PREFERENCES, PROPERTY RIGHTS AND ANONYMITY IN BARGAINING GAMES

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December. 1991

ABSTRACT

Recent experimental research on ultimatum and dictator games has found that first movers in such games tend to offer more to **their counterparts than noncooperative game theory would predict. In fact, the modal offer is generally half the pie to be divided, while noncooperative game theory would suggest an offer of the smallest monetary unit. It is often argued that these results suggest a taste for fairness on the part of students participating in these experiments. In this paper we report the results of ultimatum and dictator games experiments designed to explore the underlying reasons for this apparent taste for "fairness." We find that if the right to be the first mover is earned by scoring high on a general knowledge quiz, and that right is reinforced by the instructions as being earned, then first movers behave in a significantly more self-regarding manner. Because our instructional procedures for earning rights can be interpreted as a "demand" treatment, but also to remove ail social influences on choice, we conducted "double blind" dictator experiments, in which individual subject decisions cannot be known by the experimenter or by anyone except the decision maker. The results yielded by far our largest observed number of self-regarding offers – significantly more than obtained in any of our other treatments: or any previously reported in the literature. Our interpretation is that offers in ultimatum and dictator games appear to be determined predominantly by strategic and expectations considerations. Other-regarding behavior is primarily an expectations phenomenon, rather than the result of an autonomous private preference for equity.**

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I. INTRODUCTION

Game theory is about strangers, with no shared history, who meet, interact strategically in their self-interest according to well specified rules and payoffs, and who will never meet again. These stark conditions are necessary to assure that the game theoretic prediction for the interaction is not part of a sequence with a past and a future. Thus, repeated games are analyzed differently because now the strangers can develop their own history and future. Experimental economists have found that generally, but with important exceptions, such theories have predictive value in games with 'large' numbers (at least 3-4 players).[1] The situation may be otherwise in two-person bargaining games, the outcomes of which are thought to be sensitive to procedures affecting subject anonymity and the context of bargaining. Because of this sensitivity, such experiments regularly use elaborate procedures to guarantee between-subject anonymity. In spite of these precautions, bargaining experiments do not always replicate, particularly in the absence of monetary rewards [Forsythe, Horowitz. Savin and Sefton. 1988].

Recent experimental research on ultimatum games has found the unexpected result that first movers in such games tend to offer more to their counterparts than noncooperative game theory would predict. In fact, the modal offer is half the surplus to be divided, although noncooperative game theory would suggest an offer by the first mover of the minimum positive amount that is feasible. It has been argued that these results suggest a taste for "fairness" on the pan of students participating in these experiments. We report the

results of ultimatum and related game experiments designed to explore what it is about experimental procedures and context that produce or modify such outcomes.

The importance of such an investigation is indicated by the fact that this tendency toward 'fair' outcomes does not seem to characterize classical bargaining situations in the field, such as labor-management bargaining in which the adversaries assume quite self-regarding stances and, judging from their pronouncements, feel entirely justified in so doing. Consequently, such bilateral bargaining situations tend to be conducted and analyzed on the basis of strategic considerations [Brown and Ashenfelter, 1986].

II. ULTIMATUM AND DICTATOR GAMES

In an ultimatum game an amount of money M is to be divided between two subjects. One subject, designated the proposer announces a split of M - X to the proposer and X to the proposer's counterpart. After the proposal is made, the counterpart either accepts or rejects it. If the counterpart accepts, then the proposal is carried out; but, if the counterpart rejects, then both the proposer and counterpart get zero. If the counterpart is rational and nonsatiated in money, then he or she should accept $X = \epsilon > 0$, where ϵ is the minimum unit of account. Thus the Nash equilibrium prediction is for the proposer to offer $X = \epsilon$ and for the counterpart to accept. Experiments in ultimatum games by Guth, Schmittberger, and Schwarze [1982], Kahneman, Knetsch and Thaler [1986], and Forsythe, Horowitz, Savin and Sefton [1988] (hereafter, FHSS) show that first mover proposers in such bargaining games offer much more to their counterparts than noncooperative game theory leads one to expect. Explanations for this phenomena have centered on 'fairness' or 'focal'

considerations, which are words chosen to convey the idea that subjects have a taste for equal split shares or in an expectational sense find equal split to be natural or noncontroversial and therefore unlikely to be vetoed.

These results are all contrary to those of the first 'ultimatum' game experiments reported by Fouraker and Siegel [1963, pp 30-36, 215-221] (hereafter, FS). They tested the Bowley (Nash) equilibrium bargaining prediction in the context of a single transaction. The institution used was what today we call posted price: the seller begins the process by choosing a price; this price is communicated to the buyer, who then chooses quantity, ending the game. The FS procedures and design differed from the above ultimatum experiments in three ways: (1) all bargaining was described as a buyer/seller transaction; (2) the Nash equilibrium yielded more than an ϵ payoff to the buyer -- in the asymmetric design the Nash equilibrium buyer's payoff was $2.44, the seller's $6.44; (3) both sellers and buyers have multiple price/quantity choices available so that the all-or-none feature of the ultimatum game is not present. These early FS findings suggest that the results of the more recent ultimatum games may be due to: (1) the different context or procedures used; or (2) the fact that the second mover is expected to accept a boundary reward/ϵ! In both experiments and exchange transactions in the economy, agents generally do not expect to receive boundary rewards.

FHSS have also run an important baseline control for fairness in the ultimatum game: the dictator game. In the dictator game the proposer decides on a split which is final. The counterpart cannot reject the offer. Consequently, the strategic feature of the ultimatum game is not present.

In the ultimatum game the proposer must form expectations on the reservation value of **the counterpart, i.e., the amount X which the counterpart will reject. Thus, concerns for 'fairness' are confounded by the proposer's strategic expectations over reservation values. Since, in the dictator game, the proposer's split is final, expectations about reservation values on X are not assumed to enter into the proposer's decision. Theory predicts that a self interested, nonsatiated dictator will split M/zero. FHSS [1988] find that proposers in the dictator game take significantly more of M (where M is either 55 or S10) than proposers in** the **ultimatum game. However,** a **substantial number** do **not split M/zero. They conclude** 'that the **distribution** of **proposals** in the ultimatum game **cannot** be fully **explained by a** taste for **fairness among proposers.' (p.** 23) **But** how do we **explain** the **ultimatum data?** The **dictator data?**

A **reasonable rational model** of the **data in both games can** be **stated** in **terms of subjects' expectations.** In **such simple experiments, particularly** the **dictator game, subjects** may **ask themselves (unconsciously): What** is **the experimenter**'s **objective? (1) They may think that their actions in this game will affect the experimenter's decision** to **have them participate in future experiments.** (2) **They think they will be chosen** to **participate in future experiments: but they may be concerned that their current decisions will affect which later experiments they are selected for. (3) They may be concerned about appearing greedy and being judged so by the experimenter. Under this latter interpretation 'fairness' is not 'own' preference, but a derivative of judgement by others. Note that none of these 'explanations' requires a personal fairness ethic or focal considerations. In the ultimatum game the proposer must form expectations about his or her counterpart's reservation value. Thus, a**

risk averse proposer may give his or her counterpart more than is predicted by noncooperative theory in order to insure acceptance of the proposal. Rational behavior is to choose $X^* = \arg\max u(M-X)F(X)$; where F is the first mover's subjective probability that offer X will be accepted, and captures the expectations of the proposer. But even a subject dictator may still be influenced by expectations about the experimenter's judgmatic response, or future (subject recruiting) behavior, and thus may still give the counterpart a positive amount of money.

Experimenter knowledge of subject expectations is null, and control over them is limited to instructions and pregame treatments. Moreover, certain controls may be inadvertent. For example in past experiments subjects were randomly assigned a type. Usually, randomization would be justified: e.g. when we can t control for a variable we randomize across treatment. But in the ultimatum experiments randomization may not be neutral, since it can be interpreted by subjects as an attempt by the experimenter to treat them fairly. Lotteries are often used for the fair' award of rights such as hunting permits and basketball seats. Thus experimenters may unwittingly induce 'fairness.' A subject may feel that, since the experimenter is being fair to them, they should be fair to each other.

III. PROPERTY RIGHTS

A property right is a guarantee to dispose of property within guidelines defined by the right. The guarantee is against reprisal, in that a property right places restrictions on punishment strategies which might otherwise be used to insure cooperative behavior. Such

rights are taken for granted in private ownership economies, but is this so for the subjects in bargaining experiments?

In bargaining experiments subjects may be less influenced by the experimenters' implicit objectives, or by the possibility of punishment strategies by a counterpart, if they have earned the right to make use of an advantaged position and the right is common knowledge. Hoffman and Spitzer [1982, 1985] (hereafter HS) present experimental data which supports this view.[2] In the HS [1982] experiments two persons bargained face to face over the split of $14. Before bargaining began one subject was chosen at random to be the controller. If subjects could not agree on a split the controller would receive $12: the controller's choice was final. In these experiments 12 out of 12 pairs agreed to split the $14 evenly even though this gave less to the controller then he or she could obtain by not agreeing. In the HS [1985] experiments, when the controller earned the right in a contest, and this right was reinforced as common knowledge in the instructions, only 4 of 22 bargaining pairs split equally and. on average, proposers took $12.52.

Our contest assignment is meant to extend the HS [1985] assignment treatment to ultimatum games.[3] This contest is a current events quiz where subjects are ranked from highest to lowest using correct answers. This assignment technique has been used previously by Binger, Hoffman and Libecap [1990]; Cech [1988]; and Wellford [1990].[4] If there are ties, subjects' total time answering questions is used as a tiebreaker (i.e. shortest time first). In Hoffman and Spitzer [1985] a game of Nim was played by two players to see who would be the controller, but partners were randomly paired. In the contest reported in this paper

both the choice of proposer and the pairings of proposers and counterparts are determined by subjects' ranking in the contest.

Except for two control experiments in which we use the FHSS instructions and the subjects' task is to divide $10, all of our experiments are formulated as an exchange between a buyer and a seller as in FS. This allows us to test for the effect of Exchange versus Divide $10. Usually, bargaining theory is treated as an exchange. This context may itself confer legitimacy and common expectations on a more self-regarding offer by the first mover.[5]

IV. EXPERIMENTAL DESIGN

In each experimental session. 12 **subjects participate simultaneously. Each subject** is **paid $3 for arriving on time for the experiment. When all subjects have arrived, they first read and then have read to them (by Hoffman) a set of instructions which describe the** buy/**sell task. In the random assignment treatment, subjects are then randomly assigned the positions of buyer and seller and randomly (and anonymously) paired with one another.**[6] **In the contest assignment treatment, subjects answer 10 current events questions. The subject ranked #1 is the seller, paired with the subject ranked** #7 **as the buyer. The subject ranked #2 is paired with the subject ranked #8. and so on. No subject is informed of the identity of his or her counterpart and each experimental session involves only one pairing and one decision. Participants earn $0.25 for each correct answer, in addition to their earnings in the subsequent experiment.**

After the buyer and seller assignments have been made, each seller chooses a price given the payoff chart shown in Figure 1. This payoff chart shows that the game is essentially an ultimatum game embedded in an exchange. There is $10 to divide between the seller and the buyer. If the seller states a price of $9 and the buyer agrees to buy, the seller gets $9 and the buyer gets $1. Similarly, if the seller states a price of $8 and the buyer agrees to buy, the seller gets $8 and the buyer gets $2. As in other ultimatum games, and in FS, if the buver decides to NOT BUY, both buver and seller receive SO.

While the sellers are choosing prices, the buyers are answering a questionnaire [labelled Buyer Questionnaire in the Appendix]. The questionnaire serves two purposes. First, it allows us to give a piece of paper to each participant, thus obscuring the identification of the buyers and sellers. Second, the questionnaire asks the buyer to tell us both what price he or she would have chosen and what price he or she expects the seller to choose. These data allow us to test whether expectations are affected by the assignment of the property right.

Once the sellers have chosen prices, we circle the appropriate seller's price choice on **each buyers choice form and ask the buyers to circle BUY or NOT BUY. While the buyers are making their choices, we ask the sellers to answer a questionnaire about their expectations of buyer behavior. This questionnaire also serves the additional purpose of continuing to obscure the identification of buyers and sellers. Once the buyers have made their decisions, we determine each individual subject's earnings, including payment for correct answers in the current events quiz, and pay them individually and privately.**

The above procedures are also applied to the dictator game, except that the buyer has no decision to make. In the exchange context, this means that the buyer has a prior commitment to make the purchase whatever the price chosen by the seller.

Table 1 lists the number of bargaining pairs that participated in all the experiments that we report here. For example, we ran 24 subject pairs in Ultimatum Exchange and in Dictator Exchange, as indicated by the column headings, and with Random Entitlement, as indicated in the row heading. In row 1, for comparison, we list those experiments reported by FHSS which we describe here as the Divide $10 experiments to distinguish them from our Exchange experiments. Thus, in the FHSS instructions subjects are told that "A sum of S5 (S10) has been provisionally allocated to each pair ..." [FHSS. 1988. p. 27: also see Kahneman. Knetsch and Thaler, p. 105]. Note particularly that this instruction suggests that neither bargainer has a clear property right to the money; literally it provisionally belongs to both of them. FHSS paid their subjects a $3 participation fee in addition to the proceeds of the division of $10. In all but one of the experiments reported here we also paid our customary $3 participation fee in addition to each bargainer's split of the $10.

As a means of comparing our subjects and procedures with those of FHSS, we conducted one Random Entitlement and one Contest Entitlement experiment using the FHSS Divide $10 instructions. Note, however, that we did not follow FHSS in assigning buyers and sellers to separate rooms, because we wanted to maintain same-room comparability with all our other experiments. Thus, these are not intended as pure replications of FHSS. Rather we ask if their results are robust with respect to the experimenters, subjects, and same-room condition.

Finally, and most importantly, we conducted a series of three Double Blind experiments under the Divide $10 condition. As indicated above, we have been concerned that subjects in bargaining experiments may be influenced either by (1) imagined use by the experimenter of their decisions to decide whether to recruit or how to use subjects in a later experiment or by (2) judgements of the subject's decision by the experimenter or others who see the data in spite of guarantees of anonymity. The point is that in all of the anonymous' bargaining experiments known to us the subject knows that the experimenter is fully informed as to who made what decision: i.e. anonymity' means that neither bargainer in each pair knows the identity of the other. This between-subject anonymity has been standard in private bargaining studies going back to Siegel and Fouraker (1960) and this protocol was continued in FS and in all recent private bargaining studies. This procedure has been justified on the grounds that the absence of anonymity, as in face-to-face interactions, brings into potential play all the social experience with which people are endowed, causing the experimenter to risk losing control over preferences (see e.g. Roth, 1990). We agree with this assessment, but propose that it also applies to the experimenter as a potential socializing factor. Consequently, one purpose of our Double Blind experiments was to give subjects anonymity with respect to everyone: other subjects, the experimenter, and anyone who might view their decisions. A second purpose was to minimize any perceived 'demands' by the experimenter. For example, in the Contest Entitlement experiments, subjects were told that the purpose of the contest was to determine who would "have earned the right to be sellers." HS [1985] earlier established that this "moral authority" was a crucial pan of the entitlement treatment, and we have

continued this procedure in the present experiment. The importance of this instruction is that it can be interpreted as a 'demand' characteristic of the experimenter, especially given the presumed sensitivity of bargaining experiments to procedural or instructional variations. Therefore, we wanted to report some experiments which removed the experimenter as completely as possible as a factor in the experimental outcome.

In a Double Blind experiment 15 people are recruited to room A and 14 to room B. The same instructions are read by each subject, and then read orally by an experimenter in each room (A. McCabe: B, Smith). All subjects were paid a $5 show-up fee (now standard in our lab. this experiment being one of the first). One of the subjects in room A is voluntarily selected to be the monitor in the experiment. The instructions state that each of 14 plain white unmarked opaque envelopes contain the following: 2 envelopes contain 20 blank slips of paper, and 12 contain 10 blank slips and 10 one dollar bills. Each subject is given an envelope by the monitor, proceeds to the back of the room, and opens the envelope inside a large cardboard box which maintains his/her strict privacy. The subject keeps zero to ten of the one dollar bills and ten to zero of the blank slips of paper, such that the number of bills plus slips of paper add up to 10. For the envelopes with 20 blank slips, 10 are returned to the envelope. (In this way all returned envelopes feel the same thickness. Moreover, each person in room A knows that if his/her counterpart in room B receives an envelope with 10 slips of blank paper, it could be because there was no money in the envelope originally. Thus, it is really true that 'no one can know'). After everyone is finished in room A, the monitor goes to room B, sits outside the room and calls each person out one at a time. The person selects an envelope, opens it, and keeps its contents,

which are recorded by the monitor on a blank sheet of paper containing no names. The experimenter accompanies the monitor to answer any questions that arise, but does not participate in this process. These procedures are intended to make it transparent that room A subjects are on their own in deciding how much to leave their counterparts in room B, and that no one can possibly know how much they left their counterparts.

V. EXPERIMENTAL RESULTS

FHSS evaluate the power of five non-parametric tests to distinguish between different sample distributions: the Cramer-von Mises. Anderson Dariing (AD). Koimorogov-Smirnov. Wilcoxon rank-sum and Epps-Singleton (ES) test. They find that the AD and ES tests have the most statistical power in the context of ultimatum games. They also note that the ES test has the added advantage of not requiring the distributions being tested to be continuous. Epps and Singleton [1086] also investigate the power of the ES test versus the Anderson-Darling, Cramer-Von Mises and Koimorogov-Smirnov tests. Epps and Singleton find that the power of the ES test is superior to the other tests in distinguishing between different continuous distributions. Furthermore, the difference is even more pronounced when the distributions being compared are discrete.

The ES test is based upon characteristic functions. It compares the difference between the characteristic functions of two samples to test the null hypothesis that the characteristic functions, hence the distributions are equal. In Table 2 we report the results of pairwise comparisons using the ES test with the small sample correction.

Figure 2 charts the data from FHSS for their $10 ultimatum experiments and their $10 dictator experiments. Since the FHSS paper and data provided one of the three major motivations for the present study (the second being HS. 1985; the third being FS. 1963), Figure 2 sets the stage for reporting our results. In the comparison of Figure 2, FHSS report that the dictator results are significantly different (more self-regarding) than the ultimatum data (also see Table 2).

Figure 3 provides a four way comparison among our Divide $10. Random and Contest experiments using FHSS instructions, and the parallel experiments presented as a buyer/seller exchange. Note first that our Divide $10 ultimatum experiments (Figure 3(a)) replicate those of FHSS (Figure 2(a)): ie. different subjects, different experimenters, and same room' conditions yield results that are not significantly different from the FHSS results ($p = 0.27$ in Table 2). Comparing Random versus Contest when presented as Divide $10 (Figures 3(a) and (b)) we observe a statistically significant, ($p = 0.04$) shift toward lower offers in the contest treatment. In the experiments presenting the task as a buyer/seller exchange, the contest entitlement also shifts the offers to a lower level as compared with the random entitlement (Figures 3(c) and (d)), but the difference is not significant ($p = 0.21$). Comparing Divide $10 versus Exchange under Random entitlement (Figure 3(a) and (c)), Exchange shifts the offers to a significantly lower level ($p = 0.03$). With contest entitlements (Figure 3(b) and (d)), however, the lowering of offers as a result of the exchange treatment is not significant ($p = 0.22$). Comparing the combined affect of exchange and contest (Figure 3(d) with 3(a) we observe a highly significant ($p = 0.00$) shift

toward self-regarding offers. Much of this shift, however, is due to the effect of exchange alone, which helps to account for the early results reported by FS.

Figures 4(a) and (b) chart the frequency distributions of the data for our dictator games under the Random and Contest entitlements, respectively. The contest treatment lowers the offer distribution and the difference is significant ($p = 0.01$). In Figure 4(c) we repeat the chart for the FHSS dictator data, allowing visual comparison of their dictator results with ours for exchange, and all three with our double blind dictator data (Figure 4(d)). From the latter it is clear that the double blind treatment is by tar our most potent. When no one can know what the first mover offers his/her counterpart, the offer distribution is dramatically lowered relative to all dictator and ultimatum treatments. It is significantly different (lower offers) from all our other treatments and from the FHSS treatments, with one exception: the contest entitlement, dictator exchange, the next most powerful treatment ($p = 0.09$. Table 2). Specifically, two-thirds of the first movers now offer zero and 84% offer zero or one: only two of thirty-six subjects offer a fair' equal split of $5; and one enigmatic subject offers $9.

VI. CONCLUSION AND DISCUSSION

Here is a brief summary and interpretation of our primary findings.

(1) In ultimatum games first mover offers are sensitive to the procedural, contractual and instructional setting of the experiment. In particular, offers are smaller if the context is that of an exchange between a seller and a buyer instead of a Divide $10 task, or if the first mover earns the (instructionally reinforced) right to his/her role instead of having it

assigned in our unspecified (putatively random) manner. When an earned entitlement is combined with exchange, less than 45% of the first movers offer $4 or more. When we combine Random Entitlement with Divide $10, more than 85% offer $4 or more, in line with previously reported ultimatum game outcomes. But, the strategic/expectational character of ultimatum games makes it impossible to conclude from offer data alone whether offers in excess of $1 are due to other-regarding preferences or to the first mover's concern that his/her offer might be rejected unless it is deemed satisfactory by the second mover. The dictator game proposed by FHSS controls for strategic considerations in the ultimatum game.

(2) In dictator games reported by FHSS. where the task is to Divide $10 (Random Entitlement), only about 20% of the first movers offer $4 or more. Our replication of FHSS reinforces their results, although our subjects were in the same room.

(3) We find that dictator games are also sensitive to the procedural, contractual and instructional settings of the experiment. When exchange is combined with the contest entitlement, only 4% of first movers offer S4. none offer S5. But, over 20% give S3 or $4; so. these results also show that some kind of other-regarding behavior cannot be ignored entirely as an element in either dictator games or ultimatum games under the usual anonymity conditions.

(4) What is the nature of this other-regarding behavior? The answer to this question is illuminated by our double blind dictator experiments, in which subjects are guaranteed anonymity not only with respect to other subjects, but also with respect to the experimenters and everyone else -- only the first mover knows his/her offer. In our double blind

experiments only 4 in 36 subjects, or 11% give $3 or more to their counterparts. This, we think, approaches the appropriate indicator of fairness as a pure preference phenomenon.

(5) These double blind dictator results imply that the outcomes in both dictator and ultimatum games should be modelled not primarily in terms of other-regarding preferences (or 'fairness') but primarily in terms of expectations -- either explicit strategic expectations as in ultimatum games, or implicit concern for what the experimenter (or others) might think or do in dictator games. Our double blind experimental results are inconsistent with any notion that the key to understanding experimental bargaining outcomes is to be found in subjects' autonomous, private, other-regarding preferences. At the very minimum other-regarding preferences have an overwhelming social, what-do-others-know. component, and therefore must be derived formally from more elementary expectationai considerations. The results also emphasize that the argument for the use of anonymity in bargaining experiments as a means of controlling for social influences on preferences, has not gone far enough. The presence of the experimenter, as one who knows subjects bargaining outcomes, is one of the most significant of all treatments for reducing the incidence of self-regarding behavior.

The results of these double blind experiments appear to raise fundamental questions regarding the nature and origins of other-regarding behavior in our society. The results suggest that such behavior may be due not to a taste for 'fairness (other-regarding preferences), but rather to a social concern for what others may think, and for being held in high regard by others. If this view is correct, other-regarding behavior can be interpreted as a form of social exchange in which I share some of my resource claims with others, in return for their esteem and good offices (or, in return for shares of their resource claims,

as is frequently observed in aboriginal tribes). This interpretation predicts that truly anonymous gift giving, would be rare; ie. the contribution is not even known to family members or close friends. For example, it is customary at church services to pass collection plates in public, during the service. Perhaps the best form of gift-giving is the potlatch, wherein gift-exchange is highly ceremonial, even rivalrous.

The ethnologist, Diamond Jenness, who was asked by the Canadian Government in 1913 to join Stefansson's Arctic expedition to study Eskimos for three years, records the following in his diary:

"Not ail the cabins that stood empty had been vacated until the next winter ... and from two poles dangled a score or more fox skins. It was the latter that particularly caught my attention. Here were what amounted to a year's earnings exposed wide open to the heavens, where the first passerby could appropriate them at his leisure. In reality, of course, they were as safe as in Brower's storeroom, for with a population so small, everyone always knew who was living where, and a pilferer had little or no chance of escaping detection.... honesty comes much more easily in a tiny community than it does in a great city, where misconduct always hopes that the multitude of alien tracks will cover up its own footprints." (Jenness. 1957, pp. 128-9).

FOOTNOTES

* **The authors wish to thank Peter Buntin for research assistance and to acknowledge helpful comments from Glenn Harrison and seminar participants at the Econometric Society 1990 Winter Meetings, the Federal Trade Commission, and the California Institute of Technology. We are grateful for support from the National Science Foundation.**

1. **See Plott [1982] and Smith [1982] for summaries. But recently Kachelmeier. Limberg and Schadewald [1991a, 1991b] report that prices are fairly' increased when traders are informed that sellers are subject** to **a** *509c* **profits tax. Since this paper is restricted to single play bargaining games, we do not address the fairness' issue raised in the large literature on repeated play, alternating offer, bargaining games. For an excellent new treatment of this literature, and the controversial 'fairness' issues raised by this research, as well as a theoretical/experimental examination of a utility model of fairness in such repeated games, see Bolton [1991].**

2. **Also see Burrows and Loomes [1989] who investigate further the hypothesis that people behave in a more self-interested manner when they have earned the right to do so. They report support for the hypothesis, but the results also show that people continue to place a value on 'fair' outcomes, which is consistent with Hoffman and Spitzer (1985).**

3. **Other experimental treatments might also result in similar changes in the expectations of first movers in ultimatum games. For example, Harrison and McKee [1985] and Burrows and Loomis [1989] essentially replicate the Hoffman and Spitzer**

[1985] experimental results using different mechanisms for inducing self-regarding behavior.

4. Contest software for use on IBM networked personal computers is available on disk by writing author Smith.

5. Typically experimenters want to infer some conclusion about markets when discussing their experimental results. For example Kahneman, Knetsch, and Thaler [1986, p. 105-6] report experiments in which subjects are asked to reallocate $10, provisionally allocated to each pair, using simultaneous move rules: i.e., the second mover marks those first mover offers that are acceptable and those that are not before knowing the first mover's decision. They report a strong tendency toward equal split with a substantial portion of second movers willing to reject positive offers. The authors suggest that such resistance to unfairness "is of the type that might deter a profit-maximizing agent or firm seeking to exploit some profit opportunities (p. 106)." In order to better justify the extension of such results to firms we hypothesize that it may be important to describe the setting as an exchange between a buyer and a selling firm, and not as one of reallocating $10 provisionally allocated to each pair.

6. We do not, however, use the word "random" in the instructions to the subjects. We tell them they have been paired anonymously. See the instructions labelled "random" in the appendix.

7. The tests are conducted in the following manner. The first step is to form a vector representing the real and imaginary parts of the characteristic function for each sample(treatment);

$$g(X_{km}) = (\cos\hat{t}_1 X_{km},\ \sin\hat{t}_1 X_{km},\ \cos\hat{t}_2 X_{km},\ \sin\hat{t}_2 X_{km})$$

where $\hat{t} = \frac{t}{\hat{\sigma}}$ and t is a real number,

$$g_k = n_k^{-1} \sum_m g(X_{km}) ,$$

m is an index on the observation within a specific sample and k is an index on samples.

ES provide calculations to determine the power maximizing values for t_1 and t_2. $\hat{\sigma}$ is a scaling measure for t and is calculated:

$$\hat{\sigma} = 0.5\left[\frac{(Y_U - Y_{U-L})}{2} + \frac{(Y_L - Y_{L+1})}{2}\right] ,$$

where $\{Y_i\}$ is sample 1 and sample 2 combined and then placed in ascending order; L is the greatest integer in $(n_1 + n_2)/4$; and U is $n_1 + n_2 - L$. The test statistic is W_1 given by;

$$W1 = N (g_1 - g_2)' \Omega^{-1} (g_1 - g_2)$$

where $\Omega = (\hat{S}_1 + \hat{S}_2)\ N\frac{(n_1^{-1} + n_2^{-1})}{2}$,

and $\hat{S}_k = n_k^{-1} \sum_{m=1}^{n_k} g(X_{km})\, g(X_{km})' - g_k g_k'$.

If the null hypothesis that the characteristic functions are the same is true, then the test statistic is distributed as a chi square with 4 degrees of freedom.

ES also derive a small sample correction that improves the power of the test in small samples. The small sample correction is given as;

$$\hat{C}(n_1, n_2) = \left[1 + (n_1+n_2)^{-0.45} + 10.1\,(n_1^{-1.7} + n_2^{-1.7})\right]^{-1}$$

$$W2 = W1 \cdot \hat{C}$$

The results reported in Table 1 include the small sample correction.

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TABLE 1

Number of Bargaining Pairs by Game Type and Game Context

Game Type	Ultimatum		Dictator	
Game Context	Divide $10	Exchange	Divide $10	Exchange
FHSS Results	24		24	
Random Entitlement, FHSS instructions	24			
Contest Entitlement, FHSS instruction	24			
Random Entitlement		24		24
Contest Entitlement		24		24
Double Blind			36	

TABLE 2

Pairwise Epps-Singleton Tests

X^2 Statistic (Probability Significance level)	FHSS Results Divide $10 Dictator	Random Entitlement Divide $10 FHSS Instructions Ultimatum	Contest, Entitlement Divide $10 FHSS Instructions Ultimatum	Random Entitlement Ultimatum Exchange	Random Entitlement Dictator Exchange	Contest Entitlement Ultimatum Exchange	Contest Entitlement Dictator Exchange	Double Blind Divide $10 Dictator
FHSS Results, Divide $10 Ultimatum	31.4 (0.00)	5.2 (0.27)	28.0 (0.00)	23.1 (0.00)		31.5 (0.00)		220.0 (0.00)
FHSS Results, Divide $10 Dictator					5.4 (0.25)		5.5 (0.24)	23.5 (0.00)
Random Entitlement, Divide $10 FHSS Instructions, Ultimatum			10.2 (0.04)	10.6 (0.03)		18.7 (0.00)		223.9 (0.00)
Contest Entitlement, FHSS Instructions, Ultimatum				2.5 (0.64)		5.7 (0.22)		167.1 (0.00)
Random Entitlement, Ultimatum Exchange					6.4 (0.17)	5.8 (0.21)		141.7 (0.00)
Random Entitlement, Dictator Exchange							12.6 (0.01)	32.1 (0.00)
Contest Entitlement, Ultimatum Exchange								108.2 (0.00)
Contest Entitlement, Dictator Exchange								8.4 (0.09)

FIGURE 1

PAYOFF CHART

Seller Chooses

PRICE

Buyer Chooses to		$0	$1	$2	$3	$4	$5	$6	$7	$8	$9	$10	
	BUY	$0	$1	$2	$3	$4	$5	$6	$7	$8	$9	$10	Seller profit
		$10	$9	$8	$7	$6	$5	$4	$3	$2	$1	$0	Buyer profit
	NOT BUY	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	Seller profit
		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	Buyer profit

Figure 2(a)
Ultimatum; FHSS Results,
Divide $10, N=24

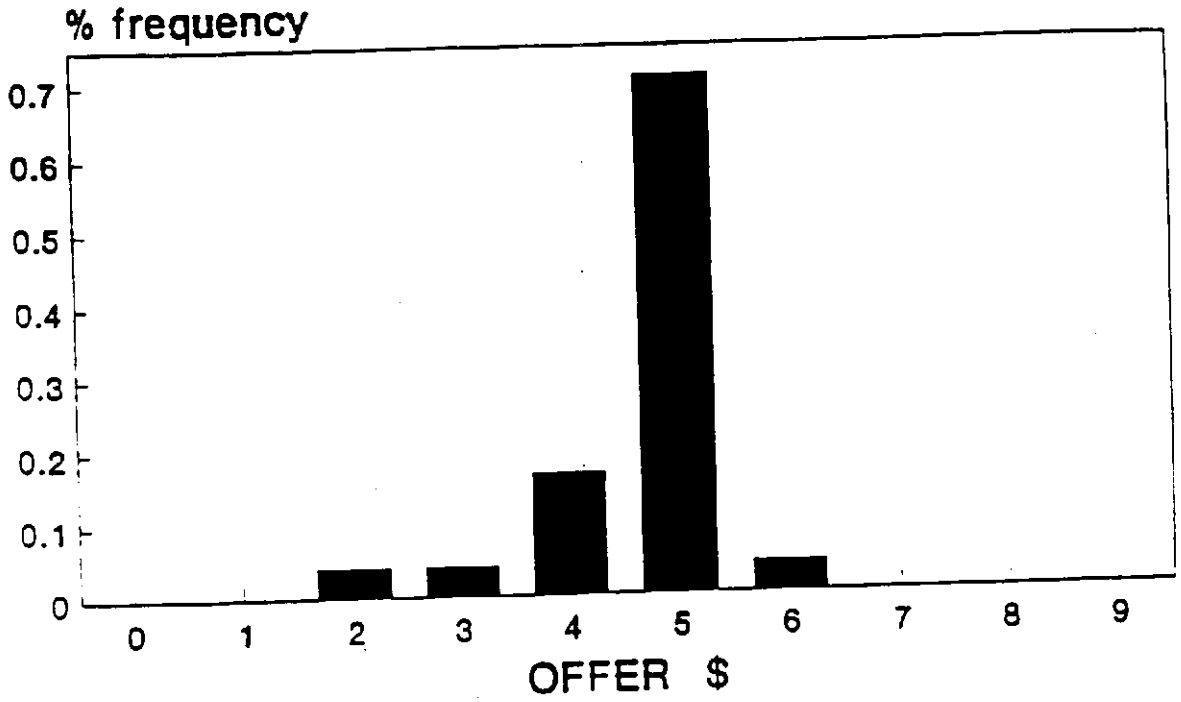


Figure 2(b)
Dictator; FHSS Results,
Divide $10, N=24

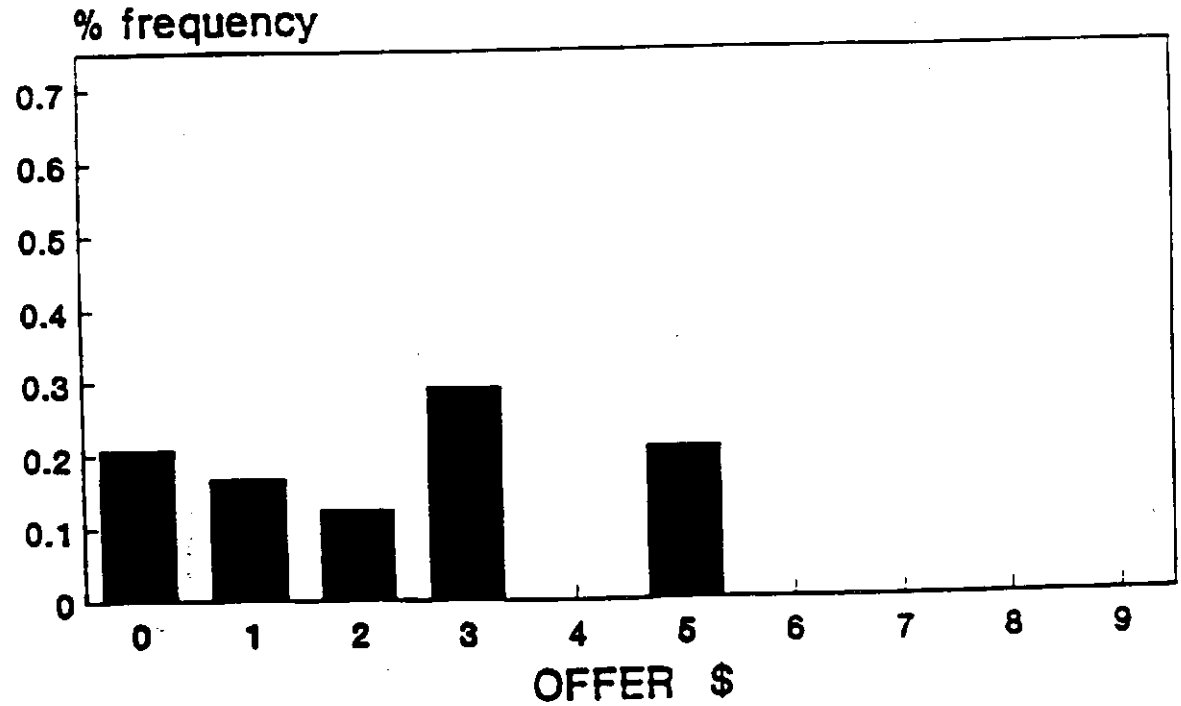


Figure 3(a)
Ultimatum; Random Entitlement,
FHSS Instructions, Divide $10, N=24

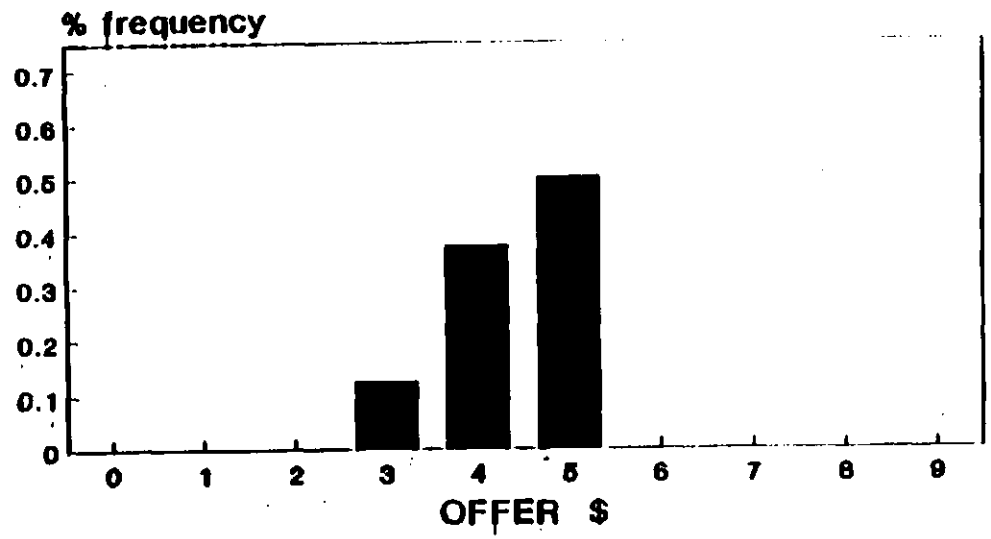


Figure 3(b)
Ultimatum; Contest Entitlement,
FHSS Instructions, Divide $10, N=24

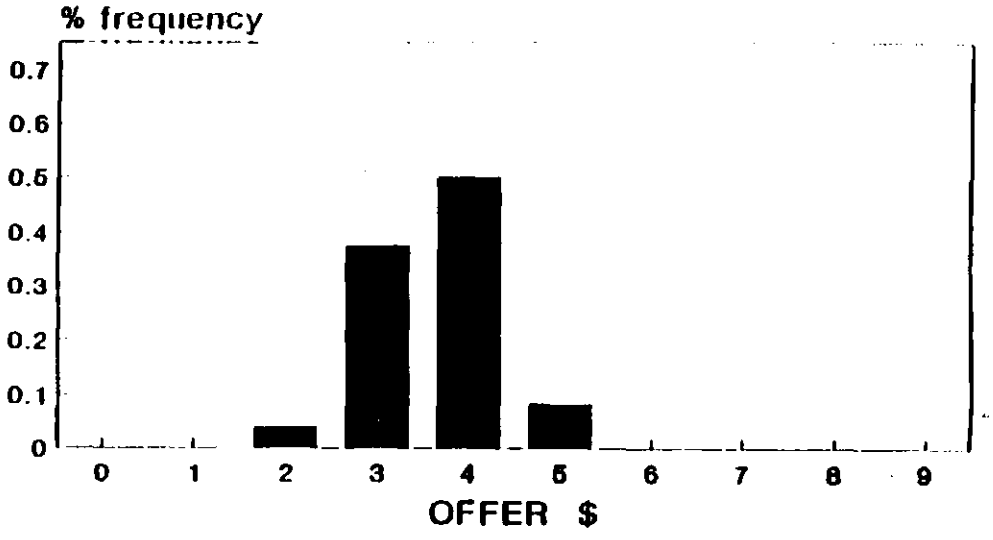


Figure 3(c)
Ultimatum; Random Entitlement,
Exchange, N=24

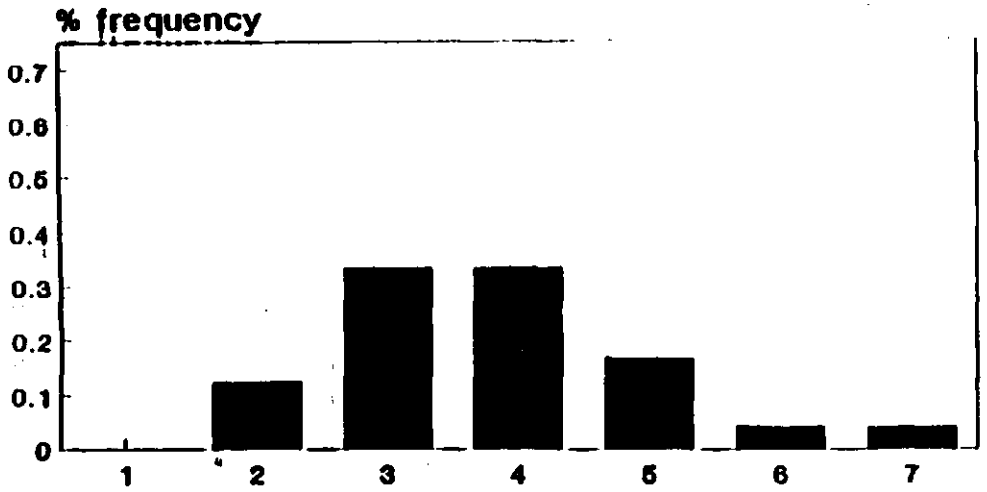


Figure 3(d)
Ultimatum; Contest Entitlement,
Exchange, N=24

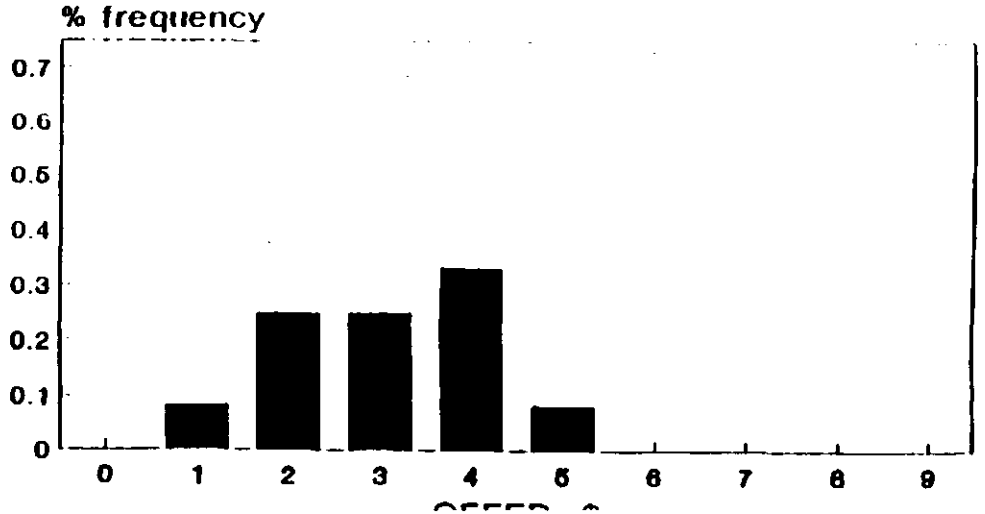


Figure 4(a)
Dictator; Random Entitlement Exchange, N=24

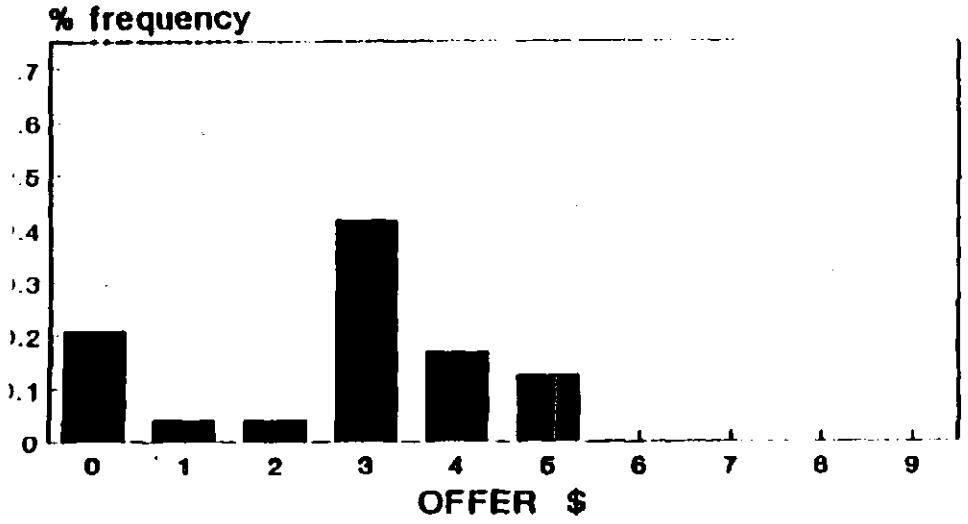


Figure 4(b)
Dictator; Contest Entitlment Exchange, N=24

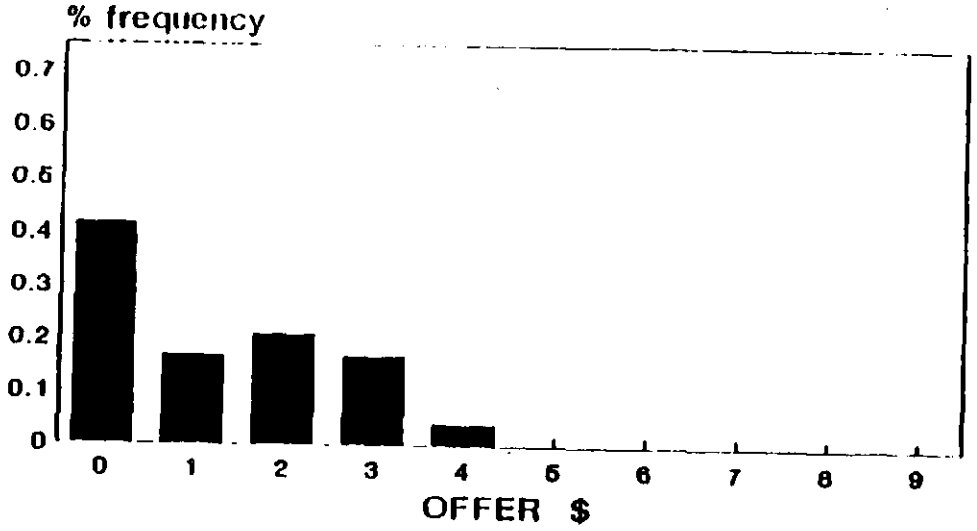


Figure 4(c)
Dictator; FHSS Results, Divide $10, N=24

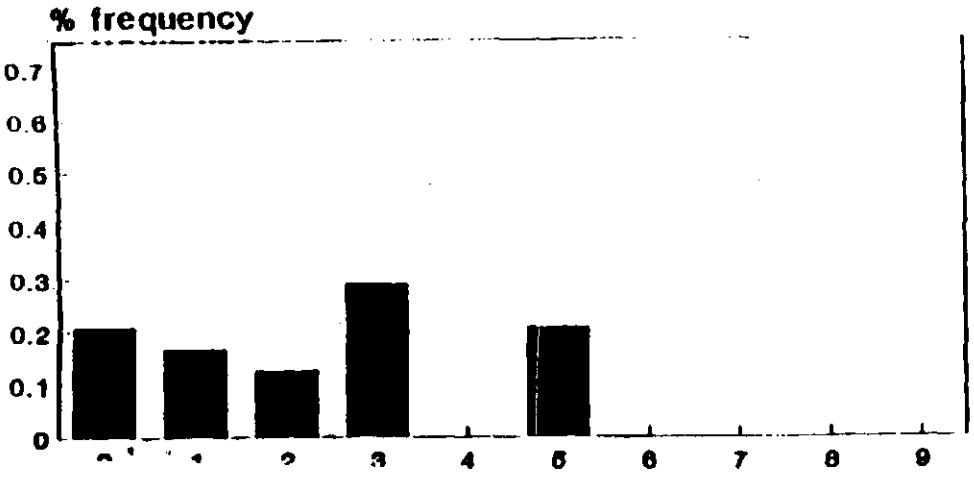
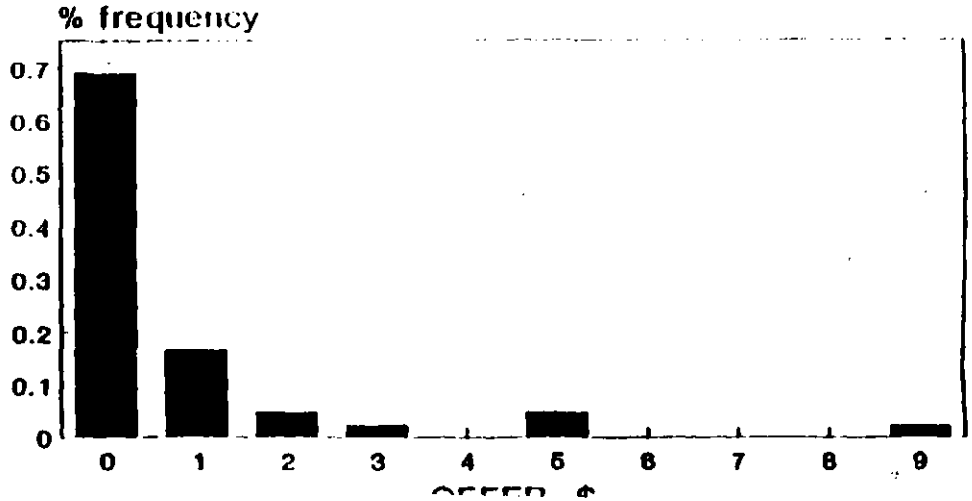


Figure 4(d)
Dictator; Random Entitlement, Divide $10, Double Blind, N=36



APPENDIX

INSTRUCTIONS FOR EXPERIMENTS

FHSS REPLICATION
RANDOM ENTITLEMENTS
INSTRUCTIONS

You have been asked to participate in an economics experiment. In addition to the $3 you already received for participation, you may earn an additional amount of money, which will be paid to you at the end of the experiment.

In this experiment each of you will be paired with a different person in this room. You will not be told who that person is either during or after the experiment, and he or she will not be told who you are either during or after the experiment.

The experiment is conducted as follows: a sum of $10 has been provisionally allocated to each pair, and person A in each pair can propose how much of this each person is to receive. To do this, person A will fill out a "Proposal Form." The proposal consists of an amount that person B is to receive and the amount that person A is to receive. The amount that person A is to receive is simply *zhe* amount to be divided, $10, minus the amount that person B is to receive.

When each person A has made a proposal, the proposal forms will be distributed to the appropriate B's and each person B will be given a chance to accept or reject the proposal made by his or her counterpart person A. If person B accepts the proposal, then the amount of money will be divided as specified in the proposal. If person B wishes to accept the proposal he or she should check "accept" on the proposal form. If person B does not wish to accept the proposal he or she should check "reject" on the proposal form. If person B rejects the proposal, both A and B will be paid nothing.

After all the B's have accepted or rejected the proposal made by the A's each person will be paid according to the terms of the proposal.

Are there any questions?

FHSS REPLICATION
CONTEST ENTITLEMENTS
INSTRUCTION CHANGES

[The first two paragraphs and the first sentence of the third paragraph are identical to the random instructions.]

[Paragraph three continues ...] The positions of persons A and B in each pairing will be determined by your scores on a general knowledge quiz. The quiz will be given concurrently to 12 participants. Each of you will be asked to answer the same set of 10 questions, selected from a large data bank of questions. Your quiz score will be the number of questions you answer correctly. Quiz scores will be ranked from highest to lowest and ties will be decided by giving a higher ranking to the person who finishes the quiz in the shortest amount of time. Note #1 is the highest rank while 12 is the lowest. Once the complete ranking of participants is determined, those ranked 1-6 will have earned the right to be A's. Notice being an A and making the proposal is a definite advantage in this experiment. The other six participants will be B's. The A with the highest rank (A1) will be paired with the highest ranking B (B7), the A will the second-highest rank (A2) will be paired with the second-highest ranking B (B8), and so on. Your total score will not be publicized under your name.

Once person A has earned the right to be an A, he or she will fill out a "Proposal Form." The proposal consists of an amount that person B is to receive and the amount that person A is to receive. The amount that person A is to receive is simply the amount to be divided, $10, minus the amount that person B is to receive.

[The rest of the instructions are identical to the random instructions.]

FHSS REPLICATION
PROPOSAL FORM

(1) Identification Number ____A

(2) Paired With ____B

(3) Amount to divide _____

(4) Person B receives _____

(5) Person A receives (3) - (4) _____

(6) Accept _____ Reject _____

ULTIMATUM, BUY-SELL
RANDOM ENTITLEMENTS

Instructions

In this experiment you have been paired anonymously with another person. One of you will be the seller the other the buyer. The seller chooses the selling PRICE. Then the seller's choice is presented to the buyer who chooses to BUY or NOT BUY. In the following table each cell shows the possible profit, in dollars, in the upper right corner for the seller, and in the lower left corner for the buyer. For example, if the seller chooses PRICE = $8, and then the buyer chooses BUY, the seller will be paid $8 and the buyer will be paid $2. If the seller chooses PRICE = $1, and then the buyer chooses BUY, the seller makes $1, and the buyer $9. If the buyer chooses NOT BUY, each of you will be paid nothing, whatever might have been the seller's choice of PRICE. The seller will be given a choice form. After he/she has circled a PRICE choice, the experimenter will circle this PRICE on the buyer's choice form, and the buyer will choose BUY or NOT BUY.

ULTIMATUM, BUY-SELL
CONTEST ENTITLEMENTS

Instruction Changes

In this experiment you will be paired with another person. One of you will be the seller the other the buyer. The positions of buyer and seller in each pairing will be determined by your scores on a general knowledge quiz. The quiz will be given concurrently to 12 participants. Each of you will be asked to answer the same set of 10 questions, selected from a large data bank of questions. Your quiz score will be the number of questions you answer correctly. Quiz scores will be ranked from highest to lowest and ties will be decided by giving a higher ranking to the person who finishes the quiz in the shortest amount of time. Note #1 is the highest rank while 12 is the lowest. Once the complete ranking of participants is determined, those ranked 1-6 will have earned the right to be sellers. Notice being a seller and choosing price is a definite advantage in this experiment. The other six participants will be buyers. The seller with the highest rank (seller 1) will be paired with the highest ranking buyer (buyer 7), the seller with the second-highest rank (seller 2) will be paired with the second-highest ranking buyer (buyer 8), and so on. Your total score will not be publicized under your name.

Once the seller has earned the right to be the seller, he/she chooses the selling PRICE. [The rest follows from sentence two of the random instructions.]

ULTIMATUM, BUY-SELL
CONTEST ENTITLEMENTS

Buyer Questionnaire (Changes)

1. If you had earned the right to be a seller in this experiment what PRICE would you have chosen? _____ (write in the PRICE).

[Questions 2 and 3 are the same as for the random entitlements.]

ULTIMATUM. BUY-SELL
RANDOM ENTITLEMENTS

Buyer Choice

You are the buyer. The price chosen by the seller is shown circled in the top row of the table below.

Please circle your choice of BUY or NOT Buy in the left column of the following profit table.

ULTIMATUM. BUY-SELL
CONTEST ENTITLEMENTS

Buyer Choice (Changes)

[Add following sentence at end of 1st paragraph]: Recall that the seller earned the right to be a seller.

[Rest is the same as for the random entitlements.]

ULTIMATUM, BUY-SELL
RANDOM ENTITLEMENTS

Seller Choice

You are the seller. Please circle your choice of PRICE in the top row of the following profit table.

ULTIMATUM. BUY-SELL
CONTEST ENTITLEMENTS

Seller Choice (Changes)

You have earned the right to be the seller.

[Sentence two of random seller choice follows.]

ULTIMATUM. BUY-SELL
RANDOM ENTITLEMENTS

Buyer Questionnaire

1. If you had been the seller in this experiment what PRICE would you have chosen? _____ (write in the PRICE).

2. What PRICE do you expect the seller to choose? _____ (write in the PRICE).

3. What choice do you think the seller expected you to make?
BUY _____ NOT BUY _____ (check your answer).

ULTIMATUM, BUY-SELL
RANDOM AND CONTEST ENTITLEMENTS

Seller Questionnaire

1. If you had been the buyer in this experiment would you have chosen to BUY ____, or NOT BUY ____? (check your answer).

2. What did you expect the buyer to choose?
BUY ____, or NOT BUY ____ (check your answer)

3. What PRICE do you think the buyer expected you to choose? ____ (write in the PRICE)

ULTIMATUM, BUY-SELL
RANDOM AND CONTEST ENTITLEMENTS
CHOICE FORM

Seller Chooses

PRICE

Buyer Chooses to		$0	$1	$2	$3	$4	$5	$6	$7	$8	$9	$10	
	BUY	$0	$1	$2	$3	$4	$5	$6	$7	$8	$9	$10	Seller profit
		$10	$9	$8	$7	$6	$5	$4	$3	$2	$1	$0	Buyer profit
	NOT BUY	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	Seller profit
		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	Buyer profit

DICTATOR, BUY-SELL
RANDOM ENTITLEMENTS

Instructions

In this experiment you have been paired anonymously with another person. One of you will be the seller the other the buyer. The seller chooses the selling PRICE, and the buyer must buy at that price. This determines the profits of both the seller and the buyer. In the following table each cell shows the possible profit, in dollars, in the upper right corner for the seller, and in the lower left corner for the buyer. For example, if the seller chooses PRICE = $8, the seller will be paid $8 and the buyer will be paid $2. If the seller chooses PRICE = $1, the seller makes $1, and the buyer $9. The seller will be given a choice form. After he/she has circled a PRICE choice, the experimenter will collect the forms.

DICTATOR. BUY-SELL
CONTEST ENTITLEMENTS

Instruction Changes

In this experiment you will be paired with another person. One of you will be the seller the other the buyer. The positions of buyer and seller in each pairing will be determined by your scores on a general knowledge quiz. The quiz will be given concurrently to 12 participants. Each of you will be asked to answer the same set of 10 questions, selected from a large data bank of questions. Your quiz score will be the number of questions you answer correctly. Quiz scores will be ranked from highest to lowest and ties will be decided by giving a higher ranking to the person who finishes the quiz in the shortest amount of time. Note #1 is the highest rank while 12 is the lowest. Once the complete ranking of participants is determined, those ranked 1-6 will have <u>earned</u> the right to be sellers. Notice being a seller and choosing price is a definite advantage in this experiment. The other six participants will be buyers. The seller with the highest rank (seller 1) will be paired with the highest ranking buyer (buyer 7), the seller with the second-highest rank (seller 2) will be paired with the second-highest ranking buyer (buyer 8), and so on. Your total score will not be publicized under your name.

Once the seller has <u>earned</u> the right to be the seller, he/she chooses the selling PRICE, and the buyer must buy at that price. This determines the profits of both the seller and the buyer. [The rest follows from sentence three of the random instructions.]

DICTATOR, BUY-SELL
RANDOM ENTITLEMENTS

Seller Choice

You are the seller. Please circle your choice of PRICE in the top row of the following profit table.

DICTATOR. BUY-SELL
CONTEST ENTITLEMENTS

Seller Choice (Changes)

You have earned the right to be the seller. [Same 2nd sentence.]

DICTATOR, BUY-SELL
RANDOM ENTITLEMENTS

Buyer Questionnaire

1. If you had been the seller in this experiment what PRICE would you have chosen? _____ (write in the PRICE).

2. What PRICE do you expect the seller to choose? _____ (write in the PRICE).

DICTATOR, BUY-SELL
CONTEST ENTITLEMENTS

Buyer Questionnaire (Changes)

1. If you had earned the right to be a seller in this experiment what PRICE would you have chosen? ____ (write in the PRICE).

[Same question 2]

DICTATOR, BUY-SELL
RANDOM AND CONTEST ENTITLEMENTS

Buyer Form

You are the buyer. The price chosen by the seller is shown circled in the top row of the table below.

DICTATOR, BUY-SELL
RANDOM AND CONTEST ENTITLEMENTS
CHOICE FORM

Seller Chooses

PRICE

$0	$1	$2	$3	$4	$5	$6	$7	$8	$9	$10	
$0	$1	$2	$3	$4	$5	$6	$7	$8	$9	$10	Seller profit
$10	$9	$8	$7	$6	$5	$4	$3	$2	$1	$0	Buyer profit

Instructions

You have been asked to participate in an economics experiment. For your participation today we have paid you $5 in cash. You may earn an additional amount of money, which will also be paid to you in cash at the end of the experiment.

In this experiment each of you will be paired with a different person who is in another room. You will not be told who these people are either during or after the experiment. This is room A.

You will notice that there are other people in the same room with you who are also participating in the experiment. You will not be paired with any of these people.

One of the persons in room A will be chosen to be the monitor for today's experiment. The monitor will be paid $10 in addition to the $5 already paid. The monitor will be in charge of the envelopes as explained below. In addition the monitor will verify that the instructions have been followed as they appear here.

The experiment is conducted as follows: Fourteen unmarked envelopes have been placed in a box. Twelve of these envelopes contain 10 one dollar bills and 10 blank slips of paper. The remaining 2 envelopes contain 20 blank slips of paper. The monitor will be given a list of names of people in the room. He or she will call one person at a time to the back of the room, and hand each person an envelope from the box. The person who was called will then go to one of the seats, with a large box on top, in the back of the room. The envelope will then be opened privately inside the box. Only the person who was given the envelope will know what the envelope contains.

Each person in room A must decide how many dollar bills (if any) and how many slips of paper to put in the envelope. The number of dollar bills plus the number of slips of paper must add up to 10. The person then pockets the remaining dollar bills and slips of paper. Examples: (1) Put $2 and 8 slips in the envelope, pocket $8 and 2 slips. (2) Put $9 and 1 slip in the envelope, pocket $1 and 9 slips. These are examples only, the actual decision is up to each person. If the envelope has 20 blank slips, put 10 blank slips in the envelope and pocket the other 10. This is done in private and we ask that you tell no one of your decision. Notice that each envelope returned will look exactly the same. Also note that no one else, including the experimenter will know the personal decisions of people in room A.

Once you have made your decision you will seal your envelope and place it in the box marked return envelopes. You may then leave the room.

After all fourteen envelopes have been returned the monitor will take the box to room B. There are 14 people in room B. Each of these persons has been paid $5 to participate. The monitor will

be given a list of names of people in room B. The monitor will then call up the people in room B. The monitor will choose an envelope from the box, open the envelope, record its contents, and give the contents of the envelope to the person called up. They are then free to leave. The monitor will continue until all the envelopes have been handed out and everyone else has left the room. The experiment is then over.