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Reputations and Fairness in Bargaining Experimental Evidence from a Repeated Ultimatum Game with Fixed Opponents

Tilman Slembeck

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Experimental Evidence from a Repeated Ultimatum Game With Fixed Opponents[1]

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Abstract

The results of Ultimatum Game experiments are often quoted as evidence for the role of fairness in bargaining or in economic behaviour more generally. This paper argues that the observed fairness levels are contingent on the traditional experimental design where players are newly matched each round, and reputations are therefore excluded. Evidence from a new experiment shows that average behaviour is more competitive and conflict rates are higher when subjects play against the same opponent repeatedly. This finding is not expected by the traditional fairness hypothesis. A detailed analysis of the dynamics of pairs of players shows that different types of players coexist in the subject pool. Whereas previous experiments found evidence for the existence of "fair" players, the present study reports also a significant number of "tough" players. Hence, there is evidence that allowing for reputations in repeated ultimatum bargaining induces different patterns of behaviour that have not been observed before in this game.

JEL Classification: C72, C78, C92
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1. Introduction

The Ultimatum Game is probably the most frequently studied bargaining game. In the standard setting two players bargain over the split of a given amount, called the *pie*. The proposer (player 1) suggests a split between him and a responder (player 2) who can accept or reject the proposed split of the pie. If player 2 accepts, she receives the share player 1 proposed for her (called the *offer*), and player 1 receives the pie minus the offer. If player 2 rejects, both players receive nothing. Under the assumption that players try to maximise their own incomes, the unique subgame-perfect Nash equilibrium is that proposers offer the minimal possible amount and responders accept this offer. Evidence from a great number of laboratory experiments, however, shows that responders often reject offers of less than 40% of the pie and offers below that level are relatively rare (see GÜTH AND TIETZ (1990) and ROTH (1995) for overviews).[2] The fact that many responders accept less than fifty-fifty splits is usually explained by the proposer's *first-mover advantage* in that he can propose the split while the role of the responder is restricted to accepting or rejecting offers without having the opportunity to make counter-offers (GÜTH ET AL. (1982), KAGEL ET AL. (1996)). Reputations are assumed to play no role in these experiments since players are anonymous and matched with new players each round when the stage-game is played repeatedly in the laboratory.

One intuition behind the Ultimatum Game is that two people "negotiate" over the surplus of some transaction. The first person proposes a split of the surplus while the second person can only accept the deal, or "walk away" – so that no surplus is created, leaving both with no gain. Hence, ultimatum bargaining can be thought of as the final stage of an extended bargaining process, or as a model of posted price systems where a consumer can either accept the prices posted by a merchant, or look for another opportunity to buy. One weakness of this model is that real life people may not always know how much there is at stake for the other person. The problem of asymmetric information about the size of the pie has been investigated in a number of experimental studies (e.g., MITZKEWITZ AND NAGEL (1993), CROSON (1996), KAGEL ET AL. (1996)). The case where responders are completely ignorant of the pie is analysed in SLEMBECK (1998).

Another problem is that in real life the same bargainers may interact repeatedly so that *reputations* come into play. The present paper looks for the first time at such a more realistic situation in a laboratory experiment where subjects play with the same opponent in a finitely repeated Ultimatum Game of complete information. The goal is to investigate the roles of reputations and fairness in such a setting with respect to the hypotheses discussed in the next section.

[2]Throughout this paper, offers of less than 40% of the pie will be referred to as "low offers", while offers between 40% and 50% are labelled "fair offers", and offers of more than 50% will be called "high offers".

The paper is organised as follows: in Section 2 the concepts of reputations and fairness are discussed with respect to the Ultimatum Game, and two hypotheses with diverging predictions are stipulated. Section 3 describes the experimental procedures. The results are presented in Section 4 and discussed in Section 5.

2. Reputations and Fairness

Despite their obvious importance in real life, the role of reputations is not often analysed in the bargaining literature (see ROSENTHAL (1979) and ROSENTHAL AND LANDAU (1979)). In bargaining experiments, reputations have be used to manipulate players' expectations (ROTH AND SCHOUMAKER, 1983), but are usually not studied in their own right. The main contribution of this paper is to investigate the role of reputations in ultimatum bargaining for the first time.

The *reputation of a player* will be defined as the sum of information about his or her past behaviour. Hence, reputations allow players to form expectations about each others future behaviour based on past behaviour. Therefore, rational players behave strategically not only with respect to the stage-game but also with respect to the supergame –which includes all stage games a pair plays– when the stage-game is played repeatedly against the same opponent. By forming a reputation, a player may try to signal a supergame strategy or his own "type" to his opponents. In a coordination game, for example, a player may want to evoke one of several equilibria by using his or her reputation for playing a certain strategy as a coordination device. In other games like the Prisoner's Dilemma a reputation for being a cooperative "type" may improve chances for Pareto-efficient outcomes when binding commitments are not feasible and pre-game talk is cheap (see the reputation model of KREPS ET AL. (1982) and its test by ANDREONI AND MILLER (1993) who present experimental evidence for the effects of reputation formation on cooperation in the finitely repeated Prisoner's Dilemma).[3] The effects of random rematching have been tested in a number of public goods experiments. In their recent review ANDREONI AND CROSON (1998) report that evidence is mixed, and that reputation effects do matter in some but not in all experiments.

In the Ultimatum Game, the effects of reputations are not straightforward. One reason is that "fairness" seems to play some role in this game.[4] In the literature there are several interpretations of this role. One is that proposers make offers higher than the minimum because they feel that such low offers would be "unfair" to responders, and proposers reject low offers on the same grounds (fairness as altruistic impulse). Several experimental studies have provided

[3] GÄCHTER AND FALK (1997) investigate the role of reputation and reciprocity in a Gift Exchange Game and report evidence for both. More general discussions of the role of reputations, social norms and emotions in repeated interactions can be found in FRANK (1988) and BINMORE (1994).

[4] The problem with "fairness" is that "*everybody knows that people care about 'fairness'... But nobody has any clear idea what it means*." (BINMORE, 1998, 37)

evidence that this interpretation is unsatisfying in that subjects do not care about each other's welfare *per se* but "*desire some kind of equity in the context of this particular interaction*" (CAMERER AND THALER, 1995, 216). Camerer and Thaler favour the notion of "manners" in the sense of adopted rules of behaviour that subjects think apply to themselves and others, regardless of the situation (fairness as learned norm). In this interpretation, rejections of "unfair" offers serve to enforce fairness.[5] Hence, behaviour is guided by social norms and reputations may help to promote them. The fact that responders do reject low offers is taken as evidence that subjects cannot curb their repeated-game impulses (HOFFMAN ET AL., 1994) and bring norms of fairness, reciprocity or "manners" to the laboratory that they have learned in everyday life (CAMERER AND THALER (1995), GALE ET AL. (1995)).

It seems important to note that these interpretations refer to behaviour observed in experiments where new pairs of players are formed each round by rotation out of a common pool of players (rotation design). Subjects are usually told that they are matched with a "new" opponent each round and have no information on whether or how often they will play against the same opponent again. For some experiments it is not strictly true that subjects play new opponents each round, since the number of rounds exceeds the number of opponents so that subjects sometimes play against the same opponents repeatedly without knowing it. Therefore, *learning effects* reported in some studies (eg., ROTH ET AL. (1991), SLONIM AND ROTH (1998)) are likely to be influenced by the rotation design, but this effect is usually not discussed in the ultimatum bargaining literature. Instead, it is commonly assumed that subjects behave as if playing against a new opponent each time so that reputation or supergame effects do not play a significant role.[6] It is the major goal of the present study to explicitly account for reputations since they may have substantial behavioural effects.[7]

To see why this may be the case, note that playing repeatedly against the same opponent provides opportunities for *supergame strategies* that are not available in repeated one-shot games against new opponents. If players care about fairness –in the sense of equitable outcomes as the mentioned literature suggests– these strategies are used to promote fairness. However, if players are selfish, they will employ supergame strategies to maximise their own incomes. These players may try to establish reputations as "tough" players in early rounds of the

[5]Similar arguments haven been put forward to stress the importance of reciprocity in human (and animal) behaviour. Reciprocity is seen as a "*key mechanism for the enforcement of social norms*" (FEHR AND GÄCHTER, 1998, 854).

[6]Interactions are usually anonymous (eg. via computer or manual transmission between rooms) and experimenters seem to be confident that subjects cannot build up reputation in these experiments. BOLTON AND ZWICK (1995) have investigated the role of anonymity.

[7]For general discussion of matching schemes that efficiently preserve the best reply structure of a one shot game see KAMECKE (1997). For a Prisoner's Dilemma game experiment without reputation effects see COOPER ET AL. (1996).

supergame in order to achieve higher incomes in later rounds. Of course, playing tough involves the risk of disagreements that are costly in that money is left on the (experimental) table. But if short-run costs outweigh long-run gains, playing tough may be an income maximising strategy in the supergame (maximising hypothesis, MH).

From this discussion, two hypotheses seem plausible for the case of repeated ultimatum bargaining with reputation. According to the notion of fairness as a learned norm reputation is used to promote this norm (learned norm hypothesis, LNH). Therefore, repeated play with fixed opponents does not differ substantially from behaviour observed under a rotation design. Hence, if playing fair is a repeated-play impulse learned in everyday life, proposer and responder behaviour should be very similar under both designs with respect to offer size, rejection rates and the first-mover advantage. Reputations may be assumed to allow responders to signal their acceptance level more efficiently and to facilitate proposers' learning of that level. Therefore, the fixed pairs design is expected to ease players' coordination on Nash equilibria[8] and provide more overall opportunities to earn income.

In contrast, if players care less about fairness than the literature suggests, but play "tough" (as assumed under the MH), more disagreement, i.e., higher rejection rates, will be observed in a fixed pairs design. The zero-sum character of the Ultimatum Game becomes more obvious and the proposers' first-mover advantage is diminished.

To test these predictions a laboratory experiment was designed where one group of subjects played the Ultimatum Game with standard instructions via computers in a rotation design (T1). A second group of subjects played exactly under the same conditions but in fixed pairs (T2).

3. Experimental Procedures

A total of 58 students from a large university in the United Kingdom took part in the treatments reported in this paper. 20 subjects were allocated to the control group and 38 subjects participated in the experimental group. Each subject played 20 rounds of the Ultimatum Game. Each round a pie of £10 was to be divided. Instructions were given on computer screens and participants were allowed to ask questions. During the sessions, participants could not see each other and the only communication was via computers according to the following rules. Proposers were allowed to make offers between £0.10 and £9.90 in increments of £0.10. Offers were transmitted via computers and displayed on the screens of responders who could accept or reject the offer by pressing the appropriate key on the keyboard. Feedback concerning the

[8]Note that each accepted split is a Nash equilibrium. For the case that only discrete offers are allowed (as in experimental settings) the number of Nash equilibria is equal to the number of offers allowed in the stage game. For the one shot stage game, however, making and accepting the minimal offer is the unique subgame-perfect Nash equilibrium.

responders' choice was given to proposers and the payoffs for each round were displayed on the screens of both players. At the end of the session, two of the twenty rounds were randomly chosen by the computer, and participants were paid in cash according to the actual outcome in those rounds. A show-up fee of £5 was added to the final payments.

All participants had complete information about the game as described above. The only difference between the two groups was that the control group played under a rotation system (treatment 1) while the subjects of the experimental group played in fixed pairs (treatment 2). In both groups subjects were informed about the pairing mechanism. In treatment 1 they were told that they would be matched each round with a new player, while subjects in treatment 2 knew that they were playing 20 rounds with the same opponent. Subjects in both treatments played either in the role of a proposer or a responder throughout the session. These roles were allocated randomly at the beginning of the experiment. The instructions and player screens are given in the Appendix.

4. Experimental Results

4.1. Overview

The results for treatment 1 (control group) are similar to those from other studies under complete information (see SLONIM AND ROTH, 1998, for a recent overview of typical results). The mean offer is £4.21, with a mode of £5.00 and a median of £4.00 (see Table 1). Treatment 2 (fixed pairs) shows similar proposer behaviour in mean (£4.17) and modal (£5.00) offers, however, the median offer is £4.95, i.e. 25% higher than in treatment 1.[9]

	Treatment 1 (rotation pairings)	Treatment 2 (fixed pairs)
mean offer	4.21£	4.17£
modal offer	5.00£	5.00£
median offer	4.00£	4.95£
rejection rate	26.5%	37.9%
proposer advantage	5.06%	1.65%

Table 1: Overview of Main Results

There are several other evident differences between treatments. Rejection rates are clearly higher in T2 (38%) than in T1 (27%) on average so that subjects in T2 earned less money due

[9]A closer look at the modal offers shows that in T2 the mode of £5.00 is a "strong" mode in that 36% of all offers have this value and no other value is offered with similar frequency. In T1 the modal offer is also £5.00 (13% of all offers) but this is a "weak" mode because £4.00 is offered with almost the same frequency (11.5% of all offers).

to more disagreements. The *first-mover advantage of the proposers* in T1 was 5% compared to less than 2% in T2.[10] Hence, responders in T2 were able to size relatively more of the pie for themselves, though at the cost that substatially more money was lost, or left on the table. These differences are analysed in more detail next.

4.2. Proposer Behaviour

When looking at proposer behaviour *across rounds* there appear to be no major differences between treatments. In both treatments mean offers did not change much over the course of play (see Figures 1a, 1b). The only obvious difference is in the first round where proposers in T2 offered about £1 less than proposers in T1 on average. As a more detailed analysis of individual pairs will show (see Sec. 4.4), proposers in T2 typically started with relatively low offers and increased their offers only gradually. This tendency is reflected by a slight increase of mean offers across rounds in T2 which cannot be found in T1 (see Figs. 1a, 1b). This difference in offers across rounds is not statistically significant, however.

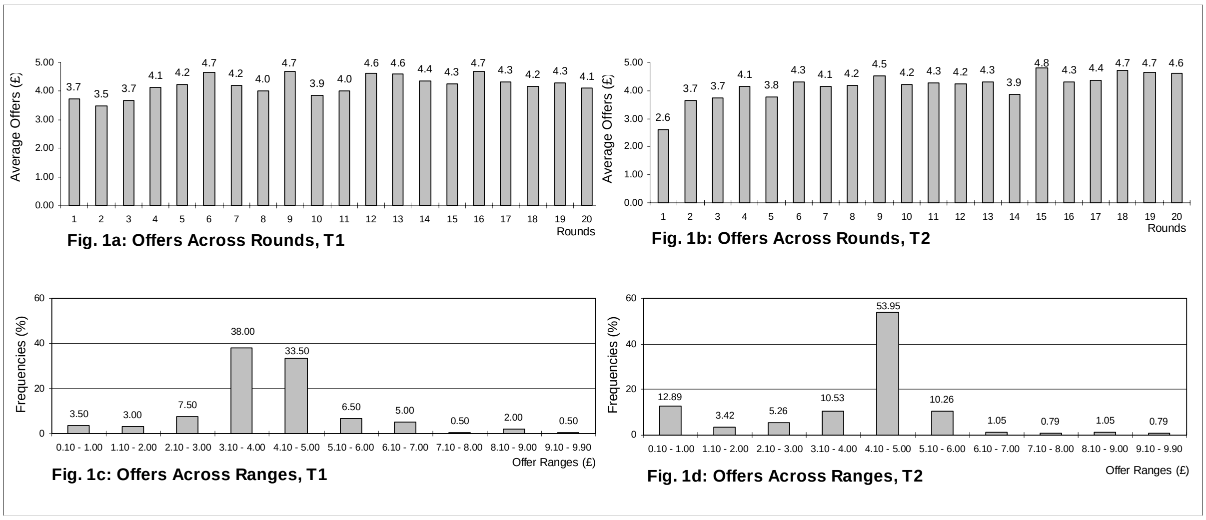

Figure 1: Proposer Behaviour; Offers Across Rounds and Value Ranges

Significant differences between treatments are found when comparing offers *across value ranges* ($p < .01$ for the χ^2 test). In Figures 1c and 1d offers are shown in histograms that give the frequencies (in %) of offers in 10 value ranges (in £). The distribution of offers across ranges shows that in T2 many more offers fall in the range between £4.10 and £5 (54%) than in T1 (33.5%) where offers in the range of £3.10 to £4 were more frequent (38% in T1 vs. 10.5% in

[10]The proposers‘ first mover advantage (*fma*) als shown in Table 1 was calculated in the following way:

$$fma = \frac{e(p) - e(r)}{\Pi}$$

with e(p) and e(r) being the total earnings over all rounds of proposers and responders respectively; Π is the total size of the pie.

T2). Hence, there seems to be a tendency to make more “fair” offers in T2. However, in the lowest range of offers (£0.10 to £1) there are three times as many offers in T2 (13%) than in T1 (3.5%). Overall, mean offers are more polarized in T2 in that there is a tendency to make either “high” or “low” offers. This pattern is interpreted as the result of the competitive behaviour of many pairs in T2, as will be discussed in Section 4.4.

4.3. Responder Behaviour

The analysis of *rejections across rounds* shows two statistically different patterns of responder behaviour in the two treatments ($p < .01$ in the Mann-Whitney test). Whereas there seems to be no distinct behavioural pattern in rejection rates in T1, rejection rates in T2 tend to decrease over time (see Figs. 2a and 2b). In the first 5 rounds rejection rates in T2 are 50% on average (compared to 26.5% in T1) and drop to an average of about 40% during rounds 6 to 15 (23% in T1). Only in the last 5 rounds rejection rates are lower in T2 (23%) than in T1 (28%). This decline in rejection rates in T2 indicates *learning processes* when pairs are fixed that do not occur under a rotation design. This pattern is part of the specific dynamics of play among many pairs of players in T2, as will be analysed in Section 4.4.

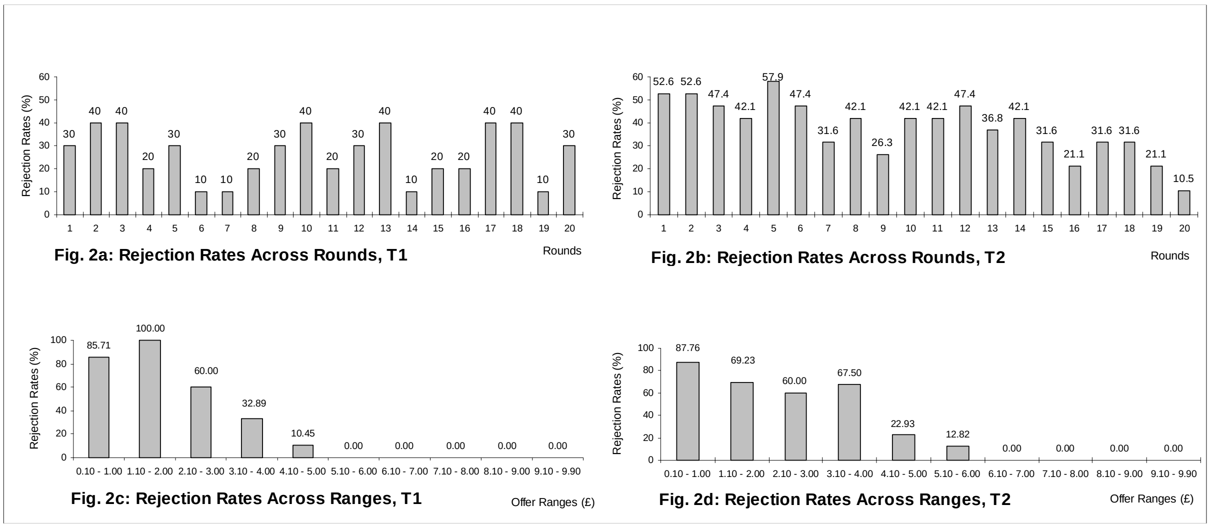

Figure 2: Responder Behaviour; Rejection Rates Across Rounds and Value Ranges

Differences between treatments are also found in *rejection rates across ranges of offers* (see Figs. 2c and 2d). While rejection rates are similar for the lowest range in both treatments, rejection rates in T1 tend to fall as offers increase. In T2, however, there is no such distinct decrease for offers up to £4, and the average rejection rate stays at 60% or above. Rejection rates fall strongly only for offers of more than £4, but are still more than twice as high in T2 (23%) than in T1 (10.5%) for the range between £4.10 and £5. Furthermore, even offers above £5 are sometimes rejected in T2 (13%), but are always accepted in T1. This difference is not significant in the statistical sense, however.

In sum, the analysis of responder behaviour shows that rejection rates are mostly higher across rounds *and* across offer ranges in T2 than in T1, although mean offers are higher in the former. This difference is statistically significant, and is analysed in more detail in the next section by looking at the history of play of pairs of players in T2.

4.4. Analysis of Pairs of Players

Analysing pairs of players individually gives additional insights into strategic behaviour and dynamics of repeated play that are obscured by averages. When looking at single pairs, a variety of play can be observed. However, three broad categories of pairs may be distinguished: (i) convergent pairs, (ii) pairs with “tough” responders and (iii) pairs with “tough” proposers.

In *convergent pairs* behaviour converges to “fair” equilibrium play after a few rounds. Rejections are found mainly in early rounds. The behaviour of both types of players is similar to what is observed in the control group. Pairs with *tough responders* are characterized by many “fair” offers and responders who try to “win” over the opponent by rejecting such offers. In pairs with *tough proposers* mean offers are lower and the play is dominated by proposers. For both groups with tough players the zero-sum nature of the Ultimatum Game is more manifest in behaviour, and longer periods of rejections occur throughout the session. Table 2 gives an overview of key figures for the three types of pairs.[11]

	Convergent Pairs	Tough Responders	Tough Proposers
mean offer	4.40£	4.72£	3.17£
rejection rate	21.4%	42.0%	55.0%

Table 2: Comparison of Types of Pairs (Treatment 2)

Convergent Pairs

The play of 7 pairs appears to converge to equilibrium after a few rounds.[12] Figure 3 shows offers and rejections for these pairs for all 20 rounds. Offers are presented in vertical bars (left

[11]The case for the proposed categorization to be significant and economically relevant can also be made in terms of differences in income distributions for the three types of pairs, since total and responder earnings differ statistically significant between convergent pairs and pairs with tough players in the Mann-Whitney test ($p < .05$) The two types of pairs with tough players, however, do not differ significantly in terms of earnings.

[12]The term *equilibrium* is here used for rounds with accepted offers since every such outcome is a Nash equilibrium of the stage-game. It is not used in the sense of the realisation of equilibrium strategies in the supergame.

scale) and responder behaviour is shown on the right-hand scale of the graph for each pair; the symbol x indicates whether an offer is accepted (x = A) or rejected (x = R).

Generally speaking, convergent pairs play in "fair" equilibrium after round 6 most of the time. The first four pairs in Figure 3 (i.e., pairs 1, 2, 3 and 4[13]) are in an almost equal split equilibrium from round 7 on. In pairs 5, 6 and 7 proposers start with relatively low offers (which are mostly rejected) but reach equilibrium play by round 7 as well. The difference, however, is that average splits for these three pairs are more in favour of proposers (i.e., proposers can preserve their first-mover advantage). After round 6, rejections occur only when offers are lower than previous offers which indicates an upward adjustment of the responders' aspiration level. Overall, convergent pairs display behaviour that is most similar to the control group, thereby lending support to the LNH.[14] In contrast, the other two types of pairs discussed next show much different behaviour, especially in that rejection rates are twice as high, and play is much less harmonic.

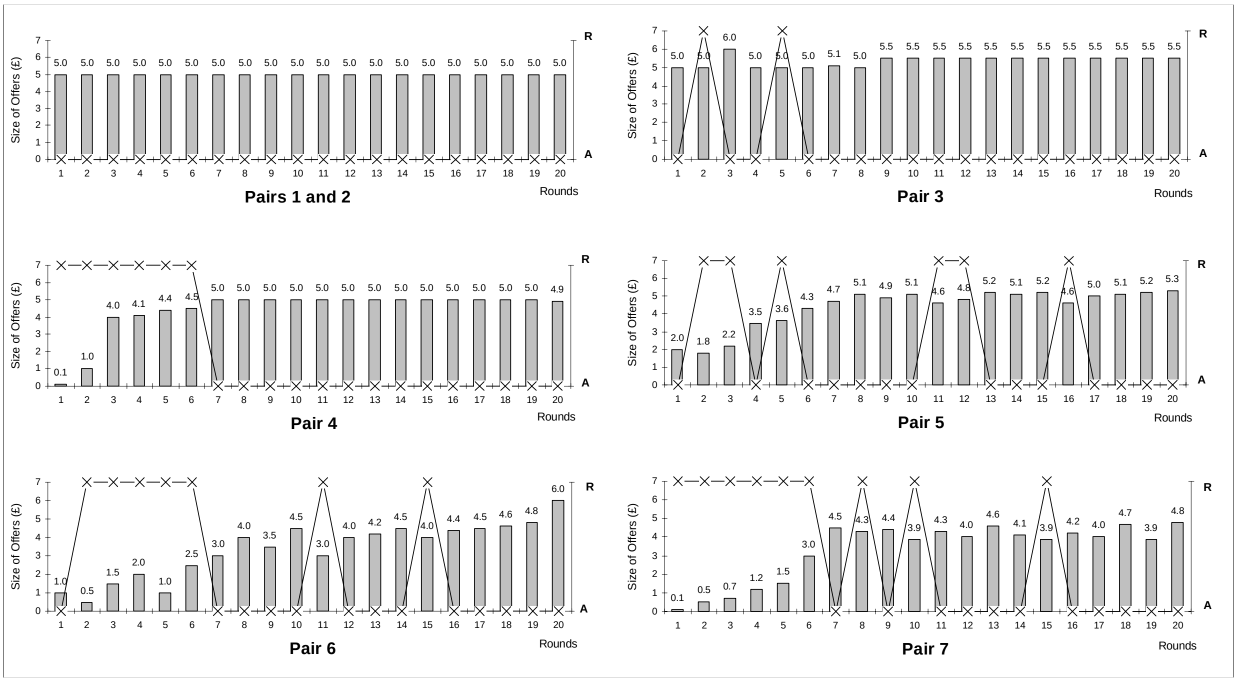

Figure 3: Convergent Pairs

Tough Responders

The play of the seven pairs in Figure 4 differs from the play of convergent pairs in several respects. Mean offers are higher (£4.72 vs. £4.40 for convergers), but average rejection rates are much higher as well (42% vs. 21.4% for convergers). Also, there are many rejections of "fair"

[13]Note that there is only one graph for pairs 1 and 2 in Figure 3 since both pairs played identically.

[14]Mean offers in convergent pairs are £4.40 (vs. £4.21 in T1) and the average rejection rate is 21.4% (vs. 26.5% in T1), see Tables 1 and 2. These differences are not statistically significant.

offers after such offers have been accepted. These findings may be interpreted as symptoms of strategic fights that are mostly initiated by responders who do not seem to accept the proposers' first-mover advantage. Hence, responders are trying to build a reputation for playing tough in order to get a larger share of the pie by rejecting "fair" offers. That is, responders try to teach proposers to make offers even beyond the equal split.

Consider, for instance, the responder in pair 8 (see Fig. 4) who rejects £5 in round 14 after 10 rounds of "fair" equilibrium play. The responder seems to try to "push" the proposer beyond the equal split. This pattern of behaviour can be found in all other pairs in Figure 4 even more pronouncedly. In pairs 12, 13, and 14 even some "more than fair" offers above £5 are rejected. In all pairs (but pair 8) proposers succumb to the "pushing" of responders to some extent by making higher offers (though the proposer in pair 13 sometimes retaliates for the rejections of "fair" offers by making minimal offers). As a result, average rejection rates are about twice as high for pairs with tough responders than for convergent pairs, although mean offers are higher for the former group.

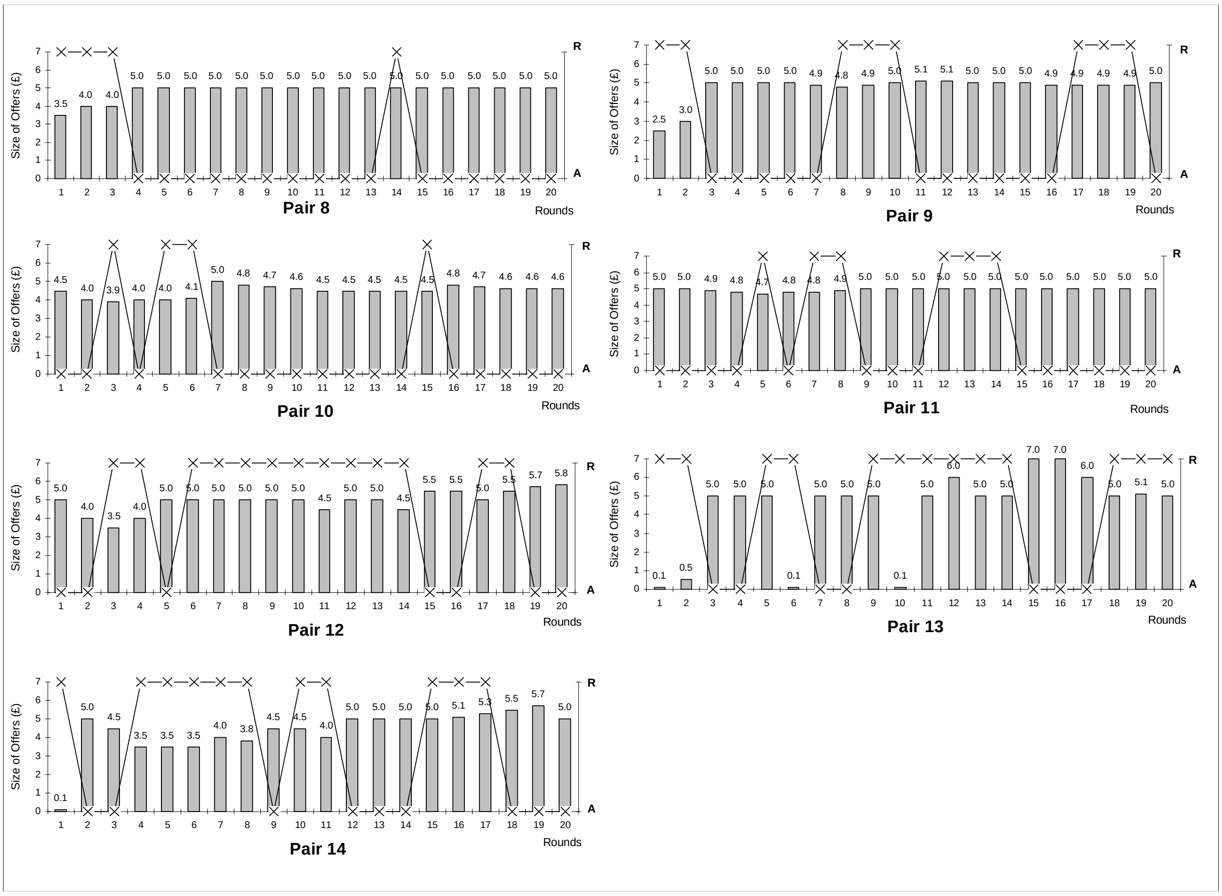

Figure 4: Pairs With Tough Responders

When looking at pairs with tough responders it seems difficult to make the case for the learned norm hypothesis (LNH). It may be argued that the rejections of "fair" offers serve to teach proposers to make "more than fair" offers in order to *compensate* for earlier "unfair" offers, thereby trying to establish "overall fairness" in the supergame. Although this argument may play a role for some pairs (like pairs 9, 13 and 14 where proposers start with low offers), it does not seem to provide a convincing interpretation of the overall dynamics of playing these pairs. First note that offers of less than £4 are relatively rare and do occur only once or twice in a pair.[15] Therefore, there is not much room for compensation after several rounds of "fair" or "more than fair" play.[16] Second, in most pairs (9, 11, 12, 13 and 14) such rejections of "fair" and high offers occur for periods of 3 or more rounds repeatedly which cannot easily be explained in terms of overall fairness or a desire for compensation.

Another interpretation is that responders do not acknowledge the proposers' first-mover advantage and try to "push" offers higher in order to maximise income as predicted by the MH. This maximisation, however, seems myopic in that rejections of "fair" and high offers are an extremely costly device for achieving even higher offers in later rounds. For example, rejecting offers of £4.5 and £5 during 9 rounds in pair 12 is rewarded by two offers of £5.5 (see Fig. 4). The same holds for other pairs with tough responders as well and for none of the responders rejecting "fair" and high offers is a long-run maximising strategy. The fact that these rejections nevertheless occur may be interpreted as the result of very "*myopic maximising*". This means that players do not attempt to maximise their overall income, but "win rounds." In this view, winning over the opponent by getting more of the pie has a positive value *per se*. The observation that most proposers do not seem to learn that playing tough is not a long-run income maximising strategy, and instead continue to play tough in the second half of the session seems to suggest that this type of maximising is not their primary goal. Therefore, both hypotheses (LNH and MH) do not seem to be supported by the behaviour of tough responders.

Tough Proposers

The group of pairs with tough proposers is characterised by many *low offers* (mean offers are £3.17 vs. £4.40 for convergers) and *many rejections* (the rejection rate is 55% vs. 21% for convergers; see Tab. 2) throughout repeated play. Proposers appear to insist on their first-mover advantage and try to establish a reputation for toughness. Pairs 15 and 16 are typical examples where proposers try to keep their offers as low as possible (see Fig. 5). Virtually no agreement

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[15]The two very low offers in rounds 6 and 10 in pair 13 may be interpreted as a strategic response to the rejections of "fair" offers as already discussed.

[16]Only for pair 14 there may be some case for compensation after the proposer made offers between £3.5 and £4 for 5 consecutive rounds.

is reached in pair 15, although the responder signals to accept low offers once. The responder in pair 16 is accepting offers of £3 or more, but the proposer tries to undercut this level, although he may have learned to successfully offer £3 (or more) by round 10.

In pairs 17 and 18 proposers do not seem to have well established strategies since the size of offers varies greatly across rounds. They appear to play tough at least sometimes. Responders are willing to accept very low offers only after very generous offers have been made. In pair 19 the responder first seems to accept offers of £5 or more, but then rejects £5 in round 9. The proposer reacts in a tough way by reducing offers for 6 consecutive rounds to the effect that play is in equilibrium for the last 5 rounds with a mean offer of £5 again.

For the behaviour of the proposer in this last pair (19) fairness may play some role since he may be "offended" by the rejection of £5 in round 9 so that his or her reaction may be interpreted as "punishment". For the other pairs one has to ask why some level of fairness or equilibrium play is not established or learned over the course of play if proposers care for fairness, as assumed by the LNH. The insistence of proposers on their first-mover advantage (especially in pairs 15 and 16) seems again to imply some sort of *myopic maximising* that cannot easily be explained either by the LNH nor by the MH alone.

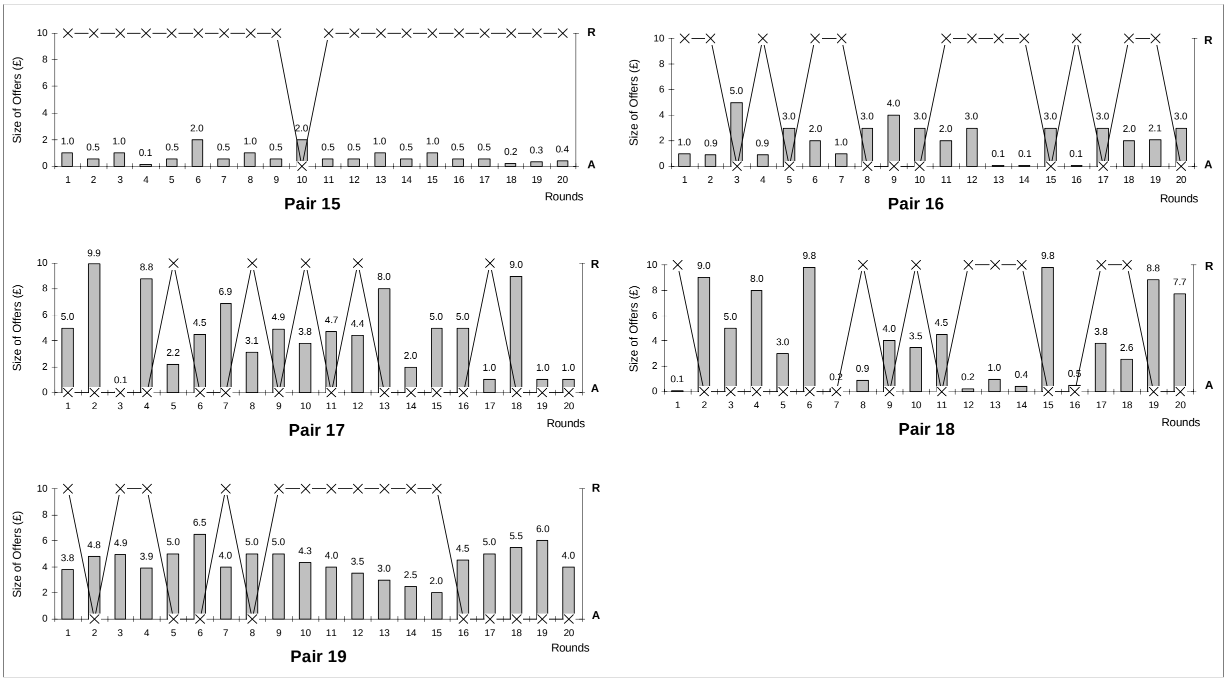

Figure 5: Pairs with Tough Proposers

5. Summary and Discussion

The results presented in the previous Section show significant differences in proposer and responder behaviour between the two conditions of the experiment. When allowing for the formation of reputations, offers tend to be either high or low (see Fig. 1) and rejection rates are clearly higher than for the control group. Especially, many more "fair" and high offers are rejected (see Fig. 2) and the proposers' first-mover advantage is much reduced when playing in fixed pairs (see Tab 1). These findings are not expected under the hypothesis of fairness as a learned norm (LNH) as discussed in Section 2.

A detailed analysis of single pairs of players in Section 4.4., however, shows that the behaviour of seven pairs –called convergent pairs (see Fig. 3)– conforms with LNH in that offers and rejections are not statistically different from those in the control group. In pairs with tough proposers and tough responders much higher rejection rates (42% for tough responders, 55% for tough proposers vs. 21.4% for convergers; see Table 2) indicate strategic fights that cannot be explained by the LNH alone. The play of these proposers and responders is characterised by a strive to build a reputation for playing though in order to win over the opponent. The alternative hypothesis that players try to maximise their long-run incomes, however, seems not to be supported by this behaviour either. In Figures 4 and 5 it is easy to see that playing tough is not a long-run income maximising strategy since the costs of disagreement are not covered by later gains. Another interpretation, therefore, is that these subjects engage in costly fights because they try to "win" single rounds.

With respect to the hypotheses overall evidence from the present experiment is mixed. While the play of eight pairs conforms with the hypothesis of fairness as a learned norm,[17] eleven pairs do not seem to support this hypothesis. However, the long-run maximisation hypothesis is not supported either because many pairs engage in costly fights. This behaviour may be interpreted as myopic rather than long-run maximising.

In sum, allowing for the formation of reputations in the finitely repeated Ultimatum Game has several effects. Many more "fair" and high offers are rejected in such a setting and players in fixed pairs earn about 12% less income than when subjects repeatedly play against different opponents. Also, the proposers' first-mover advantage is clearly lower in fixed pairs. Hence, there is evidence that the higher degree of interdependency in fixed pairs induces the average subject to play "tougher", and the zero-sum character of the Ultimatum Game is more pronounced. Contrary to what may have been expected from the literature, playing against the same opponent repeatedly increases conflict rates significantly, and does not make it easier to reach agreement for the average pair.

[17] See pairs 1 to 7 in Figure 3, and pair 19 in Figure 5.

From the present experiment, that investigates a somewhat more realistic bargaining setting for real-life applications, two main conclusions follow. First, conflict rates in repeated ultimatum bargaining depend much on whether the possibility of reputation formation is present or not. The finding that conflict rates are strongly increased in the presence of reputations has been interpreted as supporting the view that fairness (as an altruistic impulse or as a learned norm) becomes less important for the average player in this setting.

Second, the personal characteristics of players are likely to influence the dynamics of play *within* a pair. When two players that both “care for fairness“ are matched, not much disagreement is to be expected. However, when such a player is matched with a “tough” player, or when two “tough” players are matched up, much disagreement is probable. Evidence from the present experiment suggest that both “tough” and “fair” players do exist in the subject pool, which is a result not found in the existing Ultimatum Game literature.

This finding, however, should not come as a complete surprise, since everyone who ever tried to buy a used car from a professional dealer knows about different types of bargaining behaviour. The extent to which “tough“ and “fair“ players exist in the population is not know. Previous experiments have provided evidence mainly for the existence of fair players because reputations did not play a role in these studies. Further research is needed to investigate the relationships between fairness, toughness and reputation, which are three concepts that are likely to be important in real life bargaining.[18]

[18]One attempt to explore such topics is done in an experiment by ANDERHUB, GÜTH AND SLEMBECK (1999) where subjects played in fixed pairs for 20 rounds but switched partners after 10 rounds in order to investigate the role of the players‘ experience on behaviour. The experiment also tests for the potential effects of random lottery payments design (as used in the present study) compared to a payment design where all rounds are actually paid. Prelimenary results indicate that rejection rates are significantly higher, i.e., subjects play “tougher“, under the latter design.

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Appendix: Instructions and Player Screens

[**bold face** and underlined text appeared in colour on screens]

Screen 1 for all players

Welcome!

Today you will have the opportunity to participate in a decision making experiment. If you follow the instructions carefully and make good decisions, there will be an opportunity for you to earn money during the session.

The Rules of the Game

Text for Treatment 1

•The session consists of 20 rounds.
•In each round two players are matched randomly, i.e. you will play with a new player in each round.

Text for Treatment 2

•The session consists of 20 rounds.
•You will be matched randomly with some other player.
•You will play with that same person in all 20 round.

In each round the two players face the following task:

First, player 1 decides how to split the amount of £10 between him or her and player 2.

- •The amount player 1 wants to give to player 2 is called an offer.
- •The offer can be any amount between £9.90 (highest possible offer) and £0.10 (lowest possible offer), in increments of £0.10.
- •That is, player 1's offer can be £9.90, £9.80, £9.70......£0.30, £0.20, or £0.10.
- •In each round player 1 can choose a new offer that may be identical to or different from previous offer(s).
- •The offer is transmitted to player 2 via the computer, and player 1 will see how player 2 reacted before the next round begins (see next).

Second, player 2 has to decide whether to accept or reject player 1's offer.

- •If player 2 accepts the offer, player 2 receives the amount offered, and player 1 receives £10 minus the offer.

  Example: If the offer is £X.XX, and player 2 accepts it, player 2 receives £X.XX and player 1 receives £10 – £X.XX.
- •If player 2 rejects the offer, both players receive £0 in this round.

Third, both players are informed about how much they and the other player earned in that round.

These three steps are identical in all 20 rounds.

These instructions can be accessed any time during the session by clicking on the <Help> button.
<OK, I understand. Please continue with the instructions>

Screen 2 for all players

Please note

Text for Treatment 1

•Each round is new and independent of other rounds.
That is,
-you are matched with a new player in each round.
-in each round there is a new £10 to be split.

•You will be assigned randomly to be either in the role of player 1 or player 2.
•You will keep that role throughout the session, i.e. in all 20 rounds.

Text for Treatment 2

•Each round is new and independent of other rounds.
That is, in each round there is a new £10 to be split.

•You will be assigned randomly to be either in the role of player 1 or player 2.
•You will keep that role throughout the session, i.e. in all 20 rounds, and always play with the same person.

Method of Payments
•At the end of this session 2 rounds from the 20 rounds played by each player will randomly be selected.
•The cash value earned in these two rounds will be paid to each player in addition to the £5 for participating.

Final Comment
•You play completely anonymously. Neither the experimenter nor the other participants in this experiment will know your identity, or how you behaved in this experiment.
•What you earn is your own business.

<scroll back to previous screen> <continue>

Screen 3 for all players

The computer will now decide randomly if you are player 1 or player 2.

You are player " 1 / 2 " throughout this session, i.e. in all 20 rounds.

<continue>

Player Screen for Player 1

Round # (1-20)

You are payer 1.

Please choose the amount you want to offer to player 2 out of £10.

Please recall that you will receive £10 minus your offer if the offer is accepted, and player 2 will receive your offer. If your offer is rejected both of you will receive £0.
Your offer must be in increments of £0.10.

I want to offer “ __x.y0___ ” £ to player 2.

<Confirm> <Change>

Player Screen for Player 2

Round # (1-20)

You are player 2.

The amount player 1 offers to you is “ ___ ”£ out of £10.

<I accept> <I reject>

<Confirm> <Change>

Feedback Screen for Player 1

Round # (1-20)

Player 2 has decided to “accept”/”reject” your offer of “__” £.

You earned “___”£ in this round.

Player 2 earned “___”£ in this round.

Please prepare for the next round.

<continue>   <help>

Feedback Screen for Player 2

Round # (1-20)

You have decided to “accept”/”reject” the offer of “__” £.

You earned “____”£ in this round.

Player 1 earned “____”£ in this round

Please prepare for the next round.

<continue>   <help>