BIN02. As Figure 8, Panel *b)* shows, the prevailing sharing rule in case of agreement is "2/3 to the proposer, 1/3 to the responder", typical of many Ultimatum Game experiments.

Result 8. *Agreement rates do not differ significantly between US and ALB14, while BIN02 is characterized by lower agreement rates. Similarly to ours, in ALB14 players share equally the surplus in case of agreement (although the difference is statistically significant), while in BIN02 the proposer gets significantly more.*

Altogether, our Result 8 suggests that concession bargaining quite generally enhances equality seeking at least with finally agreeing or, turned around, weakens the effect of asymmetric power structures.

5. Conclusion

Rather than letting participants play the normal form ultimatum game, based on monotonic acceptance strategies (responders choose acceptance thresholds), they were encountering normal form versions of concession ultimatum games varying in the maximal number of possible concessions, horizon T=3 and T=5, and whether after a failed agreement attempt at least one concession is needed for a further attempt (C vs. N treatment). Compared to usual concession bargaining the innovative aspect is that conceding a lower acceptance threshold is not really a sacrifice for the responder (one only hypothetically accepts offers which before would have been rejected) whereas the proposer definitely would lose when conceding leads to an agreement.

How do results compare to usual (T=1) normal form ultimatum experiments? Regarding agreement ratios

the missing (significant) difference between T=3 and T=5, e.g. as very pronounced for C-treatments, suggest to extend our result to T=1, e.g. when comparing our findings to those of Binmore *et al.* (2002) what, however, was rejected. The fact that conceding is possible at all seems to matter more that the number of possible attempts. For the C treatment the longer horizon T=5 induced more frequent conflict due to neither party conceding after a failed attempt. Across trials, if an agreement has been reached at all, the overwhelming agreement trial is the last one, in line with the so called deadline effect (see Figure 3).

Regarding the fairness of the final agreements the usual moderately lower share of responder participants is confirmed. The pie of the responder is, however, significantly higher in the C-treatment. One reason could be that proposers concede more often to prevent early conflict by which they would lose more than responders. This, however, is not supported by our data (see Result 4). In our view, responder participants concede more often across conditions since this means to substitute one (monotonic response) strategy by one which is weakly dominating it, i.e. conceding for them is no real sacrifice.

Regarding the negotiation patterns, initial attempts are far more distant when concessions are needed (C-treatment) what goes along with larger concessions for the C than for the N treatment. Since, compared to usual concession bargaining, the ultimatum game rules out anti-conflict (parties share less than available), concessions for the last trial t=T reveal systematic overshooting (see Figure 6), i.e. on average slightly smaller last concessions would also have led to an agreement. Interestingly there is no such average overshooting before the last trial T, irrespective of horizon T, 3 versus 5, and treatment, N versus C.

Finally we could demonstrate how heterogeneity in individual concession behavior in both rather different roles, proposer and responder, can be partly accounted for by one psychological characteristic, the post experimentally elicited index of the Cognitive Reflection Test.

Acknowledgements

We are greatly indebted to Hande Citler, Sara Elsermann, Rocío Fernandez, Albrecht Noll, Megan Sierz and Claudia Zellmann for their precious research assistance. The usual disclaimers apply. The main funding was provided by the Max Planck Institute of Jena. Esther Mata and Giovanni Ponti acknowledge additional financial support from the Spanish Ministry of Economics and Competitiveness (ECO2012- 34928), MIUR (PRIN 20103S5RN3_002) and Generalitat Valenciana (Research Projects Gruposo3/086 and PROMETEO/2013/037).

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Appendix A. Personality tests

As mentioned in text (3.5. Debriefing) subjects responded a debriefing questionnaire at the end of each session that included a *CRT* test and *Big Five* personality inventory.

A1. The Cognitive Reflection Test

The Cognitive Reflection Test (CRT, Frederick, 2005) is a three-item task that is meant to measure the tendency to override the first, apparently "intuitive, response alternative -that is incorrect- and to engage in further reflection that leads to the correct answer. This test has been shown to be positively related with numerical literacy, mathematical skills, and to psychological dimensions related to impulsiveness (Morsanyi *et al.*, 2014; Toplak *et al.*, 2011).

CRT_1. A bat and a ball cost $1.10. The bat costs $1.00 more than the ball. How much does the ball cost? ___ cents. **Correct Answer: 5.**

CRT_2. If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? _____ minutes. **Correct Answer: 5.**

CRT_3. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? _____ days. **Correct Answer: 47.**

As Frederick (2005) points out, the beauty of the test lies in the fact that "…*The three items on the CRT are "easy" in the sense that their solution is easily understood when explained, yet reaching the correct answer often requires the suppression of an erroneous answer that springs "impulsively" to mind.*" (p. 27). In the test, these "erroneous answers" (100, 100 and 24, respectively) corresponds to the modal choices in our dataset (and in many others, see Frederick 2005).Following Frederick (2005), it is standard practice to use the CRT to build up an index -an integer from 0 to 3- by simply counting the number of correct answers (see Brañas-Garza *et al.*, 2012 and Grimm and Mengel, 2012).

A2. The "Big 5" test

The "Big 5" test of psychological traits, in its various forms, is among the most relied-upon measures of

personality in psychology (see, e.g., Digman, 1990; John *et al.*, 2008). It measures personality according to five broad dimensions, or "traits", defined as

- *Openness*: reflects the degree of intellectual curiosity, creativity and a preference for novelty and variety a person has. It is also described as the extent to which a person is imaginative or independent, and depicts a personal preference for a variety of activities over a strict routine.
- *Conscientiousness:* A tendency to be organized and dependable, show self-discipline, act dutifully, aim for achievement, and prefer planned rather than spontaneous behavior.
- *Extraversion:* Energy, positive emotions, surgency, assertiveness, sociability and the tendency to seek stimulation in the company of others, and talkativeness.
- *Agreeableness:* A tendency to be compassionate and cooperative rather than suspicious and antagonic towards others. It is also a measure of one´s trusting and helpful nature, and whether a person is generally well tempered or not.
- *Neuroticism:* tendency to experience unpleasant emotions easily, such as anger, anxiety, depression, and vulnerability. Also refers to the degree of emotional stability and impulse control and is sometimes referred to by its low pole, "emotional stability".

Recent studies (Borghans *et al.* 2009; Daly *et al.* 2009) show that these measures of personality traits are a reliable predictor of labor market performance and academic achievement (Barrick and Mount, 1991; Judge *et al.*, 1999; Heckman and Rubinstein, 2001; Zhao and Seibert, 2006; Heckman and LaFontaine, 2010).

We implemented *ii*) as a control to be used in case of unusual findings and thereby focus mainly on *i*).

Appendix B. Experimental instructions (translated from German)

CONCESSIONS UG3R_NG3

In this experiment you will be interacting with another participant whose identity will not be revealed by us. You will interact not only once but repeatedly with a randomly changing other participants. Each participant will constantly either assume role *X* or the other role *Y*. Both *X* and *Y* can potentially share … ECU.

In role *X* the participant determines the amount y of the total amount … which (s)he offers to the participant in role Y. In role *Y* the participant states the minimally acceptable amount $\underline{y}$, i.e. in role *Y* one's choice of $\underline{y}$ rejects offered amounts …-y smaller than $\underline{y}$. For given choices y and $\underline{y}$ by *X*, respectively *Y*, an agreement would be reached if … - y is at least as high as $\underline{y}$. In that case the *X*-participant receives …-y and *Y*-participant the offer y which is at least as high as $\underline{y}$. If however y is smaller than $\underline{y}$, the two participants have not agreed on how to share the total amount of … ECU.

To make it easier to find an agreement, the *X*-participant and the *Y*-participant do not state only one offer y, respectively one minimally acceptable amount $\underline{y}$, but rather state three demands y_1, y_2, y_3, which cannot decrease, respectively minimally acceptable amounts $\underline{y}_1, \underline{y}_2, \underline{y}_3$, which cannot increase. More specifically, it is required that

$0 < y_1 \leq y_2 \leq y_3 < \ldots$ and

$0 < \underline{y}_3 \leq \underline{y}_2 \leq \underline{y}_1 < \ldots$

where all these amounts are in ECU. How does this determine whether an agreement is reached and, if so, which agreement how to share … is reached? This is determined as follows:

- If $y_1 \geq \underline{y}_1$, then an agreement is reached with *X* earning …- y_1 and *Y* getting y_1.
- If not one checks whether $y_2 \geq \underline{y}_2$. If so, an agreement is reached with *X* earning …- y_2 and *Y* getting y_2.
- If not one checks whether $y_3 \geq \underline{y}_3$. If so, an agreement is reached with *X* earning …- y_3 and *Y* getting y_3.
- If even $y_3 < \underline{y}_3$, the two participants have not agreed.
- With no agreement, X and Y earn nothing, i.e. the amount of ... is lost for them.

CONCESSIONS UG5R_NG5

In this experiment you will be interacting with another participant whose identity will not be revealed by us. You will interact not only once but repeatedly with a randomly changing other participants. Each participant will constantly either assume role *X* or the other role *Y*. Both *X* and *Y* can potentially share … ECU.

In role *X* the participant determines the amount y of the total amount … which (s)he offers to the participant in role Y. In role *Y* the participant states the minimally acceptable amount $\underline{y}$, i.e. in role *Y* one's choice of $\underline{y}$ rejects offered amounts …-y smaller than $\underline{y}$. For given choices y and $\underline{y}$ by *X*, respectively *Y*, an agreement would be reached if … - y is at least as high as $\underline{y}$. In that case the *X*-participant receives …-y and *Y*-participant the offer y which is at least as high as $\underline{y}$. If however y is smaller than $\underline{y}$, the two participants have not agreed on how to share the total amount of … ECU.

To make it easier for *X* and *Y* to find an agreement, the *X*-participant and the *Y*-participant do not state only one offer y, respectively one minimally acceptable amount $\underline{y}$, but rather state five demands y_1, y_2, y_3, y_4, y_5, which

cannot decrease, respectively minimally acceptable amounts $\underline{y}_1$, $\underline{y}_2$, $\underline{y}_3$, $\underline{y}_4$, $\underline{y}_5$ which cannot increase. More specifically, it is required that

$0 < y_1 \leq y_2 \leq y_3 \leq y_4 \leq y_5 < \ldots$ and

$0 < \underline{y}_5 \leq \underline{y}_4 \leq \underline{y}_3 \leq \underline{y}_2 \leq \underline{y}_1 < \ldots$

where all these amounts are in ECU. How does this determine whether an agreement is reached and, if so, which agreement how to share … is reached? This is determined as follows:

- If $y_1 \geq \underline{y}_1$, then an agreement is reached with *X* earning …- y_1 and *Y* getting y_1.
- If not one checks whether $y_2 \geq \underline{y}_2$. If so, an agreement is reached with *X* earning …- y_2 and *Y* getting y_2.
- If not one checks whether $y_3 \geq \underline{y}_3$. If so, an agreement is reached with *X* earning …- y_3 and *Y* getting y_3.
- If not one checks whether $y_4 \geq \underline{y}_4$. If so, an agreement is reached with *X* earning …- y_4 and *Y* getting y_4.
- If not one checks whether $y_5 \geq \underline{y}_5$. If so, an agreement is reached with *X* earning …- y_5 and *Y* getting y_5.
- If even $y_5 < \underline{y}_5$, the two participants have not agreed.
- With no agreement, X and Y earn nothing, i.e. the amount of ... is lost for them.

CONCESSIONS UG3R_YG3

In this experiment you will be interacting with another participant whose identity will not be revealed by us. You will interact not only once but repeatedly with a randomly changing other participants. Each participant will constantly either assume role *X* or the other role *Y*. Both *X* and *Y* can potentially share … ECU.

In role *X* the participant determines the amount y of the total amount … which (s)he offers to the participant in role Y. In role *Y* the participant states the minimally acceptable amount $\underline{y}$, i.e. in role *Y* one's choice of $\underline{y}$ rejects offered amounts …-y smaller than $\underline{y}$. For given choices y and $\underline{y}$ by *X*, respectively *Y*, an agreement would be reached if … - y is at least as high as $\underline{y}$. In that case the *X*-participant receives …-y and *Y*-participant the offer y which is at least as high as $\underline{y}$. If however y is smaller than $\underline{y}$, the two participants have not agreed on how to share the total amount of … ECU.

To make it easier to find an agreement, the *X*-participant and the *Y*-participant do not state only one offer y, respectively one minimally acceptable amount $\underline{y}$, but rather state three demands y_1, y_2, y_3, which cannot decrease, respectively minimally acceptable amounts $\underline{y}_1$, $\underline{y}_2$, $\underline{y}_3$, which cannot increase. More specifically, it is required that

$0 < y_1 \leq y_2 \leq y_3 < \ldots$ and

$0 < \underline{y}_3 \leq \underline{y}_2 \leq \underline{y}_1 < \ldots$

where all these amounts are in ECU. How does this determine whether an agreement is reached and, if so, which agreement how to share … is reached? This is determined as follows:

- If $y_1 \geq \underline{y}_1$, then an agreement is reached with *X* earning …- y_1 and *Y* getting y_1. Otherwise, if $y_2 + \underline{y}_2 = y_1 + \underline{y}_1$, no agreement has been reached.
- However, if $y_2 + \underline{y}_2 < y_1 + \underline{y}_1$, one checks whether $y_2 \geq \underline{y}_2$. If so, an agreement is reached with *X* earning …- y_2 and *Y* getting y_2. Otherwise, if $y_3 + \underline{y}_3 = y_2 + \underline{y}_2$, no agreement has been reached.

- However, if $y_3 + \underline{y}_3 < y_2 + \underline{y}_2$, one checks whether $y_3 \geq \underline{y}_3$. If so, an agreement is reached with *X* earning …- y_3 and *Y* getting y_3.

- If even $y_3 < \underline{y}_3$, the two participants have not agreed as in the no-agreement cases above.

- With no agreement, X and Y earn nothing, i.e. the amount of ... is lost for them.

CONCESSIONS UG5R_YG5

In this experiment you will be interacting with another participant whose identity will not be revealed by us. You will interact not only once but repeatedly with a randomly changing other participants. Each participant will constantly either assume role *X* or the other role *Y*. Both *X* and *Y* can potentially share … ECU.

In role *X* the participant determines the amount y of the total amount … which (s)he offers to the participant in role Y. In role *Y* the participant states the minimally acceptable amount $\underline{y}$, i.e. in role *Y* one's choice of $\underline{y}$ rejects offered amounts …-y smaller than $\underline{y}$. For given choices y and $\underline{y}$ by *X*, respectively *Y*, an agreement would be reached if … - y is at least as high as $\underline{y}$. In that case the *X*-participant receives …-y and *Y*-participant the offer y which is at least as high as $\underline{y}$. If however y is smaller than $\underline{y}$, the two participants have not agreed on how to share the total amount of … ECU.

To make it easier for *X* and *Y* to find an agreement, the *X*-participant and the *Y*-participant do not state only one offer y, respectively one minimally acceptable amount $\underline{y}$, but rather state five demands y_1, y_2, y_3, y_4, y_5, which cannot decrease, respectively minimally acceptable amounts $\underline{y}_1, \underline{y}_2, \underline{y}_3, \underline{y}_4, \underline{y}_5$ which cannot increase. More specifically, it is required that

$0 < y_1 \leq y_2 \leq y_3 \leq y_4 \leq y_5 < \ldots$ and

$0 < \underline{y}_5 \leq \underline{y}_4 \leq \underline{y}_3 \leq \underline{y}_2 \leq \underline{y}_1 < \ldots$

where all these amounts are in ECU. How does this determine whether an agreement is reached and, if so, which agreement how to share … is reached? This is determined as follows:

- If $y_1 \geq \underline{y}_1$, then an agreement is reached with *X* earning …- y_1 and *Y* getting y_1. Otherwise, if $y_2 + \underline{y}_2 = y_1 + \underline{y}_1$, no agreement has been reached.

- However, if $y_2 + \underline{y}_2 < y_1 + \underline{y}_1$, one checks whether $y_2 \geq \underline{y}_2$. If so, an agreement is reached with *X* earning …- y_2 and *Y* getting y_2. Otherwise, if $y_3 + \underline{y}_3 = y_2 + \underline{y}_2$, no agreement has been reached.

- However, if $y_3 + \underline{y}_3 < y_2 + \underline{y}_2$, one checks whether $y_3 \geq \underline{y}_3$. If so, an agreement is reached with *X* earning …- y_3 and *Y* getting y_3. Otherwise, if $y_4 + \underline{y}_4 = y_3 + \underline{y}_3$, no agreement has been reached.

- However, if $y_4 + \underline{y}_4 < y_3 + \underline{y}_3$, one checks whether $y_4 \geq \underline{y}_4$. If so, an agreement is reached with *X* earning …- y_4 and *Y* getting y_4. Otherwise, if $y_5 + \underline{y}_5 = y_4 + \underline{y}_4$, no agreement has been reached.

- However, if $y_5 + \underline{y}_5 < y_4 + \underline{y}_4$, one checks whether $y_5 \geq \underline{y}_5$. If so, an agreement is reached with *X* earning …- y_5 and *Y* getting y_5.

- If even $y_5 < \underline{y}_5$, the two participants have not agreed as in the no-agreement cases above.

- With no agreement, X and Y earn nothing, i.e. the amount of ... is lost for them.