Time preferences: do they matter in bargaining?

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Abstract

Experimental studies of bargaining generally *impose* time preferences' on subjects, in the sense that in case of disagreement, the experimenter reduces the size of the surplus bargained over by imposing exogenously some monetary cost. Contrary to this practice, in this study time preferences are first elicited in a preliminary phase, and then bargaining begins. I show that although subjects are sensitive to the timing of a monetary reward, this plays no role in determining bargaining behaviour. To the contrary, when the bargaining game is played in conventional experimental setting with monetary cost of delay, these do have an impact on subjects' conduct in negotiations.

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1 Introduction

The role that time plays in economic decisions and behaviour is paramount, and has long been recognised. The literature is huge[1], dating back at least to the 17th century, and models of intertemporal allocation of resources are the staple diet for undergraduate students in economics. However, actual behaviour is often at odds with conventional economic wisdom[2].

We all shop around for the lower mortgage rate or the highest savings rate, but when the transaction is not purely financial behaviour seems less 'rational'. For instance, in the real estate market, there is evidence[3] that we tend to stay focused on achieving the maximum possible price, and only a small proportion of house sellers does revise the asking price downwards, in spite of the obvious trade-off between sale price and time on the market.

More generally, casual evidence would suggest that when people are involved in a task where time is not the only relevant dimension, its effect may be somewhat "watered down"[4]. My objective in this paper is to test this hypothesis. The specific task I consider is a bargaining situation, so as to study whether or not bargaining over time incorporates peculiar features which cannot be accounted for by traditional experimental design.

My results indicate that, although when involved in a task which involves purely time subjects do 'react' to it, when the principal task is such that time is only *one* of the relevant features involved, it seems not to matter. I will refer to this as *time prominence* (or lack of it).

The reason why I look at a bargaining task is that time preferences (i.e. impatience) are considered as one of the fundamental forces driving the outcome in non-cooperative models of bargaining[5]. This feature is translated in experimental settings by modelling the agents' preference for an earlier (rather than a delayed) agreement by means of an *exogenous* reduction of the surplus bargained over every time disagreement occurs. So if, say, subjects are negotiating over the division of a surplus between them, the experimenter can impose a rate of time preferences τ_i on player i,

[1] For choices among 'single' time dependent outcomes Fishburn and Rubinstein (1980) provide representation theorems for utility maximising agent with a monotonic and continuous preference ordering on $X \times T$ (where X is the set of outcomes and T is the set of times). Meyer (1976) considers the case of preferences over *sequences* of time dependent outcomes, as more recently Fishburn and Edwards (1997). See Frederick, Loewenstein and O'Donoghue (2001) for a thorough review of these issues.

[2] The stark contrast between actual behaviour and the theoretical conjecture on *Homo Oeconomicus'* conduct are commanding more and more the attention of the professionals. See for instance Thaler (1991), Elster (1998), Rabin (1998), O'Donoghue and Rabin (1999), Rabin, Goeree and Holt (2000), Starmer (2000), Henrich et al. (2001) and Loewenstein (2001) to cite just a few.

[3] Ortalo-Magné and Merlo (2000) find that only about 25% of house sellers in England lower the selling price (after an average of 11 weeks on the market). Anglin et al (2001) finds a higher proportion for Canada (around 46%).

[4] The fact that "distractors" worsen task performance is well reserached in the cognitive neurosciences. For instance, interference (from subsequent terms in a list of numbers) impairs short term memory (see Gazzaniga, Ivry and Mangum (1998), chapter 7, and references therein), and time preferences are dramatically affected by addiction (see for instance Bickel and Marsch, 2001).

[5] Theoretical non-cooperative bargaining models with an alternating offers structure and proportional discounting have proven somewhat more popular than those with fixed costs of delay; even more so in the

(corresponding to the intertemporal discount factor $\delta_i = \frac{1}{1+\tau_i}$) by having the surplus reduced by a factor[6] δ_i at every round following disagreement (so that subject *i*'s share x_i is worth $\delta_i x_i$ if agreement is reached at time t). Whether or not this is a legitimate way to render time preferences in a laboratory environment is then crucial for the interpretation of the experimental results.

The development of theoretical tools for analysing non cooperative bargaining and its relevance for real life have happily conjured to favour the flourishing of a rich literature on experimental models of bargaining over "shrinking" pies[7]. But all these experiments share the problem that they try and implement the theoretical framework of bargaining over time in experimental settings where on the contrary time has no role at all. What these experiments really study is therefore the extent to which backward induction type of reasoning is "used", if at all, by subjects in negotiations[8].

In this paper I therefore consider alongside "conventional" experimental settings - where time is modelled as some cost to be incurred in case of failure to reach immediate agreement - a bargaining game where disagreement entails receiving the agreed share at a later point in time. In order to make the "conventional" and "real time" comparable, real time bargaining is preceded by a stage in which the subjects' time preferences are assessed.

There is a problem, though, with addressing the issue of time preferences directly, as the debate on how actual time preferences should be modelled is still as open as it is unsettled. A number of violations of representations of time preference of the form outlined above have been noted[9]. Often "dread"'' and "savouring" effects'' are observed[10], which refer to the fact that people prefer to postpone a pleasant activity (so as to enjoy also the "build up"'to it), or to anticipate an

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experimental bargaining literature. For a review of the huge literature sparked by Rubinstein (1982), see for instance Osborne and Rubinstein (1990) and Binmore, Osborne and Rubinstein (1992).

[6] Such discount factor can be imposed to be the same for both players (as for instance in Binmore, Shaked and Sutton (1985), Guth and Tietz (1988) , Neelin, Sonnenschein and Spiegel, 1988), or different (as in Ochs and Roth, 1989).

[7] See Roth (1995) for a thorough survey of this vast literature; Rapoport ET AL consider alternating offers bargaining models where the cost of delay is some fixed constant.

[8] The debate has initially focused on checking the accuracy of subgame perfect equilibrium as a predictor of the outcome of experimental negotiations. Failing that, the next step has been to trying and individuate possible heuristics used by experimental subjects. The evidence on this is somewhat mixed (see e.g. Prasnikar and Roth (1992), who investigate off the equilibrium path incentives to players to conform to behaviour which is subgame perfect in both ultimatum and "best shot" games.), and it is not uncommon to observe subjects reject an offer and make a counter-proposal that leaves them with a smaller payoff than the one previously rejected. Thus, there might be fairness considerations lurking in the background, which may trigger rejection of an 'insultingly low' offer. This in turn poses the problem of detecting what sort of agreements people deem fair; on this, see for instance Binmore, Morgan, Shaked and Sutton (1991). However, see also Forsythe et al. (1994) for an example where bargaining power is totally exploited in the absence of punishment. Other studies of fairness are for instance Bolton and Ockenfels (2001) and Fehr and Gachter (2000).

[9] For a survey of these violations, see Loewenstein and Thaler (1989) or Loewenstein and Prelec (1992). For a thorough treatment of issues concerning choice over time see Elster and Loewenstein (1992) and more recently Frederick, Loewenstein and O'Donoghue (2001).

[10] Results of this kind have been obtained for instance by Loewenstein (1987).

unpleasant task (so as to avoid contemplating this unfavourable outcome for too long). Furthermore, observed preferences are rarely stationary, and people often exhibit a strict preference for immediacy: they may be indifferent between some immediate outcome and a delayed one, but in case they are both brought forward in time, the immediate outcome loses completely its attractiveness[11]. Besides, there is an abundance of papers which argue that discounting behaviour is more consistent with hyperbolic rather than exponential discounting[12].

In this paper I take an agnostic view on the competing theories on time preferences, and do not fully investigate alternative possible representations. As it will become clear further below, for my purposes it is not necessary to estimate discount factors[13] precisely. It is enough for me to be able to establish that subjects are indeed sensitive to the timing of a monetary reward by some form of (incentive compatible) measure of time attitude. Then, I will be able to show that the experimental designs conventionally adopted for bargaining games fail to approximate negotiations over time-dependent outcomes, where bargaining behaviour is totally *unaffected* by the cost of delay.

The experimental design for this paper is described in the next section. Section 3 overviews the results, which are discussed in detail in sections 4 and 5. Section 6 concludes.

2 Experimental design

The experiment was conducted over two consecutive days (during term time) at the Economics Department of LUISS University in Rome. The subjects were first year undergraduates with no prior exposition to Game Theory.

Three treatments were considered. The first one consisted of two stages. In the first stage time preferences (over delays of one and two months) were elicited by using a modification of the Becker-Marschack-De Groot procedure[14], hence this treatment is referred to as BDM. In the second stage subjects played a two round bargaining game on the division of a sum of money (300 monetary units[15]). The other two treatments consisted of the second stage only (bargaining). As explained more in detail below, in the BDM treatment delayed agreement (i.e. agreement in the second round) resulted in subjects receiving their payment with a time lag of one month. For the other two treatments, agreement in the second round entailed either a payment of a fixed fee (out

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[11] This phenomenon is reminiscent of violations of expected utility theory. For instance, Burgos, Grant and Kajii (1997) model an alternating offers bargaining model where agents' preferences exhibit a certainty effect (see Kahneman and Tversky, 1979). Loewenstein and Prelec (1991) present a treatment of choice over time and under risk from a unifying'' perspective.

[12] Hyperbolic discount functions imply that discount rates decrease over time. For evidence documenting this phenomenon, consult for instance Ainslie (1975), Benzion, Rapoport and Yagil (1989), Laibson (1997), Loewenstein and Prelec (1992) and Thaler (1981). On the contrary, other papers have argued that hyperbolic discounting does not accurately describe time preference (e.g. Rubinstein, 2000 and Frederick, Loewenstein and O'Donoghue, 2001).

[13] For a thorough review of papers measuring discount factors see Frederick, Loewenstein and O'Donoghue (2001).

[14] See Becker, DeGroot and Marschak (1964), or Bohm, Linden and Sonnegard (1997).

of the share of the surplus) in the FIXED treatment (henceforth FXD), or a fall in the value of the chips bargained over in the DISCOUNT treatment (henceforth DSC).

2.1 Elicited time preferences (BDM)

In the first stage subjects' preferences were elicited by a modification of the Becker-De Groot-Marschak procedure, where a good is substituted for a "bad" (waiting). More precisely, each of the 40 subject was told that by participating in the experiment s/he was entitled to collect a prize of 300 monetary units, which however would have to be collected with a delay of X months. They were then asked to write down on special forms the amount of money (limit price) *LP* they would be willing to pay in order to avoid having to wait X months to collect their entitlement. The forms were then collected and the declared limit price was compared with a randomly[16] determined asking price. If the latter was *lower* than the named pay price, then the subject would receive the payment *net of the random asking price* the next day[17]; if instead the asking price was *equal or greater* than the declared limit price, the subjects would receive the full sum with one day and X months and one day delay.

In order to test the constancy of time preferences, subjects were asked to declare two limit prices, one for a delay X=1 month and one with delay X=2 months; consequently, two (possibly distinct) asking prices (one for each version) were drawn. In the end one for the two versions (one or two months) was randomly selected, and payment proceeded accordingly.

As with the usual BDM, here too the dominant strategy for the subjects is to state the true reservation price: the incentive to bid a low price is offset by the fact that the lower the limit price, the less likely it is that the asking price is even lower, resulting in the delayed collection of the prize. Thus, it was possible to measure the subjects' monetary evaluation of the time unit X.

Subjects then were told that the first stage of the experiment was over, and that they would now have to negotiate with an anonymous opponent to share some money (additional 300 monetary units). In the bargaining stage negotiations proceeded over two rounds, with the role of first proposer (Bargainer East) and first responder (Bargainer West) assigned randomly, and with subjects of each type sitting in separate rooms.

In order to exchange proposals subjects had to fill in a paper bargaining form (see appendix) which was carried between rooms by an assistant. Each form reported for each of the two bargainers the one month limit price elicited in the first stage.

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[15] Each monetary unit corresponded to 100 Italian Liras (ITL), which at the time (May 2000) corresponded to about 30 British Pence roughly.

[16] The asking price was determined by randomly drawing three table tennis balls, one for each digit of the asking price, from three bags, the first of which contained three balls only numbered 0 to 2 (first digit of the asking price) and the other two containing 10 balls each numbered 0 to 9 (for the second an third digits of the asking price). Thus any figure between 000 and 299 had equal probability to be drawn.

[17] In this way all subjects had to come back for payment, whether this was "immediate" or delayed of one or two months. This way possible confounds due to the "hassle"'of coming back only in case of either one or two month delay were removed.

Agreement in the first round entailed payment on the following day; agreement in the second round entailed payment with one month delay, whereas failure to reach agreement resulted in no subject receiving any payment.

On remark which is important at this point is that in experimental test involving delayed monetary payments the issue of credibility arises. In the experiment of this paper, however, I do not think this aspect was particularly relevant. The trustworthiness of the enterprise was corroborated by the involvement of a senior member of faculty there, who took part in the recruitment of the subjects. The reliability aspects concerning the practicalities as to payment was ensured by telling subjects that for the "immediate" payment (i.e. "tomorrow") I would have been available on campus for the whole of the next day. For the "delayed payment" (one and two month, depending on the version extracted) separate envelopes containing cash would have been sent by courier on the specified date to the Students office on Campus - which is very small - where subjects could then collect them. Anonymity was preserved throughout by assigning a random "Personal Identification Code" to each student, who would have to present it in order to collect his/her payment.

2.2 Fixed cost of delay (FXD) and proportional cost of delay (DSC)

In both these treatments the task consisted of the bargaining phase only. As in the BDM treatment, 40 subjects were randomly assigned one role (either Bargaining East or Bargainer West) and seated in two different rooms. The bargaining forms used were similar to the one for the BDM treatment, with the idea to replicate in each of the 20 bargaining pairs the costs elicited in stage 1 of the BDM treatment. The way these costs were modelled was however different.

The FXD treatment was based on a fixed cost of delay: agreement in the second round of negotiations resulted in the payment of a fixed fee out of the agreed share. In the FXD treatment a "no bakrupcy rule" established that any agreement in the second round would have to be such that shares were enough to cover both agent's fees in order not to be void (thus resulting in no payment at all). For each bargainer this fee corresponded to each of the one month limit prices observed in the BDM treatment, and bargainers were matched so that each pair of negotiators in the FXD treatment "mirrored" exactly one bargaining pair in the BDM treatment. Similarly, in the DSC treatment subjects had to divide between them 300 chips, worth initially one monetary unit each. If agreement was reached in the second round, the value of each chip would diminish of some amount, which was determined so as to correspond to the pair of limit prices of each bargaining pair in the BDM session (see section 5.3 below for the details).

In both FXD and DSC the bargaining forms reported the cost for delayed agreement (fixed or proportional) to both players. Subjects were paid at the end of the experiment.

3 Overview of the results[18]

The first thing to observe is that overall subjects displayed sensitivity to the timing of a monetary reward for the time frame chosen[19]. Specifically, the amount of money subjects were prepared to pay in order to avoid a one month delay in payment was statistically greater than zero. Furthermore, for 23 out of 40 subjects the limit price increased in the "two months" version, and the two observed median of the limit price distributions (10 and 35 monetary units for the "one month" and "two month" versions, respectively) were statistically significant (the Wilcoxon signed rank statistics is -3.182 for a test of equality of medians in the two distributions).

The next question to ask is whether this time sensitivity is carried to the bargaining phase. Furthermore, it would be interesting to see which model (fixed or proportional cost of delay) best mimics bargaining over time.

To start with, consider treatment effects on bargaining behaviour[20]. First of all, there appears to be no significant difference in location between the various treatments: the unbiased estimate[21] of the (true) difference in the median offer (or claim) across any two treatments is zero, and both the Wilcoxon and the Robust rank order statistics applied to the various pairs of offers show no statistically significant differences in the medians (see appendix). However, a simple visual inspection of the data suggests that the distribution of claims/offers are different in the three treatments.

Tests for the equality of variance seem to suggest that the variance in the distribution of claims/offers in both the DSC and FXD treatments is higher than in BDM (the Ansari-Bradley statistics are 1.491849 for a test of $\sigma_{FXD}/\sigma_{BDM}=1$ against the alternative $\sigma_{FXD}/\sigma_{BDM}>1$ and 1.69973 for a test of $\sigma_{DSC}/\sigma_{BDM}=1$ against the alternative $\sigma_{DSC}/\sigma_{BDM}>1$, with p-values of .07 and .05, respectively).

More interestingly, the distribution of claims for both DSC and FXD is asymmetric around the median, unlike the one for BDM. That is, in both DSC and FXD the distribution of claims is skewed to the right, revealing a more aggressive behaviour of first movers in this case[22].

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[18] Here I report only part of the statistical tests. The full set of results is in sections 4 and 5, with further details contained in the appendices.

[19] In pilot experiments I tried a shorter time horizon, setting X=1 week and X=2 weeks. In this case only a very small subset of the subjects displayed any sensitivity at all to time. However, those who did had marked differences in costs between one and two weeks delay.

[20] The frequencies for offers of Bargainer East can be found in tables and figures in section 5 below.

[21] I use $\hat{\Delta} = \text{med}(X_i - Y_j)$ as an unbiased estimate of the shift parameter Δ in $G(x)=F(x-\Delta)$, where F and G represent the response distributions of subjects in two different treatments. Note that the Wilcoxon test for instance would test the null hypothesis F=G against the alternative that one distribution stochastically dominates the other. The estimator $\hat{\Delta}$ is median unbiased (i.e. $E(\hat{\Delta})=\Delta$, and $\hat{\Delta}$ is distributed symmetrically around Δ, which is the median of the distribution of $\hat{\Delta}$. See Lehmann (1975), chapter 2.

[22] Randles et al. (1981)'s test statistic for distributional symmetry, returns 2.330609 for FXD and 3.047766 for DSC, while only .3409593 for BDM. The statistic is distributed as a standard normal under the null hypothesis of symmetric distribution, so that for both FXD and DSC the test rejects the null hypothesis

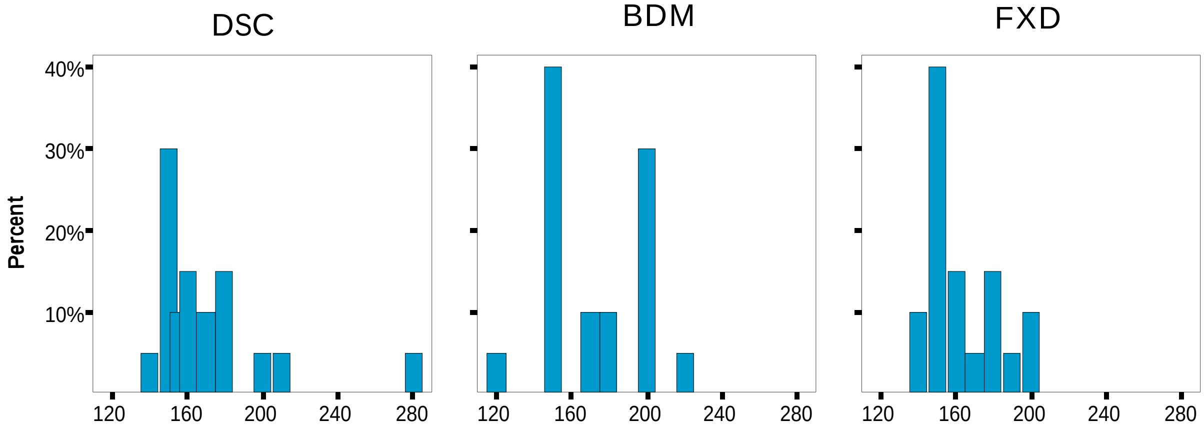

Figure 1: Distribution of Bargainer East's opening claim across treatments

In addition to this, in both DSC and FXD Bargainer East's claim is *significantly positively correlated with his opponent's limit price*, a result which survives even if the observation relative to the outlier (limit price of 299 for Bargainer West) is removed: Kendall's τ test for all observations yields a correlation coefficient between East's claim and West's limit price of .446 for FXD (significant at .006, one tailed) and of .463 for DSC (significant at .004, one tailed), whereas for BDM the correlation coefficient is much lower (.154) and anyway not statistically significant. The correlation between East's claim and the limit price differential (limit price of bargainer East-limit price of bargainer West) is even stronger (though this time is negative, obviously) for both DSC and FXD, whereas once again in the BDM treatment this correlation is low and not significant[23].

All these results taken together support the hypothesis of lack of time prominence: although bargainers do prefer their monetary rewards sooner rather than later in an exercise which involves merely time considerations, embedding the possibility of delayed agreement in a bargaining setup completely focuses attention away from the potential cost of delay: subjects in the BDM experiment seem to discard completely their opponent's cost for time. In this treatment two norms, the equal split and the 2/3-1/3 split work as very powerful attractors.

On the other hand, when the bargaining framework is completely devoid of time considerations, and the penalty for delayed agreement is directly monetary in nature, subjects do react to the cost of delay, and try to tailor (at least to some extent) their actions to the financial (opportunity) cost of the responder. In this case the claim of first movers is positively correlated to the responders

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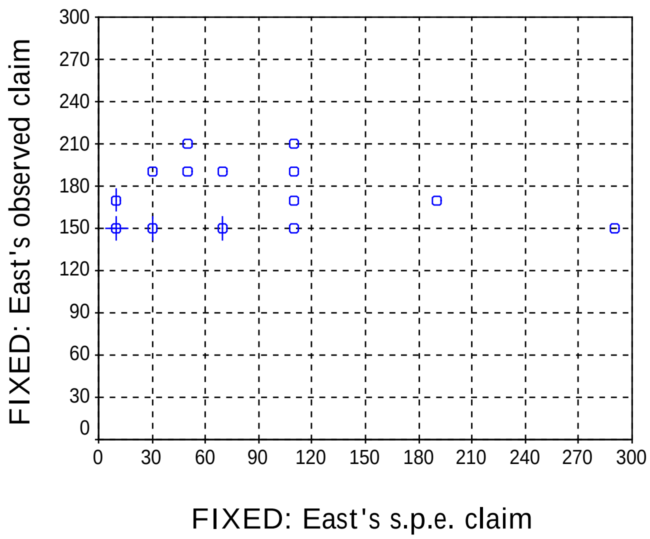
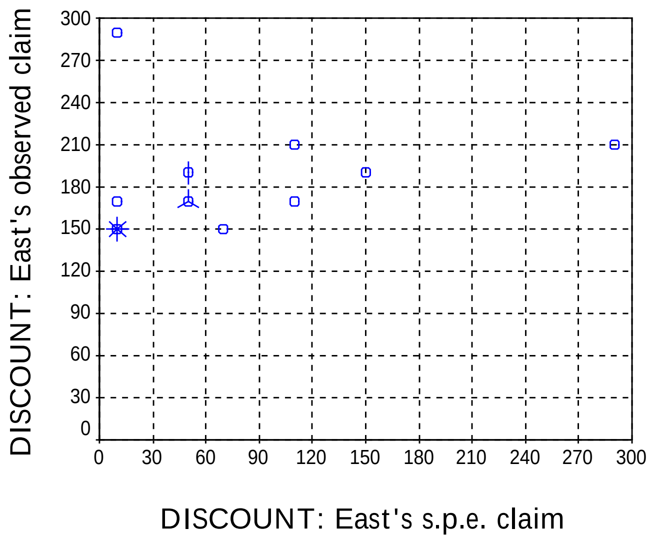
of symmetry against the one sided alternative of right-skewedness at 1% significance (see Hollander and Wolfe (1999), comment 61). Details of this test are in appendix A.2.3.

[23] All these results are detailed in section 5 and in the appendices.

cost of rejection, and even more to the differential between own and opponent's cost. For both these treatments (FXD and DSC), as we know from plenty of experimental evidence (see Roth, 1995), s.p.e. opening claims are hardly observed in practice. However, the conjecture (see Davis and Holt (1993), chapter 5) that in two round bargains subjects' opening claims are *smaller* than the s.p.e. prediction when the latter is sufficiently high (around at least 80% of the available surplus), and *closer* to the s.p.e. when the latter is more "reasonable" (around 50-75%) is partly contradicted here. As can be seen in the figures below, while it is true that for the highest s.p.e. claims (2 cases in the FXD treatment and one case in the DSC case) observed claims show more restraint, in all other cases the observed claim exceeds by far the s.p.e. prediction.





What about rejected offers? In the BDM treatment the same pattern observed in the first round is repeated, with a concentration of offers on the two norms. Incidentally, these counteroffers are not always accepted; indeed the BDM treatment was the most fractious, and agents seemed to resent what they perceived as "low" offers, as time cost were not taken into account.

For both the other treatments (FXD and DSC) it is possible to compute the subgame perfect equilibrium claims in the second round (off the equilibrium path; see section 5 below). In both FXD and DSC responders move boldly away from the equal division (which is *never* offered) and embrace a 2/3-1/3 convention.

The results are analysed in detail in the following sections.

4 Time preferences

Subject's evaluation of time was elicited by means of a modified BDM procedure as described above (see instructions in the appendix).

Figures 1 and 2 report the scatterplot for one month and two months limit prices.

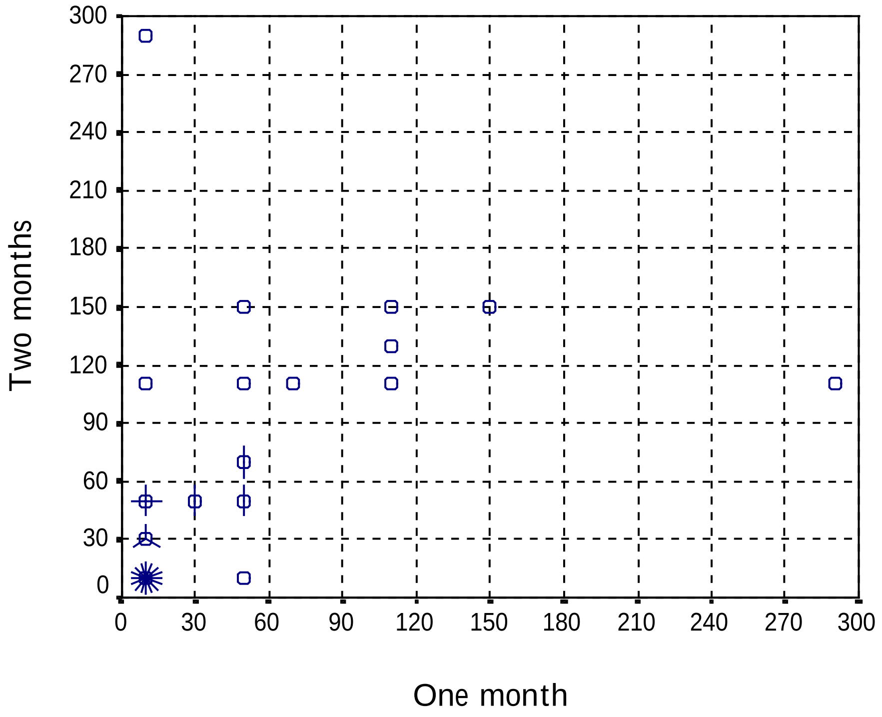


Figure 2: limit prices for all observations

In Figure 2, which refers to all data collected, it can readily be seen that for two individuals preference reversal occurred (points lying below the diagonal). These have been removed from Figure 3, where it is easier to see how prices vary.

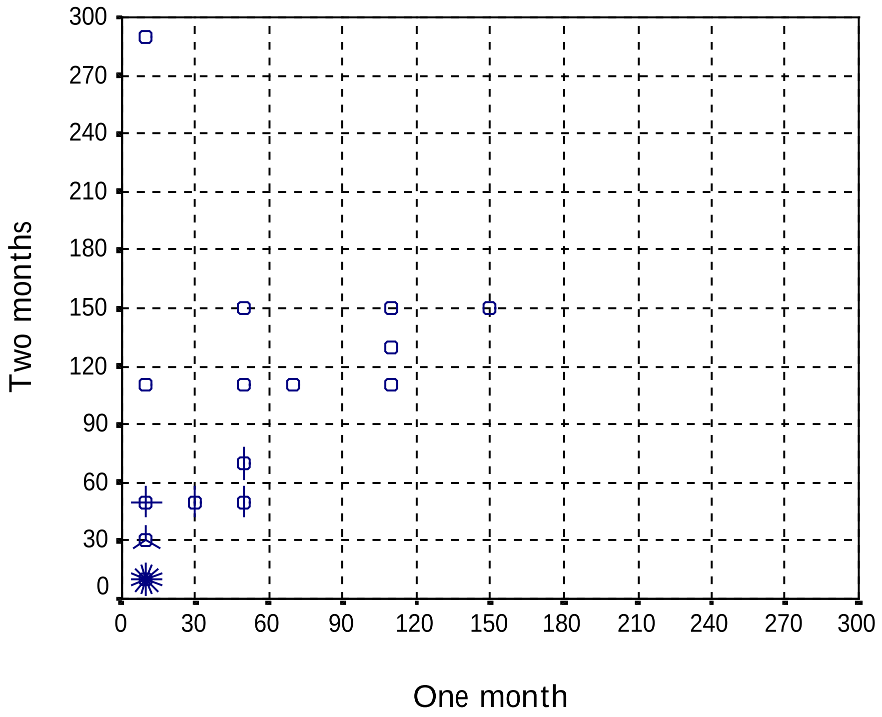


Figure 3: Limit prices with exclusion of cases with preference reversal

Although most observations are concentrated around the bottom left corner of the scatter, subjects exhibit a pronounced variability in their time preferences. This can be seen more readily from Figure 4.

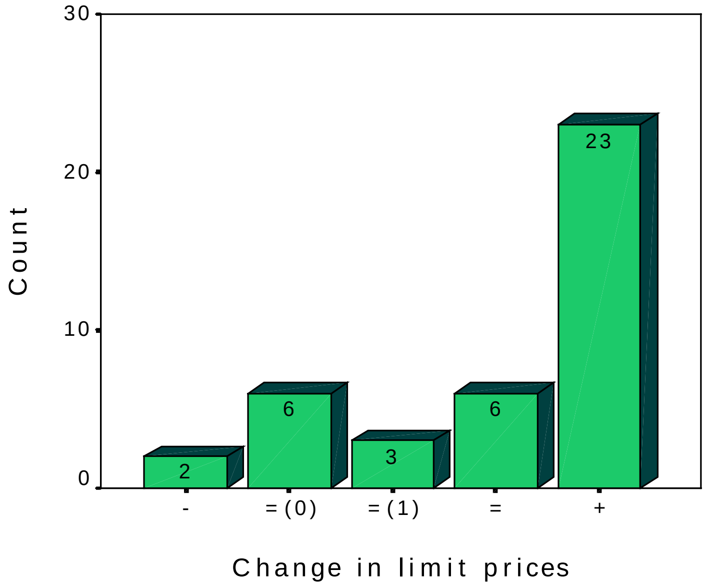


Figure 4: Qualitative changes in limit prices (two months-one month). Negative, positive and no change are indicated with -, + and =, respectively. The column denoted by =(0) refers to limit prices which were zero and did not change over time; the column denoted by =(1) refers to limit prices which were only equal to 1, and did not change over time.

For 6 individuals preferences appear to be insensitive to the time horizon chosen (i.e. their limit price is always zero); further 9 of them are sensitive to the first delay (i.e. one month), but not to the second (i.e., the difference between two months and one month limit price is zero). However, for 23 subjects the limit price increased (from a positive value) between one and two month. The dispersion of the data can be visualised with the aid of Figure 5. Descriptive statistics are reported in the table below.

		One month	Two months
N		40	40
Mean		32.88	50.88
Median		10.00	35.00
Mode		0	0, 50
Std. Dev.		55.82	61.39
Minimum		0	0
Maximum		299	299
Percentiles	25	.25	3.25
	50	10.00	35.00
	75	50.00	90.00

Table 1: Descriptive statistics for observed limit prices

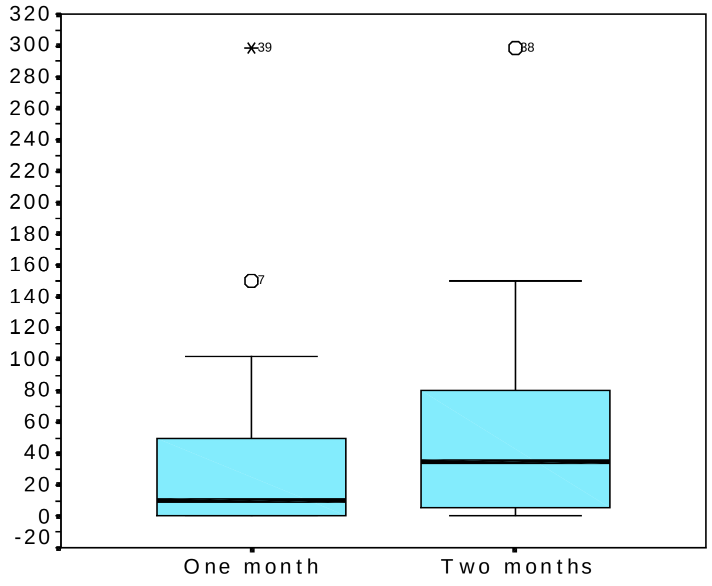


Figure 5: limit price distributions (the thick line represent the median)

A Wilcoxon test performed on the data is consistent with the hypothesis that the two month (TM) limit price distribution first order stochastically dominates the one month (OM)'limit price distribution, that is, TM has a statistically significant higher median than OM. Note that this effect is enhanced if we exclude from the analysis the cases which exibhited preference reversal (indicated in parenthesis in Table 2).

		N	Mean Rank	Sum of Ranks
TM-OM	**Negative Ranks** [a]	2 *(0)*	22.25 *(0)*	44.50 *(0)*
	Positive Ranks [b]	23	12.20 *(12)*	280.50 *(276)*
	Ties [c]	15		
	Total	40 *(38)*		

[a] two months< one month; [b] two months> one month; [c] two months = one month

Test Statistics [a, b]

	TM-OM
Z	-3.182 *(-4.209)*
Asymp. Sig. (2-tailed)	.001 *(.000)*

[a] Based on negative ranks
[b] Wilcoxon Signed Ranks Test

Table 2: Test for equality of medians between one month and two month limit prices.

All in all, then, the results above support the hypothesis that subjects were sensitive to the time frame chosen.

5 Bargaining behaviour

As a preliminary, note that in the three types of bargain the subgame perfect equilibrium (henceforth s.p.e.) offers differ. Assuming linear utility for money, in the DSC treatment, solving backwards, if the game were to reach the second stage, Bargainer West (player 2) would claim the whole surplus, i.e. all of the 300 chips bargained over. Letting δ_W denote the amount that each chip is worth to him in the second round, the most bargainer East (player 1) can claim in the first round is $300\text{-}300\delta_W = (1\text{-}\delta_W)\ 300$.

On the other hand, in the FXD treatment in second round player West has to ensure that player 1 receives an amount sufficient to cover his second period tax, as because of the "no-bankruptcy constraint"'any agreement which failed to cover both player's cost would be void. Additionally, bargainer West would have to cover his own fee, too. Consequently, West's payoff in the second round would be $300\text{-}LP_E\text{–}LP_W$, which then is what player East would have to concede in the first round, retaining for himself LP_E+LP_W.

Thus the main difference between the s.p.e. first offers in the DSC and FXD treatment is that under DSC the discount treatment first offers depend only on the responder's cost of delay, whereas in the FXD case equilibrium first offers depend on both player's cost of delay.

Proportional costs of delay (discount factors) in the DSC treatment were constructed quite crudely from the one month limit prices elicited from subjects via the BDM procedure as $\delta_i = \frac{300 - LP_{iBDM}}{300}$, where LP_{iBDM} is the limit price of the "mirror" bargainer West in the BDM treatment. This way of deriving discount factors may under-estimate the corresponding actual discount factors for the subject in the BDM treatment, especially if the utility function is not linear in money. However the only purpose of proportional discounting in this paper is to evaluate whether it constitutes the appropriate frame to describe the essential features of negotiations over real time. What is crucial for my results is that both the "correct" discount factor underlying the subjects' preferences and my own crude representation of it are some function of the limit prices - a mild requirement. This is enough to allow a correct interpretation of the various non-parametric tests[24] my analysis relies on, for which the only relevant information is rank. Consequently, these tests are invariant to any order preserving transformation of the variable of interest.

With this caveat in mind, it is possible to express the s.p.e. opening offer in the discount case as $(1-\delta_i)300 = \left(1 - \frac{300 - LP_{iBDM}}{300}\right)300 = LP_{iBDM}$. The table below reports the figures used in this conversion between limit prices and discount factors used in the experiment[25].

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[24] See also footnote 29 below.

LP_{iBDM}	0	1	9	10	12	13	20	30	40	45	50	60	100	101	102	150	299
δ_i	1	.99	.97	.97	.96	.96	.93	.90	.87	.85	.83	.80	.66	.66	.66	.50	0

Table 3: Conversion between elicited limit prices (LP_{iBDM}) and discount factors (δ_i). All numbers in hundreds of ITL.

Subgame perfect equilibrium strategies are described in the following table:

		Fixed cost (Proposal is an amount of money)	**Proportional discounting** (Proposal is an amount of chips)
Bargainer East	Proposes	$(LP_E + LP_W;300-(LP_E+LP_W))$ if $LP_E+LP_W \le 300$; claims all surplus otherwise	$((1-\delta_W)300;\delta_W 300) = (LP_W;300-LP_W)$
	Accepts	$x \ge LP_E$	$x \ge 0$
	Rejects	$x < LP_E$	$x < 0$
Bargainer West	Proposes	$(LP_E;300-LP_E)$ if $LP_E+LP_W \le 300$; claims all surplus otherwise	$(0;300)$
	Accepts	$x \ge 300-(LP_E+LP_W)$	$x \ge \delta_W 300 = 300 - LP_W$
	Rejects	$x < 300-(LP_E+LP_W)$ Note that W's s.p.e. payoff in the second round (off the equilibrium path) is *$300-LP_W-LP_E$*.	$x < \delta_W 300 = 300 - LP_W$

Table 4: Subgame perfect equilibrium strategies in FXD and DSC.

In all cases East's claims have wildly exceeded the s.p.e. predictions. Similarly for West's claims in the second round. Significantly, though, none of the second period offers were at the equal split level. This seems to show that as long as some focal point/convention other than the equal split is available it can be used to anchor and justify more aggressive behaviour.

These results are analysed in more detail below.

5.1 Elicited time preferences (BDM)

The frequencies are reported in Table 5, and visualised in Figure 6. The first thing to observe is that although the modal claim is 150, there is another "mass point" at 200. Furthermore, more than 55% of the offers lie above the sample mode, as well as the sample median (which is 170).

[25] Because of roundings, in some cases the same discount factor may correspond to slightly different limit

	Frequency	Percent	Cumulative Percent
120	1	5.0	5.0
150	8	40.0	45.0
170	2	10.0	55.0
180	2	10.0	65.0
200	6	30.0	95.0
220	1	5.0	100.0
Total	20	100.0	

Table 5: Frequency distribution of Bargainer East's claims

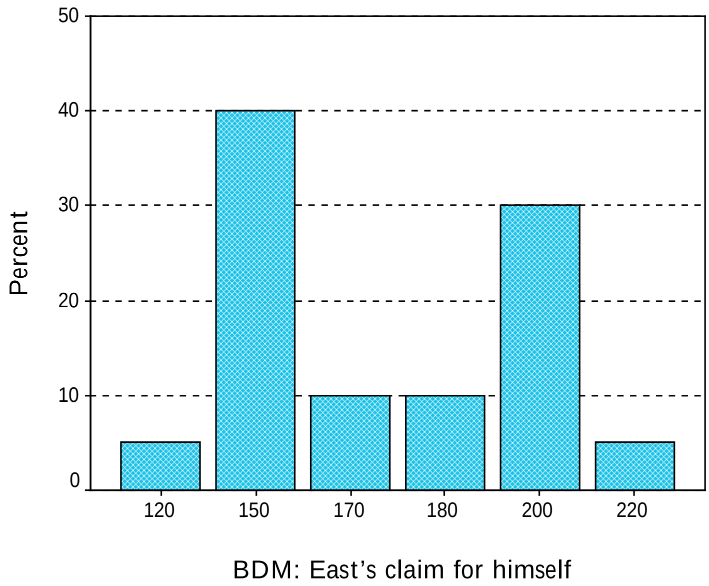


Figure 6

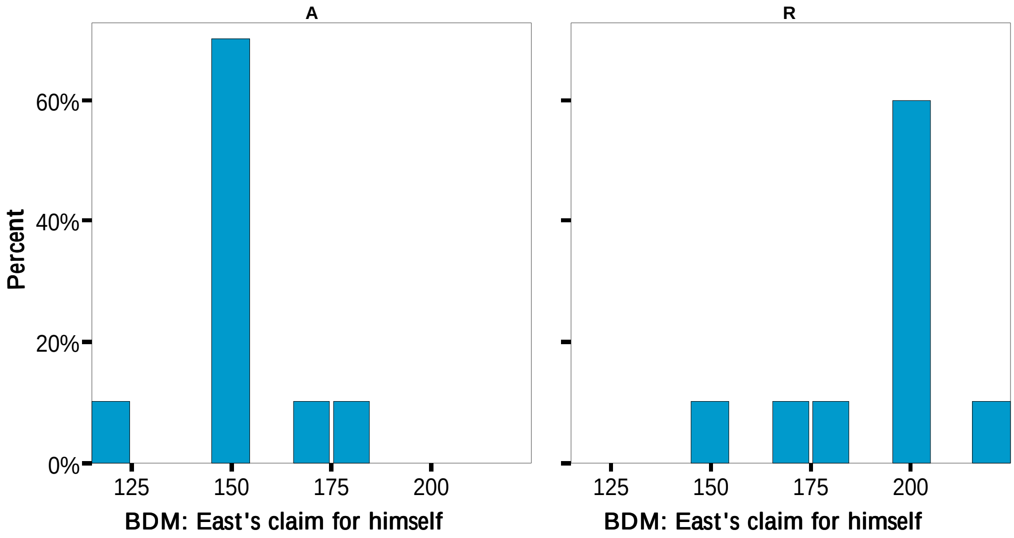
So, it seems that as a heuristic subjects used the either a fifty-fifty or a 2/3-1/3 convention[26] (recall that the amount to be divided was 300 monetary units).

But which of these offers are accepted? Below is the distribution of successful and rejected proposals. Not surprisingly, the highest offers get rejected.

---

prices. However such discrepancies are so small that this does not constitute a problem for the analysis.

[26] The choice of convention *may* depend on the opponent limit prices, however the evidence in this respect is weak. Specifically, the average limit price for bargainer West is 36.83 in correspondence of the 200 mark, and either 13.29 or 49 in correspondence of the 150 claim, depending on whether the observation related to the only subject with limit price 299 is excluded or not from the analysis. So, while dropping the outlier seems to suggest some rule of thumb for the choice of convention, there is not enough evidence to warrant the deletion of this observation from the data-set. Furthermore, remember that at any rate there is no evidence of correlation between opponents' limit prices and own offers.



A Wilcoxon test shows a clear difference in the medians of the two distributions.

Ranks

	West's response	N	Mean Rank	Sum of Ranks
East's claim	A	10	14.75	147.50
	R	10	6.25	62.50
	Total	20		

Test Statistics(b)

	East's claim for himself
Mann-Whitney U	7.500
Wilcoxon W	62.500
Z	-3.370
Asymp. Sig. (2-tailed)	.001
Exact Sig. [2*(1-tailed Sig.)]	.000(a)

a Not corrected for ties.

b Grouping Variable: BDM: West's response

Table 6: Test for equality of medians between accepted and rejected offers in the first round.

However, there is now a significant negative correlation of *rejected offers* with the rejector's limit price, as can be seen from the table below. This reinforces the conclusions drawn above that limit prices are not taken into account in the bargaining phase of the BDM treatment: the responders with the higher limit prices seem oblivious of their “condition” and reject also pretty “central” offers, as visualised in the figure above.

<table>
<tr><th colspan="3"></th><th>Limit price for bargainer west</th><th>Limit price for bargainer East</th><th>Limit price differential (i.e. East-West)</th></tr>
<tr><td rowspan="6">East’s claim</td><td rowspan="3">A</td><td>Cor. Coeff.</td><td>. 287</td><td>-.036</td><td>-.246</td></tr>
<tr><td>Sig. (1-tailed)</td><td>. 154</td><td>. 453</td><td>. 186</td></tr>
<tr><td>N</td><td>10</td><td>10</td><td>10</td></tr>
<tr><td rowspan="3">R</td><td>Cor. Coeff.</td><td>.479(*)</td><td>-.117</td><td>-.495(*)</td></tr>
<tr><td>Sig. (1-tailed)</td><td>.040</td><td>.337</td><td>.033</td></tr>
<tr><td>N</td><td>10</td><td>10</td><td>10</td></tr>
<tr><td colspan="6">** Correlation is significant at the .05 level (1-tailed).</td></tr>
</table>

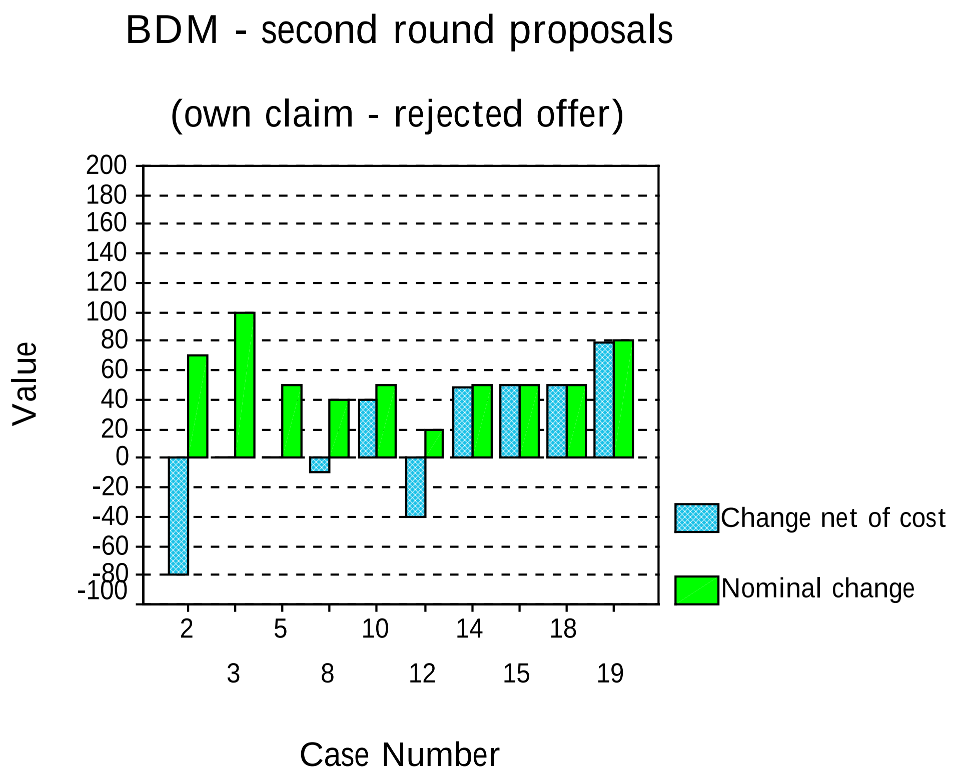
Table 7: Correlations based on Kendall’s τ test - accepted vs. rejected offers

As one would expect, all the counteroffers in the second round yield bargainer East less than his initial claim. Furthermore, indifference to the opponent’s limit prices persists, and similarly to East’s claims in the second round, West’s offers turn out to be uncorrelated with the opponent’s limit prices:

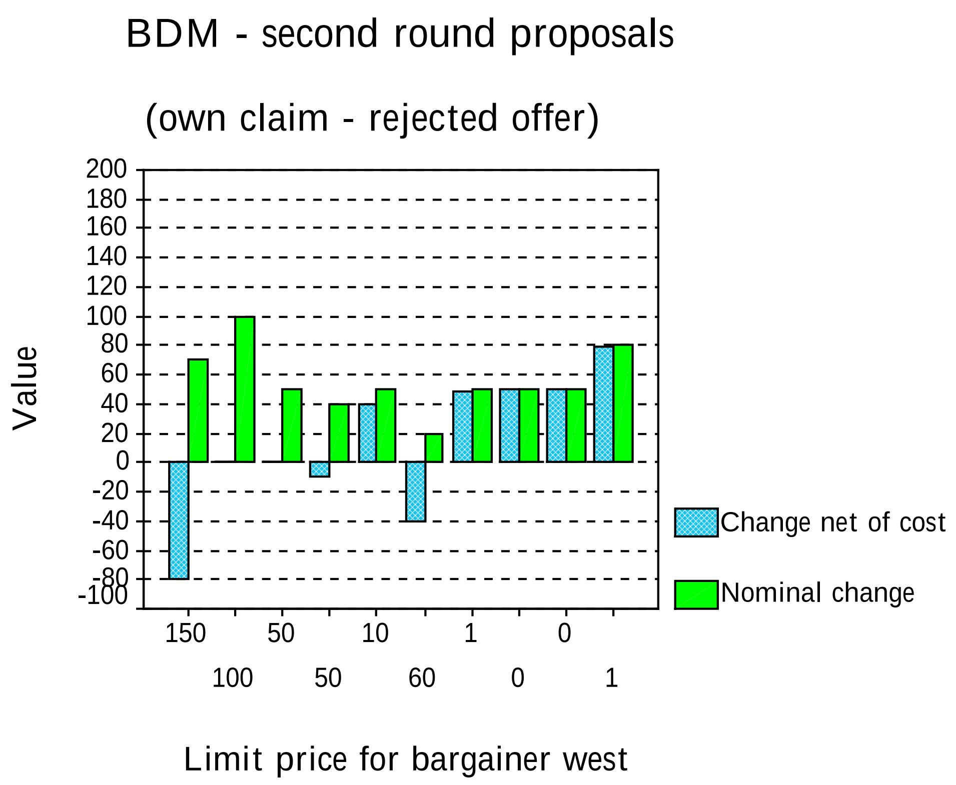
<table>
<tr><th colspan="2"></th><th>Limit price for bargainer west</th><th>Limit price for bargainer East</th><th>Limit price differential (i.e. East-West)</th></tr>
<tr><td rowspan="3">West’s offer in the second round</td><td>Correlation Coefficient</td><td>.191</td><td>-.113</td><td>-.187</td></tr>
<tr><td>sig. (1-tailed)</td><td>.245</td><td>.343</td><td>.246</td></tr>
<tr><td>N</td><td>10</td><td>10</td><td>10</td></tr>
<tr><td colspan="5">** Correlation is significant at the .01 level (1-tailed).</td></tr>
</table>

Table 8: Correlations based on Kendall’s τ test - counteroffers

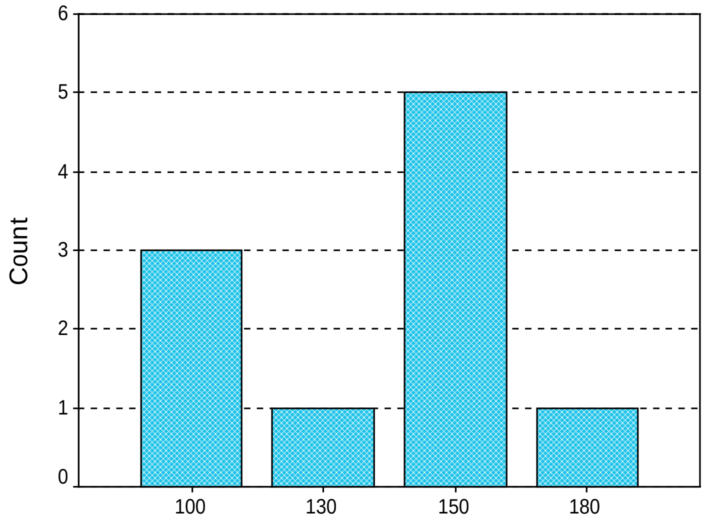
But perhaps the most striking feature is that counteroffers in the second round did give the proposer more than the rejected offer in terms of monetary payoff, but a smaller “utility”once the limit price is taken into account. This is visualised in the figure below, which represents the differences between the own claim and the rejected offer in the previous period. While all monetary differences are strictly positive and of considerable value, once the cost of waiting is taken into account 50% of these differences become either zero or negative (and considerably so).



Interestingly, this happens quite independently of the rejector's limit price:



Furthermore, it is evident a predilection for two norms, the fifty-fifty split and the 2/3-1/3 division, as from the picture below:



BDM: West's offer in the second round

Of all treatments, this was the most fractious: 50% of first offers were initially rejected, and three of the negotiations ended with no agreement, with both bargainers obtaining a null payoff.

These results suggest that, although subjects did show a sensitivity to time (i.e. when confronted with a task which involves purely time, subjects do notice), when the principal task is such that time is only *one* of the relevant features involved, it seems not to matter. There is not a great deal of dispersion in the initial offers (as compared to the other treatments, as we will see below), which are uncorrelated to limit prices, and agents concentrate their proposals around two conventions, 50/50 and 2/3-1/3.

The rejected offers are indeed correlated with respondent's limit prices: however, the fact that they are rejected shows that responders do not recognise the role of time. This is further reinforced by two facts:

- counteroffers follow a similar pattern to those of first movers: proposals are uncorrelated with limit prices, are not very dispersed and concentrate around the two conventions.
- In monetary terms counteroffer are advantageous to bargainer West; however, they become negative if limit prices are taken into account.

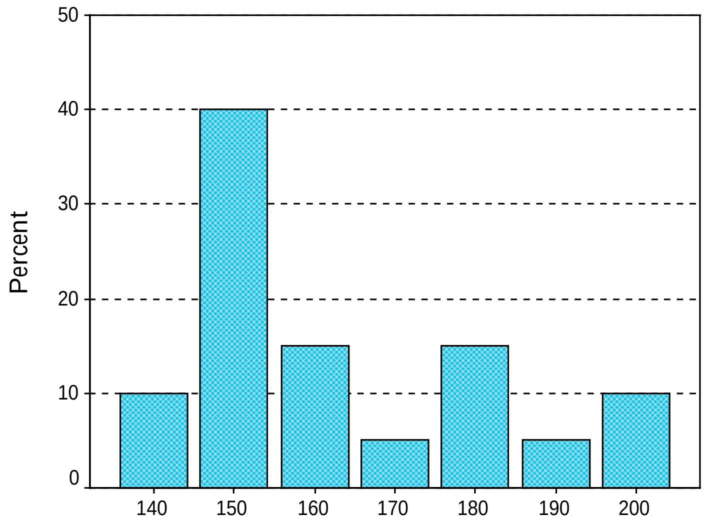
5.2 Fixed cost of rejection (FXD)

In this treatment the mode and median for the distribution of bargainer East's claim coincide at 150 (i.e. equal split). However, while the average for the first half of the cases is 145, the average for the second half is much higher at 178.

	Frequency	Percent	Cumulative Percent
140	2	10.0	10.0
150	8	40.0	50.0
160	3	15.0	65.0
170	1	5.0	70.0
180	3	15.0	85.0
190	1	5.0	90.0
200	2	10.0	100.0
Total	20	100.0	

Table 9: Frequency distribution of Bargainer East's claims

Moreover, this distribution has a narrower support than that for the BDM, as depicted in the figure below:

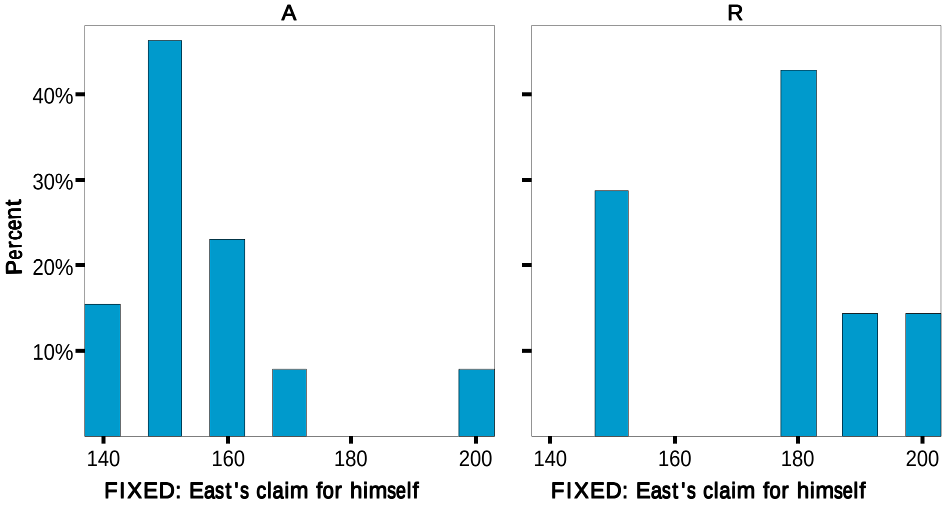


FIXED: East's claim for himself

The first thing to note is that, as in the BDM treatment, a considerable proportion (40%) of the claims are at the equal split division; however, although 50% of the claims are in excess of the equal split, the second convention observed in the BDM treatment (i.e. the 2/3-1/3 partition) is no longer focal.

This comes as no surprise once the relationship with the opponent's cost of rejection is inspected: as observed in section 7, opening offers are significantly positively correlated to responder's cost of rejecting an offer, and a nonparametric test of distributional symmetry shows that both distributions (East's claims and West's cost of rejection) are skewed to the right[27].

Consider now rejections. As above, the highest offers end up being rejected, and there is a significant difference in the medians of the accepted and rejected proposals.



Although less pronounced than in the BDM treatment, here as well there is a significant difference between the median accepted and rejected proposals, as from the table below.

	West's response	N	Mean Rank	Sum of Ranks
East's claim	A	13	8.58	111.50
	R	7	14.07	98.50
	Total	20		

Test Statistics[b]

	East's claim
Mann-Whitney U	20.500
Wilcoxon W	111.500
Z	-2.055
Asymp. Sig. (2-tailed)	.040
Exact Sig. [2*(1-tailed	.046[a]
[a] Not corrected for ties.	
[b] Grouping Variable: FIXED: West's response	

Table 10: Test for equality of medians between accepted and rejected offers in the first round.

Furthermore, only seven proposals (rather than 10 in the BDM treatment) are rejected. Counteroffers appear to be rational insofar as they yield the first mover less than he originally claimed for.

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[27] See appendix A.2.3.

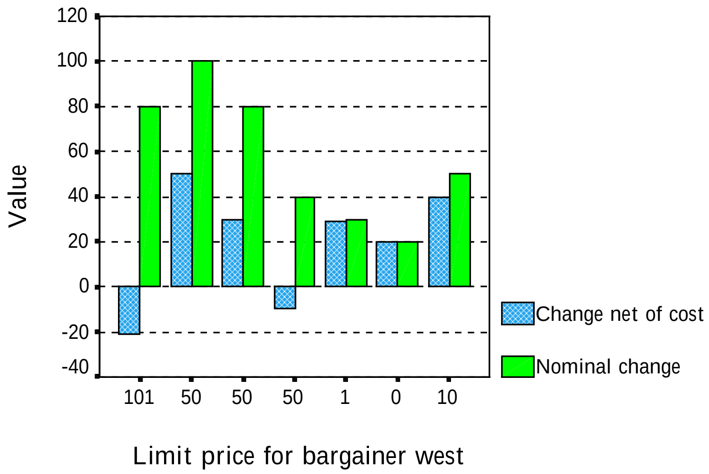
FIXED - second round proposals

(own claim - rejected offer)

Moreover, only two out of the seven rejected offers yield a non-positive monetary payoff to the proposers, and no bargain end in disagreement.

FIXED - second round proposals

(own claim - rejected offer)



The data show a less ‘recognisable’ pattern as compared to the BDM case, as shown in the figure below. Responders seem very aware of the weakness which derives from their own cost of delay, and apparently fail to realise that there is a role reversal. Incidentally, during post-experimental debriefings, in the mains those subjects who were selected to be responders in the first round (i.e. bargainers West) felt that they were at a disadvantage in negotiations because of their role as responders.

This anxiety about own cost of disagreement tallies well with the experimental behaviour. As mentioned above, proposers in the second round (bargainers West) consistently offered to their opponent (bargainer East) less than what they had claimed in the previous round. The differential turns out to be significantly negatively correlated with bargainers West's own cost of disagreement[28], as reported in the table below:

		Cost for bargainer West	Cost for bargainer East
Difference between West's offer to East and East's claim in the previous round	**Correlation Coefficient**	**-.685(*)**	-.065
	Sig. (1-tailed)	**.020**	.429
	N	7	7
* Correlation is significant at the .05 level (1-tailed).			

Table 11: Correlations based on Kendall's τ test

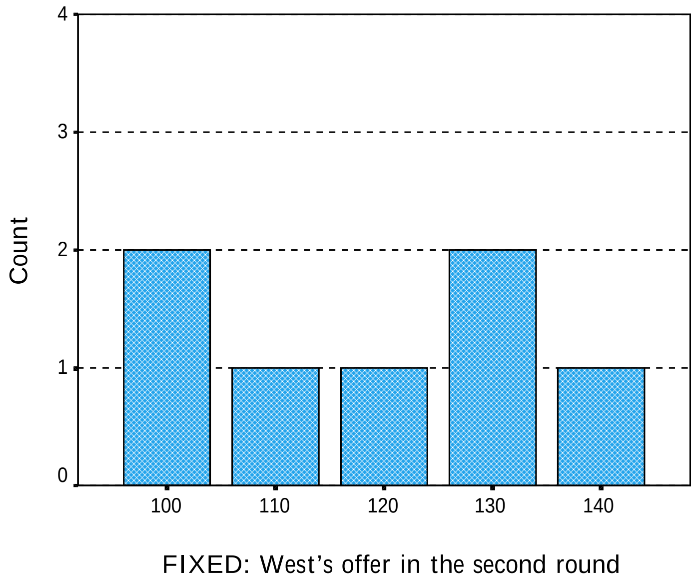


Figure 7

The analysis above seems to suggest that a *fixed cost* of disagreement is very clearly perceived by the subjects: First movers' offer are significantly negatively correlated with responders' costs of disagreement, and the correlation coefficient is high (in excess of .4 in absolute value). The effect of costs of delay is significant in offers in the second round too. Only, in this case subjects perceive their own cost as a source of reduced bargaining power, and their proposals are less aggressive the higher their own cost of disagreement.

[28] Recall that no such behaviour is observed in the BDM treatment.

5.3 Discount

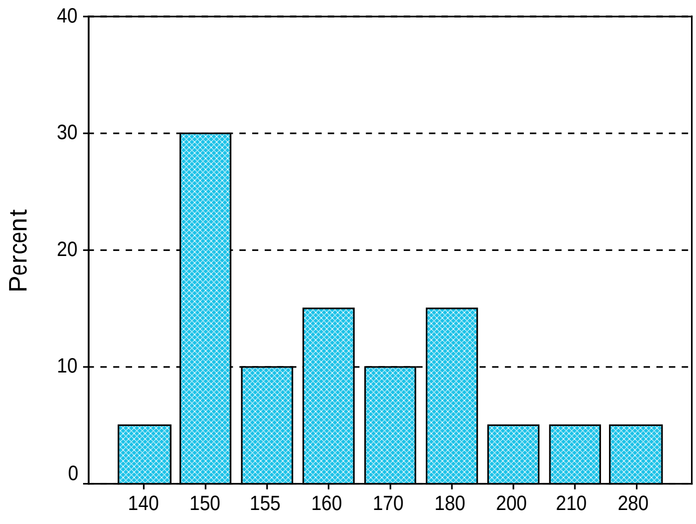
The support of the distribution of initial claims (which is skewed to the right) in this treatment is much larger than for the other two cases; as shown in appendix A.2.2 this distribution is more dispersed than for the BDM treatment, whereas non statistically significant differences can be detected with respect to the FXD treatment.

Although the equal split constitutes the modal claim (and accounts for 40% of the cases), both the median and the average initial claims are higher, at 160 and 170, respectively. Moreover, 60% of claims do not correspond to any established norm; once again, the key to explain this pattern of offers is the positive correlation with the opponent's cost of rejecting an offer (see appendix A.2.4).

The frequencies are reported in the table below, and represented in the picture below.

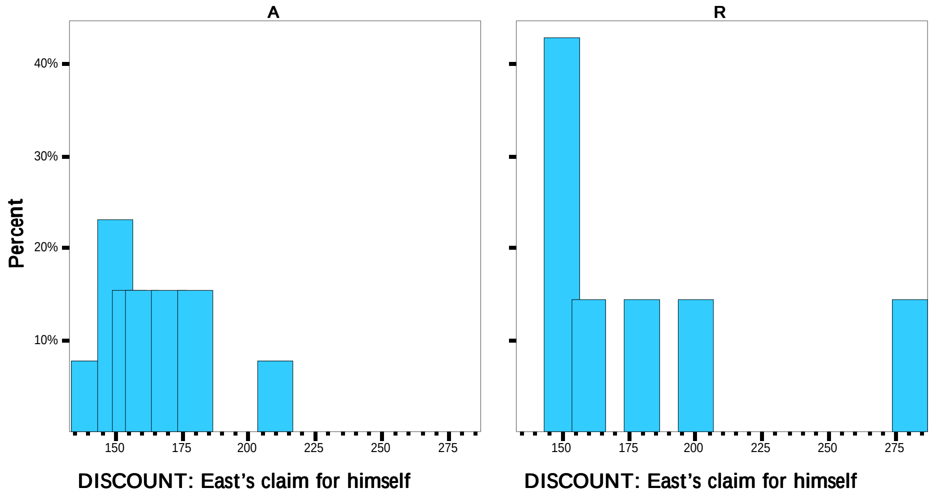
	Frequency	Percent	Cumulative Percent
140	1	5.0	5.0
150	6	30.0	35.0
155	2	10.0	45.0
160	3	15.0	60.0
170	2	10.0	70.0
180	3	15.0	85.0
200	1	5.0	90.0
210	1	5.0	95.0
280	1	5.0	100.0
Total	20	100.0	

Table 12: Frequency distribution of Bargainer East's claims



DISCOUNT: East's claim for himself

Consider now the responder's behaviour. In this treatment the median of rejected offers is not much higher than of the accepted ones, as shown in the picture below.



A Mann-Withney test confirms indeed that the two medians do not differ statistically in a significant way:

	West's response	N	Mean Rank	Sum of Ranks
East's claim	A	13	10.12	131.50
	R	7	11.21	78.50
	Total	20		

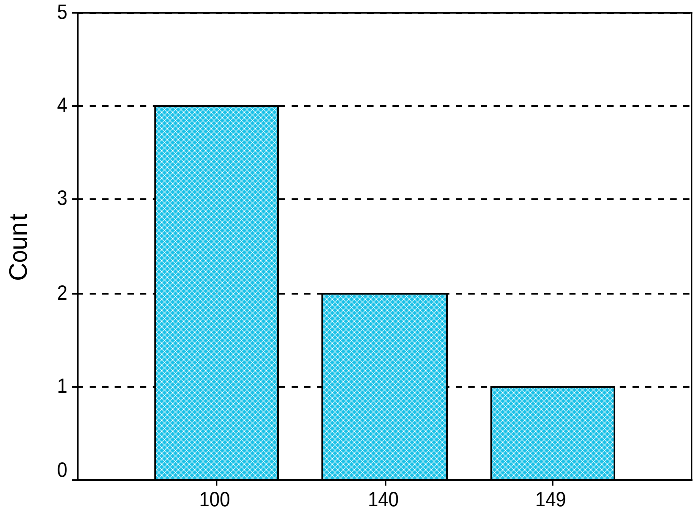
Test Statistics[(b)]

	East's claim
Mann-Whitney U	40.500
Wilcoxon W	131.500
Z	-.403
Asymp. Sig. (2-tailed)	.687
Exact Sig. [2*(1-tailed Sig.)]	.699[(a)]
[a] Not corrected for ties.	
[b] Grouping Variable: DISCOUNT: West's response (0=accept, 1=reject)	

Table 13: Test for equality of medians between accepted and rejected offers in the first round.

Regarding counteroffers, they are "rational", in the sense that they yield a *discounted* payoff which is in excess of the rejected offer. Unlike the other two treatments, here payoffs in case of agreement are (by construction) always non-negative.

As in the FXD treatment (and to less extent in the BDM treatment), the 1/3-2/3 division seem to attract most counteroffers, as the picture below shows:



DISCOUNT: West's offer in the second round

Finally, as in all other treatments, bargainer West's offer is uncorrelated to any of the limit prices[29].

The analysis above seem to suggest that a *discounted cost* of disagreement is clearly perceived by the subjects, which take it into account when making their offers. On the other hand, responders are more aware of their own vulnerability in the first round due to their own cost of disagreement. This effect persists in the second round, where counteroffers are negatively correlated to their own cost of disagreement.

6 Discussion

One point that is worth stressing is that, regardless of the specific discount factors underlying subjects' preferences, the fact that delay is imposed in the same way in both stages of the BDM treatment implies that there is no reason to expect a different evaluation of monetary outcomes in the two phases as far as time attitudes are concerned[30]. Thus, it seems reasonable to attribute any differences in the attitude towards time to the superimposition of the bargaining structure.

The upshot of this analysis is therefore that even if subjects do show that they are sensitive to the timing of a monetary reward, superimposing another task (bargaining) introduces a distractor which focuses attention away from time considerations altogether.

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[29] Note that obviously, being Kendall's τ a non-parametric test, the result is invariant to considering the discount factor rather than the limit price (in level). This is why in this analysis the precise way discount factors are derived from limit prices is not crucial.

[30] One possible exception could be wealth effects, as in the second stage the subjects were potentially richer (because of the 300 monetary units gained in the first stage). However the "aggressiveness" of the opening claims during bargaining may be evidence enough to show thus such wealth effects, if present, were not too strong.

This is all the more striking when one considers that the negotiations in which subjects were involved were very stylised, and were still on monetary outcomes. On the other hand, when the costs of disagreement are explicitly expressed in monetary terms, they do affect bargaining behaviour.

Of course, these results do not have the pretense to undermine the vast and rich non-cooperative bargaining theory based on time preferences[31], though they hint that there is room and scope for reinterpretation of what ‘time preferences’ really mean in those models.

[31] Nor would I want to, as most of my contributions are in this field!

A Appendices

A.1 Limit prices

A.1.1 Symmetry

The test performed is based on Palomino et al. (1981). It consists in classifying all possible subset of size three of observations coming from each sample as either right (if the average of the observations is greater than the median) or left (if the reverse is true). The difference T between the number of right and left triples is then found. An estimate of the variance, σ_T is then computed, and the statistic $T/\sqrt{\sigma_T}$ is distributed as a standard normal under the null hypothesis of symmetric distribution.

The results are reported below:

	West	East	
T	564	544	
σ_T	23216.52	25859.13	
$T/\sqrt{\sigma_T}$ p. value (1 tailed)	3.701524 *.000*	3.382921 *.000*	

Table 14: **Test for distributional symmetry.**

A.2 Comparison of Bargainer East's claim in all treatments

A.2.1 Location

In the first instance a Wilcoxon-Mann-Whitney test was performed on the claims by bargainers of type East (first movers) to check for a difference in medians. The results are reported in the following table.

		N	Mean Rank	Sum of Ranks
FIXED - BDM	Negative ranks	8[(a)]	9.38	75.00
	Positive Ranks	6[(b)]	5.00	30.00
	Ties	6 *(5)*[(c)]		
	Total	20 *(19)*		
DISCOUNT - BDM	Negative Ranks	9[(d)]	9.50	85.50
	Positive Ranks	8 *(7)* [(e)]	8.44 *(7.21)*	67.50 *(50.50)*
	Ties	3 *(3)* [(f)]		
	Total	20 *(19)*		

DISCOUNT - FIXED	**Negative Ranks**	6[g]	7.67	46.00
	Positive Ranks	8 *(7)* [h]	7.38 *(6.43)*	59.00 *(45.00)*
	Ties	6 *(6)* [i]		
	Total	20 *(19)*		
Note: all variables refer to East's claim for himself in the various treatments. Data in parenthesis refer to the case where outliers are included, which however does not affect the calculations for the statistic				
[a] FIXED< BDM; [b] FIXED > BDM; [c] BDM = FIXED				
[d] DISCOUNT < BDM ; [e] DISCOUNT > BDM; [f] BDM = DISCOUNT				
[g] DISCOUNT < FIXED; [h] DISCOUNT > FIXED; [i] FIXED = DISCOUNT				

Test Statistics[(c)]

	FIXED - BDM	**DISCOUNT - BDM**	**DISCOUNT - FIXED**
Z	-1.420 [a]	-.428 *(-.909)* [a]	-.411 *(-.035)* [b]
Asy. Sig. (2-tailed)	.156	.669 *(.363)*	.681 *(.972)*
[a] Based on positive ranks.			
[b] Based on negative ranks.			
[c] Wilcoxon Signed Ranks Test			

Table 15: Wilcoxon test for equality of medians in the distribution of East's claim in all treatments.

The Wilcoxon test however relies on the assumption that the observations come from the same distribution, in particular assuming identity of variance. As - based on test which follow in this appendices - equality of variance (and surely of distribution) is rejected, a Robust Rank Order test (which is appropriate in this case) was performed. The statistic[32] is calculated as

$$\grave{U} = \frac{mU(YX) - nU(XY)}{2\sqrt{V_X + V_Y + U(XY)U(YX)}} \overset{asy}{\sim} N(0,1)$$

where U(YX) is the average of $U(YX_i)$, the number of observations in Y placed ranked below each of the m observations X_i in X; V_X is the sum of the squared deviations of $U(YX_i)$ around the mean (and similarly for the symmetric variables).

U(FXD,BDM)=12	U(BDM,FXD)=8	V_{FXD}=378	V_{BDM}=819	Ù=1.1124
U(DSC,BDM)=10.65	U(BDM,DSC)=9.35	V_{DCS}=456.55	V_{BDM}=876.55	Ù=0.3434
U(DSC,FXD)=8.8	U(FXD,DSC)=10.9	V_{DSC}=617	V_{FXD}=701.7	Ù=-0.5581

[32] Tabled values for this statistic can be found in Fligner et al (1981). The distribution of the statistic under the null of no change in location approaches the standard normal distribution as the sample sizes increase (as in the case for this paper). See for instance Siegel and Castellan (1988).

Table 16: Robust Rank Order test for equality of medians in the distribution of East's claim in all treatments.

Finally, in support of the above note that the median unbiased estimate of the treatment effect can be computed as $\hat{\Delta} = \text{med}(X_i - Y_j) = 0$.

A.2.2 Dispersion

The results reported below are for the Ansari-Bradley test. Similar results are obtained with other test (e.g Siegel-Tuckey) which assume equality of median in the underlying populations.

	BDM	**FXD**
FXD p. value (1 tailed)	1.491849 *.07*	.
DSC p. value (1 tailed)	1.69973 *.05*	0.6353 *.26*
Each cell reports the value of the Ansari-Bradley statistic for the test of H_0: $\sigma_{row}/\sigma_{column} = 1$ against the one sided alternative of H_A: $\sigma_{row}/\sigma_{column} > 1$. The statistic is distributed as a standard normal distribution under the null.		

Table 17: Robust Rank Order test for equality of medians in the distribution of East's claim in all treatments.

A.2.3 Symmetry

The tests are based on Palomino et al. (1981) (see appendix A.1.1).

	BDM	**FXD**	**DSC**
T	68	322	511
σ_T	39775.23	19088.55	28111.14
$T/\sqrt{\sigma_T}$ p. value (1 tailed)	.3409593 *.36*	2.330609 *.009*	3.047766 *.001*

Table 18: Test for distributional symmetry - East's claim in all treatments.

A.2.4 Correlations

		Limit price for bargainer west	Limit price for bargainer East	Limit price differential (i.e. East-West)	Discount rates corrsponding to West's cost	Discount rates corrsponding to East's cost
BDM	Correlation Coefficient	.157	-.074	-.210	-.164	.041
	Sig. (1-tailed)	.194	.347	.121	.184	.415
	N	20	20	20	20	20
FXD	Correlation Coefficient	**.446(**)**	-.059	**-.402(*)**	**-.441(**)**	.066
	Sig. (1-tailed)	**.006**	.375	**.011**	**.007**	.361
	N	20	20	20	20	20
DSC	Correlation Coefficient	**.463(**)**	-.163	**-.658(**)**	**-.459(**)**	.160
	Sig. (1-tailed)	**.004**	.184	**.000**	**.004**	.192
	N	20	20	20	20	20
** Correlation is significant at the .01 level (1-tailed).						
* Correlation is significant at the .05 level (1-tailed).						

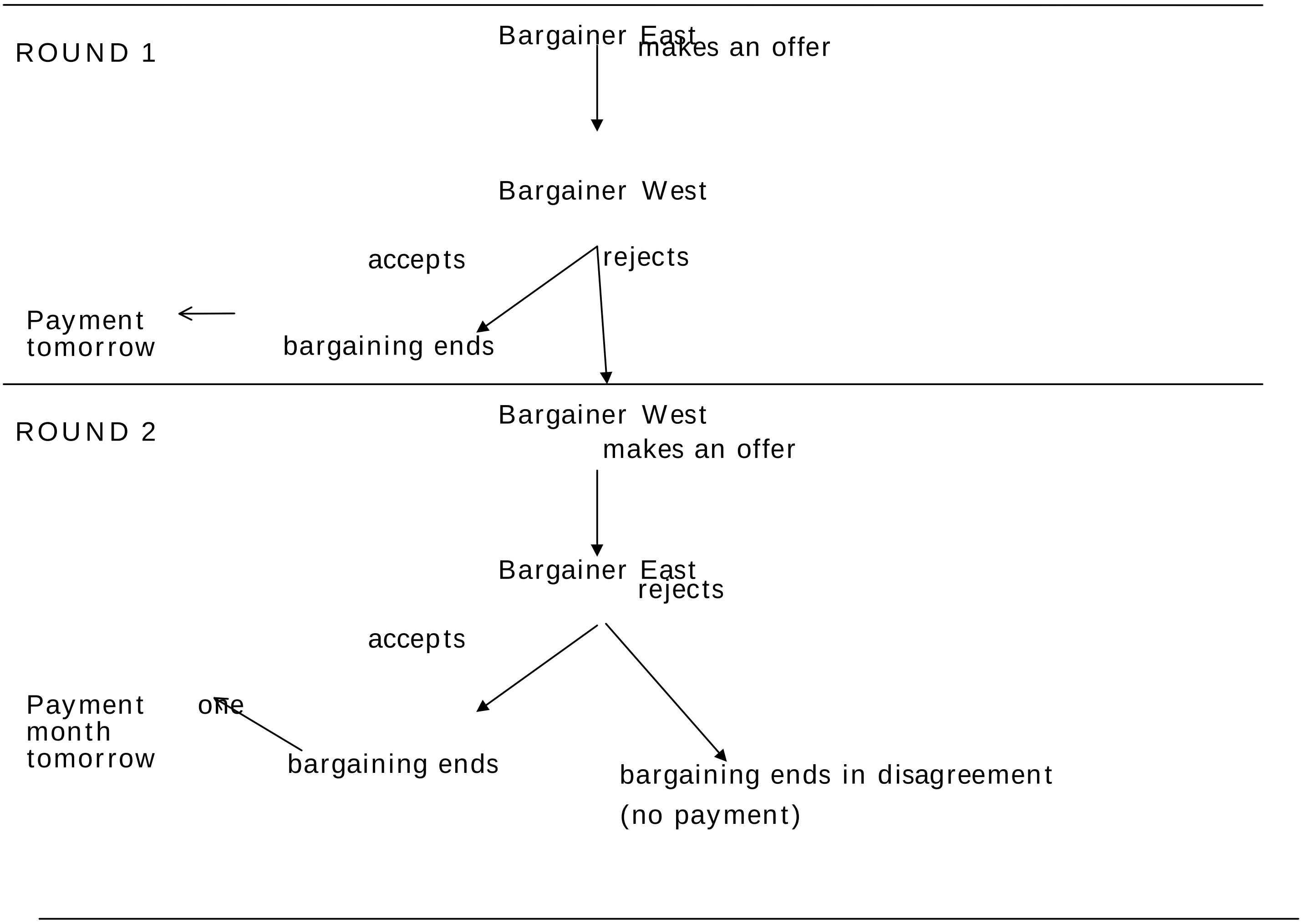
Table 19: Correlations based on Kendall's τ test - East's offer in all treatments (all observations)

		Limit price for bargai-ner West	Limit price for bargainer East	Limit price differential (i.e. East-West)	Discount rates corre-sponding to West's cost	Discount rates corresponding to East's cost
BDM	Correlation Coefficient	.244	-.125	-.301	-.252	.090
	Sig. (1-tailed)	.097	.259	.052	.090	.323
	N	19	19	19	19	19
FXD	Correlation Coefficient	**.546(**)**	-.092	**-.496(**)**	**-.541(**)**	.101
	Sig. (1-tailed)	**.001**	.313	**.003**	**.002**	.298
	N	19	19	19	19	19
DSC	Correlation Coefficient	**.409(*)**	-.097	**-.628(**)**	**-.404(*)**	.092
	Sig. (1-tailed)	**.012**	.301	**.000**	**.013**	.313
	N	19	19	19	19	19
* Correlation is significant at the .05 level (1-tailed).						
** Correlation is significant at the .01 level (1-tailed).						

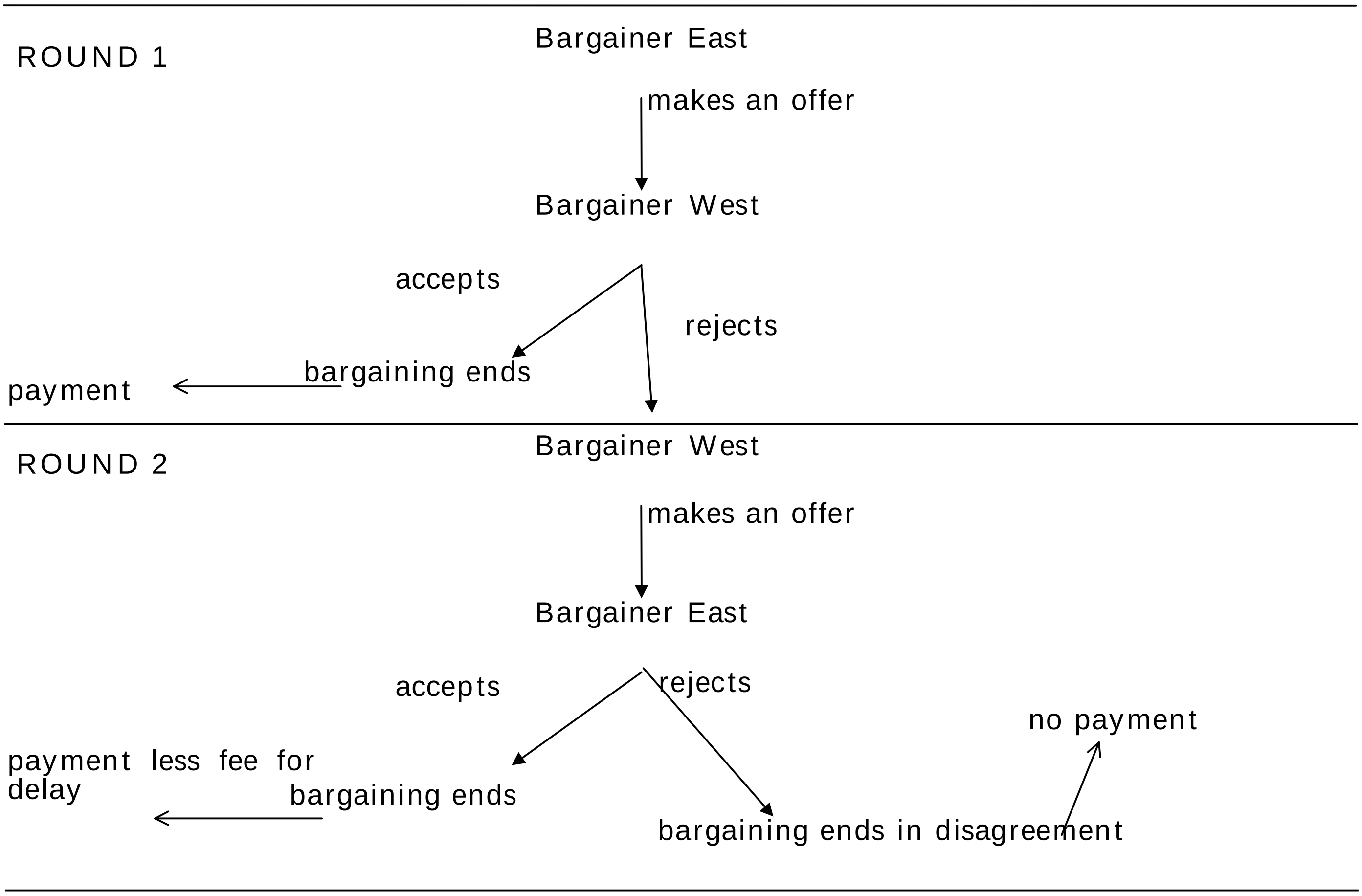
Table 20: Correlations based on Kendall's τ test - East's offer in all treatments (no outliers)

B Structure of the game in the three treatments (picture handed out to subjects)

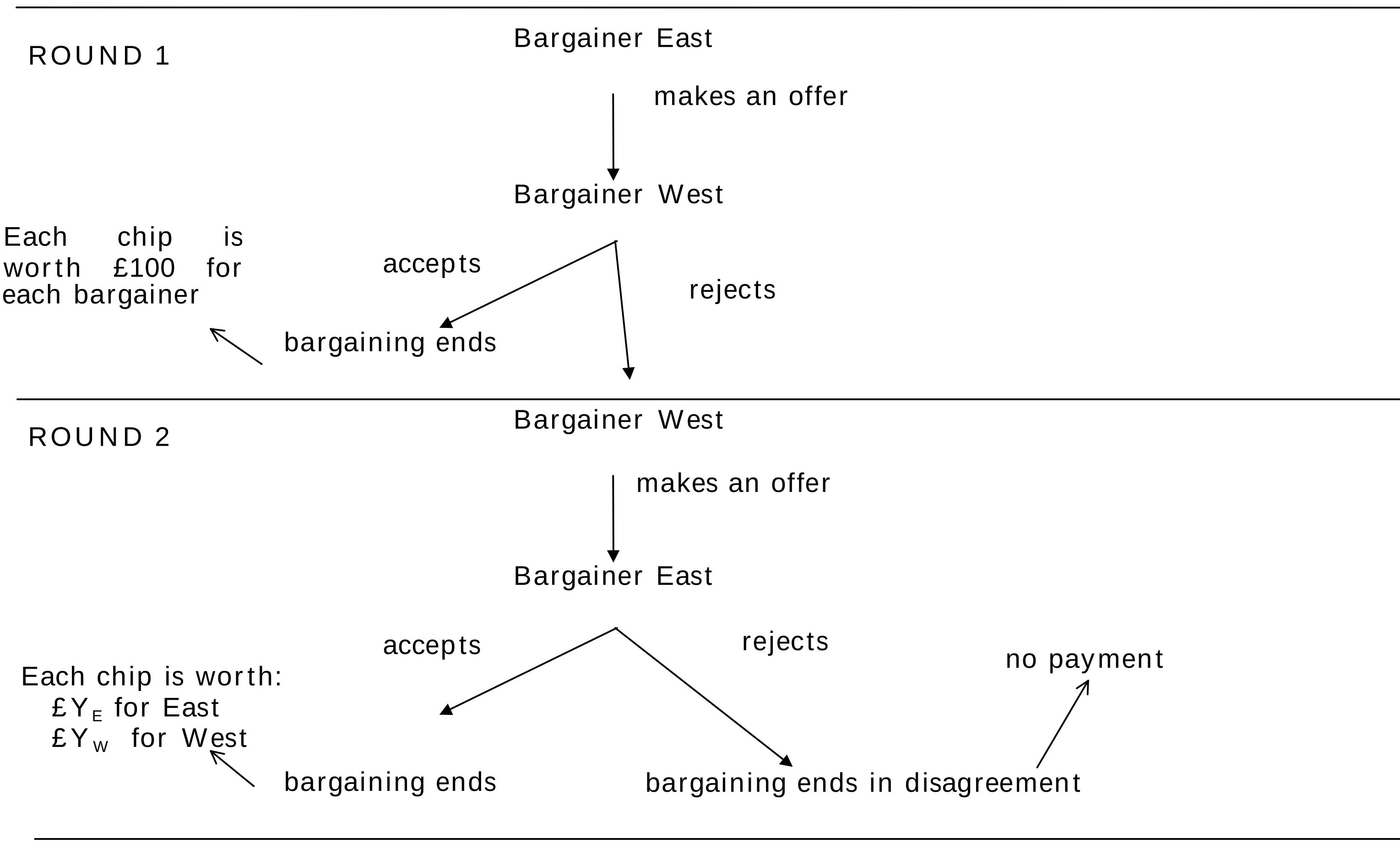
C



Structure of negotiations: BDM



Structure of the bargain: FXD



Structure of the bargain: DSC

References

Anglin, P., D. Rutheford and T. M. Springer (2001) "The Trade-off Between the Selling Price of Residential Properties and Time-on-the-Market: The Impact of Price Setting", mimeo, University of Windsor.

Ainslie, G. W. (1975) "Specious Reward: a Behavioral Theory of Impulsiveness and Impulsive Control", *Psychological Bulletin*, vol. 82, p.463-496.

Becker, G. M., M. H. DeGroot and J. Marschak (1964), "Measuring Utility by a Single-Response Sequential Method", *Behavioral Science*, vol. 9, p. 226-232.

Benzion, U., A. Rapoport and J. Yagil (1989), Discount Rates Inferred from Decisions: an Experimental Study, *Management Science*, vol. 35, p. 270-284.

Bickel, W. K. and L. A. Marsch (2001) "Towards A Behavioral Economic Understanding Of Drug Dependence: Delay Discounting Processes", *Addiction*, vol. 96, p. 73-86.

Binmore, K., M. Osborne and A. Rubinstein (1992), "Non Cooperative Models of Bargaining", in *Handbook of Game Theory with Economic Applications*, R.J. Aumann and S. Hart (Eds.), North-Holland, Amsterdam.

Binmore, K., P. Morgan, A. Shaked and J. Sutton (1991), "Do People Exploit Their Bargaining Power? An Experimental Study, *Games and Economic Behavior*, vol.3, p. 295-322.

Binmore, K., A. Shaked and J. Sutton (1985),"Testing Non-Cooperative Bargaining Theory: a Preliminary Study", *American Economic Review*, vol. 75, p. 1178-90.

Bohm, P., J. Linden and J. Sonnegard (1997), "Eliciting Reservation Prices: Becker-DeGroot-Marschak Mechanisms vs.Markets", *Economic-Journal*, vol. 107, p. 1079-89.

Bolton, G. E. and A. Ockenfels (2000) "ERC: A Theory of Equity, Reciprocity, and Competition", *American Economic Review*, vol. 90, p.166-193.

Burgos, A. S. Grant and A. Kajii (1997), "Bargaining and Boldness", mimeo.

Davis and Holt (1993), *Experimental Economics*, Princeton University Press.

Elster, J. (1998) "Emotions and Economic Theory", *Journal of Economic Literature*, vol. 36, p. 47-74.

Elster, J. and G. Loewenstein (1992), *Choice Over Time*, Russel Sage Foundation, New York.

Fehr, E. and S. Gachter (2000), "Fairness and Retaliation: The Economics of Reciprocity", *Journal of Economic Perspectives*, vol. 14, p. 159-181.

Fishburn, P.C. and W. Edwards (1997), "Discount-neutral Utility Models for Denumerable Time Streams", *Theory and Decisions*, vol. 43, p. 139-166.

Fishburn, P.C. and A. Rubinstein (1982), "Time Preference", *International Economic Review*, vol. 23, p.677-694.

Fligner, M. A., G.E. Policello II (1981) "Robust Rank Procedures For The Behrens-Fisher Problem", *Journal of the American Statistical Association*, vol. 76, 162-168.

Forsythe, R., J.L. Horowitz, N.E. Savin and M. Sefton (1994),"Fairness in Simple Bargaining Experiments", *Games and Economic Behavior*, vol. 6, p. 347-369.

Frederick, S., G. Loewenstein and T. O'Donoghue (2001) "Time discounting: a Critical Review", mimeo.

Gazzaniga, M., R. Ivry and G. Mangun (1998) *Cognitive Neuroscience*, W. W. Norton.

Guth, W. and R. Tietz (1988), "Ultimatum Bargaining for a Shrinking Cake - An Experimental Analysis", in R. Tietz, W. Albers and R. Selten (Eds.), *Bounded Rational Behavior in Experimental Games and Markets*, Springer, Berlin.

Henrich, J., R. Boyd, S. Bowles, C. Camerer, E. Fehr, H. Gintis, and R. McElreath (2001)"In Search of Homo Economicus: Behavioral Experiments in 15 Small-Scale Societies", *American Economic Review*, vol. 91, p. 73-78.

Hollander, M. and D. Wolfe (1999) *Nonparametric Statistical Methods*, 2nd ed., John Wiley and Sons, New York.

Kahneman, D. and A. Tversky (1979), "Prospect Theory: an Analysis of Decision Under Risk", *Econometrica*, vol. 47, p. 363-391.

Laibson, D. (1997), "Hyperbolic Discount Functions and Time Preference Heterogeneity", mimeo, Harvard University.

Lehmann, E. L. (1975) *Nonparametrics: Statistical Methods Based on Ranks*, Holden-Day Series in Probability and Statistics, McGraw - Hill, New York.

Loewenstein, G. (1987), "Anticipation and the Valuation of Delayed Consumption", *Economic Journal*, vol. 97, p. 666-684.

Loewenstein, G. (2001) "The Creative Destruction Of Decision Research", forthcoming in *Journal of Consumer Research*.

Loewenstein, G. and D. Prelec (1991), "Decision Making Over Time and Under Uncertainty: A Common Approach", *Management Science*, vol. 37, p. 770-786.

Loewenstein, G. and D. Prelec (1992), "Anomalies in Inrtertemporal Choice: Evidence and Interpretation, *Quarterly Journal of Economics*, May, p. 573-597

Loewenstein, G. and R. Thaler (1989), "Intertemporal Choice", *Journal of Economic Perspectives*, vol. 3, p. 181-193.

Meyer, R. F. (1976), "Preferences Over Time", in Keeney, R. L. H. Raiffa (eds.) *Decisions With Multiple Objectives*, Cambridge University Press.

Neelin, J., H. Sonnenschein and M. Spiegel (1988), "A Further Test of Noncooperative Bargaining Theory", *American Economic Review*, vol. 78, p. 824-836.

Ochs, J. and A. Roth (1989), "An Experimental Study of Sequential Bargaining", *American Economic Review*, vol. 79, p. 355-384.

O'Donoghue, T. and M. Rabin (1999) "Doing it Now or Later*", American Economic Review*, vol. 89, p.103-124

Ortalo-Magné, F. and Antonio Merlo (2000) "Bargaining Over Residential Real Estates: Evidence From England", mimeo, London School of Economics.

Osborne, M. and A. Rubinstein (1990) *Bargaining and Markets*, Academic Press, San Diego.

Prasnikar, V. and A. E. Roth (1992), "Considerations of Fairness and Strategy: Experimental Data from Sequential Games", *Quarterly Journal of Economics*, vol. 107, p. 865-88.

Rabin, M (1998) "Psycology and Economics", *Journal of Economic Literature*, vol. 36, p. 11-46.

Rabin, M. Goree and Holt (2000) "Ten Little Treasures of Game Theory and Ten Intuitive Contradictions" Mimeo.

Randles, R.H., M. A. Fligner, G. E. Policello and D. A. Wolfe (1980) "An Asymptotically Distribution Free Test For Symmetry Versus Asymmetry", *Journal of the American Statistical Association*, vol. 75, 168-172.

Rapoport, A., E. Weg and D. S. Felsenthal (1990), "Effects of Fixed Costs in Two-Person Sequential Bargaining, *Theory and Decision*, vol. 28, p. 47-72.

Roth, A. (1995), "Bargaining Experiments", in J. Kagel and A. Roth (Eds.), *Handbook of Experimental Economics*, p. 253-348, Princeton University Press, Princeton, New Jersey.

Rubinstein, A. (1982) "Perfect Equilibrium in a Bargaining Model", *Econometrica*, vol. 50, p. 97-109.

Rubinstein, A. (2000) "Is It 'Economics and Psychology'? : The Case of Hyperbolic Discounting", mimeo, Tel-Aviv University.

Siegel, S. and N. J. Castellan (1988) *Nonparametric Statistics For The Behavioral Sciences*, 2nd ed., McGraw Hill.

Starmer, C. (2000), "Developments in Non-expected Utility Theory: The Hunt for a Descriptive Theory of Choice under Risk" *Journal of Economic Literature*, vol. 38, p. 332-382.

Thaler, R. H. (1981), "Some Empirical Evidence on Dynamic Inconsistency, *Economics Letters*, vol. 8, p. 201-207.

Thaler, R. H., ed. (1991) *Quasi Rational Economics*, Russel Sage Foundation, New York