Chapter 38

RECIPROCITY IN EXPERIMENTAL MARKETS

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1. Introduction

This chapter summarizes main findings of five experimental studies. These studies (Fehr, Kirchsteiger and Riedl, 1993; Fehr and Falk, 1998; Fehr et al., 1998; Fehr and Tougareva, 1995) were primarily designed to test the fair wage–effort hypothesis in the context of competitive experimental markets. The fair wage–effort hypothesis (Akerlof, 1982; Akerlof and Yellen, 1990) stipulates that wage increases raise workers' effort levels. Facing the incompleteness of labor contracts it may, therefore, be profitable for firms to pay wages above the competitive level, which in turn may lead to involuntary unemployment. Besides this labor market interpretation, our experiments can however also be interpreted as stylized versions of incomplete goods or service markets. Suppose an incomplete market in which the price of the good or service is fixed before the good is produced or the service is rendered. If the quality of this good or service cannot be specified in the contract or if the quality is not verifiable by third parties the well-known *lemons* phenomenon may arise (Akerlof, 1970). Goods with quality levels above the minimum are driven out of the market and only goods with minimum quality are traded.

The common feature of all experiments reported in this paper is the so-called "Gift Exchange Game." This game consists of two stages. The first stage is a wage determination stage. Workers and firms trade for jobs with each other. This stage is followed by a second stage where those workers that have concluded a contract with a firm have to choose an effort level. The higher the chosen effort level the higher is the profit of the corresponding firm. Since effort levels above the minimum effort level are (increasingly) costly, workers have a pecuniary incentive to provide only the exogenously given minimum level irrespective of the wage they receive. Rational firms will anticipate that minimum effort choice. Firms' best response is, therefore, to pay the competitive wage that corresponds to the minimum effort level.[1]

Contrary to this prediction we found the following:

(1) Average wages are substantially above the competitive wage that corresponds to the minimum effort level. Moreover, firms' wage payments contain substantial

[1] Notice that for any given effort level there exists a competitive wage that just compensates workers for their effort costs.

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rent elements, i.e., wages are much higher than the competitive wage that corresponds to workers' *actual* effort choices. There is no tendency for wages to converge towards the competitive level in late periods.

(2) There is a significantly positive relationship between wages and effort levels.

(3) This positive wage–effort relation turns out to be very robust not only within but also across different institutions. It drives results in markets that are organized as bilateral gift-exchange institutions as well as in one-sided and double auction markets.

(4) Even with rather high stake levels, no decline in the effects of fairness on market outcomes can be observed.

We find thus convincing evidence for the fair wage–effort hypothesis. Firms do not enforce competitive wages. Instead they voluntarily pay "fair" wages that is, wages that contain substantial rents. Since workers exhibit reciprocal effort choices a "fair" wage strategy earns higher profits than a "low" wage strategy. Due to sellers' (workers') reciprocal choices, average quality (effort) levels above the minimum are a persistent phenomenon. It is not the case that non-minimal quality levels are driven out of the market.

2. Experimental Design

2.1. Common Features of All Treatments

In all treatments, the game under study was a version of the so-called "Gift-Exchange Game." The Gift-Exchange Game is a sequential move game, which consists of two stages. In the first stage, firms and workers bargain over wages according to specified rules. In the second stage, all workers who conclude a contract with a firm have to choose an effort level e. A firm's payoff function in terms of experimental money, π, is given by

$$\pi = (v - w)e, \tag{1}$$

where v represents an exogenously given redemption value.[2]

A worker's payoff function, U, is simply the difference between the accepted wage, w, and the incurred effort costs $c(e)$ plus fixed costs c_0:

$$U = w - c(e) - c_0. \tag{2}$$

In case a firm or a worker does not conclude a contract, period income is zero. The available effort levels and their corresponding effort costs are depicted in Table 1.

[2] We implemented this payoff function instead of the more familiar function $\pi = ve - w$ to avoid the possibility of losses. It is a well-known fact that loss aversion can affect behavior (Tversky and Kahneman, 1992). In later experiments (Fehr and Gächter, 1998; Fehr, Gächter, and Kirchsteiger, 1997) the function $p = ve - w$ was implemented.

Table 1
Effort levels and costs of effort

Effort	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
$c(e)$	0	1	2	4	6	8	10	12	15	18

The roles of firms and workers were always randomly assigned to the experimental subjects. After subjects' roles were determined, workers and firms were located in two different, yet adjacent, rooms in which they sat remote from each other. Procedures and payoff *functions* were common knowledge. *Payoffs*, however, were always private information in the sense that a worker's effort choice was only revealed to the firm with which the worker had concluded a contract. Identities of trading partners were never revealed and subjects were informed that they would never learn a trading partner's identity. In all treatment conditions it was, therefore, impossible for individual subjects to develop a reputation.

The major differences between the various treatments (one-sided auction, double auction, bilateral bargaining) concern the wage determination and the matching process. Table 2 presents a summary.

2.2. The One-sided Auction-treatment

In the Fehr, Kirchsteiger and Riedl (1993, 1998) papers prices were determined by a *one-sided oral bid auction*.[3] Buyers publicly announced their price offers which had to obey the improvement rule. These offers could be accepted by any seller. Sellers could not make counteroffers. Buyers were allowed to revise their offers. In case an offer was accepted, a contract was concluded. Both, sellers and buyers could at most conclude one contract per period. The number of sellers always exceeded the number of buyers, i.e., there was always an excess supply.

2.3. The Double Auction-treatment

In the Fehr and Falk (1998) paper, the chosen institution is a *double auction*. Both firms and workers were free to submit and accept wage bids and offers at any time during the trading period. Bids and offers had to obey the improvement rule. Whenever a bid or an offer was accepted, a contract was concluded. As in the one-sided auction workers and firms could at most conclude one contract per period. Again, there was an excess supply of workers. The double auction treatment allows the explicit investigation of the impact of workers' underbidding on wage formation.

[3] In these experiments we did not use a labor frame. Instead a goods market language was used.

2.4. The Bilateral Bargaining-treatment

In this treatment condition (Fehr et al., 1998) there were always ten firms and ten workers who traded for ten periods. There was no competition among workers or firms, respectively. Instead, firms and workers were exogenously matched. Each worker was matched with the same firm exactly *once* and subjects knew that they were rematched in each period with a *different* person. In each period firms could propose a wage to "their" worker. In case of acceptance the worker had to choose his effort. If the worker rejected, no trade occurred.

2.5. Standard Predictions

The standard prediction rests on the assumption that rationality and selfishness of all agents are common knowledge. Notice that in all treatments effort levels above the minimum are not enforceable if workers are completely selfish. Since effort choices above the minimum of $e = 0.1$ are (increasingly) costly, rational and selfish workers will always choose the minimum effort independent of the wage they receive. Rational firms will anticipate the choice of that minimum effort level. This means that at the first stage the good that is traded is a well-defined homogeneous good, i.e., labor that provides an effort of $e = 0.1$. The firms' best response is to enforce the lowest wage a worker is just willing to accept. This equilibrium outcome yields low profits for both, firms and workers. Put differently, there is – in principle – a considerable scope for reciprocity-based cooperation to achieve a joint improvement compared to the equilibrium predicted by the standard approach.

3. Results

Across all treatments, average wages substantially exceed the equilibrium wage. Figure 1 shows that this deviation is systematic and stable across all periods, i.e., there is no tendency for wages to converge towards the equilibrium outcome in late periods. The natural question that arises is why do firms refuse to enforce lower wages?

The answer lies in the workers' effort behavior. As Figure 2 shows workers exhibit a positive wage–effort relation. The higher the wage paid the higher is the effort level a firm receives on average. Given workers' reciprocal effort behavior it is optimal for firms *not* to enforce low wages. Firms can substantially improve their profits if they pay "fair" wages. Therefore, our results provide convincing evidence for the validity of the fair wage–effort hypothesis.

Both results, wages that persistently exceed the equilibrium prediction and the positive wage–effort relation are remarkably robust. As Figures 1 and 2 show these regularities hold in a bilateral institution as well as in competitive market institutions. In view of the fact that double auctions are among the most competitive institutions we know it is remarkable that wages in the double auction are roughly similar to wages in the bilateral

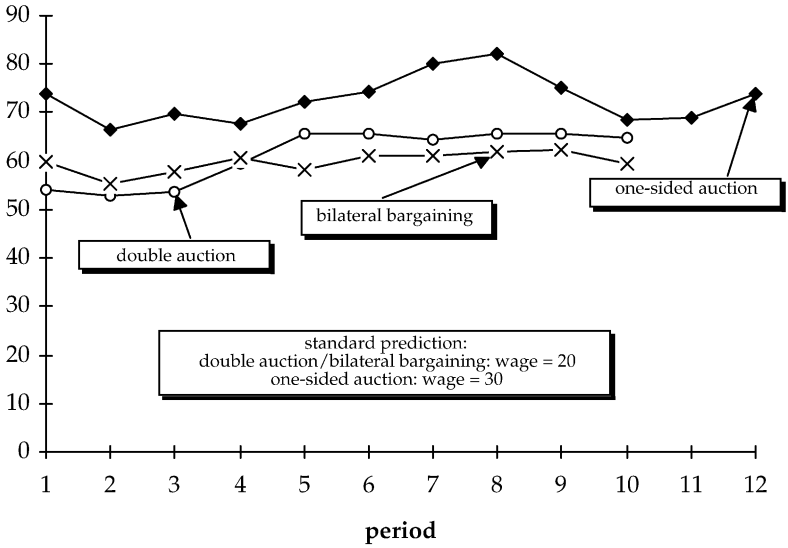
Table 2
Parameters of the one-sided auction treatment, the double auction treatment and the bilateral bargaining treatment

Parameters	Treatments		
	One-sided auction (Fehr, Kirchsteiger, and Riedl, 1993)	Double auction (Fehr and Falk, 1998)	Bilateral bargaining (Fehr et al., 1998)
Redemption values v and fixed costs c_0	$v = 126$, $c_0 = 26$	$v = 120$, $c_0 = 20$	$v = 120$, $c_0 = 20$
Feasible effort levels e (quality levels q)	$q \in [0.1, 1]$	$e \in [0.1, 1]$	$e \in [0.1, 1]$
Feasible wages w (prices p)	$30 \leqslant p \leqslant 125$ (multiples of five)	$c_0 \leqslant w \leqslant v$	$c_0 \leqslant w \leqslant v$
Wage (price) determination	One-sided oral auction buyers are price setters	Double auction firms and workers are wage setters	Firms commit themselves to a wage level
Matching process	Via acceptance of price offers	Via acceptance of wage offers	Exogenous
# firms (buyers) # workers (sellers)	50–8 buyers 8–12 sellers (exogenous excess supply of at least 50%)	7 firms 11 workers	10 firms 10 workers
# sessions	4	4	4
# periods	12	10	10
Information conditions	v, $c(q)$, c_0, number of buyers and sellers were common knowledge; identity of trading partners unknown	v, $c(e)$, c_0, number of firms and workers were common knowledge; identity of trading partners unknown	v, $c(e)$, c_0, number of firms and workers were common knowledge; identity of trading partners unknown
Predictions with rational money maximizers	Convergence towards $p = 30$ and $q = 0.1$	Convergence towards $w = 20$ and $e = 0.1$	Convergence towards $w = 20$ and $e = 0.1$
Framing	Goods market	Labor market	Labor market

institution. This fact suggests that competition among workers in the double auction has a negligible impact on wage formation. It seems that wages are solely determined by firms' attempt to appeal to workers' reciprocity by paying "fair" wages.

4. Reciprocity Under Conditions of High Stakes

To what extent do *higher stake* levels change the results mentioned above? Fehr and Tougareva (1995) conducted gift-exchange experiments in Russia to examine whether



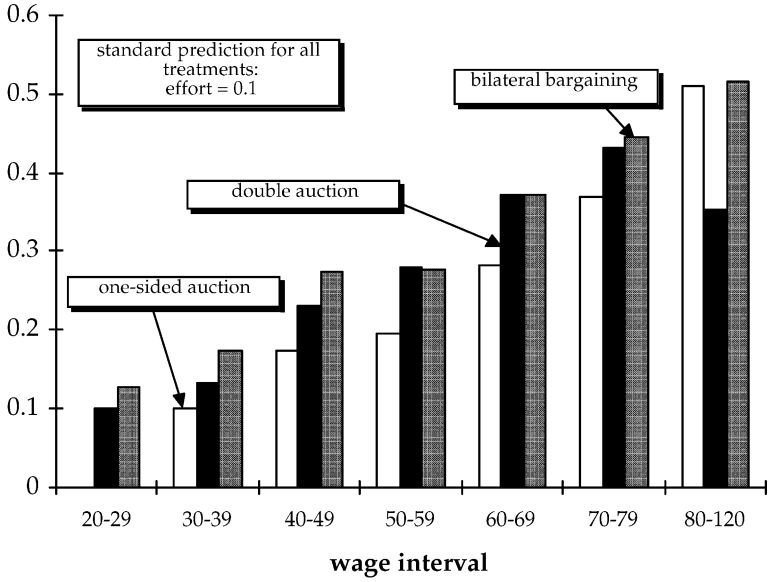
Data base:
One-sided auction: Fehr, Kirchsteiger and Riedl (1993).
Double auction: Fehr and Falk (1998).
Bilateral bargaining: Fehr, Kirchler, Weichbold and Gächter (1998).

Figure 1. Evolution of average wages across market institutions as described in Table 2.

a large rise in stakes removes the impact of reciprocal fairness on the market outcome. The parameters of their high stake sessions were exactly as in the double-auction treatment described in Table 2. However, the wage determination process was organized as a one-sided auction. On average, subjects earned the income of *ten weeks* in a high stake session. In the control treatment subjects earned on average the income of *one week*. It turns out that despite this ten-fold increase in the stake level, no decline in the impact of reciprocal fairness can be observed. Instead, the high stake results are very similar to the results observed in the control treatment. This holds for the evolution of average wages (compare Figure 3) as well as for the wage–effort relationship (compare Figure 4). Moreover, the results in the high stake and the control sessions are both very similar to the results obtained with regular stake size as reported above (compare Figures 1 and 2).

5. Related Experiments

At first sight our results seem to suggest that competitive market institutions *in general* fail to promote convergence towards the competitive prediction if they are combined with incomplete contracts. However, a comparison with the results of other double

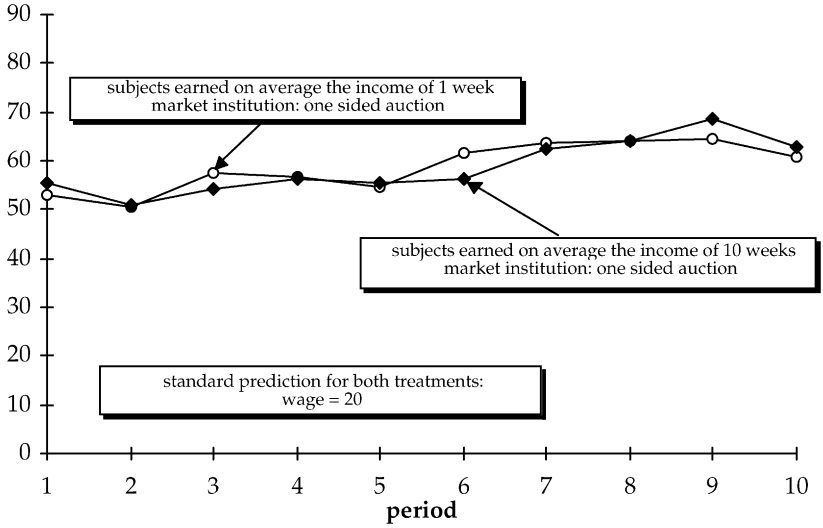


Data base:
One-sided auction: Fehr, Kirchsteiger and Riedl (1993).
Double auction: Fehr and Falk (1998).
Bilateral bargaining: Fehr, Kirchler, Weichbold and Gächter (1998).

Figure 2. Wage–effort relationship across market institutions as described in Table 2.

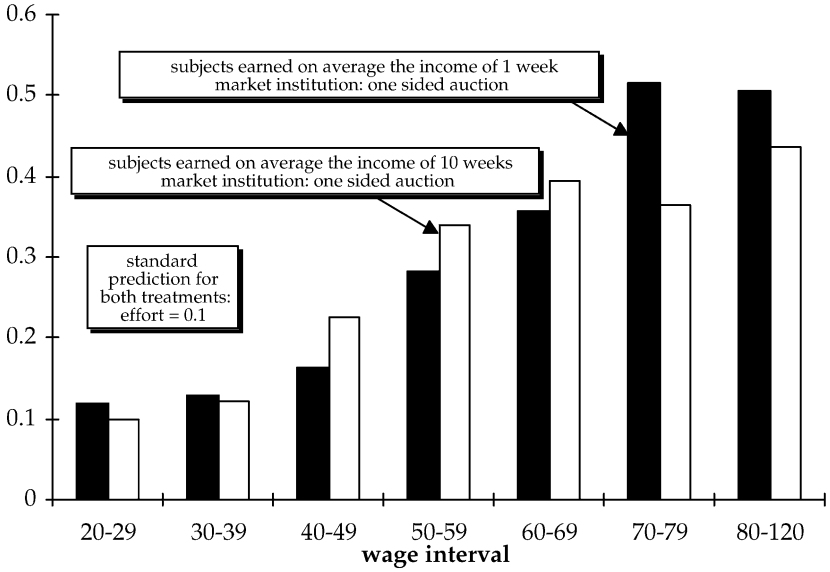
auctions with incomplete contracts reveals that the incomplete contracts feature is not sufficient for our results. In the Lynch et al. (1986, 1991) experiments[4] buyers also did not know the quality of the good they bought from sellers in a double auction market. The good purchased could either have a regular (i.e., low) quality or a superior (i.e., high) quality. High quality was more valued by the buyers but also more costly for the sellers. As in our experiments, quality was not contractible. In the Lynch et al. (1986, 1991) experiments high quality goods (called supers) were only traded in the early periods. In total 96 percent of the goods traded were low quality goods (called regulars). Moreover, these regulars were traded at prices that were very close to the competitive equilibrium price. In the context of our experiments the analogous (lemons-) result would be that workers almost always choose $e = 0.1$ and that firms pay wages that are very close to the corresponding competitive equilibrium wage.

[4] We refer here only to those treatment conditions in the Lynch et al. (1986, 1991) experiments that are similar to our double auction treatment.



Data base: Fehr and Tougareva (1995).

Figure 3. Evolution of average wages under conditions of high stakes.



Data base: Fehr and Tougareva (1995).

Figure 4. Wage–effort relationship under conditions of high stakes.

Where does this remarkable difference between our results and the Lynch et al. (1986, 1991) results come from? In our view this difference is generated by the following three-parameter and design differences: *First* of all, and perhaps most importantly, in the competitive equilibrium[5] for both regulars and supers almost the whole surplus from trading is reaped by the sellers because there is an experimentally induced *excess demand*. In contrast, in our experiments the competitive equilibrium wage for any effort level[6] allocates the whole surplus from trading to the firm (buyer) because there is an *excess supply* of labor (sellers). This means that in the Lynch et al. (1986, 1991) experiments excess demand pressures forced buyers to pay high prices. As a consequence, they could not signal their generosity by voluntarily paying more than they had to pay according to demand and supply conditions. Buyers had thus in fact no opportunity to appeal to sellers' reciprocity, i.e., to elicit high quality choices. The *second* reason arises from the fact that buyers in the Lynch et al. (1986, 1991) experiments could easily experience *losses* if they offered prices above the competitive equilibrium price for regulars. Lynch et al. (1986, 1991) report that losses occurred in the first period. We conjecture that these losses deterred buyers from further attempts to elicit high quality choices from the sellers. Notice that in our experiments losses were ruled out and, thus, loss aversion could not inhibit firms' propensity to elicit reciprocity by paying high wages. A third reason stems from the fact that in the Lynch et al. (1986, 1991) experiments only two qualities could be chosen by the sellers and that the cost difference was rather big.[7] Binary effort (quality) choices with large cost differences are likely to inhibit reciprocity. Only those workers (sellers) with a large propensity to respond reciprocally will, under such conditions, *behave* reciprocally while those with a lower propensity will prefer the minimum effort (quality). If our arguments are valid the contrast between our results and the Lynch et al. (1986, 1991) results is very informative. Our experiments indicate the conditions under which one can expect noncompetitive outcomes in competitive markets whereas the Lynch et al. (1986, 1991) experiments indicate the conditions under which standard economic analysis provides good and reliable predictions.

Acknowledgement

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[5] By the competitive equilibrium price for high quality goods (supers) we mean the price that would be obtained for supers in the competitive equilibrium with full information and fully contractible and exogenously (by a third party) enforceable quality levels.

[6] The competitive equilibrium wage for effort levels above 0.1 is defined as the wage that would be obtained in the competitive equilibrium under full information and fully contractible and exogenously (by a third party) enforceable effort levels.

[7] For example, the choice of a high quality at the competitive equilibrium price for low quality goods would have reduced sellers' profits per trade from (approximately) 145 to 45.

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