JENA ECONOMIC RESEARCH PAPERS

2013 – 052

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www.jenecon.de

ISSN 1864-7057

The JENA ECONOMIC RESEARCH PAPERS is a joint publication of the Friedrich Schiller University and the Max Planck Institute of Economics, Jena, Germany. For editorial correspondence please contact markus.pasche@uni-jena.de.

Impressum:

Friedrich Schiller University Jena
Carl-Zeiss-Str. 3
D-07743 Jena
www.uni-jena.de

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Concession Bargaining

An Experimental Comparison of Protocols and Time Horizons

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Abstract. Concessions try to avoid conflict in bargaining and can finally lead to an agreement. Although they usually are seen as unfolding in time, concessions can also be studied in normal form or by conditioning only on failure of earlier agreement attempts. We experimentally compare three protocols of concession bargaining, the normal form or static one, the one where concessions only condition on earlier failures and the truly dynamic one. In spite of their considerable differences in conditioning, the three protocols do not differ in agreement ratio, efficiency and inequality of agreements. There are, however, effects of the maximal number of trials to reach an agreement by concession making and of protocol on when to abstain from conceding.

Keywords: concession bargaining, dynamic interaction, emotions, deadline, conflict, experiment.

JEL-Codes: C72, C78.

1. Introduction

Negotiations often unfold in time and are characterized by gradual concessions by the involved parties. One important aspect appears to lie in the dynamic interaction, which allows each party to condition their behaviour on the history of play.

Concessions in order to avoid conflict in negotiations have already been theoretically analysed by Zeuthen (1930) whose prediction is closely related to the bargaining solution proposed by Nash (1950 and 1953), as shown by Harsanyi (1956). However, the so-called Nash-bargaining solution does not appeal to timing.[1] On the other hand, other approaches to bargaining, such as, e.g. Rubinstein (1982) alternating offers bargaining, substantially restrict interaction over time with profound consequences for equilibrium predictions. This already foreshadows our research topic.

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[1] We abstract from endogenous threats which, according to Nash (1953), are strategically chosen before trying to reach an agreement, an at least debatable timing assumption. This is done by assuming exogenously given conflict payoffs as in Nash (1950).

Does it behaviourally matter whether concession making is allowed to unfold in time? More specifically, does behaviour change if we restrict feedback about earlier attempts to find an agreement, even if such restrictions do not alter the fundamental incentives?

Of course, game-theoretically – except for dynamic games whose state variables determine the rules for future choice making – what matters strategically is only how choices can be conditioned, where conditioning in playing sequential bargaining games can be captured by their normal form representation. Experimentally, the latter aspect is studied by comparing the ("cold") strategy method with the ("hot") sequential play method (see, for example, Brandts and Charness, 2011, or the final section of Fischer and Güth, 2012). However, emotional arousal in concession bargaining comes from learning about the other party's concessions (or lack thereof) and reactions to one's own offers. A mere comparison of strategy method vs. sequential play method therefore is not enough.[2] We therefore compare the proper dynamic game to a reduced version of it, where conditioning on actual choices is not possible. We distinguish between:

- Dynamically unfolding concession making with feedback information about previous failures, described as "hot".
- Quasi-dynamic timing where all what is known about earlier attempts is that they have failed, describe as "quasi-hot", and
- Static interaction where all concessions are made not knowing whether or not they will be needed, characterised as "cold".

Thus, "hot" versus "cold" is still applied but partly not in the form of two alternative representations of the same bargaining game. Game theoretically, the last two protocols capture the same game, whereas the first presents a more realistic and richer one– allowing for true dynamics and strong emotional arousal during the negotiation.

Recently Grimm and Mengel (2011) raised interest in the relevance of emotions for negotiations. Building on Bosman et al. (2001) who showed that (self-reported) emotions strongly correlate with acceptance of ultimatum offers, Grimm and Mengel find that enforcing a break of about ten minutes before deciding whether to accept an ultimatum offer suffices to increase acceptance of low offers considerably. In one of their treatments, Oechssler et al. (2008) make a similar observation. Related evidence comes from research exploring the relevance of anger, such as in Zizzo (2004 and 2008).

Counterintuitively, the literature comparing ultimatum bargaining behaviour under the ("hot") play- versus ("cold") strategy method, either finds no difference or a strengthening of fairness concerns in the strategy method (see discussion in Fischer & Güth, 2012).

[2] Note also that the strategy method for the fully dynamic game is almost impossible to implement, due to the large strategy spaces which grow exponentially in the number of available attempts of finding an agreement.

When exploring how relevant sequential interaction is for concession bargaining, we therefore expected the following effects: As the quasi-dynamic interaction is more prone to emotional arousal than the static one, we expect more conflict in the former. The proper dynamic interaction, on the other hand, allows for the strongest emotional arousal, but at the same time to better coordinate. As far as conflict rates are considered, these two effects may oppose each other so that no clear prediction is possible. However, due to better coordination, efficiency of agreements is likely to be higher in the dynamic than in the other two protocols.[3] Furthermore, this effect could be stronger after more trials to find an agreement. This is why we also compare different deadlines, a short and a long one, the latter allowing for twice as many concessions before an agreement has to be reached. While we expected emotions to remain unaffected by the longer the time horizon, we predicted that coordination increases, especially in the proper dynamic protocol.

Contrary to our expectations, crucial outcome characteristics like agreement ratio, efficiency and inequality of agreements do neither depend on protocol nor time horizon, irrespective whether the comparison relies on the same game or on different games. In our view, this is comforting for the institutional design of bargaining and negotiation rules. Committees do not have to meet and reconvene frequently in order to reach an agreement via concession making, at least in situations of complete information.[4] Nevertheless, the protocols affect more subtle aspects of concession bargaining.

Section 2 introduces the basic scenario of bilateral concession bargaining with complete information and the three protocols differing mainly in the feedback information about earlier attempts, on which later behaviour can condition, as well as in the number of possible concession attempts. Section 3 describes the details how the different treatments of our 2×3-factorial design, based on deadlines "$T = 3$ vs. $T = 5$" and protocols "S, P or D", were actually implemented experimentally. Section 4 reports the important invariance results for crucial outcome variables as well as the more subtle different consequences of protocol and maximal number of trials. Section 5 provides a more detailed analysis of behaviour, trying to find out whether there are any differences in the bargaining processes. Section 6 concludes by summarizing and discussing the consequences of our findings for the design of bargaining rules.

[3] In line with much of the experimental literature, the experimental protocol allows for anti-conflict in the sense of agreements on less than the total available pie.

[4] See Harsanyi and Selten (1972) for a study of incomplete information bargaining, similar to Nash's analysis of complete information, which also appeals to conditioning

2. The bilateral bargaining problem and the protocols

Two parties or players 1 and 2 can divide 650 points, convertible to money at a known exchange rate, with conflict payoffs of 175 or 25 points, respectively, which are commonly known, i.e. each pair involves one player with high and one with low conflict payoff. In all protocols bargaining is based on hierarchically ordered demands d_i^t in the sense of $d_i^{t+1} \leq d_i^t$ for $i = 1,2$. If $d_i^{t+1} < d_i^t$ we speak of a concession by player i in trial $t + 1$. Correspondingly, whenever $d_i^{t+1} = d_i^t$, player i does not concede. What we compare for all three protocols, is the number of trials $t = 1, \ldots, T$, specifically $T = 3$ and $T = 5$. In case of $T = 3$ there can be at most two attempts of concession making, in case of $T = 5$ at most four.

In the **static protocol S** players $i = 1,2$ determine their demand vectors

$$d_i = (d_i^1, d_i^2, \ldots, d_i^T) \text{ with } d_i^{t+1} \leq d_i^t \text{ for all } t < T$$

independently and simultaneously before the play. If for all $\tau < t$ it holds that $d_1^\tau + d_2^\tau > 650$ but $d_i^{\tau+1} < d_i^\tau$ for at least one player[5] $i = 1,2$, an agreement is reached in trial t when $d_1^t + d_2^t \leq 650$ with each player receiving what he demanded. If, however, $d_1^t + d_2^t > 650$ and $t = T$ or, in case of $t < T$, $d_1^{t+1} = d_1^t$ and $d_2^{t+1} = d_2^t$ (i.e. no concession) bargaining ends with conflict after trial t and players receive their respective conflict payoff c_i.

If at any time a pair reached trial t but is unable to agree at t, there will only be a later agreement attempt at $t + 1$ if at least one player $i = 1,2$ made an at least minimal concession $(d_i^t < d_i^{t-1})$[6]. Concessions are thus not only attempts to align total demand with what is available but also necessary for preventing "early" conflict. Another aspect concerns anti-conflict, i.e. agreement in trails $t = 1,2, \ldots T$ with $d_1^t + d_2^t < 650$. This never occurs in equilibrium. Here, we simply assume that $650 - d_1^t - d_2^t$ is lost for the two interacting parties.

The **quasi-dynamic** or **positional-order protocol P** only differs from S by first asking only for initial demands d_1^1 and d_2^1 and for later demands only when they are needed. More specifically, demand d_i^{t+1} is only elicited from i when there is no "earlier" agreement, i.e. $d_1^\tau + d_2^\tau > 650$ and $d_1^\tau + d_2^\tau < d_1^{\tau-1} + d_2^{\tau-1}$ for all $\tau \leq t$.

Of course, when stating d_i^{t+1} according to protocol S, players $i = 1,2$ should also be aware that these demands only matter in the same circumstances. The protocols S and P thus differ in that players $i = 1,2$ know when stating d_i^{t+1} that earlier attempts have failed according to protocol P,

[5] For every τ this may be another player or both.

[6] In the light of the prominence of certain numbers, we required minimal concessions of 25. This is about 3.85% of the available pie – realistically any smaller concession is negligible. We therefore experimentally enforce Zeuthen's (1930) model of concession bargaining which appeals to a gradual process, where at each trial either at least one party makes a concession, accepts the terms offered by the other party or quits.

whereas according to protocol S they must assume such failure of earlier attempts. In other words: the comparison of protocol S and P confronts the “cold” strategy method (protocol S) with the (quasi-) “hot” sequential method in a richer setting than usual. Strategically, the two protocols implement the same game.

The third, truly **dynamic protocol D**, however, represents a different and richer game, allowing for all sorts of path dependency like alternating in concession making, reciprocity in the sizing of one’s concession, etc. As in protocol P players $i = 1{,}2$ only have to choose d_i^{t+1} in trial $t + 1$ in case of no earlier agreement, but knowing all earlier demands d_1^τ, d_2^τ for $\tau \leq t$ and why they led to another trial in $t + 1$. This allows for stronger emotional arousal but at the same time also for better coordination than in the other protocols.

Altogether we rely on a 2×3 factorial design, $T = 3$ versus $T = 5$ as well as protocols S, P, and D. All six treatments have a large multiplicity of strict agreement equilibria whose agreement demands $(d_1^{t^*}, d_2^{t^*})$ satisfy $d_1^{t^*} + d_2^{t^*} = 650$ and with i’s demand exceeding the conflict payoff c_i of player $i = 1{,}2$. To select among the efficient equilibria one can rely on the bargaining solution of Nash (1950 and 1953) predicting

$$d_i^t = c_i + \frac{(650 - 200)}{2} = c_i + 225$$

for $c_i \in \{25, 175\}$. Another relevant focal point is the equal split with 325 each.

Behaviourally, we expect the vast majority of agreements to lie between these two benchmarks. Despite D differing from S and P, incentives are identical. The only difference is that D has a considerably larger space of conditional strategies. This justifies why we did not expect strong treatment effects but rather subtle ones due to different emotional arousal as implied by protocol and the maximal number of concession attempts, for example, due to more experiences of “earlier” failures in reaching an agreement.

There also exists a multiplicity of inefficient conflict equilibria, with both parties offering the other at most its conflict payoff. However, related experimental evidence, such as in Fischer, et al. (2007) and Anbarci and Feltovich (2013) suggests that this is of only little behavioural relevance as one usually will strive for an agreement.

3. Experiment

Experimentally, we have explored the protocols S, P, and D between subjects, and $T \in \{3,5\}$ within subjects but with the order "$T = 3$ first, $T = 5$ second" or "3→5", respectively reversed as "5→3", implemented between subjects.[7] Table 1 illustrates all treatment combinations.

[Insert Table 1 around here]

For each cell in Table 1 we ran three sessions with two matching groups of eight participants each. We therefore have observations from a total of 288 participants, with twelve[8] independent matching groups per combination of protocol with T. Within each session we once repeated both treatment combinations in order to check for effects of experience. More specifically, participants in Sessions $S_{3\to5}$ first played two rounds of protocol S with $T = 3$, followed by two rounds of protocol S with $T = 5$. Rematching between rounds used a stranger design.[9] Throughout a session a participant kept the same conflict payoff c_i and the outcome of every round was paid.

All sessions were conducted in the experimental laboratory of the Max Planck Institute of Economics in Jena, Germany. Recruitment was among students at the two local universities and relied on ORSEE (Greiner, 2004), the experimental software relied on zTree (Fischbacher, 2007). On average sessions lasted for 50 minutes including admission and payment. Participants earned on average 16.44€, including a show up fee of 5€.[10]

4. Main Findings

For the total of 288 participants, about 51.7% were female, and the average age was 24 years (min 19, max. 34). Everyone either was a student or had just finished university, only 2.8% were economists.[11] With respect to these and other (self-reported) socio-demographic characteristics[12] there were no differences between protocols. We therefore did not fall victim to an unfortunate sample selection.

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[7] By "within subjects" we mean that every participant played both conditions, $T = 3$ and $T = 5$. "Between subjects" implies that every participant only played one of the three protocols.

[8] For example for combination S/3 we have six independent matching groups from $S_{3\to5}$ and another six from $S_{5\to3}$.

[9] No one interacted with anyone more than once.

[10] The exchange rate was 1 point = 0.01 EUR.

[11] Field of studies from the following areas: 14.9% social sciences, 13.5% Business, 11.8% Humanities, 11.5% Teaching studies, 9.4% natural sciences, 7.3% Human Health, 6.3% Law, 5.6% engineering, 9.7% other, remainder unreported.

[12] These are length of studies, income, and experience with laboratory experiments. Unfortunately we only have partial observations.

As indicated above, in line with game theoretic considerations, we did not expect strong treatment effects but invariance results, especially when comparing the S– and P-treatments. However, with respect to the most crucial outcome variables like frequency of conflict, efficiency of agreement as measured by the sum of agreement demands and the (in)equality of agreement dividends, invariance applies to all three protocols.

Result 1: For each deadline T individually, and for both combined, the protocol (S, P, or D) does not significantly affect frequency of conflict, efficiency or (in)equality[13] of agreements.

Figure 1 shows the distributions of these variables separately for every combination of protocol and T. Table 2 illustrates the results of rank-sum tests, based on the distributions of averages over all rounds per independent matching group. Despite, for example there being higher efficiency of agreements in D compared to S and P when $T = 3$, all differences between protocols are insignificant.[14] We ran further robustness tests, which all confirm this null-result.[15]

Thus, conjectures of higher agreement rate in S rather than P due to emotional arousal and the higher efficiency in D than in S and P (especially when $T = 5$) are not confirmed. As expected, the level of inequality for most agreeing pairs lies between 0 and 150, however it is more frequent to observe a value of or near 0. The equal split is more focal than the Nash bargaining solution.

[Insert Figure 1 and Table 2 around here]

Protocol effects are unobserved, but how about the number of possible concessions ($T = 3$ versus $T = 5$)? Actually, here we find a significant effect for one of the outcome variables, namely the frequency of conflict.

Result 2: The frequency of conflict increases with horizon T.

The boxplots in Figure 2 represent the distributions of the following variables, separately for $T = 3$ and $T = 5$: rate of agreement, efficiency- and inequality of agreements. Table 3 reports the results of sign-ranked tests on these variables across $T = 3$ and $T = 5$. If we pool across protocols, the difference in the rate of agreement is significant ($p = 0.0076$). For each protocol individually it also holds that there are fewer agreements for $T = 5$, however, differences are insignificant. Surprisingly, efficiency of agreements does not significantly change with the number of available trials.

Result 3: Efficiency of agreements does not increase with horizon T.

[13] Here we measure inequality as the difference of the payoff of the subject with $c = 175$ minus that of the participant with $c = 25$. Qualitatively results do not change if we use the absolute difference.

[14] If not mentioned otherwise, we rely on a 5% acceptance threshold throughout the paper.

[15] We qualitatively observe identical result if we only look at data (a) from the first two, (b) the last two, (c) the first and third, (d) the second and fourth round. The same holds for independent first round data per bargaining pair. According to Kruskal-Wallis tests the distributions of agreed payoffs in the first round do not differ across protocols. Parametric methods (controlling for the panel structure) also confirm our results.

Whereas Result 1 was expected, Results 2 and 3 are surprising. A longer horizon allows obviously for more attempts to find an agreement, and to fine-tune an agreement by trying to render it more efficient. The contrary effects stated by Results 2 and 3 could be due to more emotional arousal when emotions can enfold more over time. A more detailed analysis of the data might help to clarify this.

[Insert Figure 2 and Table 3 around here]

5. Detailed Analysis of Behaviour

Given the invariance of bargaining protocol, are there any differences in the bargaining process, which average out over the entire game? First we check whether there are different reasons for ending up with conflict or different kinds of agreements across protocols and horizon T. There are four possible outcomes: a) efficient agreement, b) anti-conflict agreement, c) conflict due to no concession and d) conflict due to insufficient concessions. An agreement is efficient when $d_1^t + d_2^t = 650$. If $d_1^t + d_2^t < 650$, we speak about anti-conflict agreement. Conflict due to no concession occurs when at one point both players refuse to concede. Conflict due to insufficient concessions occurs when the pair was unable to reach an agreement up to deadline T.

[Insert Figure 3 and Table 4 around here]

Figure 3 shows the relative frequencies of the four outcomes for each protocol and T. With only one exception[16], we find no significant difference between protocols in any of the outcomes. However, if we compare ratios of outcomes between $T = 3$ and $T = 5$ in each protocol, we observe a consistently higher ratio of anti-conflict agreement, a lower ratio of conflict due to no concession and a higher ratio of conflict due to insufficient concessions when $T = 3$. As Table 4 indicates, some of the differences are statistically significant. Even if we pool the data from all protocols, the differences in anti-conflict agreements and conflict due to insufficient concessions are significant. On the other hand, there is no significant difference in efficient agreements between $T = 3$ and $T = 5$. Thus, the drop in agreement rate when $T = 5$, as observed in Result 2, is primarily a drop in anti-conflict agreements, which is accompanied by an increase in early break ups. This increase in conflict due to insufficient concessions for $T = 5$ is probably unsurprising since fewer players tend to reach the longer deadline $T = 5$.

To check whether this increase in early break ups is a mere consequence of increased opportunity, we looked at the evolution of outcomes as illustrated in Figure 4. The graphs show for every trial the

[16] The results of the Wilcoxon sign-rank test for anti-conflict agreement ratios show a significantly higher result in P than in S ($p = 0.0463$) and in P than in D ($p = 0.0392$) when $T = 5$.

share of pairs which find an agreement or end in conflict (due to no concession or at T due to insufficient concessions) of all pairs which are still bargaining at that point. The patterns over time look very similar for the three protocols, what confirms Result 1 of no effect of protocol. With respect to early break ups, for $T = 5$ the likelihood of a pair breaking up early is already large at trial 2 and 3. Thus, it appears that a larger horizon renders participants more stubborn. We therefore compared the rate of no concessions of players with low and high conflict payoffs for each T and protocol. To clarify, “no concession” rate means the probability that a player refuses to concede in a trial $t > 1$. There is a tendency that players of any conflict payoff are less likely to concede in case of $T = 5$ in all protocols. However, only two cases are statistically significant: players with high conflict payoff in S and D are more likely to engage in no concession when $T = 5$ rather than $T = 3$ (Wilcoxon signed rank test $p = 0.0121$ in S, $p = 0.0309$ in D). We conclude that the increase in early break ups is due to high conflict types becoming more stubborn with increasing time horizon.

[Insert Figure 4 around here]

We also checked the demand levels when players make no concessions. It seems obvious from Table 5 that in most cases players with low conflict payoff stop conceding at 325, the equal split demand. However, players with high conflict payoff refuse to make further concessions at a higher demand level i.e. between the equal split and the Nash bargaining solution. Especially in protocol D, the demand level of no further concession increases considerably but remains insignificantly different.

[Insert Table 5 around here]

As a further test whether there are different causes of conflict, we compare between protocols distributions of last relevant demands by bargaining pairs which failed to agree. Using the Kruskal-Wallis test, as for agreements, distributions of last conflict demands do not differ significantly between protocols.[17] Finally, a categorization of agreements into one of the following categories, generous, equal split, in-between, mid-point, cheeky and selfish[18], also does not reveal any differences between protocols, with the only exception that in D high conflict types are initially reluctant to go for the equal split. If we depict agreement payoffs in the plane by points (d_i, d_j), where i, j are defined by conflict payoffs $c_i = 25$ and $c_j = 175$, then 79% of all agreements lie in the triangular between the mid-points (250, 400), the equal split (325, 325), and (250, 325), 58% of

[17] Kruskal-Wallis test of equality of populations from first round observations per pair, all p-values lie between 0.1967 and 0.5127.

[18] Let us denote the relevant demand of a high- and low type of an agreeing pair by d_{25} and d_{175}, respectively. Then categories are defined as follows: generous: $d_{25} < 250$, $d_{175} < 325$, mid-point: $d_{25} = 250$, $d_{175} = 400$, in-between: $250 < d_{25} < 325$, $325 < d_{175} < 400$, equal split: $d_{25} = d_{175} = 325$, cheeky: $325 < d_{25} < 475$, $400 < d_{175} < 625$, selfish: $d_{25} \geq 475$, $d_{175} \geq 625$. Categorization is made on each member individually.

all agreements give the low type exactly 325 and 75% give one party exactly 325. All agreements yield each party at least its conflict payoff, and there is no conflict which constitutes a Nash equilibrium.

6. Conclusions

For concession bargaining, inspired by Zeuthen (1930), we are unable to find any effects of dynamic interaction on bargaining behaviour or outcomes. This holds irrespective of whether we compare two different representations of the same game (S vs. P) or a much more complex game (D) allowing for proper dynamic interaction. The first result confirms other null results of protocol on bargaining behaviour (see, for example, Brandts and Charness, 2011, or the final section of Fischer and Güth, 2012). The latter result, that behaviour in the relatively rich dynamic game is indistinguishable from the reduced versions, may seem comforting for bargaining theory. However, (strict) equilibrium theory as such makes only broad (set) predictions whereas actual behaviour is much more specific and partly even not in (strict) equilibrium at all, as revealed by both, conflict and anti-conflict. A strong focus of behaviour on the equal split underscores the predictive power of equality seeking in bargaining games. Inefficient equilibria are never observed.[19] Thus, striving for efficiency and coordination around the equal split and the split-the difference solution, irrespective of protocol, appears to be the best predictor of behaviour.

Clearly, the invariance of bargaining to protocol is comforting for the institutional design of bargaining and negotiation rules. Furthermore, the good news is that outcomes do not improve by longer bargaining procedures. On the contrary, a longer time horizon increases conflict. Therefore, the fact that real world bargaining is often very time consuming may be due to imperfect information about the other party’s bargaining position or due to displaying what seems to signal toughness, e.g. by conceding minimally or not at all (hoping the other party will concede).

[19] The conflict demand of either player always allowed for more than the conflict payoff for the other player.

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Figures

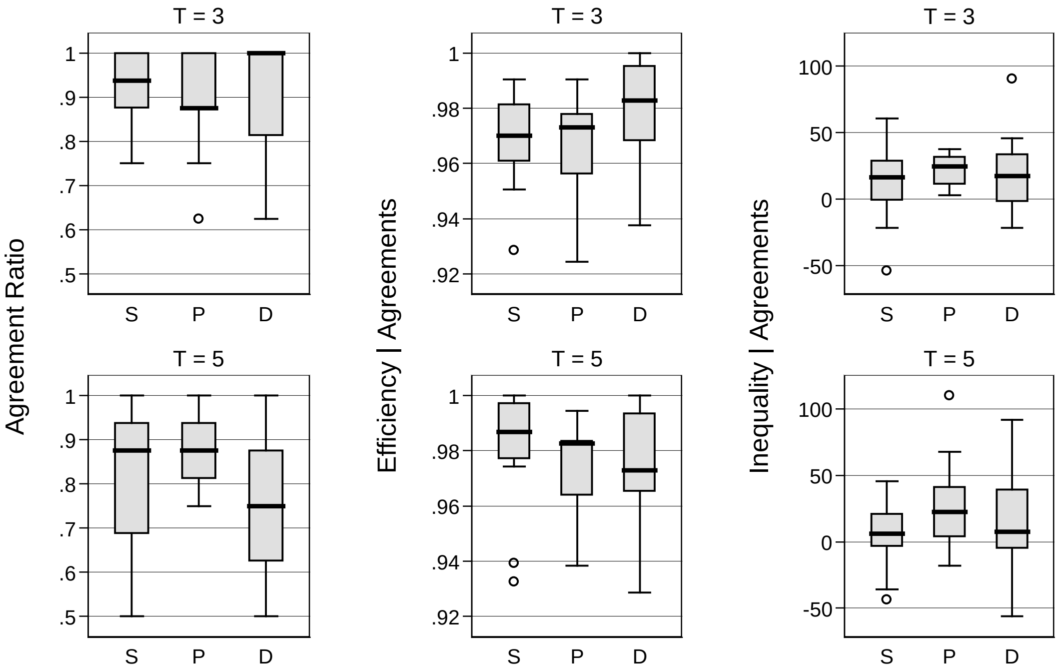

Figure 1 Agreement ratio, efficiency and inequality by protocol and maximum number of available trials *T*

Notes: Efficiency and inequality are defined as $(d_{25} + d_{175})/650$ and $d_{175} - d_{25}$ respectively when agreement is reached. Each observation is the mean value at the group level.

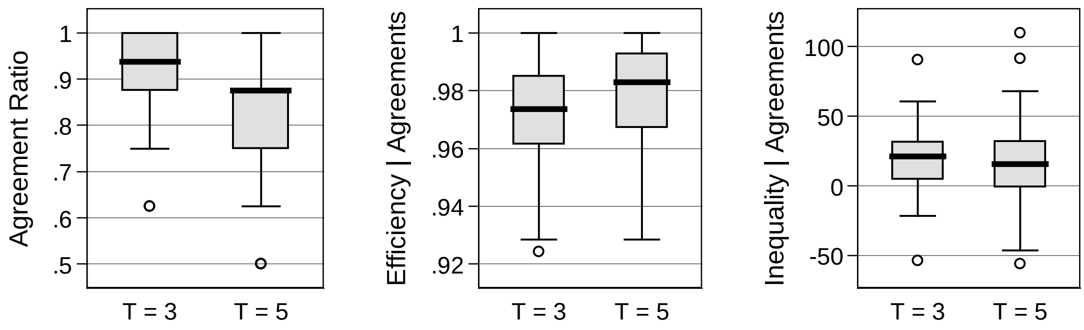

Figure 2 Agreement ratio, efficiency and inequality by *T*

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

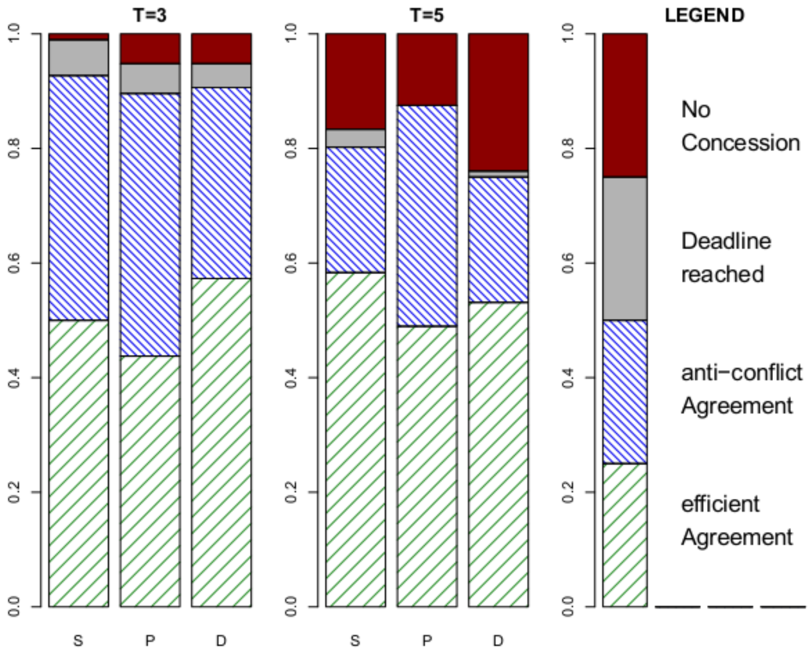

Figure 3 Types of Outcomes

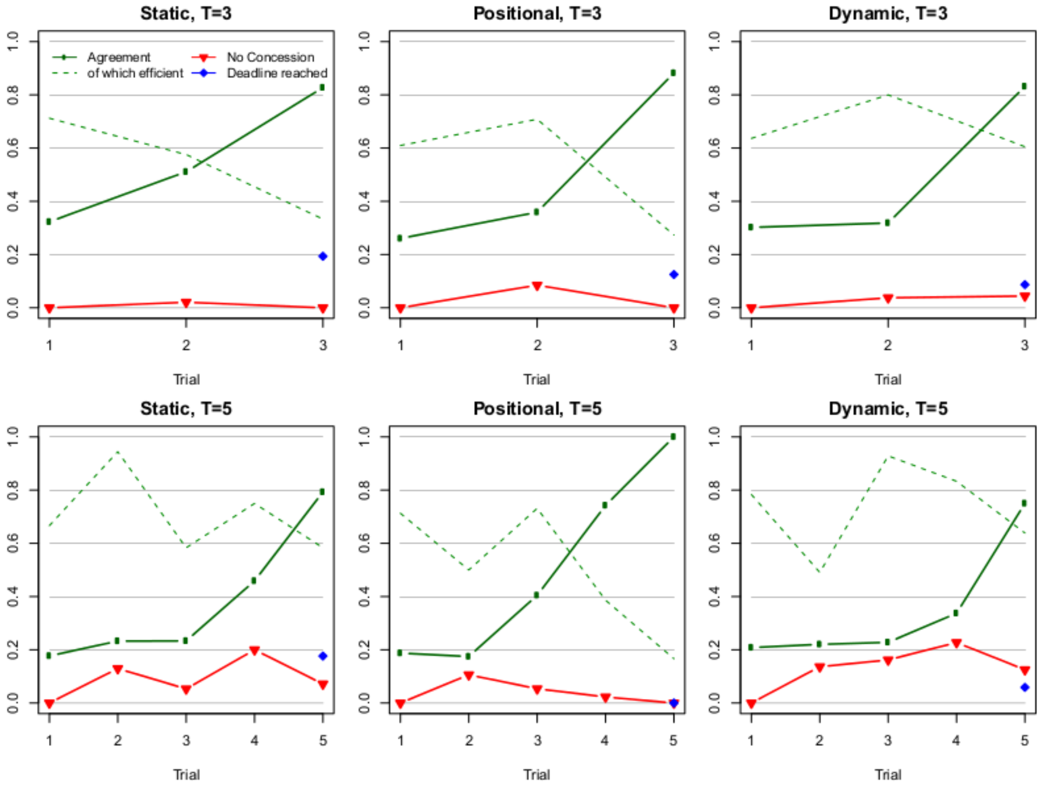

Figure 4 Evolution of Types of Outcomes

Tables

Table 1 Treatment combinations

	Order	
Protocol	3→5	5→3
S	$S_{3\to5}$	$S_{5\to3}$
P	$P_{3\to5}$	$P_{5\to3}$
D	$D_{3\to5}$	$D_{5\to3}$

Table 2 Rank-sum tests on agreement ratio, efficiency and inequality by protocol

Agreement Ratio

	T = 3				*T* = 5				Combined			
Protocol	Mean	(N)	P	D	Mean	(N)	P	D	Mean	(N)	P	D
S	0.9271	(12)	0.5689	0.9490	0.8021	(12)	0.4123	0.4600	0.8646	(12)	0.6343	0.3599
P	0.8958	(12)		0.6610	0.8750	(12)		0.0722	0.8854	(12)		0.1206
D	0.9063	(12)	p-value ranksum test		0.7500	(12)	p-value ranksum test		0.8281	(12)	p-value ranksum test	

Efficiency | Agreement

	T = 3				*T* = 5				Combined			
Protocol	Mean	(N)	P	D	Mean	(N)	P	D	Mean	(N)	P	D
S	0.9688	(12)	0.7947	0.1056	0.9806	(12)	0.1933	0.3842	0.9746	(12)	0.2854	0.9310
P	0.9652	(12)		0.1056	0.9747	(12)		0.7073	0.9697	(12)		0.6649
D	0.9787	(12)	p-value ranksum test		0.9751	(12)	p-value ranksum test		0.9758	(12)	p-value ranksum test	

Inequality | Agreement

	T = 3				*T* = 5				Combined			
Protocol	Mean	(N)	P	D	Mean	(N)	P	D	Mean	(N)	P	D
S	12.26	(12)	0.2985	0.6860	4.56	(12)	0.0781	0.8397	9.02	(12)	0.0833	0.4024
P	22.38	(12)		0.5441	28.99	(12)		0.2253	26.05	(12)		0.4356
D	20.11	(12)	p-value ranksum test		12.50	(12)	p-value ranksum test		17.61	(12)	p-value ranksum test	

Notes: p-values are two-sided. Each observation is the mean at the group level.

Table 3 Sign-rank tests on agreement ratio, efficiency and inequality by maximum number of available trials *T*

	Agreement Ratio				Efficiency | Agreement			
	Mean			p-value	Mean			p-value
Protocol	*T* = 3	*T* = 5	(N)	signrank	*T* = 3	*T* = 5	(N)	signrank
S	0.9271	0.8021	(12)	0.0902	0.9688	0.9806	(12)	0.1361
P	0.8958	0.8750	(12)	0.3416	0.9652	0.9747	(12)	0.2393
D	0.9063	0.7500	(12)	0.0523	0.9787	0.9751	(12)	0.5561
Combined	0.9097	0.8090	(36)	0.0076	0.9709	0.9768	(36)	0.1817

	Inequality | Agreement			
	Mean			p-value
Protocol	*T* = 3	*T* = 5	(N)	signrank
S	12.26	4.56	(12)	0.5303
P	22.38	28.99	(12)	0.9375
D	20.11	12.50	(12)	0.6379
Combined	18.25	15.35	(36)	0.5043

Notes: p-values are two-sided. Each observation is at the mean at the group level.

Table 4 Sign-rank tests on efficient agreement, anti-conflict agreement, no concession conflict and insufficient concession conflict by maximum number of trials *T*

	Ratio of Efficient Agreement				Ratio of Anti-Conflict Agreement			
	Mean			p-value	Mean			p-value
Protocol	*T* = 3	*T* = 5	(N)	signrank	*T* = 3	*T* = 5	(N)	signrank
S	0.5000	0.5833	(12)	0.2039	0.4271	0.2188	(12)	0.0141
P	0.4375	0.4896	(12)	0.4503	0.4583	0.3854	(12)	0.4067
D	0.5729	0.5313	(12)	0.3808	0.3333	0.2188	(12)	0.0864
Combined	0.5035	0.5347	(36)	0.4541	0.4063	0.2743	(36)	0.0062

	Ratio of No Concession Conflict				Ratio of Insufficient Concession Conf.			
	Mean			p-value	Mean			p-value
Protocol	*T* = 3	*T* = 5	(N)	signrank	*T* = 3	*T* = 5	(N)	signrank
S	0.0104	0.1667	(12)	0.0095	0.0625	0.0313	(12)	0.1797
P	0.0521	0.1250	(12)	0.0519	0.0521	0.0000	(12)	0.0462
D	0.0521	0.2396	(12)	0.0137	0.0417	0.0104	(12)	0.2965
Combined	0.0382	0.1771	(36)	0.0001	0.0521	0.0139	(36)	0.0116

Notes: p-values are two-sided. Each observation is at the mean at the group level.

Table 5 Sign-rank tests on no concession rate and no concession demand level by maximum number of available trials *T*

		No Concession Rate				No Concession Demand Level				
		Mean			p-value	Mean		(N)		p-value
Conflict Payoff	Protocol	*T* = 3	*T* = 5	(N)	signrank	*T* = 3	*T* = 5	*T* = 3	*T* = 5	signrank
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)	0.0121	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)	0.0309	344.7	374.2	(11)	(11)	0.0827
	Combined	0.2696	0.3921	(36)	0.0006	350.8	358.6	(34)	(35)	0.1855

Notes: For the S protocol, we used only observations from trials in which negotiations were yet to be finished. All p-values are two-sided. Each observation is at the mean at the group level.