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Gift exchange and reciprocity in competitive experimental markets[1,2]

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Abstract

One of the outstanding results of three decades of laboratory market research is that under rather weak conditions prices and quantities in competitive experimental markets converge to the competitive equilibrium. Yet, the design of these experiments ruled out gift exchange or reciprocity motives, that is, subjects could not reciprocate for a gift. This paper reports the results of experiments which do not rule out reciprocal interactions between buyers and sellers. Sellers have the opportunity to choose quality levels which are above the levels enforceable by buyers. In principle they can, therefore, reward buyers who offer them high prices. Yet, such reciprocating behaviour lowers sellers' monetary payoff and is, hence, not subgame perfect. The data reveal that many sellers behave reciprocally. This generates a positive relation between prices and quality at the aggregate level which is anticipated by the buyers. As a result, buyers are willing to pay prices

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[2] The instructions and the data set are included in Appendix A and Tables 5–8.

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which are substantially above sellers' reservation prices. These results indicate that reciprocity motives may indeed be capable of driving a competitive experimental market permanently away from the competitive outcome. The data, therefore, support the gift exchange approach to the explanation of involuntary unemployment.

JEL classification: J41; J64; C91; C92

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1. Introduction

Most economic models are based on the assumption of rational and selfish agents. In these models it is ruled out that fairness motives can affect behaviour. During the last decade many researchers have, however, provided evidence which indicates that the behaviour of economic agents may well be affected by considerations of fairness (e.g. Kahneman et al., 1986). The most convincing evidence for the behavioural importance of fairness is provided by the results of simple one-shot ultimatum games (Güth et al., 1982; Ochs and Roth, 1989; for surveys see Güth and Tietz, 1990 and Roth, 1995). In an ultimatum game a proposer has to propose a division of a fixed bargaining cake. The responder can accept or reject the proposed division. In case of rejection both players get nothing while if the responder accepts each player receives the proposed shares. For this bargaining game the standard game theoretic model predicts that proposers demand the whole bargaining cake while responders are willing to accept any positive share of the cake. Yet, responders usually reject positive offers which they consider as being too low. Most proposers seem to anticipate responders' behaviour and offer them approximately 40% of the available amount of money. This outcome is at odds with a model of rational and purely selfish behaviour but it can easily be explained in terms of fairness: Since responders are willing to reject unfair shares proposers, in general, offer them almost half of the available cake.

In principle, considerations of fairness might also affect the outcome of competitive markets. At the theoretical level many authors have claimed that fairness is also likely to affect market outcomes (e.g. Okun, 1981; Akerlof, 1982; Akerlof and Yellen, 1990; Fehr and Kirchsteiger, 1994). At the empirical level, however, there does not seem to exist the kind of rigorous evidence that is available in the case of bargaining games. Quite the contrary. The results of competitive experimental markets show that the competitive equilibrium outcome is usually reached within a few periods (Smith, 1982; Davis and Holt, 1993). Even if the equilibrium is very unfair by almost any conceivable definition of fairness, that is, if the whole market income is reaped by only one side (buyers or sellers) of the market, one can observe convergence to the competitive equilibrium (Smith, 1976; Cason and Williams, 1990; Roth et al., 1991; Kachelmeier and Shehata, 1992).

In the above mentioned competitive experimental markets subjects trade a well defined experimental good in the sense that buyers (sellers) know with certainty the monetary value (cost) of the good. In particular, the quality of the good is unambiguously determined before a pair of traders concludes a contract because the 'delivery' of the quality is exogenously enforced by the experimenter. This paper reports the results of experiments which deviate in one important respect from the complete contracts design: The quality of the good is no longer exogenously enforced. Instead, buyers have to make price offers in a one-sided oral auction without knowing the quality they will receive from those sellers who accept their price offer. After a seller has accepted an offer he has to determine the quality of the good. Since our design rules out that a trader can build up a reputation and since sellers' costs are positively related to the quality delivered, money maximizing sellers will always choose the minimum quality, denoted by q_0. Rational buyers will of course anticipate sellers' behaviour and, therefore, the market should operate as if only q_0 were enforceable. This means that a competitive experimental market with rational money maximizing agents should be expected to converge to the competitive equilibrium that corresponds to the quality level q_0.

The parameters of our experiments are chosen such that at this competitive equilibrium the whole market income is reaped by the buyers. Therefore, the competitive price coincides with the sellers' (exogenously specified) reservation price. On the basis of the results of previously conducted experiments (Fehr et al., 1993) (hereafter FKR, 1993) we hypothesized that sellers would be willing to respond to the payment of prices above their reservation level with quality choices above q_0. If this kind of reciprocation is sufficiently strong it is in the buyers' monetary interest to pay more than the reservation price. Because of the sellers' opportunity to reciprocate for a generous price offer we called this experiment the reciprocity treatment (henceforth RT).

The experimental data confirm that sellers' quality choices vary positively with the price paid. Moreover, sellers' reciprocal responses were strong enough to render a high price policy profitable for the buyers. As a result, buyers offered prices which were more than twice as high as the sellers' reservation price. To check whether it is indeed sellers' reciprocal behaviour that induces buyers to offer high prices we implemented a control treatment (henceforth CT) in which sellers could not reciprocate because the quality q of the good was exogenously fixed. It turns out that the same buyers who pay rather high prices when sellers have an opportunity to reciprocate try to relentlessly push down prices to sellers' reservation levels when q is exogenously fixed.

These results challenge models which rely exclusively on rational and selfish agents. We show, however, that sellers' reciprocal behaviour need not be considered as irrational if one allows for interdependent preferences. If sellers value buyers' monetary payoffs positively reciprocation can be perfectly rational. It is then possible to interpret the results of our reciprocity experiments as a noncooperative equilibrium of rational agents that entails a noncompetitive outcome.

Our design can be framed in labour market terms: Buyers are firms who make wage offers to the workers (sellers). After accepting an offer the worker has to determine his effort level. Due to incomplete supervision and verification technologies firms may be unable to enforce an effort (quality) level q_0. Since in our design buyers (firms) are price (wage) setters, and since the motivation problem is particularly important in employment relations, a labour market interpretation seems to be quite natural. When viewed from the labour market perspective our results provide support for equilibrium theories of involuntary unemployment that are based on the notion of fairness (Akerlof, 1982; Akerlof and Yellen, 1990).

The remainder of the paper is organized as follows: In the next section we present the basic design of our experiments. In Section 3 we discuss the predictions under the assumption that all subjects are selfish money maximizers whereas in Section 4 we determine the quality choices and reservation prices of sellers who have interdependent preferences. Section 5 presents the details of the experimental procedures and Section 6 documents the empirical regularities. Section 7 summarizes the results and discusses them in the light of competing interpretations.

2. A market with reciprocation opportunities

Consider a market with L sellers and N buyers with $L > N$. Each seller can sell at most one unit of the good traded. Likewise, each buyer can buy at most one unit. The costs of providing one unit of the good with quality $q \in [q_0, q^0]$, $0 < q_0 < q^0$, are given by

$$f + c(q), \qquad f > 0, \qquad c(q_0) = 0, \qquad c' > 0, \qquad c'' > 0$$

for each seller where c' and c'' denote derivatives. q_0 (q^0) is the exogenously given minimum (maximum) quality of the good while f represents a positive constant. Each seller's monetary payoff from a trade is defined by

$$S = p - f - c(q), \tag{1}$$

where p denotes the price at which the good is traded. Each buyer's monetary payoff is given by

$$B = (y - p)q, \tag{2}$$

where y is an exogenously given constant and $y > f$.

The RT consists of two stages. At the first stage buyers are allowed to propose prices in a one-sided oral auction. The essential feature of such an auction is that sellers can make no counteroffers. Buyers have, however, no opportunity to make bids to specific sellers because every seller can accept every bid. Price bids have to be in the interval $[f, y]$. According to Eq. (2) buyers can, therefore, make no losses[5].

If a seller accepts a price bid p, a binding contract is concluded and stage one is completed for both the seller and the buyer. If a buyer's bid is not accepted she is free to change her bid, but the new bid has to be higher than the previous highest bid (possibly by another buyer) which has not yet been accepted[6]. The first stage ends if either all sellers have accepted an offer or if a prespecified amount of time has elapsed. The monetary payoffs of buyers and sellers who do not trade are zero. At the second stage those sellers who have accepted a bid have to choose a level of q from the set $[q_0, q^0]$ of feasible quality levels. Notice that buyers can neither stipulate a quality level nor are there any sanctions associated with the choice of q[7].

The difference between the RT and the CT concerns only the second stage; in the CT there is no second stage because the experimenter ensures that all goods are traded at an exogenously specified quality level of $q = 1$. The total cost of providing one unit of this good is f_C while the monetary value of such a good for the buyers is given by y_C. If p_C denotes the price at which the good is traded in the CT, the monetary payoffs are given by

$$S_C = p_C - f_C \tag{3}$$

for the seller, and by

$$B_C = y_C - p_C \tag{4}$$

for the buyer.

3. Predictions

What are the properties of the competitive equilibrium in the RT if it is common knowledge that all subjects are selfish money maximizers? For any given price a money maximizing seller will choose $q = q_0$ because $c(q)$ is strictly increasing in q. Rational buyers will of course anticipate that only q_0 is enforceable and that f represents each seller's reservation price. Due to the excess supply

[5] The main reason why we wanted to rule out losses was that, due to loss aversion, the behaviour of experimental subjects may change considerably under conditions of potential losses (see Kahneman and Tversky, 1992). Since our experiments aimed at isolating the impact of reciprocal behaviour on the outcome of competitive experimental markets we did not want our data to be polluted with loss aversion phenomena. It is a common requirement in experimental markets to forbid that buyers (sellers) trade at prices above (below) their redemption value y (cost f). In Fehr and Gächter (1997) a design with losses is examined.

[6] This bidding rule is sometimes called 'improvement rule'. The improvement rule is usually applied in experimental markets. Notice that it does not prevent underbidding. If a subject wants to make a lower bid than the highest 'going' bid p' she has to wait until p' is accepted. After that she can bid a price below p'.

[7] In Fehr et al. (1996) we implement a design which allows buyers to offer contracts that stipulate a desired q-level. In case that sellers do not deliver the desired q-level they are fined with a certain probability.

of sellers ($L > N$) buyers will have no reason to offer more than f. Hence, the competitive equilibrium is characterized by N trades at $p = f$ and $q = q_0$. In the market with complete contracts a similar reasoning shows that the competitive equilibrium with money maximizing agents exhibits N trades at a price of $p_C = f_C$.

Plott and Smith (1978) and Walker and Williams (1988) have conducted several one-sided oral auctions with a complete contracts design. Their results convincingly show that these markets converge to the competitive equilibrium. Yet, since contracts in these experimental markets were complete there were no possibilities for reciprocation.

We know of only one series of experiments in which reciprocal behaviour, as described in Section 1, permanently survived in *competitive* experimental markets (FKR, 1993). In these experiments q was positively related to p and the market price did not converge towards f. Even after twelve trading periods the observed average price was significantly above f. The design of FKR is similar to our RT. The fact that p does not converge towards f in this design can be interpreted in several ways: (i) It may be due to buyers' altruism or buyers' attempts to obey some equity norm. (ii) It may be caused by sellers' willingness to reject prices that are close to f. If buyers anticipate sellers' willingness to reject low offers it is in their interest to offer prices that are sufficiently above f. (iii) Prices above f may also be caused by the apparent willingness of many sellers to choose a high q in response to a high p. If there is a sufficiently steep positive relation between p and q it is in the pecuniary interest of buyers to offer high prices.

On the basis of the evidence from the RT alone it is not possible to discriminate between these explanations. The main purpose of the experiments we report in this paper is to discriminate between explanations (i) and (ii) on the one hand and explanation (iii) on the other hand. We are, thus, interested in the question whether sellers' reciprocal behaviour exerts an independent impact on price formation. In the next section we show that we can answer this question by comparing sellers' share of the surplus in the RT, s, with their shares s_C in the CT[8]. In the CT explanation (iii) cannot be applied because sellers cannot reciprocate. Therefore, $s > s_C$ indicates that the opportunity to reciprocate has an additional impact on price formation in the RT.

Notice that the answer to our question has important implications for the interpretation of a high-price outcome in the RT. If high prices are due to explanation (ii) one may argue that the outcome in the RT represents a competitive equilibrium. In this equilibrium p is above f because sellers' reservation price p^r is above f. If, however, sellers' reciprocal behaviour has an additional impact on price formation actual prices in the RT represent a noncompetitive outcome because they are above p^r. In our view the fact that a noncompetitive outcome can persist in a competitive trading institution constitutes a rather remarkable result.

[8] Readers who are not interested in the details of this argument can skip Section 4.

4. Quality choice and reservation prices with interdependent preferences

Sellers who choose $q > q_0$ in case of generous price offers do not act like money maximizers. A natural interpretation of their behaviour is that they *prefer* to choose $q > q_0$, that is, that they show a concern for their buyer's monetary payoff if they receive a 'gift'. In this section we show that a reciprocal outcome in the RT can be caused by interdependent preferences. In addition, we present a method that allows us to judge whether actual prices in the RT are above sellers' (unobservable) reservation prices.

To allow for reciprocal behaviour we assume that sellers' preferences are given by

$$u = u(S, B) \quad u_S > 0, \tag{5}$$

where $u_S = \partial u/\partial S$ and B is the monetary payoff of the buyer *with whom the seller is matched*. If $\partial u/\partial B = u_B < 0$ ($u_B > 0$) for all feasible (S, B)-combinations we call a seller envious (altruistic). If $u_B = 0$ he is called selfish. It is obvious that a selfish or envious seller will never choose $q > q_0$ because nonminimum quality choices decrease S and increase B. Reciprocity means that a seller chooses 'low' quality levels if p is 'low' while if p is 'high' he chooses a 'high' q. Therefore, it may well be that a seller who behaves reciprocally exhibits locally selfish or envious preferences ($u_B \leq 0$) if p and, hence, S is 'low', that is, he responds to a 'low' price with $q = q_0$. Yet, if the price is sufficiently high he becomes locally altruistic and chooses $q > q_0$.

4.1. Implications of profitable price increases

Reciprocal sellers behave as if they value B positively at some combinations of S and B. Suppose that a seller responds to a price increase by a quality increase which is sufficient to generate an overall rise in B. Does the observation of such profitable price increases allow us to characterize the sellers' preferences in more detail? Or more specifically: Does this seller value B as a normal or as an inferior 'good'?

In order to answer this question it is useful to look more closely at the set of return combinations that can be attained for different values of p and q. Using Eq. (2) to substitute $q = B/(y - p)$ out of Eq. (1) yields

$$S = p - f - c[B/(y - p)]. \tag{6}$$

Our assumptions about $c(.)$ ensure that S is a decreasing and strictly concave function of B for $B > 0$ and $p < y$. For any given p a rational seller chooses q to maximize Eq. (5) subject to Eq. (6). Any choice of $q = B/(y - p)$ determines a particular (S, B)-combination according to Eq. (6). Thus, by choosing q the seller is effectively choosing a particular (S, B)-combination on the constraint Eq. (6). The optimal choice of S and B (or q, respectively) can, therefore, be represented as a tangency point between a seller's indifference curves and the graph of the constraint Eq. (6)[9].

A rise in p has two effects. It shifts the constraint Eq. (6) upwards in S–B-space. This gives rise to an income effect. Yet, it also renders the constraint steeper, that is, the good B becomes more expensive. This causes a substitution effect. Hence, if B is a neutral good (neither normal nor nonnormal) a rise in p will generate a decrease in B. Only if B is a normal good, a rise in p can generate an overall increase in B. Therefore, if we observe in our experiments that sellers responses to a price increase generate B-increases sellers behave as if B is a normal good.

4.2. Reservation prices

One of our main questions is whether sellers' reciprocal behaviour induces buyers to offer prices above sellers' reservation price p^r. p^r is defined as the lowest price in the feasible interval $[f, y]$ for which the seller, if he accepts this price, is not worse off compared to a rejection. Therefore, prices above p^r make a seller strictly better off compared to a non trade. This means that if trading sellers receive prices above the reservation price of non trading sellers, the latter are involuntarily rationed.

It is obvious that the p^r of *selfish* sellers coincides with f. Globally altruistic sellers are even willing to accept prices below f[10]. Only for those sellers who have (locally) *envious* preferences $p^r > f$ can occur. To see this, suppose that an envious seller gets an offer $p = f$. His monetary payoff from this offer is zero while his partner receives $B = (y - f)q_0$. Because he values B negatively he strictly prefers the monetary payoff combination $[0, 0]$, which follows from a rejection, over the combination $[0, (y - f)q_0]$. Therefore, to render him indifferent between acceptance and rejection he must be offered more than f.

The potential existence of envious subjects represents a major problem. Since it is impossible to observe subjects' preferences directly, we do not know the reservation prices of envious subjects. Therefore, observing prices above f is not in itself sufficient evidence for non competitive prices, i.e. for $p > p^r$.

Recent empirical research by Loewenstein et al. (1989) as well as the stylised facts which emerged from ultimatum game experiments also indicate that the existence of locally envious subjects is not just a theoretical possibility. The research results of Loewenstein et al. show that disadvantageous inequality, in general, causes a large utility loss. Since low prices imply a considerable amount

[9] This statement is, of course, only true if preferences are convex. In a former version of this paper we show that all relevant conclusions can also be drawn without the convexity assumption.

[10] Let $q(p)$ denote the utility maximizing quality choice while $u(0, 0)$ represents the seller's utility if he does not trade. If an altruistic seller accepts a price $p = f$ his utility is $u = u[-c(q(f)), (y - f)q(f)] \geq u[-c(q_0), (y - f)q_0] > u(0, 0)$. The first inequality holds because any seller (weakly) prefers $q(f)$ over q_0. The second inequality follows because $c(q_0) = 0$ and $u_B > 0$. Since f is a lower bound for p we set the p^r of altruistic sellers equal to f (for convenience).

of disadvantageous inequality for the seller, it may well be that sellers *prefer* to reject such offers. There is also ample evidence that in ultimatum games the responders reject low offers, although they would earn more money if they accepted these offers. This indicates that responders' reservation prices are higher than the reservation prices of selfish money maximizers which can be interpreted in terms of (our definition of) envy: responders are willing to give up money in order to reduce the income of the proposers (see Bolton (1991) and Kirchsteiger (1994)).

To tackle the problem which arises if $p^r > f$ we have developed a simple method which allows us to infer upper bounds for sellers' reservation prices in the RT from the prices they have accepted in the CT. Let us define the seller's share of the (potential) surplus $(y - f)$ in the RT by $s = (p - f)/(y - f)$; $s_C = (p_C - f_C)/(y_C - f_C)$; denotes the share in the CT. Analogously, we define the reservation shares by $s = (p^r - f)/(y - f)$; and $s_c^r = (p_c^r - f_c)/(y_c - f_c)$ where p_c^r denotes the reservation price in the CT. Our objective is to show that if the parameters of the RT and the CT meet the condition $y - f > y_C - f_C > (y - f)q_0$, for all types of sellers s_c^r will be larger than or equal to s^r. Using the definitions of s and s_C we can express the utility of an envious[11] seller as

$$u = u(S, B) = u[s(y - f), (1 - s)(y - f)q_0],$$

while in the CT his utility is given by

$$u = u(S_C, B_C) = u[s_C(y_C - f_C), (1 - s_C)(y_C - f_C)].$$

Suppose now that $s = s_C$. Since $y - f > y_C - f_C$ we have $S > S_C$. In addition, because $y_C - f_C > (y - f)q_0$ the inequality $B_C > B$ holds. Thus if an envious seller receives the same share in the RT and the CT he will be strictly better off in the RT. As a consequence, an envious seller is strictly willing to trade if he receives a share s_c^r in the RT, that is $s_c^r > s^r$.

What is the significance of $s_c^r \geq s^r$? If a seller accepts a certain share s_c in the CT, we have, of course, $s_c \geq s_c^r$. Together with $s_c^r \geq s^r$ we have, therefore, $s_c \geq s^r$. It follows that a seller who accepted a certain share s_c in the CT will be strictly better off for all $s > s_c$ in the RT. Thus, if he cannot trade in the RT whereas other sellers trade at $s > s_c$, he is involuntarily rationed.

5. Experimental procedures

In total we organized four experimental sessions[12]. In each session subjects participated in an RT as well as in a CT. There was an excess supply of sellers in all sessions. In S1 and S2 we had 9 sellers and 6 buyers, in S3 there were 10 sellers

[11] We restrict the argument to a seller who is (locally) envious because for all other types we have $p^r = f$ and hence their reservation share in the RT is below their reservation share in the CT.

[12] Session 1 (S1) was conducted at 18 November 1991, session 2 (S2) at 22 November 1991, session 3 (S3) at 16 January 1992 and session 4 (S4) at 17 January 1992.

and 7 buyers, in S4 we had 12 sellers and 8 buyers[13]. In Section 2 we described the features of one trading day of an RT and a CT, respectively. As it is common practice in experimental economics, we allowed subjects to learn by repeating these trading days. Each session consisted of 16 trading days ('periods') and at least one trial period to allow the participants to become acquainted with the trading institution; these 16 periods were divided into two subsessions of 8 periods. In S1 and S3 we conducted the CT during the first 8 periods; in period 9–16 the RT took place. To control for spillovers between markets we changed the order in S2 and S4[14].

In S1, S2 and S3 the prespecified time for the one-sided oral auction was 3 minutes. In S4 it was 4 minutes because of the larger number of participants. After three (four) minutes the market was closed and those parties which did not succeed in trading earned zero profits in this period. In the CT a trading day was over when the market was closed while in the RT the second stage of the trading day began. At this stage, sellers had to choose their quality *anonymously*, i.e. their choice was only revealed to 'their' buyer. Moreover, their choice was completely unconstrained in the sense that there were no sanctions associated with it.

Before the beginning of a session each subject had to draw a card. If there was an 'S' on the card he was a seller, if a 'B', she was a buyer. Sellers and buyers were located in different rooms. During the experiment communication took place by means of a telephone. Four supervisors were engaged in each session, two in the buyers' room, two in the sellers' room. In each room, one supervisor transmitted the price (acceptance) and quality message over the telephone.

While price messages were public knowledge, the information about quality choices was coded. It was known only to the two parties involved. In addition, buyers and sellers did not know the identity of their trading partners. These information restrictions were chosen to exclude group pressure effects on quality choice and to reduce strategic spillovers between periods as much as possible. Since the traders did not know the identities of their partners it was impossible for buyers (sellers) to reward the past action of a *specific* seller (buyer). Moreover, we wanted to rule out the possibility of hidden side payments between parties after the experiment.

The monetary returns for those subjects who traded in the RT were given by the return functions Eqs. (1) and (2). The returns of trading subjects in the CT

[13] All experimental subjects were volunteers. They were students of the University of Technology in Vienna and had no knowledge of experimental economics. They were not students of ours and most of them had never attended a course in economics. They were recruited with the promise that, dependent on their decisions, they could earn a considerable amount of money.

[14] The subjects of a session did not know that we planned to conduct two different market experiments. At the beginning of each session they were informed that the experiment consisted of 8 periods. After 8 periods we told them that another market experiment would take place which would also take 8 rounds. This arrangement ensures that behaviour in the first treatment is not affected by the fact that there is a second treatment in a session.

Table 1
Quality cost schedule

q	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
$c(q)$	0	1	2	4	6	8	10	12	15	18

were determined according to Eqs. (3) and (4). For the RT the parameters were as follows: $y = 126, f = 30, q \in [0.1, 1]$. The $c(q)$-schedule was given by Table 1.

This cost schedule is a discrete approximation of the function $c(q) = (10q - 1)^{1.3}$, which exhibits the properties assumed in Section 2. For the CT we chose $y_c = 246$, $f_c = 210$. In all four sessions we paid a commission fee of 4 Austrian schillings (4 AS$\cong$40 US-cents) to the sellers to overcome the marginal unit problem which would arise if $p = f = 30$. In S1 and S2 buyers' price offers had to be multiples of five. In S3 and S4 prices had to be multiples of 1. The reason for this change was that if prices have to be multiples of 5 it may be more difficult for buyers to enforce the market clearing price because sellers may not accept a price of 30 whereas a price of 32, for example, is acceptable for them[15].

All parameters were common knowledge. This enabled subjects to compute the returns of their trading partners. Before the beginning of the experiments subjects had to solve several exercises which involved the computation of their own returns and the returns of a hypothetical trading partner. The experiment did not start until all subjects had solved these problems correctly.

6. Experimental results

The total number of possible trades in both the CT and the RT was 216. In the CT 211 trades were conducted; in the RT 213 trades took place. On average one experimental session (8 periods CT plus 8 periods RT) lasted for 3 h and subjects earned on average AS 325 (approximately US$33). In the CT the lowest possible price of $f_C = 210$ was observed in 53 cases; the highest observed price was 229. The average price in the CT-experiments was 215 and sellers' average share was 0.14. In the RT-experiments trade at the lowest possible price of 30 was conducted in only 4 cases; the highest price offer was 110 (1 case). The average price in all RT-experiments was 74 and sellers' average share was 0.46. These data already indicate that sellers received a considerably larger part of the surplus $(y - f)$ in the RT than of the surplus $(y_c - f_c)$ in the CT.

One of our objectives concerns the occurrence of reciprocal behaviour. Does the majority of sellers behave reciprocally? Do those who behave reciprocally dominate the aggregate price–quality relationship? The answer is given by

[15] In S1 and S2 we paid the commission fee 'indirectly' by imposing costs of 26 AS in the RT (206 AS in the CT) if the seller delivered the good at minimum quality. Since prices had to be multiples of 5 the lowest price which could be offered was 30 (210) which yields an implicit commission fee of 4 AS in S3 and S4 the commission fee of 4 AS was paid explicitly and costs were 30 in the RT (210 in the CT).

Result 1: At the individual level reciprocal behaviour is the dominant behavioural pattern. Moreover, the aggregate relationship between prices and quality levels is positive.

To provide evidence for Result 1 we computed the Spearman rank correlation[16] between p and q, $\rho(p, q)$, for each seller. In total we had 40 sellers in all sessions. For 28 of these ρ is above 0.25 (see Table 2). Nine sellers exhibit no correlation or one that is close to zero. These sellers may but need not be classified as purely selfish types because our data only show sellers' responses to some wages but not to the whole range of wages[17]. Three sellers exhibit a negative relation between p and q.

For those sellers who traded less than 5 times it is (by the definition of ρ) impossible that the Spearman coefficient reaches significance levels below 10%. Unfortunately, 12 out of the above 28 sellers with a positive ρ traded less than five times. From the remaining 16 sellers twelve reach a significance level of five percent and one seller reaches 10% significance. When judging these results one should keep in mind that the ρ is an extremely conservative measure of reciprocity[18]. Despite this conservatism 13 sellers exhibit a significantly positive correlation between quality and prices.

The behaviour of sellers in the RT also gives rise to a positive aggregate relation between quality and prices. This is shown in Fig. 1 which depicts the relation between prices and average (median) quality. The number over each bar in Fig. 1 indicates the number of observations in each price interval. It is obvious that p and q are positively correlated. For all 10 prices in the interval $30 \leq p < 40$, all of which have been accepted by different sellers, $q = 0.1$ was chosen. There were 22 offers in the interval $40 \leq p < 50$ which were accepted by 16 different subjects. In 16 out of these 22 cases sellers chose 0.1; in 4 cases 0.2. The average quality was 0.145. These data indicate that those sellers who received low offers did not make gifts to the buyer, that is, they were not globally altruistic.

Notice that our data about sellers' quality choices are two-sided censored. If a seller would have preferred to choose a quality level below 0.1, he could only choose 0.1 whereas if he would have preferred to choose a quality above 1, he had no other choice than 1. Hence, to investigate whether the positive relation between q and p is significant we ran a two-sided censored Tobit regression of

[16] For a description of the Spearman rank correlation see Siegel and Castellan (1988).

[17] For example, one seller traded only two times. He got $p = 46$ two times and he chose $q = 0.1$ two times as well. Maybe, for $p > 60$ he would have chosen 0.5 which would have rendered his behaviour reciprocal. Moreover, three sellers with a $0 \leq \rho < 0.25$ always chose $q > 0.1$. There was, for example, one seller who was able to catch only two offers: $p = 92$ and $p = 100$. He chose $q = 0.5$ two times but perhaps he would have chosen a lower q at a lower p.

[18] For example, one of the three sellers who had no significantly positive correlation received wages of 80, 85, 90, 95 to which he responded with 0.5, 0.7, 0.8, 0.8. Although this behaviour looks rather reciprocal the Spearman rank correlation is *not* significantly positive at the ten percent level in this case.

Table 2
Spearman rank correlations for individual sellers

	Seller No.									
	1	2	3	4	5	6	7	8	9	10
N	7	8	3	3	8	2	5	8	4	6
$\rho(p, q)$	0.72**	−0.42	1.0[a]	0.87[a]	0.76**	1.0[a]	0.98**	0.96**	0.95[a]	0.86**
	Seller No.									
	11	12	13	14	15	16	17	18	19	20
N	5	3	7	5	4	4	6	7	8	8
$\rho(p, q)$	0.34	0.88[a]	0.99**	0.03	1.0[a]	0.00[a]	0.99**	0.14	0.87**	0.00
	Seller No.									
	21	22	23	24	25	26	27	28	29	30
N	2	4	6	8	2	8	6	2	8	8
$\rho(p, q)$	0.00[a]	−0.26[a]	0.02	0.92**	1.0[a]	0.00	0.65*	1.0[a]	0.00	0.92**
	Seller No.									
	31	32	33	34	35	36	37	38	39	40
N	3	8	4	2	5	5	8	8	4	3
$\rho(p, q)$	1.0[a]	0.29	0.99[a]	0.00[a]	0.97**	0.97**	−0.65	0.53	1.0[a]	1.0[a]

N = Number of observations.
$\rho(p, q)$ = Spearman rank correlation.
**Significant at the five percent level.
*Significant at the ten percent level.
[a]Lack of data ($N < 5$) rules out significance below 10%.

the quality level on $(p - f)$. The specification for our Tobit regression is given by

$$q_i - 0.1 = \left\{ \begin{array}{ll} 0.9 & \text{if RHS} \geq 0.9 \\ \alpha + \beta(p_i - f) + \mu_i & \text{if } 0 < \text{RHS} < 0.9 \\ 0 & \text{if RHS} \leq 0 \end{array} \right\}, \tag{7}$$

with RHS $\equiv \alpha + \beta(p_i - f) + \mu_i$. The error term is normally distributed with zero mean and constant variance[19]. If the slope of this equation turns out to be significantly positive, q is an increasing function of p. If, in addition, the intercept is significantly negative or if we cannot reject the hypothesis that it is zero we have an indication that sellers are not globally altruistic. A nonpositive α together

[19] We also ran Tobit regressions which allowed for a variable variance of μ across prices and across periods. If we regress with the data of single sessions neither price levels nor periods affect the variance significantly. If we pool the data of all sessions the variance increases significantly with p. More importantly, however, for each session the sign, the size and the significance of α and β is rather similar compared to specification Eq. (7).

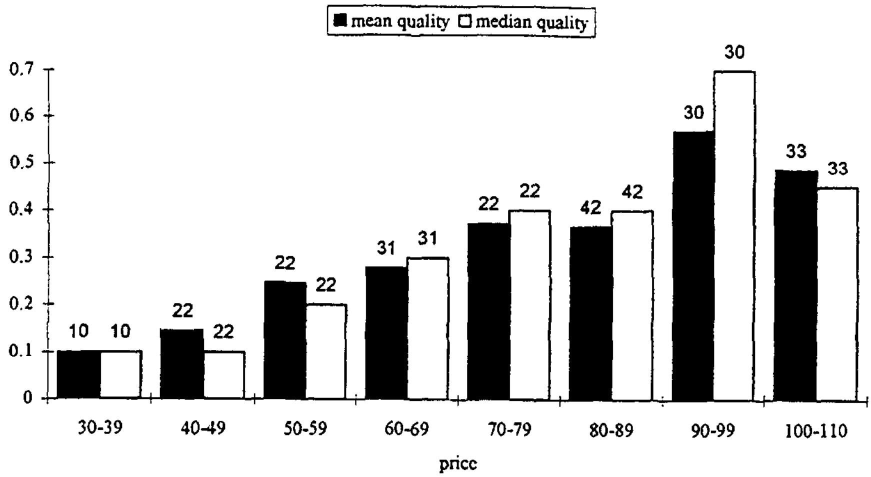

Fig. 1. The price–quality relation.

with a positive β thus means that, on average, sellers exhibit envious or selfish preferences for low prices while for high prices they have altruistic preferences.

Since Tobit regressions rely on a specific functional relation between q and p we have also computed the (nonparametric) Spearman rank correlation for the aggregate data of each session. In Table 3 the results of our Tobit regressions and the Spearman coefficients are presented. For each session as well as for the data of all sessions $\rho(p, q)$ is positive and significant below the one percent level. In all Tobit regressions α is negative. In the regression for S1, S2 and S3 α is significant at the 1% level while in S4 we cannot reject the hypothesis that $\alpha = 0$. This indicates that sellers were, on average, not globally altruistic. Low wages triggered low quality levels. For all Tobit regressions the slope is positive and highly significant. We also ran OLS and Tobit regressions with and without dummies for individual sellers. Again all β-coefficients were positive and highly significant. In addition, the inclusion of dummies increased the adjusted R^2 in the OLS regressions considerably. In the regressions without dummies the adjusted R^2 is between 0.21 and 0.47; with dummies the regressions explain between 49% and 69% of the variation in q. This increase in the adjusted R^2 confirms the presence of individual differences[20]. Taken together the results of Table 3 provide fairly strong evidence that, on average, q is an increasing function of p.

Due to the anonymity of the trading partners it was impossible for subjects to reward the past action of a specific subject. A buyer could, for example, not

[20] The existence of individual differences is also suggested by other tests. For example, the hypothesis that individual dummies are equal to the constant α in Table 3 is clearly rejected by the data.

Table 3
Relation between quality and prices

	N	α	β	$\rho(p, q)$
S1–S4	213	− 0.2233*	0.0087**	0.43**
S1	48	− 0.4844*	0.0152**	0.60**
S2	47	− 0.1566*	0.0102**	0.69**
S3	54	− 0.8916*	0.0147**	0.52**
S4	64	− 0.2017	0.0110**	0.49**

N = number of observations.
$\rho(p, q)$ = Spearman rank correlation.
**Significant at the one percent level.
*Significant at the five percent level.

reward a high q in period t by a high wage offer in period $t + 1$ because she did not know the seller's identity in period t nor could she address her offer in $t + 1$ to any specific seller. Nonetheless, in case that buyers' — for whatever reason — respond to high quality in t with high wage offers in $t + 1$ sellers' quality choices could be interpreted as an investment in *group* reputation. A seller who chooses high quality levels would then provide a public good because he induces buyers to make generous offers to the group of sellers. This behaviour is, of course, also incompatible with conventional theory because it requires non selfish cooperation among sellers. Yet, since we know from numerous public goods experiments (Ledyard, 1995) that there is significantly less free-riding than predicted by conventional theory this possibility should be taken into account.

The fact that sellers respond reciprocally to the *current* price is evidence against the group reputation hypothesis. Suppose, for a moment, that buyers respond positively to last period's quality. Under these conditions sellers should *not* respond reciprocally to the current price if they want to induce high future prices. If they choose low quality levels in response to a low current price they cause low future prices which (in case of reciprocal q-choices) give rise to low future prices, etc. Thus, the desire to induce high future prices by high present quality levels requires *unconditionally* high quality levels. But these are not observed in the data[21].

Next we are interested in the question whether sellers' reciprocal responses rendered, on average, a high price policy individually profitable for the buyers. This question is related to the steepness of the $q(p)$ relationship. According to the buyers' monetary return function a rising $q(p)$-relationship is not sufficient for a rising $B(p)$-relationship. Neither is it sufficient that sellers value B as a normal

[21] To further investigate whether there were strategic spillovers across periods we ran OLS and two-sided censored Tobit regressions of p_t on q_{t-1}. Except for S1 q_{t-1} has no significant impact on p_t. Moreover, the adjusted R^2 of the OLS regression for these sessions is below two percent. These results show that even if sellers would have been motivated by a desire to induce high future prices they would have been unable to do so in S2, S3 and S4. Only in S1 q_{t-1} has a significantly positive impact on p_t. Yet, in S1 the α-coefficient of regression Eq. (7) is also significantly negative, that is, sellers did not choose unconditionally high quality levels.

good. As we have argued in Section 4.1 the substitution effect of a rise in p causes a B-reduction. Only if the income effect of a p-rise is strong enough to overcompensate the negative substitution effect, a higher p will cause a higher B. Result 2 summarizes the evidence on this point:

Result 2: On average, there is a range of prices in the interval $[f, y]$ of the RT over which B rises with p and, hence, sellers behave as if B is a normal good in this interval.

If both, sellers and buyers, are money maximizers and if this is known by the buyers the rational buyer will offer $p = 30$ in the RT because she anticipates that sellers will chose $q = 0.1$. At this outcome sellers earn nothing while buyers reap $(126 - 30) - 0.1 =$ AS 9.6. Fig. 2 shows, however, that sellers' reciprocal actions enabled firms to earn considerably more than AS 9.6. The Figure depicts the relationship between prices and buyers' average profits in S1–S4. As in Fig. 1 the number over each bar denotes the number of observations in each price interval.

Fig. 2 gives a first hint that buyers indeed could increase their average profits by increasing the price above $f = 30$. According to the regression Eq. (7) the expected quality level q^e is given by

$$q^e = \begin{Bmatrix} 1 & \text{if } \mathrm{RHS} \geq 1 \\ 0.1 + \alpha + \beta(p - 30) & \text{if } 0.1 < \mathrm{RHS} < 1 \\ 0.1 & \text{if } \mathrm{RHS} \leq 0.1 \end{Bmatrix},$$

where $\mathrm{RHS} \equiv 0.1 + \alpha + \beta(p - 30)$. Given the above equation for the expected quality level, it follows that q^e exceeds 0.1 if $p > p^0 \equiv 30 - (\alpha/\beta)$. As long as $p^0 < 126$ there exist feasible prices in the RT for which sellers will on average choose

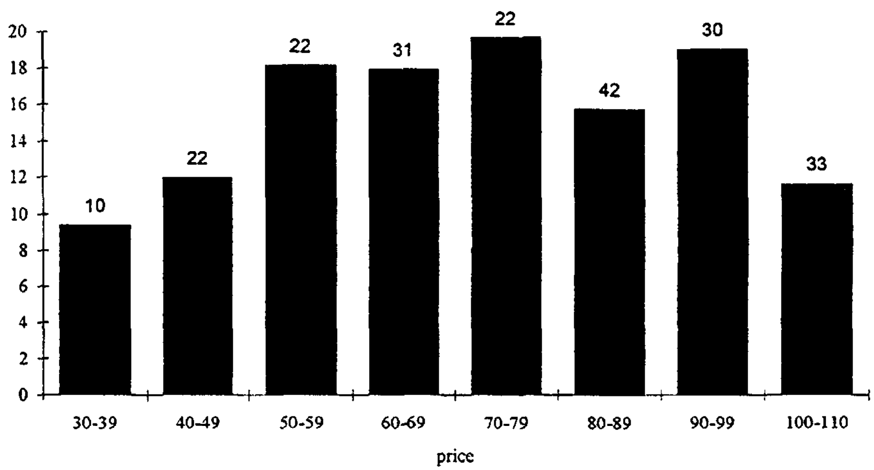

Fig. 2. Relation between price and buyers' profit.

$q > 0.1$. In Table 4 we used the estimates of our Tobit regressions to compute p^0 for each session. As we can see, p^0 varies between 45.4 (S4) and 90.7 (S3), i.e. it is always below 126. For $p \geq p^0$, we can compute the expected monetary return for a buyer, B^e, by inserting q^e into the buyers' return function. This yields

$$B^e = (126 - p)\cdot(0.1 + \alpha + \beta(p - 30)) = (12.6 + 126\alpha - 3780\beta) + (156\beta - 0.1 - \alpha)p - \beta p^2. \quad (8)$$

B^e as given in Eq. (8) is a strictly concave function of p. Differentiating Eq. (8) with respect to p yields

$$\delta B^e/\delta p \equiv B^e_p = (156\beta - 0.1 - \alpha) - 2\beta p. \quad (9)$$

Substituting the results of our Tobit estimates into Eq. (9) and evaluating the resulting expression at p^0 gives us $B^e_p(p^0)$. Table 4 shows the value of $B^e_p(p^0)$ for each session. As we can see, in each session a rise in p at p^0 increases B^e. This, together with the fact that $B^e(p) = 0$ at $p = y = 126$, means that B^e has a maximum somewhere between p^0 and $p = 126$. Moreover, since $B^e(p)$ is strictly concave the price which maximizes B (subject to $p \geq p^0$) is unique. We denote this price by p^*. Table 4 reports p^* and $B^e(p^*)$ for each session. Since in the interval (p^0, p^*) the average behaviour of sellers generates a strictly increasing $B^e(p)$-function, B is, on average, a normal 'good' in this interval.

In general, buyers in the CT may have two reasons to offer positive shares s_c. They may anticipate that sellers are envious, that is, $s^r_c > 0$, and/or they may be altruistic. Buyers in the RT may have the same reasons for shares s above 0. Yet, since $B(p)$ is a rising function of p over some feasible interval buyers in the RT have an additional reason to offer high prices. Therefore, if sellers' reciprocal behaviour is anticipated and affects buyers' price bids it shows in the difference between s and s_c. This leads to

Result 3: The average share per period in the CT, s^a_c, is below the average share per period, s^a, in the RT.

Evidence in favour of R3 is provided by Fig. 3. In all periods of all 4 sessions s^a exceeded s^a_c. In addition, Fig. 3 indicates no tendency for s^a to approach s^a_c. In

Table 4
Based on Tobit regressions of Table 3

	p^0	$B^e_p(p^0)$	p^*	$B^e(p^*)$	B^a
S1	61.9	0.875	90.6	18.95	16.81
S2	45.4	0.723	80.8	20.84	16.34
S3	90.7	0.420	104.9	6.54	8.37
S4	48.3	0.754	82.6	20.70	20.82

p^0 = Price above which sellers chose on average $q > 0.1$. $B^e_p(p^0)$ = Increase in B^e at p^0 if p increases. p^* = Price which maximizes B^e subject to $p \geq p^0$. $B^e(p^*)$ = Buyers expected return in RTs at p^*. B^a = Actual average profit per period in RTs.

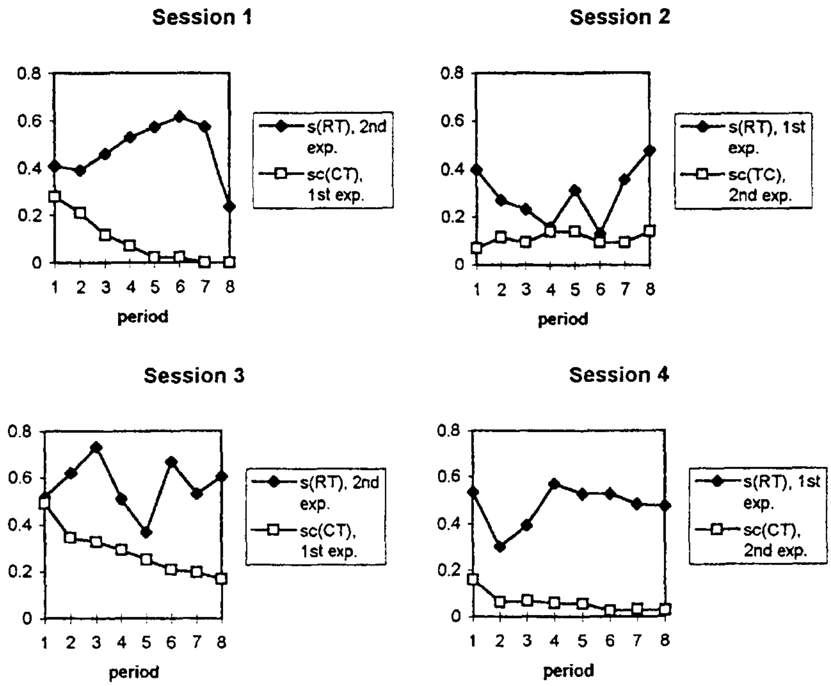

Fig. 3. Average share per period.

all sessions the difference between s^a and s^a_c is larger in the final periods compared to the initial periods of a treatment.

Remember that in Section 4.2. we have shown that for all types of sellers $s^r_c \geq s^r$. If we take, for a given population of sellers, the averages over the reservation shares, which we denote by s^{ra} and s^{ra}_c, $s^{ra}_c \geq s^{ra}$ must hold. Combining this with result 3 yields $s^a > s^a_c \geq s^{ra}_c \geq s^{ra}$. Or in other words: The shares that have been paid to sellers in the RT were, on average, strictly above the sellers' reservation shares. This means that prices in the RT do not correspond to the competitive solution.

Beyond the possibility of examining whether the outcome in the RT deviates from the *competitive solution on average* we may also analyse whether specific sellers who could not trade in a certain period have been rationed involuntarily, that is, whether they would have strictly preferred to trade at the prevailing shares. The lowest share *which was accepted by a certain seller in the CT* gives us an upper bound for his reservation share in the RT. By comparing this upper bound with the prevailing shares of those periods of the RT in which the seller could not trade we can infer whether the RT failed to clear in these periods for this specific seller. If the empirically observed upper bound on s^r is strictly below the prevailing shares the seller was involuntarily rationed.

One difficulty with the above method is that 'the prevailing share' of a period is not a unique concept. Is it the highest, the average, or the lowest observed share? To overcome this problem we allowed for different definitions of the 'prevailing share' in our next result.

Result 4: In *all* cases in which a seller has been rationed in the RT the lowest s_c which has been accepted by that seller in the CT is below the highest and the average share of nonrationed traders in the (period of rationing in the) RT. Moreover, in the *majority* of rationing cases in the RT the rationed sellers would have preferred to trade at the lowest share of nonrationed traders (in the period of rationing).

In all sessions taken together it occurred 107 times that a seller could not trade in the RT. In *all* 107 cases the lowest s_c which was accepted by the non trading sellers in the CT was strictly smaller than (i) the highest and (ii) the average s of those periods of the RT in which the sellers were rationed. Therefore, in all 107 cases these sellers would have been better off at the highest and the average prices of that period. Moreover, in 72 out of 107 cases (67.3%) the rationed sellers accepted an s_c in the CT that was below the lowest share of the period of rationing in the RT. Thus, for a majority of rationing cases the rationed sellers would have been better of even at the lowest share of the period. Recall that in the remaining 35 cases rationing may also have been involuntary (relative to the lowest share in the RT) because the lowest accepted offer in the CT provides only an upper bound for s_c^r. Perhaps rationed sellers would have accepted an s strictly less than this upper bound.

7. Summary and interpretation

The experimental results reported in this paper indicate that the existence of opportunities for reciprocation may significantly alter market outcomes. In our RT sellers persistently behaved reciprocally. They responded to low prices with minimum quality choices whereas if prices were raised they reciprocated by choosing non minimum quality levels. At the individual level reciprocal actions represent the most frequent behavioural pattern. This contributes to a significantly positive relation between prices and quality levels at the aggregate level. Moreover, this relationship was sufficiently strong to render the payment of high prices individually profitable for buyers. The comparison of sellers' shares in the RT with their shares in the CT shows that sellers' reciprocal responses had a systematic impact on prices. In this respect the comparison between the last period of the CT (RT) and the first period of the RT (CT) is most telling. When subjects enter the RT after the CT (S1 and S3) there is a large *increase* in sellers' share in the first period of the RT (see Fig. 3). When they enter the CT after the RT (S2 and S4) sellers' share *decreases* substantially in the first period of the CT. In our view these regularities provide strong evidence for a price raising effect of sellers' reciprocal behaviour. Buyers seem to have anticipated sellers' reciprocity in the RT and, as a consequence, offered sellers higher shares in the RT.

Our favourite interpretation of sellers' behaviour is based on the assumption that they are *conditionally* altruistic. In this view the behaviour of reciprocal sellers is fully rational. Low prices imply that sellers' monetary payoffs are relatively low compared to the monetary payoff of 'their' buyers. This renders them selfish or envious, that is, they choose a low quality. A high price implies that sellers are comparatively well off which renders them altruistic. As a result they respond with generous quality levels. In the theoretical part of this paper we have shown that on the basis of these assumptions on preferences, the positive relation between prices and buyers' expected profits implies that sellers value buyers' monetary payoffs as a normal 'good'. Moreover, the prevailing prices in the RT are, in general, above sellers' reservation prices. This means that prices in the RT represent a non competitive outcome. Notice that our interpretation of the RT-data does not mean that we consider the RT to be out of equilibrium. Quite the contrary, if sellers' reciprocal responses are the result of rational preference maximisation and if buyers rationally anticipate sellers' behaviour persistently, high prices may well reflect an underlying equilibrium. We 'only' claim that the RT-outcome is non competitive.

An alternative interpretation of our results might rely on the conjecture that subjects were hesitant to choose unfair actions because they knew that the experimenter could observe them. For several reasons we doubt that the observability of actions by the experimenter is behaviourally relevant in our context. First of all, sellers who received prices between 30 and 50 did in general not hesitate to choose minimum quality levels in our RT. Nor did buyers hesitate to offer prices close to f_c in the CT. Secondly, Berg et al. (1995) conducted reciprocity experiments in which the experimenter could not observe the actions of individuals. Only aggregate results could be observed. They indicate a substantial amount of reciprocal behaviour. Thirdly, the results of Bolton and Zwick (1995), who conducted fully anonymous ultimatum games, also indicate that observability of actions by the experimenter does not change subjects' behaviour.

A more important objection against our interpretation concerns the fact that we had 8 market periods in each treatment. In principle, this may create opportunities for strategic and reputational spillovers across periods. However, we have taken great care in preventing such spillovers by enforcing strict anonymity between trading partners. Due to the anonymity requirements in our design it was definitely not possible that *individual* sellers or buyers developed a reputation. Nor was it possible that past actions of any *specific* buyer or seller could be rewarded. Therefore, in our view any reputational or strategic spillovers have to rely on group effects. Perhaps a majority of co-operative, group-oriented sellers wanted to induce high future prices by choosing high current quality levels. In the previous section we have, however, shown that reciprocal quality choices are incompatible with this view. Sellers who try to induce high future prices must not respond reciprocally to the *current* price. They have to choose unconditionally high quality levels. In addition, in all but one session we could not detect any statistical effect of current quality levels on future prices. Thus the data indicate that the above mentioned spillover was not relevant in our RT.

The potential effect discussed in the previous paragraph is, of course, not the only possibility for group reputation to play a role. In principle there are many other possibilities and there seems only one method which rules them out with certainty: The conduct of one-shot experiments. In a recent paper by Fehr et al. (1994) the results of a one-shot reciprocity treatment are reported. The Fehr et al.-design has the following features: Ten buyers interact with ten sellers over ten periods but each buyer is matched bilaterally with each seller only once. This matching procedure is common knowledge. A buyer makes a price proposal to a seller. If the seller accepts he has to choose q and bears costs $c(q)$ according to Table 1. If he rejects the offer, both players earn zero. This design combines features of the ultimatum game with features of our RT. Due to the one-shot nature of these experiments it never pays for a subject to invest anything in group reputation. Fehr et al. (1994) also conducted competitive market experiments with reciprocation opportunities (like our RT) to allow for a comparison of the bilateral one-shot experiments with the competitive market experiments. Their results indicate that sellers also respond reciprocally in a one-shot situation. Sellers' response pattern in the one-shot situation is rather similar compared to their behaviour in a competitive market with reciprocation opportunities. Moreover, as in our RT sellers' shares both in the one-shot situation and in the market situation are on average between 40 and 45%. The statistical tests conducted show that there is *no* significant difference between sellers' shares in the one-shot and the repeated market situation.

A further objection that is frequently raised against experimental data is that the monetary payoffs in experiments are small relative to the stake levels in real life. In our experiments the participants earned on average $33. However, Fehr and Tougareva (1995) have replicated the experiments of Fehr et al. (1994) in Moscow with very high stakes. On average subjects in the Fehr–Tougareva experiments earned between *two and three times* their *monthly* income in a two hour session. Despite this high stake level no decline in the impact of reciprocity on the market outcome could be observed. This indicates that the results presented in this paper are not just an artefact of low stakes. Reciprocity and gift exchange give rise to noncompetitive outcomes even under rather high stakes.

Our model in Section 4 and our interpretation of the RT-data imply that the amount of excess supply does not play a role in the formation of prices. If sellers' reciprocity is sufficiently strong buyers' expected profits are a strictly concave and increasing function of prices. Therefore, as long as there is a non negative excess supply, i.e. as long as buyers can be sure to find at least one seller, they can set their prices irrespective of the extent of excess supply. In our view, the fact, that in the Fehr et al.-experiments sellers received the same shares in the one-shot (bilateral) experiments as in the market experiments with an excess supply of sellers, supports our interpretation of the data.

Finally, we would like to relate our data and our interpretation to the approaches of Binmore and Samuelson (1994; BS) and Roth and Erev (1993; RE). These authors explain the stylised facts of ultimatum games in terms of evolutionary models (BS) or in terms of psychological learning models (RE). Both in BS and in RE subjects do not act rationally on the basis of consistent preferences. They follow, instead, behavioural patterns that are — at least initially — ill-adapted to the game being played. Their actions are ill-adapted in the sense that they do not maximize subjects' monetary returns in the one-shot game. The simulations conducted by BS and RE show that these 'mistakes' can survive even in the long run, i.e. adaptive forces need not cause convergence to the subgame perfect equilibrium of the ultimatum game.

We cannot rule out that the mechanisms that have been stipulated by BS and RE also play a role in our experiments. Perhaps the reciprocal responses of our sellers in the RT are not driven by the rational pursuit of consistent preferences but by a behavioural impulse to reciprocate that has been 'inherited' from repeated interactions in the real world. If that were the case our task of proving that non trading sellers in our RT have been involuntarily rationed is much easier because we could identify sellers' reservation prices with the induced value f. The systematic and large gap between actual prices and the sellers' reservation price f in our RT would then be an unambiguous indicator for a non competitive outcome.

Appendix A. Summary of the instructions (for data see Appendix B)

A.1. General (for both market sides)

The experiment you will participate in serves the purpose of analysing decision behaviour in markets. The instructions are simple and if you read them carefully and make appropriate decisions you can earn a considerable amount of money. At the end of the whole experiment all the profits you have made by your decisions will be added and paid to you in cash.

The experiment you will participate in consists of 2 stages. In the first stage 6 of you act as buyers and 9 of you are in the role of sellers. In the second stage the sellers will determine the value of the good for the buyers.

A.2. Specific instructions for sellers in the RT-experiment

In the market one good is traded and each seller sells the same good. A seller can sell this good to any buyer and a buyer can buy it from every seller. Every buyer can offer a price that will be communicated to us by telephone. We write these offers on the blackboard and you can accept one of these offers. If e.g. a price of 50 is offered and you as seller number 5 want to accept this offer you just say: 'Number 5 sells for 50'. In this case the trade is concluded, the good is sold to the buyer who made the offer of 50. The buyer will not know your identity, he will just know that his offer is accepted.

You can sell at most one unit of the good on each trading day and each buyer can also buy at most one unit of the good per trading day. Each seller may accept an offer or not, but the sellers cannot make counteroffers. After 3 minutes the market is closed and the second stage of the trading day is conducted. After this a new trading day starts. On the whole there will be 8 trading days.

At the second stage of a trading day you can fix the value the good will have for the buyers. Buyers receive a certain amount of experimental money (reselling price) from us for each unit they have bought. This reselling price can be found in the middle of the parameter sheet distributed to you. The profit of a buyer (measured in experimental money) is the difference between the reselling price and the price at which he has bought the good from you. If 'your' buyer has bought the good for 205 and the reselling price is 405 he makes a profit of: $405 - 205 = 200$ (measured in experimental money).

How much one unit of experimental money is worth for 'your' buyer depends on you. By the choice of a conversion rate you decide how much real money 'your' buyer gets from us for one unit of experimental money. If you choose e.g. the rate 0.5 your buyer gets 100 ATS for 200 units of experimental money. At the lower part of the parameter sheet you can find the feasible range for the conversion rate. Fill in your decision in the decision sheet distributed to you. *Do not* announce your decision publicly.

You as a seller have two kinds of costs, production costs and decision costs that arise from your decision on the conversion rate. You bear, of course, costs only in case of a deal. If you do not trade on a certain day your costs are zero on this day. Production costs are shown on the upper part of the pararmeter sheet. Decision costs depend on your choice of the conversion rate. The higher the conversion rate you decide to give to 'your' buyer the higher are your decision costs. The decision costs are noted in the lower part of the parameter sheet. You will get a commission fee of ATS 4 for each trade conducted. Hence, your profit paid in ATS is given by:

$$\text{profit} = \text{price} - \text{production costs} - \text{decision costs} + \text{commission fee}.$$

If e.g. you sell your good for 175 while your production costs are 100 and you choose a conversion rate of 0.6 that is associated with decision costs of 5 your profits are given by: $175 - 100 - 5 + 4 = 74$.

A.3. Specific instructions for buyers in the RT-experiment

In the market one good is traded and each seller sells the same good. A seller can sell this good to any buyer and a buyer can buy it from every seller. If you are e.g. buyer no. 7 and you want to offer a price of 215, you have to say:

'Buyer 7 offers 215.' To avoid losses for you as buyer as well as for the sellers these offers must not be lower than the production costs announced on the parameter sheet and they must not be higher than the reselling values also announced on the parameter sheet. The offers will be communicated to the sellers by us via telephone. The sellers will not know your identity, i.e. your buyer number; they will only know the price offered. If a seller accepts an offer you will be informed by us. In this case an agreement is concluded, the good is purchased by you at the offered price. On each trading day you can buy at most one unit of the good and each seller can also sell at most one unit of the good per day. If your offer is not accepted you are free to change your offer, i.e. to make a new offer. But the new price you offer must be higher than all prices that have not been accepted so far. Each seller may accept an offer or not, but he cannot make a counteroffer. After 3 minutes the market is closed and you can no longer buy a good on this day. Then the second stage of the trading day will be conducted. After this a new trading day starts. On the whole there will be 8 trading days.

At the second stage of the trading day the seller who has sold the good to you on this day can fix the value the good will have for you. You as a buyer get a certain amount of experimental money (reselling price) from us for each unit you have bought. This reselling price is shown in the upper part of the parameter sheet. Your profit (measured in experimental money) is the difference between the reselling price and the price at which you have bought the good. If you bought the good for 205 and the reselling price is 405 you make a profit of: $405 - 205 = 200$ (measured in experimental money). How much one unit of experimental money is worth to you depends on 'your' seller. By the choice of a conversion rate he decides how much real money you receive from us for one unit of experimental money. The range of feasible conversion rates can be seen in the lower part of the parameter sheet. If he chooses e.g. the rate 0.5 you will get 100 ATS for 200 units of experimental money.

If a seller makes a deal he gets a commission fee of ATS 4. Furthermore, sellers have two kinds of costs, production costs and decision costs that arise from the decision on the conversion rate. Production costs are listed in the middle of the parameter sheet, the decision costs associated with a certain conversion rate are shown in the lower part of the parameter sheet. As you can see from the parameter sheet the higher the conversion rate 'your' seller chooses the greater are his decision costs. Hence, the profit of the sellers paid in ATS is given by:

$$\text{profit} = \text{price} - \text{production costs} - \text{decision costs} + \text{commission fee}.$$

If e.g. you have bought the good for 175 while the production costs are 100 and the seller chooses a conversion rate of 0.6 which is associated with decision costs of 5 the profits of 'your' seller are given by: $175 - 100 - 5 + 4 = 74$.

Appendix B.

For the data see Tables 5–8.

Table 5

Session	Period	Seller	Buyer	p	q	$c(q)$	S	B	Session	Period	Seller	Buyer	p	q	$c(q)$	S	B
1	1	1	8	225	—	—	19	21	1	10	2	2	55	0.3	2	27	21.3
1	1	2	6	220	—	—	14	26	1	10	4	4	65	0.1	0	39	6.1
1	1	3	7	225	—	—	19	21	1	10	5	1	60	0.5	6	28	33
1	1	4	2	225	—	—	19	21	1	10	8	6	80	0.5	6	48	23
1	1	5	1	215	—	—	9	31	1	10	9	5	85	0.7	10	49	28.7
1	1	6	5	210	—	—	4	36	1	11	2	3	80	0.1	0	54	4.6
1	2	1	6	215	—	—	9	31	1	11	3	2	60	0.2	1	33	13.2
1	2	2	2	220	—	—	14	26	1	11	5	1	80	0.4	4	50	18.4
1	2	3	1	220	—	—	14	26	1	11	7	6	85	0.7	10	49	28.7
1	2	4	5	220	—	—	14	26	1	11	8	4	60	0.2	1	33	13.2
1	2	5	7	210	—	—	4	36	1	11	9	5	80	0.5	6	48	23
1	2	6	8	220	—	—	14	26	1	12	1	4	80	0.4	4	50	18.4
1	3	1	5	210	—	—	4	36	1	12	2	1	75	0.1	0	49	5.1
1	3	2	8	215	—	—	9	31	1	12	3	5	85	0.3	2	57	12.3
1	3	3	2	215	—	—	9	31	1	12	5	3	80	0.6	8	46	27.6
1	3	4	1	215	—	—	9	31	1	12	6	6	90	0.5	6	58	18
1	3	5	3	220	—	—	14	26	1	12	8	2	75	0.4	4	45	20.4
1	3	6	9	210	—	—	4	36	1	13	1	1	80	0.4	4	50	18.4
1	4	1	8	210	—	—	4	36	1	13	2	3	85	0.1	0	59	4.1
1	4	2	7	210	—	—	4	36	1	13	5	5	90	0.7	10	54	25.2
1	4	3	9	210	—	—	4	36	1	13	7	4	80	0.6	8	46	27.6
1	4	4	4	215	—	—	9	31	1	13	8	2	85	0.6	8	51	24.6
1	4	5	5	215	—	—	9	31	1	13	9	6	90	0.8	12	52	28.8
1	4	6	2	215	—	—	9	31	1	14	1	3	90	0.4	4	60	14.4
1	5	1	2	210	—	—	4	36	1	14	2	2	85	0.1	0	59	4.1
1	5	2	3	210	—	—	4	36	1	14	3	4	85	0.3	2	57	12.3
1	5	3	4	210	—	—	4	36	1	14	5	1	85	0.6	8	51	24.6
1	5	4	1	210	—	—	4	36	1	14	8	6	95	0.7	10	59	21.7
1	5	5	5	215	—	—	9	31	1	14	9	5	95	0.8	12	57	24.8
1	5	6	7	210	—	—	4	36	1	15	1	2	75	0.1	0	49	5.1

Table 5 (Continued)

Session	Period	Seller	Buyer	p	q	$c(q)$	S	B	Session	Period	Seller	Buyer	p	q	$c(q)$	S	B
1	6	1	1	210	—	—	4	36	1	15	2	3	90	0.1	0	64	3.6
1	6	2	3	210		—	4	36	1	15	5	4	90	1	18	46	36
1	6	3	8	210	—	—	4	36	1	15	6	6	80	0.1	0	54	4.6
1	6	4	2	210	—	—	4	36	1	15	7	1	75	0.4	4	45	20.4
1	6	5	5	215	—	—	9	31	1	15	8	5	100	0.9	15	59	23.4
1	6	6	9	210	—		4	36	1	16	1	5	80	0.5	6	48	23
1	7	1	8	210	—	—	4	36	1	16	2	2	30	0.1	0	4	9.6
1	7	2	3	210	—	—	4	36	1	16	4	6	30	0.1	0	4	9.6
1	7	3	7	210	—	—	4	36	1	16	5	4	80	0.4	4	50	18.4
1	7	4	2	210	—	—	4	36	1	16	7	3	35	0.1	0	9	9.1
1	7	5	4	210	—	—	4	36	1	16	8	1	60	0.1	0	34	6.6
1	7	6	5	210	—	—	4	36	2	1	2	4	75	0.5	8	41	25.5
1	8	1	7	210			4	36	2	1	3	5	70	0.4	4	40	22.4
1	8	2	3	210	—	—	4	36	2	1	4	3	70	0.4	4	40	22.4
1	8	3	2	210	—	—	4	36	2	1	5	2	70	0.1	0	44	5.6
1	8	4	5	210	—	—	4	36	2	1	7	6	60	0.2	1	33	13.2
1	8	5	8	210	—	—	4	36	2	1	9	1	65	0.1	0	39	6.1
1	8	6	1	210		—	4	36	2	2	1	6	55	0.1	9	20	7.1
1	9	1	5	80	0.4	4	50	18.4	2	2	2	1	55	0.3	2	27	21.3
1	9	2	3	70	0.1	0	44	5.6	2	2	5	4	55	0.1	0	29	7.1
1	9	4	1	80	0.2	1	53	9.2	2	2	6	2	60	0.4	4	30	26.4
1	9	5	6	65	0.1	0	39	6.1	2	2	7	5	50	0.2	1	23	15.2
1	9	7	2	60	0.4	4	30	26.4	2	2	8	3	60	0.4	4	30	26.4
1	9	8	4	60	0.3	2	32	19.8	2	3	4	6	45	0.2	1	18	16.2
1	10	1	3	60	0.1	0	34	6.6	2	3	5	5	65	0.1	0	39	6.1

Table 6

Session	Period	Seller	Buyer	p	q	$c(q)$	S	B	Session	Period	Seller	Buyer	p	q	$c(q)$	S	B
2	3	6	3	50	0.3	2	22	22.8	2	12	5	8	215	—	—	9	31
2	3	8	4	50	0.3	2	22	22.8	2	12	6	3	215	—	—	9	31
2	3	9	2	50	0.3	2	22	22.8	2	13	1	6	215	—	—	9	31
2	4	1	1	50	0.1	0	24	7.6	2	13	2	5	215	—	—	9	31
2	4	3	6	45	0.2	1	18	16.2	2	13	3	9	215	—	—	9	31
2	4	4	4	45	0.2	1	18	16.2	2	13	4	1	215		—	9	31
2	4	7	3	55	0.2	1	28	14.2	2	13	5	3	215	—	—	9	31
2	4	8	5	35	0.1	0	9	9.1	2	13	6	2	215	—	—	9	31
2	4	9	2	40	0.1	0	14	8.6	2	14	1	3	210	—	—	4	36
2	5	1	6	50	0.1	0	24	7.6	2	14	2	4	215	—	—	9	31
2	5	2	2	65	0.3	2	37	18.3	2	14	3	1	215		—	9	31
2	5	4	5	80	0.5	6	48	23	2	14	4	8	215	—	—	9	31
2	5	5	3	60	0.2	1	33	13.2	2	14	5	9	215	—	—	9	31
2	5	6	4	60	0.4	4	30	26.4	2	14	6	6	210	—	—	4	36
2	5	9	1	45	0.2	1	18	16.2	2	15	1	8	215		—	9	31
2	6	1	6	35	0.1	0	9	9.1	2	15	2	7	210	—	—	4	36
2	6	4	5	35	0.1	0	9	9.1	2	15	3	5	210	—	—	4	36
2	6	5	3	45	0.1	0	19	8.1	2	15	4	1	215	—	—	9	31
2	6	7	4	50	0.2	1	23	15.2	2	15	5	4	215	—	—	9	31
2	6	8	1	40	0.1	0	14	8.6	2	15	6	3	215	—		9	31
2	6	9	2	50	0.2	1	23	15.2	2	16	1	3	215	—	—	9	31
2	7	1	1	65	0.2	1	38	12.2	2	16	2	6	215	—	—	9	31
2	7	2	4	60	0.3	2	32	19.8	2	16	3	1	215	—	—	9	31
2	7	3	6	60	0.4	4	30	26.4	2	16	4	8	215	—		9	31
2	7	4	5	75	0.4	4	45	20.4	2	16	5	4	215	—	—	9	31
2	7	8	3	60	0.4	4	30	26.4	3	1	6	7	228		—	22	18
2	7	9	2	65	0.2	1	38	12.2	3	1	3	1	229	—	—	23	17
2	8	1	4	100	0.7	10	64	18.2	3	1	4	4	228	—	—	22	18
2	8	2	3	65	0.1	0	39	6.1	3	1	2	3	227	—	—	21	19
2	8	4	1	85	0.6	8	51	24.6	3	1	7	8	228	—	—	22	18

Table 6 (Continued)

Session	Period	Seller	Buyer	p	q	$c(q)$	S	B	Session	Period	Seller	Buyer	p	q	$c(q)$	S	B
2	8	6	5	60	0.4	4	30	26.4	3	1	5	6	227	—	—	21	19
2	8	8	6	70	0.6	8	36	33.6	3	1	1	2	227	—	—	21	19
2	8	9	2	75	0.2	1	48	10.2	3	2	5	7	225	—	—	19	21
2	9	1	3	215	—	—	9	31	3	2	6	1	227	—	—	21	19
2	9	2	4	220	—	—	14	26	3	2	4	10	224	—	—	18	22
2	9	3	7	210	—	—	4	36	3	2	1	2	221	—	—	15	25
2	9	4	5	210	—	—	4	36	3	2	2	5	222	—	—	16	24
2	9	5	9	210	—	—	4	36	3	2	3	8	217	—		11	29
2	9	6	6	210	—	—	4	36	3	2	7	6	220	—	—	14	26
2	9	1	2	215	—	—	9	31	3	3	5	3	220	—	—	14	26
2	10	2	8	210	—	—	4	36	3	3	2	1	222	—	—	16	24
2	10	3	9	215	—	—	9	31	3	3	3	9	223	—	—	17	23
2	10	4	7	215	—	—	9	31	3	3	4	5	222	—	—	16	24
2	10	5	4	215	—	—	9	31	3	3	7	4	222		—	16	24
2	10	6	6	215	—	—	9	31	3	3	6	8	222	—	—	16	24
2	11	1	6	210	—	—	4	36	3	3	1	2	221	—	—	15	25
2	11	2	7	210	—	—	4	36	3	4	2	5	217	—	—	11	29
2	11	3	3	215	—	—	9	31	3	4	3	9	218		—	12	28
2	11	4	1	215	—		9	31	3	4	6	10	221	—	—	15	25
2	11	5	4	215	—	—	9	31	3	4	5	2	222	—	—	16	24
2	11	6	5	215	—	—	9	31	3	4	7	6	222	—	—	16	24
2	12	1	7	215	—	—	9	31	3	4	1	8	222	—	—	16	24
2	12	2	1	215	—	—	9	31	3	4	4	4	220	—	—	14	26
2	12	3	2	215		—	9	31	3	5	1	8	217	—	—	11	29
2	12	4	4	215	—	—	9	31	3	5	4	3	218	—	—	12	28

Table 7

Session	Period	Seller	Buyer	p	q	$c(q)$	S	B	Session	Period	Seller	Buyer	p	q	$c(q)$	S	B
3	5	6	1	221	—	—	15	25	3	13	8	7	50	0.1	0	24	7.6
3	5	3	2	220	—	—	14	26	3	13	9	3	104	0.6	8	70	13.2
3	5	5	6	219	—	—	13	27	3	13	10	6	55	0.2	1	28	14.2
3	5	7	9	219	—	—	13	27	3	14	1	3	110	0.5	6	78	8
3	5	2	4	219	—	—	13	27	3	14	2	7	100	0.1	0	74	2.6
3	6	3	9	217	—	—	11	29	3	14	5	6	95	0.9	15	54	27.9
3	6	6	5	219	—	—	13	27	3	14	6	5	105	0.8	12	67	16.8
3	6	2	6	218	—	—	12	28	3	14	7	2	46	0.1	0	20	8
3	6	5	8	217	—	—	11	29	3	14	8	8	96	0.1	0	70	3
3	6	7	2	217	—	—	11	29	3	14	9	1	106	0.5	6	74	10
3	6	1	10	217	—	—	11	29	3	15	1	1	106	0.5	6	74	10
3	6	4	4	217	—	—	11	29	3	15	2	3	31	0.1	0	5	9.5
3	7	1	3	216	—	—	10	30	3	15	3	5	105	0.1	0	79	2.1
3	7	2	2	217	—	—	11	29	3	15	5	7	106	0.8	12	68	16
3	7	3	8	218	—	—	12	28	3	15	6	6	90	0.4	4	60	14.4
3	7	4	5	217	—	—	11	29	3	15	8	4	46	0.1	0	20	8
3	8	5	5	217	—	—	11	29	3	16	1	6	80	0.1	0	54	4.6
3	8	4	3	216	—	—	10	30	3	16	2	5	106	0.1	0	80	2
3	8	2	2	217	—	—	11	29	3	16	3	4	106	0.1	0	80	2
3	8	6	6	217	—	—	11	29	3	16	5	1	106	0.1	0	80	2
3	8	7	8	216	—	—	10	30	3	16	6	7	45	0.1	0	19	8.1
3	8	1	9	215	—	—	9	31	3	16	8	3	85	0.1	0	59	4.1
3	8	3	10	214	—	—	8	32	4	1	1	1	89	0.1	0	63	3.7
3	9	1	2	85	0.1	0	59	4.1	4	1	2	2	86	0.7	10	50	28
3	9	2	6	86	0.1	0	60	4	4	1	3	8	93	0.4	4	63	13.2
3	9	4	5	100	0.7	10	64	18.2	4	1	4	4	85	0.3	2	57	12.3
3	9	5	1	40	0.1	0	14	8.6	4	1	8	3	92	1	18	48	34
3	9	6	7	80	0.1	0	54	4.6	4	1	9	5	55	0.3	2	27	21.3
3	9	8	3	90	0.1	0	64	3.6	4	1	10	6	90	0.9	15	49	32.4
3	9	9	4	75	0.2	1	48	10.2	4	1	12	7	60	0.4	4	30	26.4

Table 7 (Continued)

Session	Period	Seller	Buyer	p	q	$c(q)$	S	B	Session	Period	Seller	Buyer	p	q	$c(q)$	S	B
3	10	1	5	100	0.1	0	74	2.6	4	2	1	8	60	0.1	0	34	6.6
3	10	2	7	90	0.1	0	64	3.6	4	2	2	4	85	0.5	6	53	20.5
3	10	4	4	90	0.4	4	60	14.4	4	2	4	2	55	0.3	2	27	21.3
3	10	5	1	100	0.4	4	70	10.4	4	2	7	3	75	0.7	10	39	35.7
3	10	6	3	100	0.7	10	64	18.2	4	2	8	1	55	0.7	10	19	49.7
3	10	8	2	40	0.1	0	14	8.6	4	2	9	7	50	0.4	4	20	30.4
3	10	9	6	105	0.4	4	75	8.4	4	2	10	6	50	0.2	1	23	15.2
3	11	1	5	100	0.3	2	72	7.8	4	2	11	5	40	0.3	2	12	25.8
3	11	2	4	95	0.1	0	69	3.1	4	3	1	7	35	0.1	0	9	9.1
3	11	4	3	105	0.4	4	75	8.4	4	3	2	6	70	0.5	6	38	28
3	11	5	2	100	0.4	4	70	10.4	4	3	3	2	45	0.1	0	19	8.1
3	11	6	7	100	0.6	8	66	15.6	4	3	4	1	50	0.1	0	24	7.6
3	11	8	1	96	0.1	0	70	3	4	3	7	5	100	1	18	56	26
3	11	9	6	105	0.4	4	75	8.4	4	3	8	8	96	1	18	52	30
3	12	1	7	100	0.3	2	72	7.8	4	3	9	3	45	0.5	6	13	40.5
3	12	2	1	106	0.1	0	80	2	4	3	10	4	100	1	18	56	26
3	12	4	6	107	0.4	4	77	7.6	4	4	1	2	86	0.1	0	60	4
3	12	6	4	106	0.7	10	70	14	4	4	2	8	96	0.8	12	58	24
3	12	8	3	43	0.1	0	17	8.3	4	4	4	6	80	0.1	0	54	4.6
3	12	9	2	45	0.1	0	19	8.1	4	4	6	5	100	0.5	6	68	13
3	12	10	5	45	0.1	0	19	8.1	4	4	8	1	65	0.8	12	27	48.8
3	13	1	5	48	0.1	0	22	7.8	4	4	9	3	60	0.4	4	30	26.4
3	13	2	4	106	0.1	0	80	2	4	4	10	7	90	1	18	46	36
3	13	6	1	47	0.1	0	21	7.9	4	4	12	4	100	0.9	15	59	23.4
3	13	7	2	46	0.1	0	20	8	4	5	1	7	80	0.1	0	54	4.6

Table 8

Session	Period	Seller	Buyer	p	q	$c(q)$	S	B	Session	Period	Seller	Buyer	p	q	$c(q)$	S	B
4	5	2	8	96	0.8	12	58	24	4	11	3	1	215	—	—	9	31
4	5	4	1	65	0.3	2	37	18.3	4	11	1	4	212		—	6	34
4	5	5	3	45	0.1	0	19	8.1	4	11	2	9	212	—	—	6	34
4	5	6	6	92	0.5	4	62	17	4	11	8	8	212		—	6	34
4	5	7	2	90	1	18	46	36	4	11	6	3	212	—	—	6	34
4	5	10	4	76	0.8	12	38	40	4	11	5	5	212	—	—	6	34
4	5	11	5	100	1	18	56	26	4	11	4	6	212	—	—	6	34
4	6	1	8	96	0.1	0	70	3	4	12	4	12	212	—	—	6	34
4	6	2	1	66	0.1	0	40	6	4	12	3	1	215	—		9	31
4	6	4	6	95	0.2	1	68	6.2	4	12	2	4	213	—	—	7	33
4	6	5	5	76	0.1	0	50	5	4	12	1	8	213	—	—	7	33
4	6	9	3	65	0.4	4	35	24.4	4	12	6	5	211	—	—	5	35
4	6	10	7	85	1	18	41	41	4	12	7	2	212	—	—	6	34
4	6	11	2	86	0.5	6	54	20	4	12	8	3	211	—	—	5	35
4	6	12	4	76	0.4	4	46	20	4	12	5	9	210	—	—	4	36
4	7	1	1	76	0.1	0	50	5	4	13	4	5	211	—	—	5	35
4	7	2	4	91	0.8	12	53	28	4	13	3	1	213	—	—	7	33
4	7	4	8	30	0.1	0	4	9.6	4	13	1	8	212	—	—	6	34
4	7	5	7	85	0.6	8	51	24.6	4	13	5	3	212	—		6	34
4	7	7	6	75	0.7	10	39	35.7	4	13	2	11	213	—	—	7	33
4	7	8	3	70	0.9	15	29	50.4	4	13	8	9	214	—	—	8	32
4	7	10	2	86	1	18	42	40	4	13	6	4	210	—	—	4	36
4	7	11	5	99	0.7	10	63	18.9	4	13	7	12	211	—	—	5	35
4	8	1	2	86	0.1	0	60	4	4	14	7	2	211		—	5	35
4	8	2	1	76	0.1	0	50	5	4	14	4	1	212	—	—	6	34
4	8	3	4	101	0.4	4	71	10	4	14	3	12	213	—	—	7	33
4	8	4	6	80	0.1	0	54	4.6	4	14	2	4	211	—	—	5	35
4	8	5	8	96	0.7	10	60	21	4	14	6	9	210			4	36
4	8	7	5	30	0.1	0	4	9.6	4	14	8	8	210	—	—	4	36
4	8	9	3	50	0.4	4	20	30.4	4	14	1	3	210	—	—	4	36

Table 8 (Continued)

Session	Period	Seller	Buyer	p	q	$c(q)$	S	B	Session	Period	Seller	Buyer	p	q	$c(q)$	S	B
4	8	10	7	86	0.1	0	60	4	4	14	5	5	210	—	—	4	36
4	9	7	5	210	—	—	4	36	4	15	7	3	210	—	—	4	36
4	9	6	2	220	—	—	14	26	4	15	3	2	213	—	—	7	33
4	9	3	1	226	—	—	20	20	4	15	1	1	211	—	—	5	35
4	9	4	7	216	—	—	10	30	4	15	4	5	211	—	—	5	35
4	9	8	4	217	—	—	11	29	4	15	6	4	211	—	—	5	35
4	9	1	9	214	—	—	8	32	4	15	8	8	211	—	—	5	35
4	9	2	8	212	—	—	6	34	4	15	2	12	211	—	—	5	35
4	9	5	10	210	—	—	4	36	4	15	5	9	211	—	—	5	35
4	10	4	1	216	—	—	10	30	4	16	2	5	210	—	—	4	36
4	10	8	11	211	—	—	5	35	4	16	3	1	215	—	—	9	31
4	10	1	5	212	—	—	6	34	4	16	6	12	211	—	—	5	35
4	10	2	9	211	—	—	5	35	4	16	1	9	211	—	—	5	35
4	10	3	8	215	—	—	9	31	4	16	8	8	211	—	—	5	35
4	10	5	4	211	—	—	5	35	4	16	4	4	210	—	—	4	36
4	10	7	3	211	—	—	5	35	4	16	7	3	210	—	—	4	36
4	10	6	2	211	—	—	5	35	4	16	5	2	210	—	—	4	36

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