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Should the Same Side of the Market always move first in a Transaction?

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Should the same side of the market always move first in a transaction? An experimental study

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Abstract

This paper investigates whether transactions where the buyer (or the seller) always moves first, and the seller (or the buyer) always moves second in the exchange gives higher payoffs than exchanges in which it is randomly determined who moves first. We examine the effect of two treatment variables: Partners versus Strangers and fixed versus changing positions. We find that both with fixed and with changing positions, second movers take advantage of their position by exploiting the first mover by "not delivering" the demanded good. However, with fixed positions exploitation occurs significantly less while reciprocal exchanges happen more often. In spite of this, it turns out that with fixed positions payoffs are very unevenly distributed. Unequal payoff distributions occur both under Partners and Strangers, but they appear to be more extreme among Strangers.

Keywords: experiments, exchange, partners, role assignment

JEL-Classification codes: C90, D63, L14

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1 Introduction

If in the US a consumption good is purchased on delivery, or a hotel reservation is made, the customer has to give guarantees that (s)he is able to afford the expenses by giving a credit card number, or by simply paying in advance. In European countries, like the Netherlands, the customer will usually pay after delivery without him/her being asked for evidence of his/her financial standing before delivery. In labor relations an employer, in trying to fill a vacancy, usually offers a new worker a wage before the actual work effort of the worker is known. If the employer-worker relationship turns out to be more or less permanent, the employer can react to the worker's efforts by offering wage increases.

The transactions in these examples have in common that they are of a sequential nature. That is, after ordering a good some time elapses before consumption can take place or, in the case of the labor-market example, before the effort of the worker can be established. One of the two market parties involved moves first after which the other party moves. As a consequence, the first mover has to put confidence in the second mover that he will respond to her first move in a reciprocal way. For instance, if a good or service has been paid for by the buyer, it is uncertain whether the supplier will actually deliver the good or service demanded or whether the quality of the good or service is as expected. Or, the other way round, if a supplier has delivered first, she has to await whether payment will follow suit. In game-theoretic terms we could say that in these exchanges there is priority in time and priority in information.

It might be added here that in the real world confidence in the realization of a transaction can be engendered by the existence of some warranty institution. Holiday trips are a case in point: potential demanders can only infer from a brochure the quality of the offered accommodation and its surroundings. For that reason quite often these trips are sold alongside with a claim for the buyer for a refund if the quality of the lodging or the venue does not fit the description of the brochure. For the kind of transactions that we have in mind, however, such a warranty does not exist and if it did, it would not be effective as for the consumer the (money and time) costs of claiming a refund surpasses the expected reimbursement. By the same token, suppliers as fixed first movers, as is the case e.g. with mail-order houses, sometimes do not legally enforce payments from defaulting customers, as the transaction costs involved are larger than the amount of money to be claimed.

It has been observed in a variety of (experimental) settings that subjects are inclined to behave reciprocally by rewarding nice acts and punishing unkind behavior (e.g. Fehr, Gächter and Kirchsteiger (1996), Camerer and Thaler (1995); see Fehr and Gächter (2000) for a survey). The employment relationship is a case in point. Usually an employer first commits herself to paying a certain wage to a worker, after which the worker chooses an effort level. For the worker there is an incentive to shirk, which for the employer, who should anticipate this behavior, implies that she will commit herself to paying the reservation wage only. Experimental evidence shows, however, that employers make quite generous offers, while workers are on average willing to put forward extra effort above what is implied by purely pecuniary considerations (e.g. Fehr, Kirchsteiger, and Riedl (1993)), even under conditions with a rather high stake level or in very competitive double auction markets (for a survey, see Fehr and Gächter (2000) and the references therein).

In the labor market, the demand side (the firm) usually moves before the supply side (the worker) by offering a wage contract without exact knowledge of the effort to be provided by the worker. On the US consumer market the demand side usually has to move first (e.g. by producing a credit card number), while on the European consumer market the supply side has to move first (by delivering the demanded goods or services). Thus, the order of the moves is fixed: in some markets the buyer will always have to move first, and in other markets the supply side is assigned to be the first moving party. The question presents itself whether such role assignments have some economic justification. Will it help to improve exchange and to raise efficiency if demand and supply have a fixed role in concluding a transaction, i.e. by always having the same side of the market moving first, and the same side of the market moving second? Or, will it ameliorate exchange if the role assignment is subject to change, i.e. sometimes one side of the market has to move first, and sometimes the other side of the market has to move first?

A related question is whether the impact of the role assignment depends upon the permanency of the relationship. Typically, customers will stay in a certain hotel only once in their life, but the relationship between an employer and an employee has a more enduring character, and a changing role may then be more conducive to successful exchange than a fixed role.

In this paper we try to answer the questions alluded to above by experimental data. It is not the purpose of the paper to explain which side of the market will get the first- or second-mover position in exchange. Our experiments do not allow for the identification of the “supply side” or the “demand side” of the market. We use an experimental repeated bilateral exchange game where both sides of the exchange are in a symmetrical position in that they can offer their counterpart a certain part of their endowment. The (sequential) exchange game allows for reciprocal exchange. The unique Nash equilibrium involves no exchange. We relate the characteristics of exchange to two treatment variables. The first one is the so-called Partners/Strangers treatment, which has often been found to be a determining variable for the (non)emergence of voluntary cooperation.[1] In the Partners

[1] The Partners and Strangers treatments were introduced by Andreoni (1988) in a public good experiment to distinguish between simple learning and strategies. Surprisingly, he found that Strangers contribute more to the public good than Partners do. Replications of this study found, however, that Partners contribute more (Croson (1996)) or that there is no significant difference (Weimann (1994)). The general concencus seems to be that in most situations Partners are more inclined to behave cooperatively.

treatment, players play the game repeatedly against the same opponent. In terms of our examples above, labor relations can typically be named as the real-world counterpart of this treatment. In the Strangers treatment, players are randomly rematched after each round: players meet the same opponent occasionally with random probability, but typically the next opponent will be a different one than the current one. Hotel stays are an example of this treatment. It can be argued that cooperation is likely to be facilitated when repeated interaction takes place with the same opponents (Partners) rather then with varying opponents (Strangers) (see e.g. Van der Heijden et al. (2000)).

Taking this conjecture for granted we investigate whether the position of the players has an independent effect on the emergence of cooperation. To that end we introduce the fixed/changing position as a second treatment variable. Under fixed positions one player is the first mover during all repeated plays (rounds), whereas the other player is always the second mover. Under changing positions, it is randomly determined in each round who is the first and who is the second mover. We investigate whether or not fixed positions are conducive to obtaining higher payoffs and/or more reciprocal exchanges.

In the next section we briefly introduce our experimental game and procedure. The third section presents our results. We find that both in the fixed and the changing treatments second movers take advantage of their position by exploiting the first mover by "not delivering" the demanded good. Yet, in the fixed treatments second movers are significantly less engaged in exploiting their strategic advantage. This renders the guess justified that fixed positions are more conducive to generating reciprocal exchange than changing positions. On the other hand, as with changing positions an exploited subject can become an "exploiter" when she happens to get into the second-mover position, the average first mover in a fixed treatment is (significantly) worse off than the average individual with changing positions. In the Partners treatment with fixed positions even the average second mover is not better off than the average individual with changing positions. As a result, for Partners it will unambiguously increase the average payoff if exchange takes place under changing positions. Among Strangers, the result will not be that clear-cut. Converting exchange with fixed positions into exchange with changing positions will on average benefit the first mover significantly, but the second mover will on average significantly lose from such a conversion. Section 4 contains a summary and a concluding discussion.

2 Game and experimental procedure

2.1 The game

The experiment is based on a sequential exchange game (Van der Heijden et al. (1998)). In this game, the payoff-function P is given by

$$P(T_i, T_j) = (9 - T_i)(1 + T_j) \tag{1}$$

where T_i (T_j) is a transfer from player i (j) to player j (i), $i, j = 1, 2$, $i \neq j$.

The exchange game can be given the following interpretation: In period 1, player 1 has an endowment of 9, which she can use to "buy" a good, i.e. by "paying" an amount T_1 to player 2 ($0 \leq T_1 \leq 7$). In the second period player 1 has an endowment of 1. In this period, player 2 can use his endowment of 9 to "deliver" the good by giving T_2 to player 1 ($0 \leq T_2 \leq 7$).[2] Player 2 knows the size of T_1 before he has to decide on T_2. Endowments, payment T_1 and delivery T_2 together determine the final asset levels of the two players in the two periods. In the period in which player i pays or delivers T_i, his final assets are $9 - T_i$. In the period in which player i receives T_j as a payment or a delivery, player i's final assets are $1 + T_j$. The payoffs to player i are defined as the product of the final assets levels in the two periods, as shown in (1).

We employ a 2×2 factorial design, with treatment variables matching structure (Partners versus Strangers) and position (fixed versus changing positions). Under Partners, subjects are matched with the same opponent for all rounds to be played, whereas under Strangers, subjects are randomly rematched at the beginning of each round. In the fixed treatment, subjects are assigned to be player 1 or player 2 for all rounds to be played, while in the changing treatment, it is randomly decided at the beginning of each round whether a subject is player 1 or player 2 in that round.

2.2 The experimental procedure

In total 16 sessions of the sequential exchange game were run in Tilburg, the Netherlands, in March 1995 and in April 1996.[3] All sessions were run with eight subjects, which gives a

[2] Both buyer-seller examples mentioned in the introduction are covered by this design. One interpretation of the game is that in the first period player 1 pays a certain amount and that in the second period player 2 delivers the good with a certain value/quality (the US case). Alternatively, in the first period player 1 delivers the good and in the second period player 2 pays for the good (the European case). In both situations it can occur that player 1 receives less (or more) than expected or hoped for. I.e. in the first situation, player 2 can deliver a good with a lower (or higher) value/quality and in the second situation, player 2 can pay less (or more) than the value of the good. To keep the exposition clear, we use the first interpretation (the US case) in the remainder of this paper. In addition, for sake of convenience, we refer to T as the transfer.

[3] The experiments presented here are part of a research project investigating the relationship between inter- and intragenerational gift exchanges.

total of 128 participants. A session typically lasted for about an hour. The subjects were undergraduate and graduate students from Tilburg University. They came from various disciplines like law and psychology, but the majority studied economics or business.[4] Participants were mainly recruited by an announcement in the University Bulletin and by posters. None of the participants had previous experience from any related experiment and none of them participated more than once.

Upon arrival, subjects were randomly seated behind computer terminals, which were separated by partitions. Instructions, reproduced in the Appendix to this paper, were distributed and read aloud by the experimenter. After that, subjects got several minutes to study the instructions more carefully and to ask questions. Then one practice round was played.

After the practice round, the eight subjects played 15 repetitions of the exchange game. At the start of the session, four couples were formed in the Partner treatments. These persons remained paired during the remaining part of the experiment. In the fixed treatment, the role was also determined at the start, whereas in the changing treatment, this role was randomly assigned at the beginning of each round. In the Strangers treatments, subjects were randomly rematched each round. Here, the role was also assigned each round again in the changing treatment, whereas the players' roles remained unchanged in the fixed treatment.

For each couple, player 1 decided on her "payment" T_1 to player 2. After that, player 2 was informed about T_1 and he had to decide on the "delivery" T_2 to player 1. Earnings of player i in each round (P_i) were denoted in points and calculated according to equation (1). Subjects could also use a table included in the instructions (see Appendix), which gave P_i as a function of T_i and T_j. Subjects knew that a total of 15 rounds would be played and that after the last round the points earned in all rounds would be accumulated and transferred into money earnings at a fixed known rate.

After 15 rounds, an anonymous questionnaire asked for some background information (gender, age, major, and motivation). After that, subjects were privately paid their earnings in cash and left. In addition to the earnings from the experiment, which were calculated by multiplying the total number of points earned by 5 cents, the participants received 5 Dutch Guilders for showing up in time.[5]

In the Strangers treatments, all eight players interact, which gives, strictly speaking, only one independent observation per session. In the Partners treatment, the players interact in fixed pairs, and thus each session generates four independent observations.

[4] We have not found any significant difference in behavior between business or economics students and other students.

[5] At the time of the experiment, one Dutch Guilder was about \$0.50. Expected earnings, based on previous experience of the experimenters, were somewhat higher than what students could earn with one hour of work in, for instance, a bar.

Table 1 displays the features of each treatment combination, their abbreviations, and the number of sessions, subjects, plays and independent observations.

Table 1: Overview of the experimental treatments

treatment abbreviation	matching structure	role assignment	total # sessions	total # subjects	total # plays	# independent observations
P-ch	Partners	changing	3	24	180	12
P-fix	Partners	fixed	3	24	180	12
S-ch	Strangers	changing	5	40	300	5
S-fix	Strangers	fixed	5	40	300	5

3 Experimental results

3.1 Introduction

Before presenting the main results we will first briefly discuss some predictions for our game. Obviously, as the game under consideration is of a sequential nature, in each treatment it is a dominant strategy for player 2 to give nothing, i.e. $T_2 = 0$, if we assume selfish, money-maximizing subjects. For player 1, on the other hand, it is not a dominant strategy to give nothing because she has to anticipate player 2's reaction to T_1. However, a backward induction argument leads to the unique equilibrium outcome of $T_1 = T_2 = 0$. This subgame perfect Nash equilibrium yields a payoff of 9 to both players. It is clear that players forego considerable gains from exchange by playing non-cooperatively. For instance, a level of exchange of 2 would result in a payoff of 21 for both players. When both players choose 4, the optimal symmetric payoff of 25 is achieved.

Previous experiments with the same game and experimental studies with related games suggest that players often succeed in obtaining higher payoffs than predicted by the Nash equilibrium (Van der Heijden et al. (2000), Fehr and Gächter (2000)). Furthermore, if one assumes that players are not only motivated by pecuniary considerations, but for instance also by altruism, reciprocity or distributional concerns, other outcomes than the Nash equilibrium of $T_1 = T_2 = 0$ might be expected. For example, if we apply Fehr and Schmidt's model on inequity aversion[6] to our game, it turns out that, depending on the parameter values of inequity aversion, the predictions contain all symmetric outcomes,

[6] Fehr and Schmidt (1999) assume in their model that there are purely selfish individuals and individuals who dislike inequitable outcomes. Individuals of this latter type experience not only a loss in utility if they are worse off (in material terms) than the other subjects but also if they are better off (but then the loss is smaller).

i.e. $T_1 = T_2 = k$, if the first mover has perfect information on the type of the second player. If the first mover has some a priori information on the probability of meeting an inequity-averse (or reciprocal) opponent, she might earn more than implied by the Nash-outcome by offering a non-zero transfer every round, if this probability is sufficiently large.[7]

Hence, on the basis of previous experimental results as well as theoretical work, we may expect to see some degree of cooperation in our game. The relevant and interesting question then is whether we should expect to see differences among the experimental treatments under consideration. In this paper we focus on the impact of role assignment, i.e. we are interested in the question whether exchanges and payoffs are enhanced when players have the same position all the time or when they change positions. Secondly, we want to see whether this effect differs between Partners and Strangers.[8] As argued earlier, if we assume that all subjects are selfish, money-maximizing players the prediction is the same for all treatments, i.e. no exchange. This prediction may change if players are motivated by other concerns.

In the Partners treatment, subjects are matched with the same subject for all rounds. This makes it easier to know the payoffs of the partner, such that subjects who are concerned about inequity may try to avoid an unequal distribution of the payoffs. The effects of fixed or changing positions can point in different directions. On the one hand, with fixed positions coordination of strategies may be somewhat less difficult, which is likely to make cooperation easier. On the other hand, with fixed positions the first player will not be able to directly "punish" a non-cooperative second player, although she will find out pretty soon what type her second-moving partner looks like, or is trying to mimic. One might therefore expect that in this case non-cooperative actions by the second player will induce the first player to have recourse to stopping all transactions. With changing positions, however, a first mover is less vulnerable to exploitation as she can find compensation for her loss later on when she happens to be in the second-moving position. As a result, first players can allow themselves to be more "tolerant" towards uncooperative acts of her partner. Fixed positions will thus more likely be characterized by less exploitation and more Nash-exchanges than changing positions.

Subjects in the Strangers treatment are matched with a different person in each round. As noted above, if in the fixed treatment at least some second players can be expected to act cooperatively, it can be beneficial for first players to give positive transfers. A first

[7] To see this, suppose that first movers perceive a probability p of meeting an inequity averse individual who will reciprocate a received transfer by a transfer of the same size. Even if first movers are selfish and only care about their own expected payoff (so that they will maximize $E(P_1) = p(9 - T_1)(1 + T_1) + (1 - p)(9 - T_1)$ they set a non-zero T_1 as soon as $p > \frac{1}{9}$.

[8] We do not compare the results of Partners and Strangers in this paper. For this comparison we refer to Van der Heijden et al. (2000).

player in both the fixed and the changing treatment then runs the risk of being exploited by a zero return gift of the second player. But, again, a first player in the changing treatment can take more risk and is more likely to offer higher transfers in order to incite higher return transfers than a first player in the fixed treatment. This leads one to expect higher transfers by first players in the changing treatment. On the other hand, inequity averse second players in the fixed treatment will know that first players cannot make up for losses in later rounds. As a result, they will sooner reciprocate first players' gifts than if they were in a changing treatment. Previous experiments with the exchange game have indeed shown that under changing positions there is a considerable degree of exploitation by second players, i.e. $T_2 < T_1$ (see Lensberg and Van der Heijden (1998)). Assuming that in both the fixed and the changing treatment a certain percentage of the subjects will endorse non-cooperative behavior, the above reasoning suggests that the (absolute) difference between T_1 and T_2 will be smaller under fixed positions than under changing positions. Note, however, that this smaller difference can be due to higher transfers by first players in the changing treatment, or to larger transfers by second players in the fixed treatment.

In the next section we will see to what extent these predictions prove to be correct.

3.2 Results

Table 2 gives the average transfer (T) and the average payoff (P) by player position for each treatment, averaged across all sessions and all rounds.

Table 2: Average transfers and payoffs by player and treatment

treatment	T_1	T_2	P_1	P_2
P-ch	2.99	2.41	21.59	27.42
P-fix	2.40	2.12	19.49	22.33
S-ch	2.10	0.72	11.85	25.65
S-fix	2.14	0.99	13.06	24.59

From this table, the first observation can be derived:

Observation 1 : On average, there is no significant difference in the average payoffs between the treatments with fixed and changing roles for both players 1 and 2.

Observation 1 can be tested statistically by applying a non-parametric Mann-Whitney U test to the payoffs, with for Strangers session averages as units of observation ($n_1 = n_2 = 5$), and for Partners couple averages as units of observation ($n_1 = n_2 = 12$). For Partners these tests result in $p = 0.98$ for first players and $p = 0.36$ for second players.

The same test for Strangers yields $p = 0.47$ for first players and $p = 0.60$ for second players.

The first impression thus seems that role assignment has hardly any effect, as there is no distinction between the average payoffs to players 1 and 2 with fixed or changing positions. One should keep in mind, however, that while in the fixed treatments first players remain in that position during the whole session, in the changing treatments a player continuously changes position. A player will have the first- (second-)player position on average half of the time in the latter treatments. This implies that the individual payoffs are determined by the average earnings in the position of both the first and the second player. Obviously, this does not hold for the fixed treatments. Thus, if a difference in payoffs between first and second players exists, this will largely affect players in the fixed treatments, but hardly in the changing treatments. A look at the player positions indeed reveals that there are large differences in this respect. That is:

Observation 2 : On average, players 1 earn less than players 2. This difference is significant in all treatments, except for treatment P-ch.

Under Strangers the average payoff of second players is about twice as high as the average payoffs of first players (for both S-fix and S-ch a non-parametric Wilcoxon test shows that this difference is significant at $p = 0.04$). In treatment S-ch this difference does not necessarily cause unequal payoffs between players, but for treatment S-fix this leads to a very uneven distribution of the payoffs. Also for P-fix the average payoffs to first players are significantly less than the average payoffs to second players, while in P-ch the difference is considerable but not significant ($p = 0.07$ and $p = 0.20$ for treatment P-fix and P-ch, respectively).

[Insert Figure 1]

The above observations about the average payoffs suggest that among Strangers the payoffs per individual are more unequally distributed in S-fix compared with S-ch. In particular, first players in S-fix will have lower payoffs than the second players in S-fix, and, by implication, also lower payoffs than the "average" player in S-ch. This inequality also exists in the Partners treatment, given the obtained significant difference between the payoffs of players 1 and 2 in P-fix. More information about the distribution of the payoffs is depicted in Figure 1, which shows the Lorenz curve. In this figure, the subjects have been ranked according to (increasing) payoffs. The horizontal axis shows the proportion of the participants (ranked to their payoffs) and the vertical axis the proportion of the payoffs earned by any given fraction of the subjects. In S-fix 50% of the players with the lowest payoffs earn in total just slightly more than 30% of the total earned payoff. In S-ch, the latter percentage is almost 41%. In the Partners treatments these percentages are 38 (P-fix) and 43 (P-ch), respectively. This leads to:

Observation 3 : The payoffs are more equally distributed among individuals in the changing treatments and the difference with the fixed treatment is larger among Strangers than among Partners.

Similar conclusions can be drawn from Figures 2a-2d, which depict histograms of the average payoffs per individual for each treatment separately. These figures illustrate that in the treatments with changing positions the average payoff per individual is more concentrated and less dispersed in the payoff space than in the corresponding treatments with fixed positions. This observation is supported by the standard deviations (and the coefficients of variation) of the average payoff per individual, which amount to 4.76 (0.19) and 6.47 (0.31) for P-ch and P-fix, respectively, and 4.40 (0.23) and 7.24 (0.39) for treatments S-ch and S-fix, respectively.

[Insert Figures 2a-2d]

Notice once again that in the treatments with changing roles the average payoffs can be interpreted as the payoff of any individual irrespective of her position. For the treatment with fixed roles, however, the individual payoffs depend on the position in the exchange. To examine the consequences of this in more detail, Figures 3a-3d show the distributions of the average individual payoff split by role assignment of first and second players for treatments P-fix and S-fix.

[Insert Figures 3a-3d]

It is obvious that being the first player in S-fix is a very unfavorable position. For instance, the average payoffs of first players range from 9 to 19 whereas the lowest average payoff for second players is 17, and the highest average payoff is as high as 38. For P-fix an analogous conclusion can be drawn, although in that treatment the difference is less clear-cut: the distribution of payoffs for the second player is somewhat more concentrated between 25 and 35, while for the first player the average payoffs is concentrated on values between 11 and 28.

It will be clear that a fixed position in a transaction appears to hurt the first player, who is exploited to some extent. In spite of this, we observe that exchanges do occur in the fixed treatments. See Tables 3a-3d, which give the cross-tabulations of the decisions of first and second players (T_1 and T_2) for each treatment separately.[9]If we define the situation in which $0 < T_1 < 5$ and $T_2 = 0$ as being "no deliveries" and $0 < T_1 < 5$ and $0 < T_2 < 5$ as "reciprocal deliveries"[10] we get:

[9]The average values of T_1 and T_2 are reported in Table 2. Mann-Whitney tests yield that none of these averages are significantly different between the fixed and the changing treatments.

[10]"Reciprocal deliveries" could also emerge as a result of inequity aversion. Here, we do not distinguish between these two distinct motivating forces for reciprocity. For the sake of simplicity we just talk about "reciprocal deliveries" instead of "reciprocal or inequity averse deliveries".

Observation 4 : The frequency of "no deliveries" is lower and the frequency of "reciprocal deliveries" is higher in the fixed treatments compared to the changing treatments.

Table 3a: Cross-table of the decisions of the player pairs in treatment S-ch

	$T_2 = 0$	$0 < T_2 < 5$	$T_2 \geq 5$	total
$T_1 = 0$	78	6	7	91
$0 < T_1 < 5$	136	60	2	198
$T_1 \geq 5$	9	2	0	11
total	223	68	9	300

Table 3b: Cross-table of the decisions of the player pairs in treatment S-fix

	$T_2 = 0$	$0 < T_2 < 5$	$T_2 \geq 5$	total
$T_1 = 0$	63	11	2	76
$0 < T_1 < 5$	96	107	3	206
$T_1 \geq 5$	13	3	2	18
total	172	121	7	300

Table 3c: Cross-table of the decisions of the player pairs in treatment P-ch

	$T_2 = 0$	$0 < T_2 < 5$	$T_2 \geq 5$	total
$T_1 = 0$	21	1	21	43
$0 < T_1 < 5$	45	42	15	102
$T_1 \geq 5$	18	12	5	35
total	84	55	41	180

Table 3d: Cross-table of the decisions of the player pairs in treatment P-fix

	$T_2 = 0$	$0 < T_2 < 5$	$T_2 \geq 5$	total
$T_1 = 0$	49	7	12	68
$0 < T_1 < 5$	16	54	9	79
$T_1 \geq 5$	11	20	2	33
total	76	81	23	180

The frequency of "no deliveries" amounts to 96 (or 32%) in S-fix against 136 (or 45%) in S-ch. "Reciprocal deliveries" occur in 107 (36%) against 60 (20%) of the cases, respectively. Thus, the treatment with fixed positions lends itself more easily to a cooperative attitude and first players are less vulnerable to exploitation ("no deliveries") by the second player. Only the observed difference in exploitation is statistically significant ($p = 0.02$, using a Mann-Whitney U test).

Among Partners the frequency of "no deliveries" equals 16 (9%) in P-fix versus 45 (25%) in P-ch whereas "reciprocal deliveries" take place in 54 (30%) and 42 (23%) of the cases, respectively. These distinctions are the same as those in the Strangers treatment. The Nash-equilibrium of "no exchanges" ($T_1 = 0$ and $T_2 = 0$) shows a different picture among Partners and Strangers, however. Among Strangers, "no exchanges" occur less often in the fixed treatment compared to the changing treatment (63 against 78 cases, or 21% versus 26%) whereas they occur more often among Partners (49 against 21 cases, or 27% versus 12%). Also in the Partners treatment, only the difference in "no deliveries", i.e. exploitation, is significantly different between P-fix and P-ch ($p = 0.01$, using a Mann-Whitney U test).[11]

For Partners these results conform to our expectations formulated in Section 3.1. We claimed that if under P-fix the second player chooses not to deliver (i.e. $0 < T_1 < 5$ and $T_2 = 0$), the first player will sooner stop trying to complete a transaction and will rather not go into any transaction at all. Support for this claim can be obtained from inspection of the individual data. Among P-fix we observe 9 times "no deliveries", followed by $T_1 = 0$ in the next round, while in P-ch this can be observed 3 times. In 3 out of the 9 cases of "no deliveries" in P-fix, one can interpret this as an endgame effect. In one couple, the first player tries to enforce transactions five times. If these attempts turn out to be unsuccessful, she resorts to Nash behavior. In the other situations of "no deliveries" we observe that afterwards the second player invests large amounts in order to rebuild trust. The other couples in P-fix behave more or less in a reciprocal way. In half of these "reciprocal" situations both players fully cooperate and their payoffs are about equal, whereas in the other half the second player slightly exploits the first one.

Among Strangers first players first need to have insight in the "average" behavior in the group. As we noted in Section 3.1, if some players are expected to act reciprocally (or to be characterized by inequity aversion) first players might be inclined to invest during the whole game. In particular, first players will not quickly lose confidence in getting a return gift as the gain in case of a a return gift is relatively large. In S-fix we observe only three times that the first player decides to quit going into transactions after receiving "no deliveries" during a couple of rounds. Moreover, all but one first players start with spending. We further observe cooperative behavior to a large extent in this treatment. In three out of the five sessions the second player almost automatically behaves reciprocally, albeit the second transfer generally is below the first transfer's level. But, what also matters is that the second player obviously expects the first player to invest. If she does not, she is "punished" by $T_2 = 0$. This punishment behavior is nicely illustrated in one of the sessions. One of the first players consequently gives 0 and

[11] Another interesting observation from Tables 3a-3d is that several exchanges can be observed with $T_1 \geq 5$ or $T_2 \geq 5$, in particular among Partners. Exchanges of the type (T_1, T_2) with $T_1 \geq 5, T_2 \leq 3$ or $T_1 \leq 3, T_2 \geq 5$ can be called complex exchanges. They need a lot of coordination but they result in high (total) payoffs. It is beyond the scope of the present paper to explain this type of complicated behavior. Van der Heijden et al. (2000) investigate the occurence and evolution of different types of exchanges.

she almost always receives nothing. Conversely, the other 3 first players in that session give a positive transfer and in general they receive a positive transfer. So, the payoff of these three (first-moving) players is considerably above that for the one Nash-playing first player.

For the changing treatments we argued that first players can take more risk, even though the likelihood of becoming exploited is sizable. Indeed, players seem to be conscious of the possibility of exploitation by the second player, but they are also conscious of the opportunity changing roles offer to compensate losses incurred as a first player, as we frequently observe what might be called "alternating no deliveries". By this we mean the process in which a subject, while being the second player, does not deliver (and consequently exploits) and while being the first player does not receive "deliveries" in spite of a positive transfer (and consequently is being exploited). In P-ch, 8 out of the 12 couples can be characterized by "alternating no deliveries", 2 by (almost complete) reciprocal behavior and 2 by (partial) one-sided exploitation. Except for the last two couples, all couples realize a rather high payoff, albeit full cooperative behavior would result in even higher payoffs. In S-ch we observe some 15 out of 40 subjects playing "alternating no deliveries". Here, indeed, first players are aware of the risk of exploitation (as some 40% of them turn out to be exploiters when being second players themselves), but they are nevertheless induced to give positive transfers in the role of first player.

Table 4 shows, for each treatment, the difference between first and second transfers $T_1 - T_2$. It leads to:

Observation 5 : In the fixed treatments the difference between first and second transfers is smaller than in the changing treatments.

The entries in the table indicate whether the difference is about equal ($|T_1 - T_2| \leq 1$), or unequal ($T_1 - T_2 \geq 2$ or $T_1 - T_2 \leq -2$), only considering transfers below 5. If we regard transfers that do not differ by more than one as (approximately) equal to each other, then in S-fix 63.2% of the exchanges lead to equal transfers, while in S-ch this holds in 50.7% of the cases. For Partners, this difference is even more pronounced: in P-fix 84.1% of the transfers are approximately equal while in P-ch this holds for 60.6%. For both Partners and Strangers the average absolute difference between T_1 and T_2 is significantly smaller in the fixed treatment than in the changing treatment ($p = 0.03$ in both cases), i.e. transfers are more equal in the fixed treatment.

As noted earlier, Observation 5 might be explained by the more risky behavior of the first player in the changing treatment. An alternative explanation is that in a fixed treatment inequity averse second players will not permit large differences with first players to arise. The latter explanation fits the data better than the first one: first players' gifts do not differ significantly between the fixed and changing treatments (see fn. 9). As a result, it follows that second players in the changing treatment are more engaged with making up their lossed incurred as first players in earlier rounds, while in the fixed treatment second players reciprocate more.

Table 4: The distribution of the difference $T_1 - T_2$ by treatment

	S-fix	S-ch	P-fix	P-ch
$T_1 - T_2 \geq 2$	34.0	46.8	10.4	36.7
$\lvert T_1 - T_2 \rvert \leq 1$	63.2	50.7	84.1	60.6
$T_1 - T_2 \leq -2$	2.9	2.6	5.6	2.7

In conclusion, we find that no deliveries in the changing treatments occur more frequently and more intense than in the fixed treatments. In S-fix first players offer the opportunity to become exploited by consistently giving positive transfers, but on average this is beneficial compared to having recourse to Nash-exchange. Moreover, we observe some coherent reciprocal behavior among the groups in this treatment, also favoring first players. In P-fix, however, first players can more easily find out what type of individual their partner is (or mimics) and they will earlier stop trying to conclude a transaction if they know their partners' type. As a results, less exploitation occurs.

4 Summary and concluding discussion

In evaluating the effects of fixed positions in bilateral exchanges positive and negative elements can be observed. On the positive side, one consequence of having a fixed position is that a player gets specialized in behavior. Returning to one of our real-world examples from the introduction: a consumer in the US just knows that without a credit card in her pocket she will never be able to conclude any transaction. Therefore, showing a credit-card as a first move is known to be inextricably bound up with any exchange. Specialization leads to cooperative behavior in a relatively large number of cases as has been demonstrated by our experiments: in the treatments with fixed positions the number of reciprocal exchanges is higher (but not significantly higher) than in the treatments with changing positions. Strikingly, among Partners fixed positions imply a larger percentage of no exchanges as well. This can also be interpreted as the consequence of specialization inherent to a fixed position. If roles are fixed, the first mover will be in a weaker position than the second mover, as she (the first mover) can act, but not immediately *re*act whereas the second mover can respond. However, she can leave the initiative to the second mover in letting him show whether he adheres to a cooperative attitude, or not. The second mover has to "work harder" in a P-fix treatment to convince the first mover of his willingness to increase her pay-off compared to the Nash-equilibrium. If he fails to convince her, the first player will quit trying to conclude transactions. This makes her less vulnerable to exploitation by the second player. Indeed, one of our findings is that selfish reactions from second movers occur less often if the players are in a fixed position. The "specialization" argument therefore contributes to explaining typical findings on labor-market experiments where workers (second movers) show reciprocal behavior to a non-negligible degree.

On the negative side, however, it is definitely the case that being in the first position in all rounds gives a player an unfavorable position. This holds especially for exchanges among Strangers. Due to exploitation first players in treatment S-fix earn considerably less than second players (13.1 versus 24.6, see Table 2). With changing positions a player is randomly assigned to the first or second position in each round, and the overall average payoff is 18.8. So, being in a fixed first position among Strangers leads to lower average payoffs of 5.7 (=18.8-13.1). In P-fix first players also earn less than second players, but here the difference is less pronounced (19.5 versus 22.3). Yet, the loss in earnings due to being in the fixed first position is almost the same as among Strangers (namely 5.0, which follows from 24.5, the average earnings in treatment P-ch, minus 19.5). Among Partners, moreover, the second mover will not lose if the fixed-role assignment were converted into a changing-role assignment: his (average) payoff will then increase from 22.3 to 24.5.

These calculations suggest that a fixed position in exchange does not result in larger total (or societal) welfare. Among Strangers the total welfare after exchange, measured by the total payoff of both players together, is about equal in our experiments, irrespective of the fixity of positions. Among Partners changing roles even renders larger welfare. As we suggested above, under fixed roles the second mover has to "prove" being cooperative before the first mover is willing to show a cooperative attitude as well. In a number of cases the confidence of the first mover in her partner was not induced, and she stuck to giving no transfers at all. If positions are changing players start exchanging earlier and keep on exchanging longer as non-cooperative behavior by a second mover can be "punished" by the first mover later on while being in the position of the second mover. Moreover, non-cooperative acts can be "tolerated" by the first mover as the second mover might not have had the chance to learn to act cooperatively due to her being in different positions every new round.

On balance, although most experimental studies on exchanges with a sequential character take fixed positions for granted[12], our experiments suggest that fixed positions in

[12] One of the few exceptions is a paper by Forsythe, Lundholm and Reitz (1999). In their financial market experiment, subjects can be assigned to different roles: sellers, who know true assets qualities, or buyers, who only know the quality distribution of the assets. They find that sellers are willing to act as cheaters, even if they have been cheated before in the postion of a buyer. This result is similar to our finding that second movers are willing to exploit first movers, even if they themselves have been exploited before. In one of the experiments reported in Güth, Huck and Rapoport (1998), subjects switch roles too. However, their results are hard to compare to ours as in their independent moves game each subject had each role only once, and the order of play was not truly sequential. Instead, they applied a positional order protocol, in which there was priority in time, but no priority in information.

exchange do not generate unambiguous advantages compared to changing positions. In real-world markets, fixed positions appear to be the rule as well. This raises the question as to why in our experiments fixed positions do not show up as the dominant treatment. For the answer to this question one must probably take account of the way changing or fixed positions are actually determined. In our experiments with changing positions the computer decided which party had to move first in each transaction. In the real world one might not expect that some kind of lottery determines who gets the (favorable) second position in each exchange if the positions are not fixed. Rather, the determination of the position will most likely be part of some negotiation process. One determining factor for the outcome here will be the market power of the two sides of the market. If the supply side is the dominant force, it might enforce the most favorable role from the weaker demand side. If the economic power of both sides of the market is more level, negotiations on the role might entail transaction costs which are prohibitive for the conclusion of transactions. In that case, one might conjecture that some evolutionary process will wipe out many (if not all) transactions where a fixed-mover rule is absent. The investigation of the development of transfers when individuals can bargain about their position will be the subject of future research.

Appendix

This appendix gives the English translation of the (Dutch) instructions of the experiment for treatment S-ch. The text between brackets ({ }) was added when more than 8 participants showed up.

Introduction (read aloud only)

You are about to participate in an experimental study of decision-making. The experiment will last for about one hour. The instructions of the experiment are simple and if you follow them carefully and make good decisions you may earn a considerable amount of money. All the money you earn will be yours to keep and will be paid to you, privately and confidentially, in cash right after the end of the experiment

{For the experiment it is of crucial importance to have 8 participants. However, experience learns that often 1 or 2 persons do not show up or do not show up in time. Therefore, we need to have 10 instead of 8 subscriptions. This sometimes has, as now, the consequence that too many participants are present and that 1 or 2 persons cannot participate in this experiment. These persons can still put their name down for one of the following experiments and receive Dfl 10 for any inconvenience. These persons are determined by lot because one or two blank envelopes are added to the box with seating numbers, unless one of you checks in voluntarily not to participate in the experiment and receive Dfl 10 instead.}

Before we go on with the instructions, I would like to ask all of you to draw an envelope from this box and open it. The number denotes the terminal you have to be seated. {If you draw a blank envelope you cannot participate in the experiment and you receive Dfl 10.}

We will distribute the instructions of the experiment now and read through them together. After that, you will have the opportunity to ask questions. From now on, you are requested not to talk to, or communicate with, any other participant.

Instructions (distributed and read aloud)

Decisions and earnings

The experiment exists of fifteen separate rounds. In every round, each of you will earn a certain amount of points. At the end of the experiment the points earned in the 15 rounds are added up for each participant separately. Every point earned is worth 5 cent (≈\$0.028) at the end of the experiment. In addition to this, all participants receive a fixed extra amount of Dfl 5. Your total earnings will thus be equal to Dfl 5 plus the number of points earned times 5 cent. Now, we describe how the points earned in each round will be determined.

In each round you will be matched with another participant. Each round will consist of two periods. In every round you have in one period the role of Decider and in the other period the role of Receiver. The earnings of a participant in a round are determined by the final assets of a participant in the period in which he or she is a Decider, and by the final assets of the participant in the period in which he or she is a Receiver. We denote the final assets as Receiver by EO and the final assets as Decider by EB. The earnings in points of a participant in a round are determined by the product of the final assets as Receiver and the final assets as Decider. The earnings of a participant in a round are thus equal to EB $\times$ EO points. Next, we describe how the final assets as Decider EB and the final assets as Receiver EO are determined.

In each round the participants are first randomly matched two by two. After that the computer determines for each couple who will be the Decider in the first period and who will be the Decider in the second period. In the second period the roles are reversed: the Decider in the first period is thus the Receiver in the second period and the Receiver in the first period is the Decider in of the second period. The Receiver starts with an endowment of 1, whereas the Decider starts with and endowment of 9. The Decider has to decide which part of his or her endowment he or she wants to transfer to the Receiver. This transfer, which we will denote by T, is 0 at the minimum, and 7 at the maximum. After the Decider has decided about the transfer T to the Receiver, the final assets of the Receiver are EO=1+T, and those of the Decider are EB=9-T. After the Decider has decided about her or his transfer to the Receiver, the second period of the round will be started, in which the roles are reversed.

In the second period, the other participant of the couple, who is the Decider now, will have to make a decision. The determination of the final assets of the new Receiver and Decider in this period is similar to the previous period. The Receiver starts with an endowment of 1 and the Decider starts with an endowment of 9. The Decider decides again on the part of her or his endowment that will be transferred to the Receiver. This transfer T determines the final assets of both participants in the second period: EO=1+T for the Receiver and EB=9-T for the Decider.

As said, your earnings in a round are determined by the product of your final assets EB in your role of Decider and the final assets EO in your role of Receiver. Your assets EB are dependent on your transfer to the Receiver in the period you are Decider and your assets EO are dependent on the transfer from the Decider to you in the period you are Receiver. To facilitate the determination of your earnings, you may use the table below.

The table states your earnings in points in a round dependent on the transfer from you to the Receiver when you are Decider and the transfer to you by the Decider when you are Receiver. In this table the rows present the transfer from you as Decider to the Receiver and the columns present the transfer to you as Receiver from the Decider. When you first look for the transfer from you in the row and then go to the right to the column stating the transfer to you, you can read your earnings in points, EB $\times$ EO, for the round. The earnings in money are determined by multiplying the stated amount in points by 5 cents.

		Transfer *to you*							
		0	1	2	3	4	5	6	7
	0	9	18	27	36	45	54	63	72
	1	8	16	24	32	40	48	56	64
	2	7	14	21	28	35	42	49	56
Transfer	3	6	12	18	24	30	36	42	48
from you	4	5	10	15	20	25	30	35	40
	5	4	8	12	16	20	24	28	32
	6	3	6	9	12	15	18	21	24
	7	2	4	6	8	10	12	14	16

When the two period in a round are over, so when both participants have decided on a transfer, a new round will be started.

Procedure and usage of the computer

After we have gone through the instructions, first a practice round will be run. After the practice round, the fifteen rounds that determine your earnings for this experiment will be run.

In every round the computer, in a completely random manner, first determines who will be matched to whom. Then the computer determines, again in a random manner, for each couple who will get the role of Receiver and Decider in the first period. On the upper left part of the screen the Decider will see the number of the current round and the message " You are now Decider in the first period". Underneath the Decider will seethe question "How much of your endowment do you transfer (0-7)?" The Decider has to type an integer from 0 up to and including 7. The number typed is the transfer T to the Receiver with whom he has been matched in this round.

Next, the current Decider will be asked the question "How much do you expect to receive?". Here, the Decider types an integer from 0 up to and including 7, dependent on her or his expectation about the transfer she or he expects to receive as Receiver in the next period. This expectation is used by us when analyzing the experiment, but your earnings will be unaffected by it. Besides, the other participants are not informed about your expectations stated.

After all Deciders have made a decision, the first period is over. In the second period the Receivers of the first period are now the Deciders. Every new Decider will see on the screen that in this round he or she is Decider in the second period and how much he or she has received in the previous period. Underneath there is the question "How much of your endowment do you transfer (0-7)? The Decider has to type an integer from 0 up to and including 7. The number typed is the transfer T to the Receiver with whom he has been matched in this round. When all Deciders of the second period have made a decision all participants will see how much they have received and what their earnings for the rounds are. These earnings are in points and are equal to the product of the final assets as Decider and the final assets as Receiver: EB $\times$ EO. After one has been informed about this, the round is over and a new round will be started.

In the new round, the computer again determines first who will be matched with whom and next for each couple who will be the first Decider. So, you do not know with whom you are matched in a particular round and whether you will be the first or the second Decider.

Summary

The experiment consists of 15 rounds, and every round consists of 2 periods. In each round the participants are randomly matched two by two by the computer. In each round every participant has in one period the role of Decider and in the other period the role of Receiver. When you are Decider your endowment is 9 and your final assets depend on your transfer T to the Receiver: EB=9-T. When you are Receiver your endowment is 1 and your final assets depend on the transfer T by the Decider to you: EO=1+T. Your earnings in points in a round are determined by the product of your final assets as Decider and your final assets as Receiver: EB $\times$ EO. After the first period of a round is over the new Deciders are informed about the transfer T which they have received in the first period. After both periods in a round have been finished, everybody is informed about the transfer T to him or her and his or her earnings in that round.

The matching of the participants and the order in which participants are Decider in the two periods of a round are determined by the computer in a completely random way time after time. You will never be able to know whether you will be the first or the second Decider in a particular round, or with whom you are matched in a particular round.

Final remarks

After the last round, you will first be requested to answer some questions to evaluate the experiment. This questionnaire is anonymous. We can link your answers to your seat number but not to your name. After that, you will be called by your seat number to receive your earnings privately and confidentially. Your earnings are your own business; you do not need to discuss with anyone. It is not allowed to talk to or communicate with other participants during the experiment in either way.

On your table you will find an empty sheet, which you can use to take notes. Additionally, you will find a sheet labeled "REMARKS". On this sheet you can make remarks about the instructions or your decisions.

You get a couple of minutes to go through the instructions and to ask questions. When you want to ask something, please raise your hand. One of us will come to your table to speak to you.

After that we will start the practice round.

Are there any questions?

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Figures

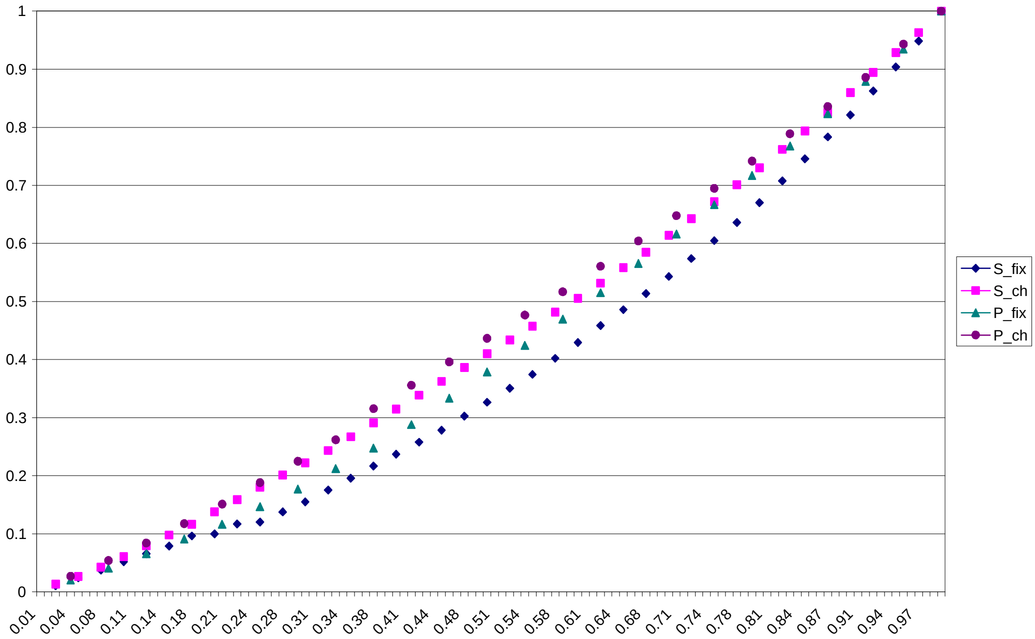

Figure 1: Lorenz curve of the payoffs per individual

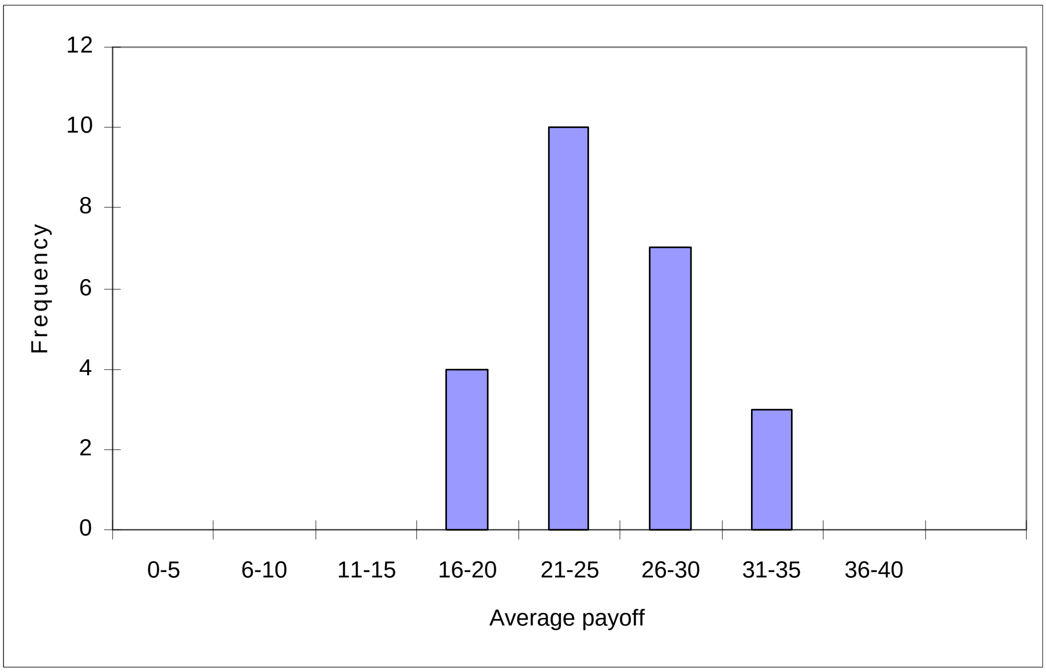

Figure 2a: Histogram of the average payoff per individual in P-ch

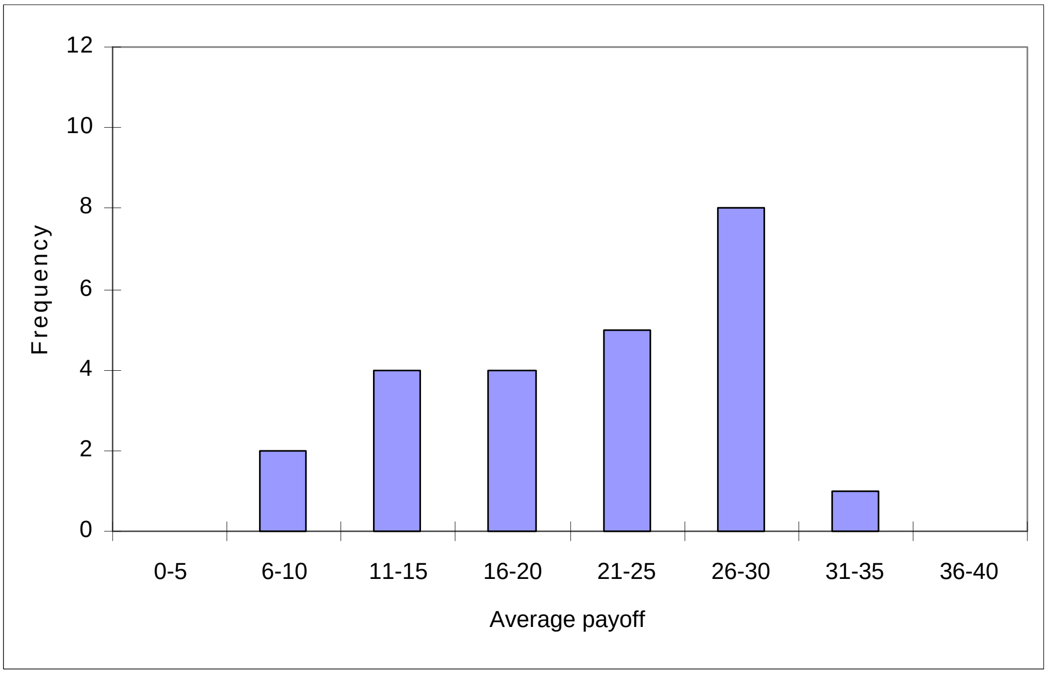

Figure 2b: Histogram of the average payoff per individual in P-fix

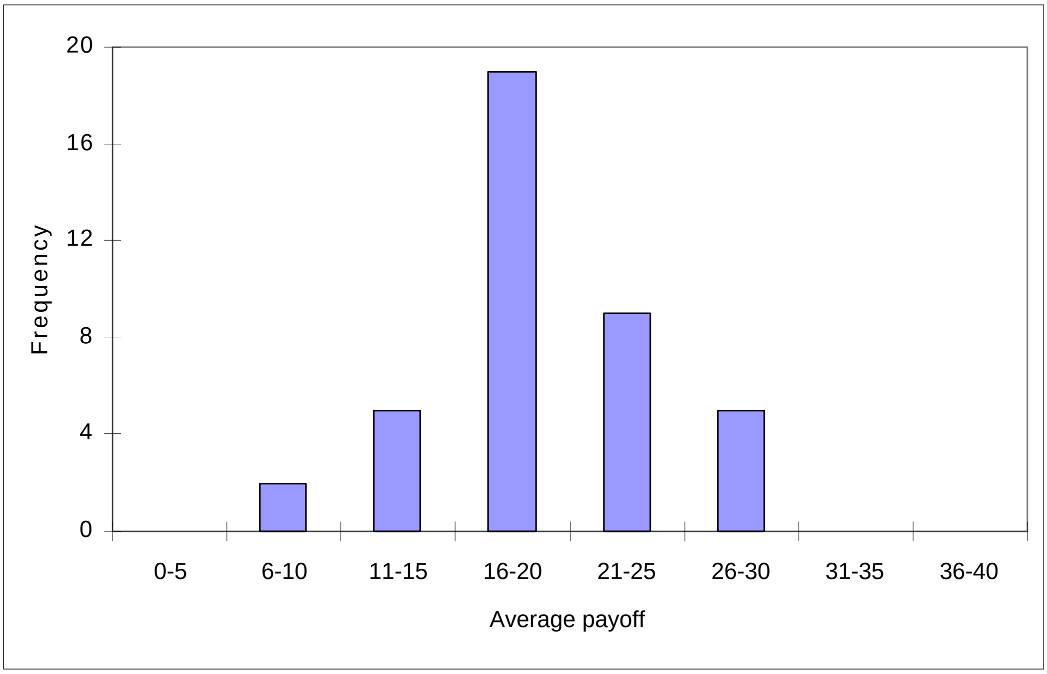

Figure 2c: Histogram of the average payoff per individual in S-ch

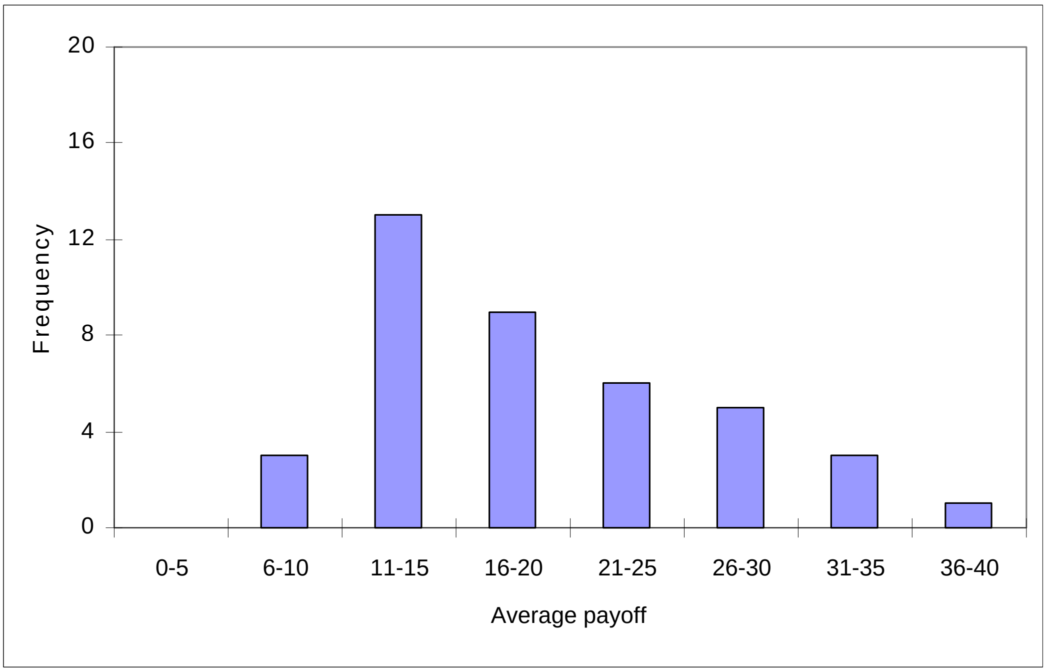

Figure 2d: Histogram of the average payoff per individual in S-fix

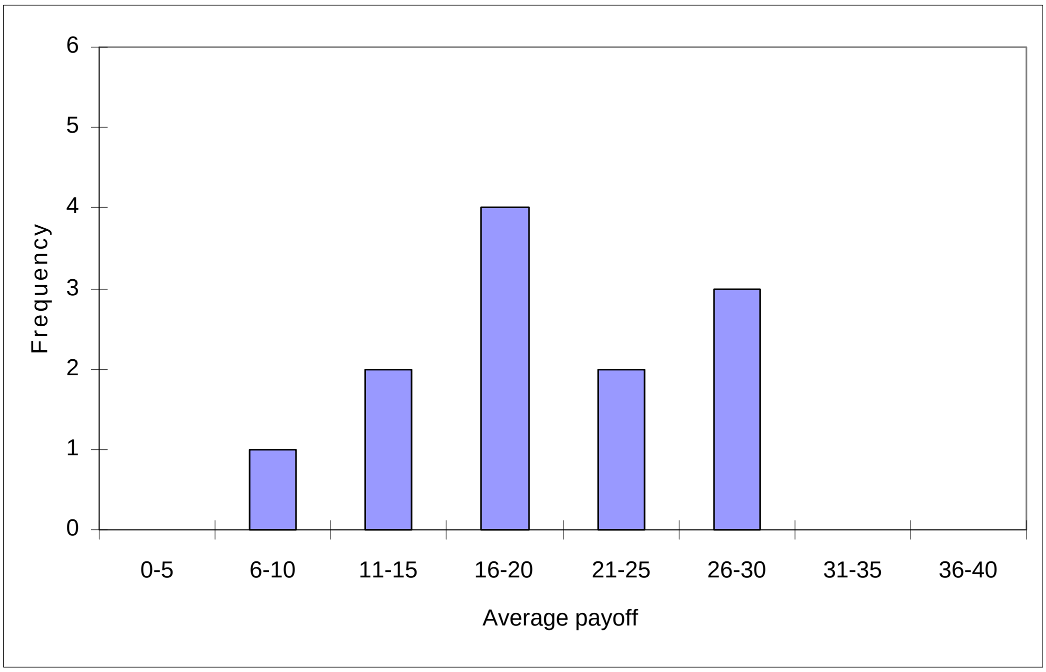

Figure 3a: Histogram of the average payoff per individual in P-fix. First players

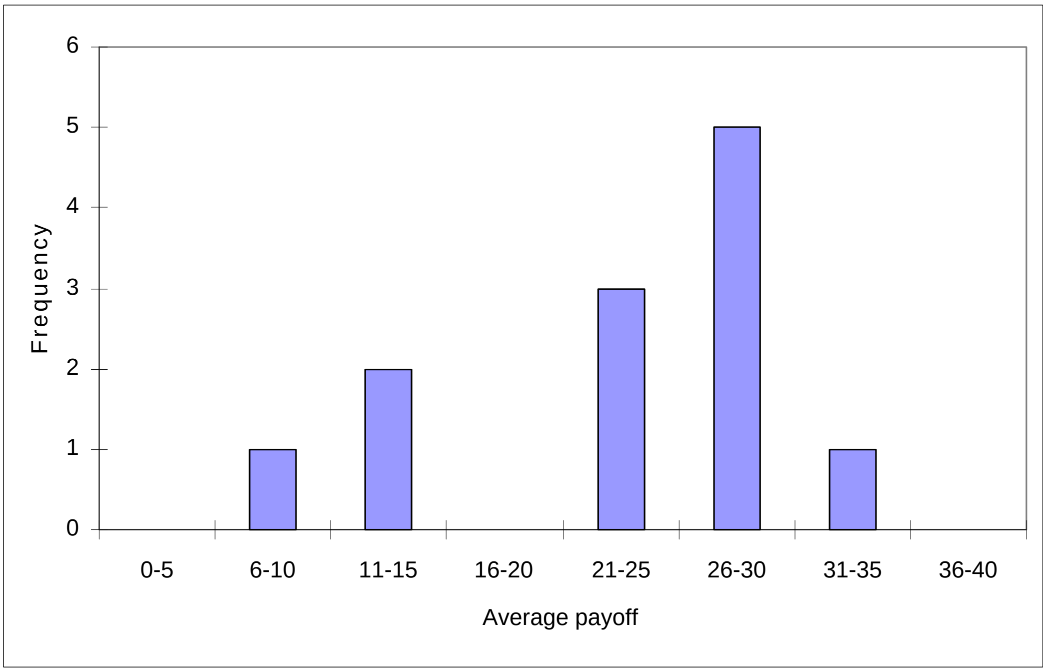

Figure 3b: Histogram of the average payoff per individual in P-fix. Second players

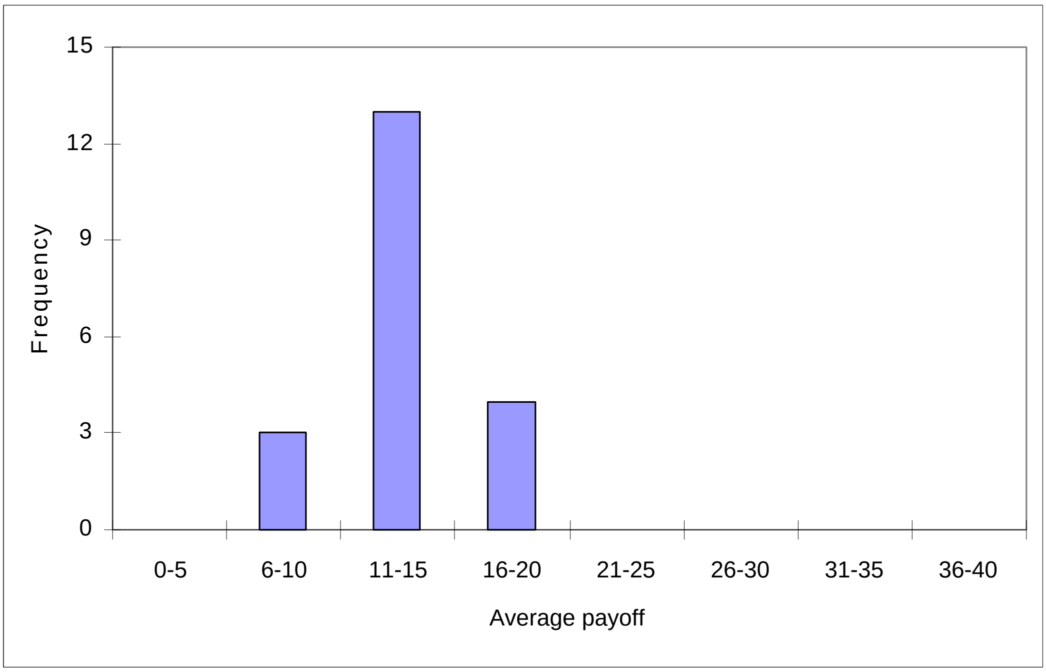

Figure 3c: Histogram of the average payoff per individual in S-fix. First players

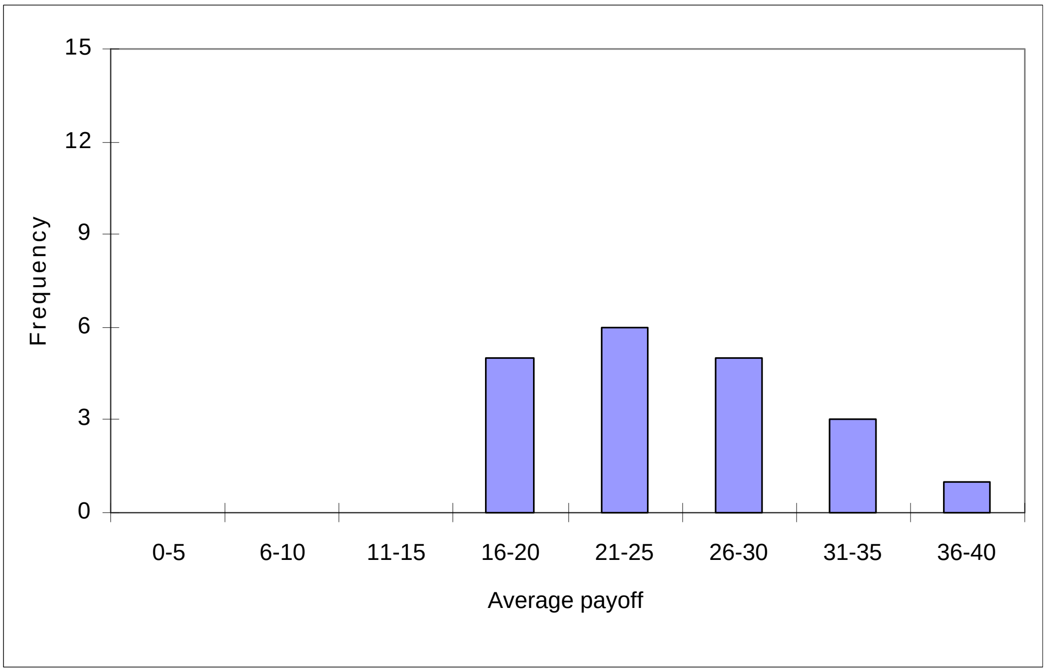

Figure 3d: Histogram of the average payoff per individual in S-fix. Second players