Experiments on Fairness and Reputation

by

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As members of the Dissertation Committee, we certify that we have read the dissertation

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DEDICATION

To my parents.

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Abstract

This dissertation consists of three essays in experimental economics. The essays investigate different aspects of reputation in fairness games in a controlled laboratory environment. It has been established in the literature of economics, sociology, and psychology that social norms together with other-regarding preferences often govern subjects' decisions in addition to strategic considerations. The dissertation examines the incentives connected with the existence of social norms that could cause deviations from standard economic model predictions. I use experiments so that I can tightly control the environment and provide rigorous tests of existing theories, stylized facts, and anecdotal evidence on the importance of reputation in economic interactions. The first essay presents findings that reputation triggers indirectly reciprocal behavior of subjects. However, reputation might only be signaling what is considered as socially appropriate behavior. This hypothesis and the results of the first essay led me to develop a set of experiments in the second essay to contrast pure reputation effects with the social influence of reputation. The third part of the dissertation, co-authored with Ninghua Du, examines reputation and efficiency wages in a labor market setting by analyzing the effects of negative technological shocks on long run relationships between firms and workers.

Chapter 1

Does Generosity Generate Generosity?

1.1 Introduction

There are numerous situations in social and economic life when reputation plays an important role. People often might wish to condition their actions on information about the other party. As a part of the social capital, it also often has significant payoffs. Reputation can affect trust and trustworthiness and thus might have non-negligible implications for outcomes in bilateral and multilateral interactions. Moreover, if the reputation can spark a positive (negative) direct and indirect reciprocity, people might be willing to forego material gain in order to reward (punish) those who have treated themselves or others nicely (poorly). When treated poorly it might also cause people to act in more self-regarding way rather than adhering to some applicable social norm. Both indirect reciprocity and reputation are relevant phenomena from the economic as well as social perspective. This study investigates the link between them within a series of one-shot dictator games.

The experiments examine whether the reputation of an individual has an impact on the behavior of others towards this person. The standard assumption about self-regarding preferences predicts that reputation does not influence agents' choices. On the other hand, the experimental literature has produced countless inconsistencies with the economic-man model. These include positive contributions in various public goods experiments, equal splits in bargaining games or behavior inconsistent with principal-agent theory in experimental labor markets. These results point to the direction that utility is not an affine transformation of only one's own monetary payoffs and that choices in certain situations depend on intentions of the other players. In the current study I find mixed evidence for the reputation effects of selfish behavior

in laboratory environments. On the other hand, I also find that observing someone's generous action causes generous behavior of others towards this individual. The data support the conclusion that virtue is contagious. People anticipate indirect reciprocity and are more generous when aware of possible reputation effects. The fact that one's own image is important to people is not surprising and has already been documented in the literature on social distance in experiments. The novel contribution presented in this paper is procedural - knowing that the choices will be revealed to others, people become more generous even though their identities are not revealed.

The effects of reputation have already been explored experimentally in certain decision making settings. Croson [1995] and Weimann [1994] study the change in the level of public good provision after players learn about the contributions by all participants. Their experiments can be interpreted as a response to the reputation of each individual in the group. Two other studies, Dale et al. [1999] and Schmidt et al. [1999], find that the reputation enhances coordination.

Berg, Dickhaut, and McCabe [1995] investigate the effects of social history in an investment game where they focus on internalization of social norms. The social history is used to provide common information about the use of trust within a group of undergraduate subjects and is understood as a trust-encouraging factor to achieve a Pareto improvement when reciprocity is available. Their approach can also be viewed as examining the group reputation effect on the decisionmaker. The social history treatment identifies conditions that strengthen the relationship between trust and reciprocity through the social influence argument.

In another paper, Grossman and Eckel [1996] find that history matters in other circumstances as well. Instead of having an anonymous recipient as in most of the related experiments, they inform the subjects that the money will be contributed to the American Red Cross. This is a significant treatment as the amount of money donated by the subjects increases. Grossman and Eckel explain that the American Red Cross has a long history of providing benefits and thus invites reciprocal behavior.

Knez and Camerer [1995] use a between-respondent comparison treatment in a three-player ultimatum game to explore the effect of outside options and social comparison. Their results show that the offers are affected by how much the other subjects offer. Cason and Mui [1998] also study social influence in market exchange framing of a sequential dictator game. In their relevant information treatment the subjects receive information about the past action of another participant with whom they were not and will not be paired. The data provide mixed evidence for social influence. The frequency at which subjects change their behavior in the irrelevant information treatment is not statistically significantly different from the relevant information one.

The current paper differs from the reputation studies in two aspects. First, it examines reputation in an environment where fairness is an important consideration and social interaction is ongoing. People often reward others' generous actions and punish hostile or selfish ones, even though they were not directed toward themselves (i.e., the explanation cannot be attributed to direct reciprocity). I test for such actions in a controlled laboratory environment.

Second, the paper explores whether people care about how they are perceived by others. In particular, I investigate whether the dictators strategically send more money in order to build a reputation as being other-regarding when knowing that another subject will learn about their choice.[1]

In society people never know with certainity the actual type of the person they encounter. They know only the person's reputation based on an information set that depends on previous interactions of that person with themselves or with other members of society. This conditional reputation arises from observations of a limited number of one-shot games. On the other hand, strategic reputation, which is explored later, includes dictator's concerns for self-image. The main research question, "Does

[1]This question is aimed at reputational concerns about one's own image rather than at social distance implications although they are closely related. The social distance is discussed in the experimental design subsection.

the reputation of being generous (greedy) trigger indirect reciprocity?", tests for the anecdotal evidence of both described types of reputation.

Indirect reciprocity is one of the foundations of moral, ethical, and legal systems. It operates on the basis of status and reputation through public and private opinions. Indirect reciprocity was first defined by Alexander [1987]. It occurs whenever rewards or punishments come from individuals or groups other than those directly involved in a social interaction involving investment or exploitation. Nowak and Sigmund [1998a] examined an evolutionary process based on simulations of a repeated helping game where a donor can help the recipient at a cost smaller than the benefit. Based on previous behavior, the recipient is awarded with an image score to which the donors respond. They find that the discriminating types are evolutionary stable. Several other papers examine indirect reciprocity in different experimental settings. For example, Dufwenberg et al. [2001] compare the effects of direct versus indirect reciprocity in the investment game. Fehr and Gächter [2002] study its role on altruistic punishment in a public good setting.

1.2 Thought Experiment

Let me provide a motivating thought experiment to illustrate the effects of reputation on indirect reciprocity outside of the laboratory. Consider Cox's [1999] driving example. You are driving in heavy city traffic during a rush-hour. There is a car trying to enter your slowly moving traffic lane from a side road but you have the right-of-way. You can either continue driving or you can slow down, delay your trip, and allow the car to merge. The probability of meeting the same car on a different day with reversed roles is virtually zero, so you cannot count on being repaid the favor. What you might care about is that this game is played in a setting with ongoing social interactions. Thus, your unselfish act might trigger similar behavior by the driver of the car towards other drivers that perhaps otherwise would not occur. If you are an altruist or you seek to strengthen the social norm of committing random acts of kindness to make driving to work a more pleasant experience, you should definitely let the car merge.

Now imagine that you observe the same car on the side road giving up the right of way and letting a pedestrian cross the road. By doing that, the car has forgone the opportunity to merge into a gap on the main road. In which of the two situations are you more likely to let the car in? I argue that given the above preferences, you should be even more likely to allow the latter car to enter your lane because of positive indirect reciprocity based on the reputation information that you just have obtained.

There are numerous other economic and social situations that fit the driving scenario. It is important to note that the reputation does not have to be observed directly, but is it rather natural to think that it could be conveyed by some third party as in any feedback (eBay and other internet market places) or referral systems (doctor's referral system, job referral, references in the school application process, etc.). In this paper I create a simple environment, similar to that of the thought experiment, yet stripped down from framing and other possible confounding effects

to test the importance of reputation.

The remainder of the paper proceeds as follows. The next section presents the description of conditional reputation treatments, procedures, and results. Section 3 deals with the strategic reputation experiment and compares its results to conditional reputation. Section 4 analyzes the behavior of self-regarding players from the two experiments. Section 5 describes a third experiment when only generous actions are feasible. The last section presents conclusions.

1.3 Conditional Reputation in a Dictator Game

The experimental design includes a dictator game identifying the player's type and an identical dictator game with known conditional reputation of the paired player. The use of a dictator game is important in order to rule out possible within-game strategic interdependence of the subject's monetary payoff on both one's own action and others' actions as well. This feature is critical to the design because the subjects can choose actions based on their moral rules, values, and beliefs without having to consider possible reactions of the paired player. Only this way the pure effect of receiving additional information about another subject's choice can be addressed. The comparison of a subjects' behavior in treatments CA where they play with a stranger, and CB where they have an information on the other player, highlights the reputation effects.

The modification of the dictator game used here was introduced by Cox, Sadiraj, and Sadiraj [2005] in a triadic experimental design with dictator controls to identify alternative motivations behind the actions of the players in the moonlighting game and separate trust (fear) in positive (negative) reciprocity and altruistic other-regarding preferences of first movers and positive or negative reciprocity and altruistic or inequality-averse other regarding preferences of second movers.

1.3.1 Treatment CA - Dictator Game with a Stranger

In the baseline treatment CA players one and two play the following version of a dictator game:[2]

At the beginning of the experiment, both players are endowed with \$10. The game consists of only one stage. Player one, the dictator, chooses a strategy s^a,

[2] Treatment A consists of two tasks. In the first one, the subjects from group X make decisions as players1 and subjects from group Y play role of players 2. In the second task their roles are reversed. An analogous role reversal takes place in treatment B.

TABLE 1.1. Experimental Conditions

Experimental Conditions	Stranger (A)	Reputation (B)
Conditional Reputation (C)	CA	CB
Conditional Reputation for Generosity (G)	GA	GB
Strategic Reputation (S)	SA	SB

where $s^a \in S$ and

$$S = \{10, 9, 8, ..., 0, -1, ..., -5\} \tag{1.1}$$

corresponding to the amount of money sent to the paired player two. A positive s^a means that player one gives money to player two. Player one's money payoff decreases by s^{a} and player two's money payoff increases by $3s^a$, i.e., the amount sent is tripled by the experimenter. A choice of negative s^a results in increasing payoff of player one by s^a because that is the amount taken from player two, and the payoff of player two naturally decreases by the amount taken from him, s^a. Any amount taken is not transformed by the experimenter. If s^a is equal to zero then no monetary payoff is changed. Player two does not make a decision in the dictator game, therefore his strategy set is restricted to the empty set. Consider the following three examples for illustration: First, suppose player one decides to take \$5. Then he ends up with \$15 and player two is left with \$5 at the end of the game. If player one sends 0, both players's payoffs are equal to their initial endowments of \$10. If player one gives \$7 to player two, his own payoff becomes \$3 and player two receives (\$7*3) + \$10 = \$31.

The Nash prediction for self-regarding preferences in the dictator game implies that player one takes the maximum amount of \$5 from player two. Player one thus foregoes the opportunity of creating additional surplus for player two. However, if he sends a positive amount to player two we can conclude that the reason for doing so is altruism or some alternative form of other-regarding preferences.

1.3.2 Treatment CB - Dictator Game with Conditional Reputation

Treatment CB is the conditional reputation treatment. Subjects again play the dictator game described in Treatment CA with the only difference that player one is acquainted with the reputation of player two. The reputation is represented by the action taken by player two in treatment CA. Player one is told the amount that player two decided to send or take as a dictator to somebody else he was paired with in the previous task. The Nash prediction for self-regarding player one is again to take $5. The implementation of treatments CA and CB is discussed below.

1.3.3 Procedures

The sequence of treatments in all three experiments is designed with the following objectives. I seek to obtain the relevant information about players' types while minimizing any confounding information.[3] The design eliminates direct reciprocity between treatments and controls for group effects by not revealing the choices of the whole population. For these reasons the order in which treatments follow is set to be CA, CB.[4] In the first two experiments I address the research question in a within-subjects design.

A rich social context is created by placing subjects in a situation that resembles a setting outside of the laboratory. This setting is realistic in that subjects partake in ongoing social interactions, such as participating in multiple tasks throughout the

[3]Subjects had to be screened first to obtain the reputation information and this has then been provided in the treatment B to their paired dictators. Another studies that use a dictator game as a screen are Cain [1998] and Charness [2000].

[4]The sequence in which the treatments follow poses a question of order effects. The current design is a compromise between the ability to observe the behavior of the same individuals in two different conditions and a possibility of a confounding effect. The third experiment presented in this paper drops the within subject design and thus eliminates the order effects. Such a change comes at a cost of not being able to asses the impact of a generous first action on the second decision. The follow up study, Servátka [2005], also addresses the issue of order effects in a similar setting. As in Cason and Mui, it introduces an another treatment with irrelevant information as a baseline with which the reputation treatment is compared. The data show no evidence of order effects.

experiment. The social context might be confounded in the data with treatment effects in the experiment. However, as noted by Cox [1999] in an investment game triad study:

> *The amounts sent and returned are higher (...) in the strong social context than they are in the weak social context. But the change from strong to weak social context*[5] *has only small effects on the measured incidence of trusting and reciprocating behavior in the game triad." (pp. 27)*

Thus the play of one shot games in the rich social context triggers social norms that are not fully internalized in the weak social context. As a consequence, it might produce stronger quantitative results, but their direction stays the same in both cases, because the multiplicity of tasks does not alter the motives of behavior.

All sessions described in this paper were conducted in the Economic Science Laboratory at the University of Arizona. Twenty eight undergraduate students served as subjects in the conditional reputation experiment. In each session one person was randomly chosen to be the monitor[6] and the rest were randomly divided into two groups X and Y. Group X subjects were seated in the front row of the laboratory in cubicles. Group Y subjects were seated in identical cubicles at the back of the room. The monitor was in charge of distributing and collecting the envelopes with decision form sheets inside.

First, in the general instructions the subjects were told they would participate in a multiple task experiment. Second, a new set of individual instructions were provided for each subject upon completion of each task. At the beginning of every task, each person in each group was credited with 10 dollars as an initial account balance. After making decisions, the subjects were asked to put the decision form in the enclosed envelope, seal it and give it to the monitor. The end of the experiment was to be

[5] Two decision tasks vs. one decision task.

[6] Monitor did not make any decisions, therefore is not included in the number of participating subjects.

announced after completing multiple tasks. The participants did not know how many tasks would be completed. At the conclusion of each session a die was rolled in subjects' and monitor's presence to determine which task would have monetary payoffs in U.S. dollars to eliminate wealth and portfolio effects. The remaining balance in dollar accounts from the randomly selected task was paid to the participants in cash. The design involved a role-reversal, so the subjects participated in the experiment both as dictators and recipients. Depending on the outcome of the roll of a die, a subject could get paid either for his/her own action or as a recipient of money sent by a dictator.

The participants were also instructed that each person in Group X would be randomly matched with a person in Group Y and no one would learn the identity of the person with whom he/she was matched. In each task a person in Group X was matched to a different person in Group Y. There was no chance of being matched with the same person more than once during the entire experiment. The matching procedure minimized, if not completely eliminated, any dynamic game effects and controlled for direct revenge/reward incentives. The subjects' instructions also stated that the choices from individual tasks would be recorded by the experimenter. The presence of a monitor guaranteed that the procedures described in the instructions were actually followed.

The subjects were acquainted with the fact that the experiment was structured so that no one, neither the experimenters nor the other subjects, nor anyone else would ever be able to trace their choices to their identities. This was accomplished by the following procedure. Each participant privately collected the money payoff contained in a sealed envelope, from a mailbox that only he/she could open with the key received in the decision form envelope during the first task. The privacy was guaranteed because neither the name nor the student identification number appeared on any form in the experiment. The only identifying mark in all records was the seat number and the code engraved on the key to the mailbox which was known only to

each individual. However, it was emphasized that although the experimenters did not know subjects' identities, they had a way to map their decisions to their own payoffs correctly.

The use of double blind protocol strengthens the social isolation of the subject's decision. According to Berg, Dickhaut, and McCabe, the anonymity along with the nature of one-shot treatments eliminates contractual precommitments and potential punishment threats in subsequent periods. The social distance of double blind protocol introduces conditions under which the subjects do not have to be concerned about their "outside-of-the-laboratory" image and thus can reveal their natural preferences. This is crucial for the investigation of reputation effects existing within the game. If fairness considerations are not revealed under the double blind protocol, then they are not economic primitives and/or the social norms are not fully internalized. However, if subjects behave in a fair way, one might conclude that the findings would be even stronger when the social distance is reduced to single or zero blind. One might expect that the behavior of individual subjects will be directly observable forcing further socialization.[7] Social distance and other-regarding behavior in dictator games were first studied by Hoffman, McCabe, Shachat, and Smith [1994] and Hoffman, McCabe, and Smith [1996] under both single blind and double blind procedures. Both studies find that the behavior of subjects becomes more self-regarding as the social distance increases. I slightly change the procedures of the double blind protocol introduced in their experiments: All the subjects are brought together at the beginning of the experimental session as opposed to different groups being put directly in different locations. This is the starting point of creating a rich social context. The goal is to have subjects understand that they are playing with actual people. At the same time this procedure controls for social status effects because the subjects observe that they belong to the same social group of undergraduate students.

[7] However, Dufwenberg and Muren [2003] present evidence that increasing the social distance may create other confounding effects.

At the end of the actual experiment the subjects were asked to fill out a questionnaire about demographics, understanding of tasks, and decision rules. After completion they walked to a separated room where the mailboxes were, to collect the envelopes with monetary payoffs. The key and mailbox were labeled with the same number. Each participant was the only person having that key and the only one who knew his/her key code. While collecting the envelopes from their mailboxes, the subjects were requested not to open them immediately but to wait until they left the lab. After collecting the envelopes, they returned their keys by throwing them in a box outside the room where they picked up their envelopes.

1.3.4 Hypotheses and Heuristic Predictions

Fundamentally, I am interested in answering the question: "Do the choices under a zero information structure differ from the choices in the reputation treatment?" If yes, then it is important to ask: What are the qualitative implications of such changes.? In which direction does the behavior change depending on the reputation type of the paired player? To answer these questions, I first examine whether there are any differences in the amounts sent under the two informational structures. The null hypothesis is:

Hypothesis 1: The dictator sends the same amount of money to strangers (CA) as he would to a subject with a known reputation (CB).

However, testing the null hypothesis might not give much insight about the reputation since the effects of meeting a taker and meeting a giver might be confounded in the data. Such test does not detect in what direction the behavior changes after learning the specific reputation of a paired player. The existing literature on moonlighting and investment game triads provides evidence that a non-trivial fraction of player ones sends positive amounts to player twos. I expect the amounts sent to be

even magnified by the presence of an ongoing interaction. Based on scientific and anecdotal observations that people also pay attention to aspects of behavior other than payoff maximization, the reputation might influence subjects' actions.

To determine the effects of certain reputation types I divide the sample into two groups. The categorization is based on the perception of actions in treatment CA. In one-shot interactions subjects may disregard preferences or motives of the paired player, they are only interested in what the paired person has done in the previous treatment. Since the subjects participate in all the treatments, they are familiar with the nature and the social context of the game. Thus, they know what it means to pass or to take money and what is the cost of doing so. Therefore, given the previous action towards a stranger, call it CA, the player 1 is considered to be a (a) giver, if he passes a positive amount of money in treatment CA ($CA_t > 0$) and a (b) taker, if he passes a non-positive amount in treatment CA ($CA_t \leq 0$). The classification of subjects who send zero as takers is arbitrary, because such action could be perceived as "nice" if the reference point is not taking money from the paired player or "not nice" when the reference point is creating social surplus and giving money. However, I perform the statistical analysis both ways. Based on the described reputation categories and on the assumption that reputation matters, I form the two following testable predictions:

Hypothesis 2: The dictator sends more to a giver (CB^{giver}) than to a stranger (CA).

Hypothesis 3: The dictator sends less to a taker (CB^{taker}) than to a stranger (CA).

Thus, the comparison of amounts sent/taken by the dictator in treatments CA and CB allows me to distinguish between behavior when facing a complete stranger as opposed to when facing an individual with the conditional reputation of being a taker or a giver.

1.3.5 Subjects' Behavior in the Conditional Reputation Experiment

The choices of subjects who participated in the conditional reputation sessions are depicted in Figure 1. The figure shows the amounts sent by dictators in treatment CA represented by the solid black bar for each subject pair. The subjects are portrayed as they were paired in condition CB. The patterned bar represents the amounts sent by dictators in condition CB after having observed choices of their paired recipients, i.e., the adjacent solid black bar. The mean of amounts sent or taken by dictators in treatment CA was equal to -3.88 dollars and in treatment CB equal to -3.5 dollars (see Table 1.2 summarizing information about all relevant samples and subsamples). The Means test presented in the first row of Table 1.3 reports that this difference is statistically insignificant (p=0.63) and Hypothesis 1 cannot be rejected. In treatment CA, 19 out of 26 subjects[8] took the maximum of five dollars from their paired players, 5 took amounts between two and four dollars, and 2 subjects gave exactly five dollars each. Thus, the behavior of 73.1% of the subjects is consistent with the self-regarding preferences model. Further, only 2 out of 26 subjects were characterized by altruistic other-regarding preferences and fall into the category of givers. In treatment CB, the 2 subjects who were paired with them responded to such conditional reputation information by sending positive amounts of three and five dollars, respectively. Since there are only two data points in this category, further evidence had to be gathered. An experiment producing conditional reputations for generosity is described in section 5.

The remaining 24 subjects in treatment CA were classified as takers. In treatment CB, 21 out of 24 subjects (87.5%) who were faced with takers took the maximum

[8] Three subjects out of 31 who participated in three sessions of Conditional Reputation experiment were selected to be monitors. Also, two data points had to be excluded from the statistical analysis, one because of recording error and the other one because the subject marked two answers on the decision form.

TABLE 1.2. Conditional Reputation Results

Data Category	Mean Amount Sent
CA	-3.88 [2.73]{26}
CA_{givers}	5.00 [0]{2}
CA_{takers}	-4.625 [0.82]{24}
$CA_{ex\ post\ paired\ with\ givers}$	-4.00 [1.41]{2}
$CA_{ex\ post\ paired\ with\ takers}$	-3.88 [2.83]{24}
CB	-3.5[3.26]{26}
$CB_{paired\ with\ givers}$	4.00 [1.41]{2}
$CB_{paired\ with\ takers}$	-4.13 [2.49]{24}

Standard deviations in brackets.
Number of subjects in braces.

of five dollars, 1 subject sent zero, 1 sent one dollar and 1 sent five. The mean of amounts sent or taken by dictators when paired with a taker was equal to -4.13 dollars. The means for CA and CB_{taker} support the prediction that the dictator would give more/take less to a stranger than to a taker. However, the Means two-sample t-test reported in the second row of Table 1.3 does not detect a statistically significant difference between the samples (p=0.37) and Hypothesis 3 is rejected.[9] The conclusion that a conditional reputation of being a taker does not spark negative indirectly reciprocal behavior[10] is similar to the finding by Cox, Sadiraj, and Sadiraj of nonsignificant direct negative reciprocity evidence in the moonlighting game. The natural interpretation of this experimental evidence could be a presence of forgiveness and understanding in subjects' behavior. Yet, the result is driven mostly by the lower bound imposed by the experimental design and the high number of self-regarding

[9]The Means test was applied because the research studies the differences in mean amounts sent or taken under several conditions and not their whole distributions.

[10]Notice that in the design of the experiment, the indirect negatively reciprocal behavior is not costly for the dictator in terms of monetary payoffs. The effect of learning about the paired player taking money in previous treatment and responding by taking money as well has two interpretations. First, if the dictator has preferences for fair outcomes (such as inequality aversion) and/or is concerned with preserving of social norms within the society, because of the strong social context of his action he might decide to take money in order to punish a taker. Second, if the dictator is self-regarding himself, but adheres to some social norm for fairness, he might be more willing to take money from the paired player who was a taker rather than giver. The "negative" reputation of the paired player justifies breaking the social norm for fairness.

TABLE 1.3. Tests for Conditional Reputation Effects

Data | Tests	Means	Wilcoxon	Sign	Mann-Whitney
Tr. CA vs Tr. CB	-0.49 $_{(.627)}$**	.14$_{(.892)}$**	$_{(1.000)}$**	0.41$_{(.682)}$
Tr. CA vs Tr. CB$^{a}_{taker}$	0.33 $_{(.373)}$*	-	-	1.10$_{(.136)}$*
Tr. CA$_{taker}$ vs Tr. CB$^{b}_{taker}$	0.36 $_{(.360)}$ * **	1.02$_{(.307)}$**	$_{(.227)}$**	0.97$_{(.166)}$*

p-values in parentheses.

* one-tail test.

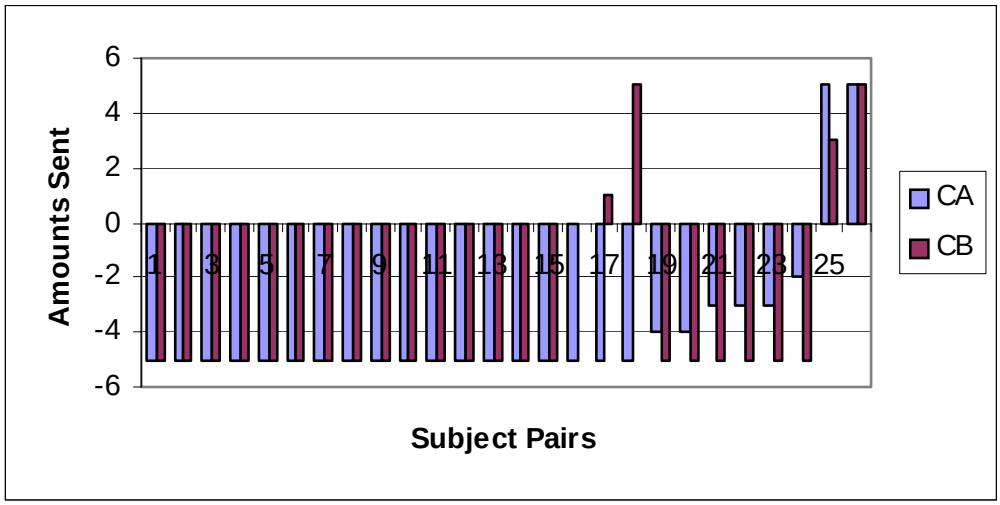
** paired test.

[a]Tr. CA vs Tr. CB when paired with taker

[b]Tr. CA$_{ex\ post\ paired\ with\ taker}$ vs Tr. CB when paired with taker

choices present in the data. The behavior of self-regarding dictators is further explored in section 4.

FIGURE 1.1. Subjects' Behavior in Treatments CA and CB



1.4 Strategic Reputation Building

Strategic reputation building - intentional behavior, motivated by prestige, social status, image of oneself, or indirect reciprocity, might have a considerable influence on economic and social interactions. In the second part of the paper I modify the experimental design to explore whether the behavior changes when subjects are informed about the strategic component of their choices. This is done to examine if people respond differently to reputation that might not reveal the true type of an individual, but instead is planned. In reality, the economic agents might behave the way they want to be perceived by other agents, not necessarily the way they would if their behavior was not observed. In the context of social distance, Hoffman, McCabe, and Smith [1996] note the following on the subject:

> *"...people act as if they are other regarding because they are better off with the resulting reputation. Only under conditions of social isolation are these reputational concerns of little force. [...] it seems unreasonable to believe that people directly consume their reputations in isolation, but instead value their reputations because of the long-term personal benefits that result. In addition, people value social interaction with others and a good reputation increases the chance of continued social interaction." (pp. 659)*

This second experiment does not directly suggest strategic reputation building. Nevertheless, it examines the effect of a prior dictator's knowledge that his choice will be revealed to a player he will be matched with in the future task. Such instructions may trigger different incentives when making a decision about how much money to send. A strategic reputation experiment relates to a situation in which an individuals' behavior is affected by anticipatory knowledge of the possible reactions of those around them in ongoing social interaction. The experiment described in this section

is not aimed at social distance in the same way as the experiment in the Hoffman, McCabe, and Smith's paper. The current design focuses on the issue of whether the dictators' decisions become more other-regarding if they are later to be revealed, but the dictators will remain anonymous. In that sense, the social distance is being kept constant. The introduction of the "strategic component" is a complementary test for internalization of social norms to changing the social distance. I argue that it has a stronger predictive power than the social distance because if one observes a shift in behavior towards more other-regarding choices just because the decisions are revealed but not the identity, revealing of the decisionsmaker's identity would yield greater effects. The last statement is, of course, a testable hypothesis.

There exists a vast theoretical literature on strategic reputation building when one type is pretending to be something she is not in order to maximize her payoffs. However, there are only a few experimental studies that touch on the connections between reputation and fairness. Such games require a history of moves that has to be known to other players. Van Huyck, Battalio, and Walters [1995, 2001] studied a trust game between a peasant who must decide how much to plant and a dictator landowner who can confiscate the outcome or its part by taxation. They find very little trust in the discretion condition when the dictators make their decisions after the peasants' decisions when compared with a precommitment condition. Allowing for reputation building with repeated matching in the game yields results closer to precommitment condition.

The aspect of being observed by someone is also explored by Seinen and Schram [2001]. They experimentally study the helping game and observe that indirect reciprocity is important since many donors base their actions on the image score of the recipient and on their own score as well. Engelmann and Fischbacher [2002] introduce two types of players - with and without the image score and separate pure indirect reciprocity from incentives for strategic reputation building on the helping rate. They find that pure indirect reciprocity is relevant but also that the helping choice seems

to be influenced by strategic considerations. In their setting the strategic players do better than non-strategic ones and non-reciprocal players do better than reciprocal players.

1.4.1 Experimental Design and Procedures

The two strategic reputation treatments, SA and SB, are analogs of conditional reputation treatments, CA and CB, with only one exception: The instructions to treatment SA inform the subjects that the dictator's choice will be revealed to a player he or she will be matched with in the next task. The experimental procedures are also identical. Treatment SB is designed to show how benevolent or malevolent a dictator could be toward player two knowing how player two behaved earlier while knowing in advance that his choice would be announced to the next paired player. This is parallel to real life interactions, when some people might take actions towards other individuals because of their personal history, realizing that the other individual's choices could have been strategic.

1.4.2 Hypotheses and Tests for Strategic Reputation Effects

In forming the predictions for strategic reputation effects the participants are again grouped into the categories of givers and takers, based on their choices made in treatment SA. I am testing the analogs of Hypotheses 1 through 3 to asses the impact of strategic reputation effects. Moreover, the across subject comparison of treatments CA and SA investigates the effects of strategic reputation, i.e., to see if people behave differently if they know that their choices will be revealed to a subject they will be paired with in the future.

Hypothesis 4: The dictators sent more money when they are explicitly aware that their choice will be revealed to a future paired player (SA) than when they are not (CA).

It is natural to expect that people will take less or send more because of the concern about how their actions will be perceived by others and/or because of payoff maximizing incentives in the strategic reputation treatment.[11]

1.4.3 Subjects' Behavior in the Strategic Reputation Sessions

The behavior of subjects who participated in three strategic reputation sessions (12 subjects plus 1 monitor in each session) is presented in Figure 2. In treatment SA, 22 out of 36 (61.1%) subjects took the maximum amount of five dollars even when they knew their choices would be revealed to paired players in future tasks, 3 people took exactly three dollars, six send zero, and five sent positive amounts. One out of the five givers sent the whole endowment, the remaining four sent amounts between 1 and 3 dollars. The average amount sent by dictators in treatment SA was equal to -2.81 (see Table 1.4).

The five subjects paired with givers in treatment SB sent on average -3.40 dollars. The means between SA and SB are not significantly statistically different from each other, so Hypothesis 1' is rejected. The Means test in Table 1.5 also rejects Hypothesis 2'. This result does not change even after changing the classification of subjects who sent zero in treatment SA to givers[12] nor after pairwise comparison of choices of subjects in treatment SA who were ex post matched with givers (including zero) in SB. As explained in Section 4, the insignificance is driven mainly by high proportion of self-regarding choices in the data.

Consequently, 23 out of 31 (74.2%) dictators paired with takers in treatment SB took five from them, 2 took smaller amounts, 2 sent zero, and 4 sent positive amounts.

[11] A comparison of choices of dictators paired with givers (takers) across treatments CB and SB is hard to interpret because of confounds caused by different types of reputation (conditional vs. strategic) and their different magnitudes faced by dictators in the two treatments. Nevertheless, the statistical analysis showed no significant difference (p-value = 0.84).

[12] The analysis of classifying dictators who sent zero in treatment CA once as takers and once as givers has not been performed since there were no zeros in the data.

TABLE 1.4. Strategic Reputation Results

Data Category	Mean Amount Sent
SA	-2.81 [3.43]{36}
SA_{givers}	3.60 [3.65]{5}
SA_{takers}	-3.84 [2.00]{31}
SA_{givers} (zero = giver)	1.64 [2.98]{11}
SA_{takers} (zero = giver)	-4.76 [0.66]{25}
$SA_{ex\ post\ paired\ with\ takers}$	-2.45 [3.57]{31}
$SA_{ex\ post\ paired\ with\ givers}$	-5.00 [0.00]{5}
$SA_{ex\ post\ paired\ with\ takers}$ (zero = giver)	-2.92 [3.59]{25}
$SA_{ex\ post\ paired\ with\ givers}$ (zero = giver)	-3.10 [2.73]{10}
$SB_{paired\ with\ givers}$	-3.40 [2.61]{5}
$SB_{paired\ with\ takers}$	-3.32 [3.52]{31}
$SB_{paired\ with\ givers}$ (zero = giver)	-2.80 [2.62]{10}
$SB_{paired\ with\ takers}$ (zero = giver)	-3.48 [3.72]{25}

Standard deviations in brackets.
Number of subjects in braces.

On average, they sent -3.32 dollars. As in the conditional reputation experiment the data suggest that strategic reputation of a taker reduces the amounts sent by dictators to such players. However, as reported by the Means test in rows six and seven of Table 1.5, this effect is not statistically significant. The Hypothesis 3' saying that the "strategic" dictator sends less to a taker than to a stranger is rejected even if the subjects who sent zero in treatment SA are categorized as givers rather than takers. Nevertheless, if Hypothesis 3' is modified to compare only the pairwise choices of subjects in treatment SA who were ex post matched with takers (including zero) in SB (means equal to -2.45 and -3.32, respectively), it cannot be rejected (p-value = 0.05). The finding is also supported by Wilcoxon and Sign pairwise tests.

The conditional versus strategic reputation comparison is reported in Table 1.6. The Means test does not reject Hypothesis 4 that the dictators send more money when they are aware that their choice will be revealed in the future, (p-value = 0.08) despite the strong evidence of self-regarding behavior in both experimental settings. Thus, the

TABLE 1.5. Tests for Strategic Reputation Effects

Data | Tests	Means	Wilcoxon♭	Sign♭	Mann-Whitney
SA vs. SB	-1.08 (.289)♭	1.10 (.269)	(1.000)	0.93 (.354)
SA vs. SB^{a}_{giver}	-0.46 (.331)*	-	-	0.09 (.464)*
SA vs. SB_{giver} (0 = giver)^{b}	0.01 (.498)*	-	-	-0.43 (.333)*
SA_{giver} vs. SB^{c}_{giver}	1.37 (.121)*♭	-1.41 (.160)	(.250)*	-1.49 (.068)*
SA_{giver} vs. SB_{giver} (0 = giver)^{d}	0.37 (.361)*♭	-0.39 (.700)	(.500)*	-0.37 (.355)*
SA vs. SB^{e}_{taker}	-0.61 (.273)*	-	-	1.01 (.156)*
SA vs. SB_{taker} (0 = giver)^{f}	-0.72 (.238)*	-	-	1.37 (.086)*
SA_{taker} vs. SB^{g}_{taker}	-1.68 (.052)*♭	1.75 (.080)	(.073)*	1.44 (.076)*
SA_{taker} vs. SB_{taker} (0 = giver)^{h}	-1.02 (.159)*♭	1.34 (.180)	(.145)*	1.09 (.138)*

p-values in parentheses.

* one-tail test.

♭ paired test.

[a] Tr. SA vs. Tr. $SB_{paired\ w/\ giver}$

[b] Tr. SA vs. Tr. $SB_{paired\ w/\ giver}$ (0 = giver)

[c] Tr. $SA_{ex\ post\ paired\ w/\ giver}$ vs. Tr. $SB_{paired\ w/\ giver}$

[d] Tr. $SA_{ex\ post\ paired\ w/\ giver}$ vs. Tr. $SB_{paired\ w/\ giver}$ (0 = giver)

[e] Tr. SA vs. Tr. $SB_{paired\ w/\ taker}$

[f] Tr. SA vs. Tr. $SB_{paired\ w/\ taker}$ (0 = giver)

[g] Tr. $SA_{ex\ post\ paired\ w/\ taker}$ vs. Tr. $SB_{paired\ w/\ taker}$

[h] Tr. $SA_{ex\ post\ paired\ w/\ taker}$ vs. Tr. $SB_{paired\ w/\ taker}$ (0 = giver)

TABLE 1.6. Tests for Conditional vs. Strategic Reputation

Data | Tests	Means	Mann-Whitney
Conditional vs. Strategic Reputation (Tr CA vs Tr SA)	1.38 $_{(.087)}$*	-1.27$_{(.108)}$*

p-values in parentheses.
* one-tail test.

experimental data support Hoffman, McCabe, and Smith's conjecture that people pay more attention to their image when they understand that it can influence the behavior of other members of society towards them. The amounts sent by dictators to strangers were lower when the dictators were not explicitly informed in the instructions that their current decision would be revealed to a paired player in the next task.

The above mentioned papers examining social distance effects in economic experiments imply that the high proportion of self-regarding subjects is caused mainly by the isolation of subject's decisions under the double blind protocol. However, the use of the double blind procedures in the current experiment is crucial in order to find out if the reputation effect is an economic primitive or if it is derived from the possible further gains because of one's image. Contrary to the social distance protocol, the multiplicity of tasks should bring the subjects' decisions closer to an environment in which people are used to thinking and acting. One can only hypothesize about interaction of these two features of design in the current study. Further exploration is needed to address this question in more detail. Also, it is important to note that the self-regarding pattern of behavior in dictator games is not completely general and that the isolation of decisions is not sufficient to observe only self-regarding choices. Cox's [2004] triad experiment (namely, the investment game dictator control treatment) provides evidence that a non-trivial portion of dictators (63%) send positive amounts even under double blind procedures, thus exhibiting significant altruistic other-regarding behavior. Section 5 is based on these results and concludes that the good reputation is indeed rewarded.

FIGURE 1.2. Subjects' Behavior in Treatments SA and SB

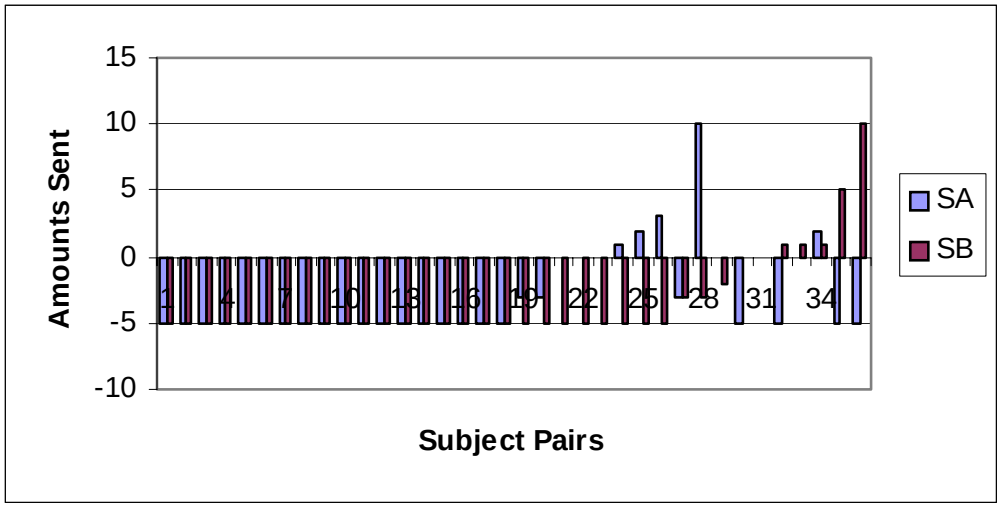
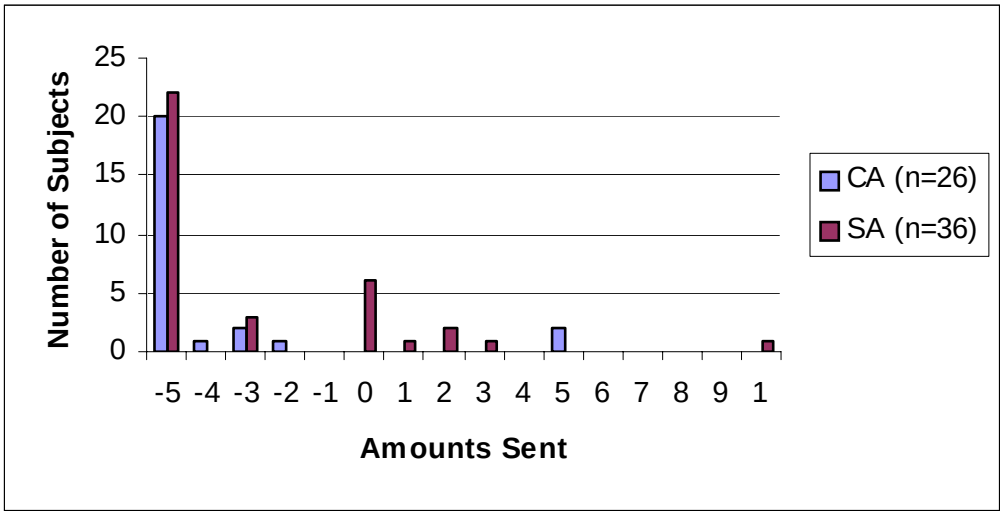


FIGURE 1.3. Subjects' Behavior in Treatments CA and SA



1.5 Do Self-Regarding Players Pay Attention to Reputation?

The experimental data involve a significant number of self-regarding choices. Table 1.7 summarizes the frequencies of change in choices between no reputation and reputation treatments across the two experiments. Cason and Mui's [1998] finding that subjects with more a self-regarding first choice are less likely to change behavior between the treatments receives considerable support in both experiments. In the conditional reputation experiment 17 out of 19 subjects (89.5%) who took five dollars did not change their decisions after learning about the paired player's choice. In the strategic reputation version it was 19 out of 22 (86.4%). These results are statistically significant (p-value = 0.000 and 0.000 Fisher's exact one-tail test for the respective experiments).

In contrast, all 7 conditional reputation experiment subjects with choice other than to take five dollars in CA change their decision when confronted with the past action of their paired player. Similarly high percentages are observed also in the strategic reputation experiment where 11 out of 14 (78.6%) subjects who had taken less than five dollars change their choices, respectively. The finding that the first choice plays a role in explaining the behavior after learning about a paired player's reputation is supported by the tobit data analysis. Rows four to eleven of Table 1.10 report statistically significant own-first-choice coefficients for the strategic experiment separately as well as for the data pooled from both experiments. The marginal effects for each tobit coefficient are presented in a row below the estimate. The general relationship among the dictator's choice towards a subject with reputation, B_t, subject's reputation, R_t, and dictator's first choice towards a stranger, A_t, for the pooled data is of the form:

$$B_t = \alpha + \beta \cdot R_t + \gamma \cdot A_t + \delta \cdot D_t + \varepsilon_t \tag{1.2}$$

TABLE 1.7. Frequency of Changes between No Reputation (A) and Reputation (B) Treatments, by First Choice

	Change between A and B	No Change between A and B	Total
Conditional Reputation[a]			
first choice = -5	2	17	19
first choice < -5	7	0	7
	9	17	26
Strategic Reputation[b]			
first choice = -5	3	19	22
first choice < -5	11	3	14
	14	22	36

[a] 1-sided Fisher's exact test p-value = 0.000.
[b] 1-sided Fisher's exact test p-value = 0.000.

where

$$D_t = \begin{cases} 0 & \text{for} \quad \text{Conditional Reputation Experiment} \\ 1 & \text{for} \quad \text{Strategic Reputation Experiment} \end{cases} . \tag{1.3}$$

The bounds for the tobit estimation are imposed by the experimental design:

$$B_t \in [-5, 10] \tag{1.4}$$

There are several possible explanations why the subjects whose first choice is self-regarding, do not change their decisions after they learn about the paired player's reputation. First, and perhaps the most obvious one, is that the choices represent dictators' self-regarding preferences and for these people the reputation does not matter. Maybe no social norms of sharing are triggered, since these subjects cannot derive any utility from being thanked by the other person for an altruistic action of passing a positive amount because of the double-blind protocol and this motivates their decisions. Second, this pattern might represent subjects' beliefs about the rest of the population which they estimate correctly to be highly self-regarding. Such choice then might just be a best response without trying to exert any effect on population because social norms cannot be maintained. Lastly, it could also represent their

preference for fairness along the lines "I take now, you take next," observed also in other experimental settings (Cox and Walker [1998], Chan et al. [2003]).

1.6 Conditional Reputation for Generosity

The purpose of the third experiment was to produce "positive" conditional reputations, i.e., dictators who are givers when paired with a stranger. Previous experimental studies by Cox [2004] and Cox, Sadiraj, and Sadiraj [2005] that use dictator games as treatments, identify that when there exists a possibility for subjects to "take" money as well as to "send" money, 93% choose to "take", mostly taking the maximum amount of $5. However, if the "take" option is removed so the strategy space only allows nonnegative numbers to be sent, 63% of the subjects choose to give money when the cost of sending $1 was only $0.33. Thus, there is a substantial evidence of unconditional altruism in the data when only generous actions are feasible. By design, the use of the latter setup generates conditional reputations for generosity.

The design of two treatments GA and GB differs from the conditional reputation treatments (CA and CB) in the following respects: Only the player one is endowed with $10, player two has $0. The strategy set S, described by equation 1, is truncated to allow for only nonnegative amounts to be sent by the dictator to the paired player. Given the new strategy set, the self-regarding subjects would keep the whole endowment, i.e., send zero. Subjects characterized by any type of other-regarding preferences would pass positive amounts.[13] Moreover, the conditional reputation for generosity experiment involves only one role reversal as opposed to two in the conditional and strategic reputation experiments. In the first task group X people play the dictator game with a stranger from group Y. In the second task, people from group Y act as dictators towards recipients with a reputation from group X. Since each group only makes one decision, this design completely eliminates any possible order effects.

Again, based on the behavioral assumption that reputation causes indirectly reciprocal behavior, I form the following testable hypothesis:

[13] Also, the show-up fees of $5 were offered for completing the questionnaire after the experiment to ensure that some subjects would not walk out with a zero monetary payoff.

TABLE 1.8. Conditional Reputation for Generosity Results

Data Category	Mean Amount Sent
Treatment GA	1.71 [1.27]{34}
Treatment GB	3.03 [2.39]{34}

Standard deviations in brackets.
Number of subjects in braces.

Hypothesis 5: The dictator sends more to a generous person (GB) than to a stranger (GA).

Provided that the conjectures introduced in the thought experiment are correct, one can anticipate a spillover effect in terms of generosity - a kindness will be rewarded by kindness even in conditions of absolute anonymity. However, the extent to which this will be observable in the data depends on the proportion of reciprocal agents.

1.6.1 Subjects' Behavior in the Conditional Reputation for Generosity Sessions

Altogether 68 subjects participated in the conditional reputation for generosity sessions, 34 in treatment GA and 34 in GB. Their behavior is depicted in Figures 4. In treatment GA the subjects sent on average 1.71 dollars. Seven out of the 34 (20.6%) participants sent zero. They seem to have only self-regarding preferences. The remaining 27 subjects chose to give money to the paired player: 7 subjects sent one dollar, 13 sent two, 4 sent three, 2 sent four, and 1 subject sent five dollars.

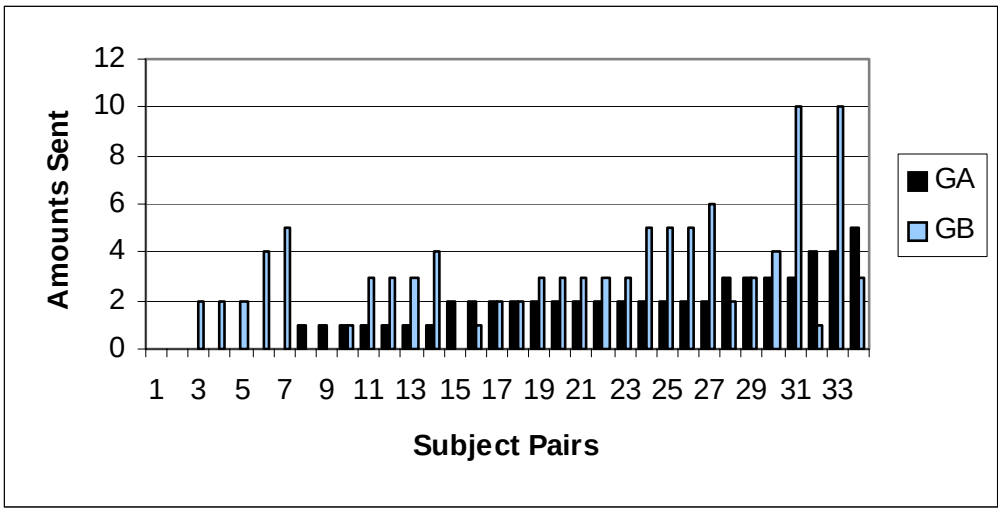
In treatment GB only 5 subjects kept the whole endowment, 3 sent one dollar, 6 sent two, 10 sent three, 3 sent four, 4 sent five, 1 sent six, and 2 subjects sent all 10, giving on average 3.03 dollars. This average amount is statistically significantly greater than the average amount sent in GA (p-value = 0.003). Thus, one can conclude that the conditional reputation for generosity triggered a positive indirectly reciprocal behavior of dictators.

TABLE 1.9. Tests for Conditional Reputation for Generosity Effects

Data | Tests	Means	Mann-Whitney
Tr. GA vs. Tr. GB	-2.85 $_{(0.003)}$ *	-2.70 $_{(0.003)}$*

p-values in parentheses.
* one-tail test.

FIGURE 1.4. Subjects' Behavior in Treatments GA and GB



The last row of Table 1.10 reports tobit estimates of the parameters of the following relation between amounts sent by dictators to recipients with conditional reputation for generosity, GB_t and the recipients' reputation,GA_t:

$$GB_t = \alpha + \beta \cdot GA_t + \varepsilon_t \tag{1.5}$$

with the bounds for the tobit estimation imposed again by the experimental design:

$$GB_t \in [0, 10] \tag{1.6}$$

Note that each subject made only one decision in this experiment, therefore, the inclusion of own first choice as an explanatory variable is not possible. β is the

TABLE 1.10. Tobit Analysis of the Dictators' Responses to Reputation and Own First Choice

Data	$\hat{\alpha}$	$\hat{\beta}$	$\hat{\gamma}$	$\hat{\delta}$	LR test
Conditional	$-2.42_{(.588)}$	$1.77_{(.040)}$	$1.02_{(.233)}$	-	$6.90_{(.032)\{26\}}$
marginal	-0.16	0.12	0.07	-	-
Conditional[a]	n/a	n/a	n/a	-	n/a †
Strategic	$-3.25_{(.135)}$	$0.68_{(.146)}$	$1.72_{(.005)}$	-	$15.03_{(.001)\{36\}}$
marginal	-0.25	0.05	0.13	-	-
Strategic[a]	$-5.78_{(.114)}$	$0.005_{(.996)}$	$1.99_{(.010)}$	-	$14.49_{(.001)\{31\}}$
marginal	-0.40	0.00	0.14	-	-
Conditional & Strat.[b]	$-2.10_{(.505)}$	$1.13_{(.015)}$	$1.61_{(.002)}$	$-1.54_{(.627)}$	$19.19_{(.001)\{62\}}$
marginal	-0.16	0.09	0.12	-0.12	-
Conditional & Strat.[ab]	$-8.78_{(.139)}$	$0.08_{(.941)}$	$1.80_{(.006)}$	$1.54_{(.704)}$	$15.03_{(.002)\{55\}}$
marginal	-0.55	0.01	0.11	0.10	-
CRG	$1.33_{(.109)}$	$0.89_{(.025)}$	-	-	$5.37_{(.02)\{34\}}$
marginal	1.14	0.77	-	-	-

p-values in parentheses.
Number of subjects in braces.
Marginal effects reported in a row below the estimated coefficients.
† Convergence not achieved.
[a] subjects paired with takers only
[b] pooled data

estimate of the effect of reputation on amounts sent by dictators. The estimated β is positive (0.89) and significant ($p = 0.025$). Hence, the tobit analysis supports the conclusion that the reputation triggered indirect reciprocity.

1.7 Conclusions

This paper reports the results from three laboratory experiments aiming at reputation effects in an environment exhibiting salient fairness considerations and ongoing social interaction. The experiments were designed to pick up eventual differences in behavior of subjects towards strangers and individuals with an established reputation in a dictator game. I find mixed evidence on the importance of reputation. A majority of dictators took money from a stranger. In the second treatment the recipient's conditional reputation of being a taker caused the dictators to take even more money, but this difference was statistically insignificant. On the other hand, the recipient's conditional reputation for generosity caused the dictators in another setting to send significantly larger amounts to givers than to strangers.

Since the reputation of a taker did not play a role but the reputation of being a giver did, it is important to ask what is it that triggers the relevance of reputation in some scenarios but does not in others. A simple explanation is that a human nature is to be merciful and forgiving to the "bad" individuals and reward the "good" ones. However, the lack of response to selfish behavior could also be interpreted as either ignoring it or realizing that taking is socially acceptable and conforming to such behavior.

The latter leads to a hypothesis that the reputation carries a signal about socially appropriate behavior. This additional feature of reputation is important to individuals whose beliefs about social norms depend on what the others consider to be socially appropriate.

The obtained results along with the testable hypothesis about the social influence being embedded in a reputation information, led me to develop a set of experiments confronting the pure reputation with social influence. The findings are presented in Servátka [2005]. Such investigations are important in order to better understand the decision process of agents found in circumstances when the actions are intentions

conditional because the traditional game theoretical predictions often fail. The finding that virtue is contagious has important implications for economic modeling of reciprocal behavior and interpersonal relations within social networks. A model of behavior situated in an ongoing social interaction environment where fairness is an important consideration should incorporate the spillover effect of one's action on the rest of the population, especially when the decisionmaker is aware of such long lasting consequence on the social norms.

1.8 Appendix

1.8.1 Conditional Reputation and Conditional Reputation for Generosity Experiments General Instructions

No Talking Allowed

Now that the experiment has begun, we ask that you do not talk or communicate any longer with each other. Because we will not be available to assist you, it will not be possible for you to ask questions. In case there is still something that you do not understand, you are kindly requested to read the instructions again.

Monitors and Two Groups

A monitor has been selected randomly from among those of you who came here today. The rest of you have been divided randomly into two groups, called Group X and Group Y. Group X people are seated in the front row A. Group Y people are asked to sit at the back of the room (row D).

Multiple Tasks

You will be asked to participate in multiple tasks during the experiment. The instructions for each task will be given to you after finishing the previous one. The end of the experiment will be announced to you after completing certain number of tasks.

Anonymity

Each person in Group X will be randomly matched with a person in Group Y. No one will learn the identity of the person she/he is matched with. In each task a person in Group X will be matched to a different person in Group Y. There is no chance of being matched with the same person more than once during the entire experiment.

Initial Account Balances

Each person in each group will be credited with 10 experimental dollars at the beginning of each experimental task.

Money Payoffs

The information about final account balances in each task will be recorded by the experimenters. At the end of the experiment a die will be rolled in front of you to decide the task for which you will be paid in cash. The remaining balance in your dollar account from the randomly selected task will be paid to you in cash at the rate of 1 U.S. dollar per 1 experimental dollar.

Complete Privacy

This experiment is structured so that no one, neither the experimenters nor the other subjects nor anyone else will ever know the personal decision of anyone in the experiment. This is accomplished by the following procedure. You will collect your money payoff contained in a sealed envelope, from a mailbox that only you can open (with your key). Your privacy is guaranteed because neither your name nor your student ID number will appear on any form that records your decisions in this experiment. The only identifying mark in all records will be your seat number and the number engraved on your key which is known only by you. However, although the experimenters will not know your identity, they have a way to map your decisions into your own payoff correctly. At the end of the experiment, you will walk one by one to the waiting room where the mailboxes are to collect your money payoff envelope. The key and mailbox are labeled with the same number. But you will be the only person in possession of that key and the only one who knows your key number. When collecting the envelope from your mailbox, you are kindly requested not to open it immediately. You should wait until you leave the building. After collecting the envelope, you must return your key by throwing it in a key-return box next to the waiting room door.

Your Private Label

At the end of the experiment you will be given a key in a sealed envelope. There will be a 5-digit number engraved on your key. The entered number will be used to select the box that your key can open, which will contain a sealed envelope with your earnings inside.

The Role the Monitor

A monitor was randomly chosen from among the students who volunteered for today's experiment. The monitor will be in charge of distributing and collecting the envelopes with decision form sheets inside little boxes that contain the envelopes containing mailbox keys. The monitor will also be asked to watch and make sure that the experimenters actually follow the procedures that have been explained here.

Decision Forms

Prior to each task you will be given a decision form on a colored paper. After completing the task, please put the decision form in the enclosed envelope, seal it and give it to the monitor. If you did not get a decision form, you are not making a decision in that task. In such case, please return the empty envelope.

Please, read the instructions for each task very carefully.

1.8.2 Strategic Reputation Experiment General Instructions

No Talking Allowed

Now that the experiment has begun, we ask that you do not talk or communicate any longer with each other. Because we will not be available to assist you, it will not be possible for you to ask questions. In case there is still something that you do not understand, you are kindly requested to read the instructions again.

Monitors and Two Groups

A monitor has been selected randomly from among those of you who came here today. The rest of you have been divided randomly into two groups, called Group X and Group Y. Group X people are seated in the front row A. Group Y people are asked to sit at the back of the room (row D).

Multiple Tasks

You will be asked to participate in multiple tasks during the experiment. The instructions for each task will be given to you after finishing the previous one. The end of the experiment will be announced to you after completing certain number of tasks.

Anonymity

Each person in Group X will be randomly matched with a person in Group Y. No one will learn the identity of the person she/he is matched with. In each task a person in Group X will be matched to a different person in Group Y. There is no chance of being matched with the same person more than once during the entire experiment.

Revealing Information about Your Decisions

The choices you make (but not your identity) will be revealed to the player(s) you will be paired with in the future when making his/her decision in consequent task(s).

Initial Account Balances

Each person in each group will be credited with 10 experimental dollars at the beginning of each experimental task.

Money Payoffs

The information about final account balances in each task will be recorded by the experimenters. At the end of the experiment a die will be rolled in front of you to decide the task for which you will be paid in cash. The remaining balance in your dollar account from the randomly selected task will be paid to you in cash at the rate of 1 U.S. dollar per 1 experimental dollar.

Complete Privacy

This experiment is structured so that no one, neither the experimenters nor the other subjects nor anyone else will ever know the personal decision of anyone in the experiment. This is accomplished by the following procedure. You will collect your money payoff contained in a sealed envelope, from a mailbox that only you can open (with your key). Your privacy is guaranteed because neither your name nor your student ID number will appear on any form that records your decisions in this experiment. The only identifying mark in all records will be your seat number and the number engraved on your key which is known only by you. However, although the experimenters will not know your identity, they have a way to map your decisions into your own payoff correctly. At the end of the experiment, you will walk one by one to the waiting room where the mailboxes are to collect your money payoff envelope. The key and mailbox are labeled with the same number. But you will be the only person in possession of that key and the only one who knows your key number. When collecting the envelope from your mailbox, you are kindly requested not to open it immediately. You should wait until you leave the building. After collecting the envelope, you must return your key by throwing it in a key-return box next to the waiting room door.

Your Private Label

At the end of the experiment you will be given a key in a sealed envelope. There will be a 5-digit number engraved on your key. The entered number will be used to select the box that your key can open, which will contain a sealed envelope with your earnings inside.

The Role the Monitor

A monitor was randomly chosen from among the students who volunteered for today's experiment. The monitor will be in charge of distributing and collecting the envelopes with decision form sheets inside little boxes that contain the envelopes containing mailbox keys. The monitor will also be asked to watch and make sure that the experimenters actually follow the procedures that have been explained here.

Decision Forms

Prior to each task you will be given a decision form on a colored paper. After completing the task, please put the decision form in the enclosed envelope, seal it and give it to the monitor. If you did not get a decision form, you are not making a decision in that task. In such case, please return the empty envelope.

Please, read the instructions for each task very carefully.

1.8.3 Blue Task Instructions - Conditions CA and SA

Decisions

Each Group X person has a single decision to make. He/she can decide to change or not the dollar account balances of both people. The Group Y person has no decision to make. Hence, after the Group X person makes his/her decision, the task ends and the account balance of both persons for this task can not be changed any more.

Initial Account Balances

Each person in each group will be credited with $10 at the beginning of this task. The $10 credit will be in your dollar account.

What Happens if a Group X Person Decides to Decrease the Other's Account Balance?

If Person X decides to decrease the Y Person's account balance by $1 then the X person's account balance increases by $1. The Group X person cannot decrease the Y person's account balance by more than $5.

What Happens if a Group X Person Decides to Increase the Other's Account Balance?

If Person X decides to increase the Y Person's account balance by $3 then the X person's account balance decreases by $1. The Group X person cannot increase the other person's account balance by more than $30.

Review of the Decision Task of a Person from Group X

Each person in Group X will choose a column from the TABLE X. Each column summarizes how much both matched X and Y persons get or lose, and their resulting account balances.

TABLE X

	You can ***decrease*** the Other Person's Account as follows					You can ***increase*** the Other Person's Account as follows										
If you change your Account by	+5	+4	+3	+2	+1	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
Then the Y person's Account changes by	-5	-4	-3	-2	-1	0	+3	+6	+9	+12	+15	+18	+21	+24	+27	+30
Y person's Account Balance becomes	5	6	7	8	9	10	13	16	19	22	25	28	31	34	37	40
Your Account Balance becomes	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Review of the Group Y Decision Task

Group Y Persons have no decision to make. This means that their final account balance is determined by the Group X Persons.

Examples

Initial account balances for both X and Y group people are 10 dollars.

If Person X decides to change his/her account balance by +4, say, person Y's account changes by -4. The payoffs for this task will yield 14 dollars for Person X and 6 dollars for Person Y.

If Person X decides to change his/her account balance by 0, person Y's account does not change. The payoffs for this task will yield 10 dollars for Person X and 10 dollars for Person Y.

If Person X decides to change his/her account balance by -6, person Y's account changes by +18. The payoffs for this task will yield 4 dollars for Person X and 28 dollars for Person Y.

1.8.4 Blue Task Decision Form for a Person from Group X - Conditions CA and SA

Your and your paired Group Y's person initial account balance for this task is $10 each.

Please choose a column from the following table. Indicate your choice by drawing an arrow that points at the bottom of the column you have chosen.

	You can ***decrease*** the Other Person's Account as follows					You can ***increase*** the Other Person's Account as follows										
If you change your Account by	+5	+4	+3	+2	+1	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
Then the Y person's Account changes by	-5	-4	-3	-2	-1	0	+3	+6	+9	+12	+15	+18	+21	+24	+27	+30
Y person's Account Balance becomes	5	6	7	8	9	10	13	16	19	22	25	28	31	34	37	40
Your Account Balance becomes	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1.8.5 Green Task Instructions - Conditions CA and SA (role reversal)

Decisions

You are matched with a different person than in the previous task. Each Group Y person has a single decision to make. He/she can decide to change or not the dollar account balances of both people. The Group X person has no decision to make. Hence, after the Group Y person makes his/her decision, the task ends and the account balance of both persons for this task can not be changed any more.

Initial Account Balances

Each person in each group will be credited with $10 at the beginning of this task. The $10 credit will be in your dollar account.

What Happens if a Group Y Person Decides to Decrease the Other's Account Balance?

If Person Y decides to decrease the X Person's account balance by $1 then the Y person's account balance increases by $1. The Group Y person cannot decrease the X person's account balance by more than $5.

What Happens if a Group Y Person Decides to Increase the Other's Account Balance?

If Person Y decides to increase the X Person's account balance by $3 then the Y person's account balance decreases by $1. The Group Y person cannot increase the other person's account balance by more than $30.

Review of the Decision Task of a Person from Group Y

Each person in Group Y will choose a column from the TABLE Y. Each column summarizes how much both matched Y and X persons get or lose, and their resulting account balances.

TABLE Y

	You can ***decrease*** the Other Person's Account as follows					You can ***increase*** the Other Person's Account as follows										
If you change your Account by	+5	+4	+3	+2	+1	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
Then the X person's Account changes by	-5	-4	-3	-2	-1	0	+3	+6	+9	+12	+15	+18	+21	+24	+27	+30
X person's Account Balance becomes	5	6	7	8	9	10	13	16	19	22	25	28	31	34	37	40
Your Account Balance becomes	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Review of the Group X Decision Task

Group X Persons have no decision to make. This means that their final account balance is determined by the Group Y Persons.

Examples

Initial account balances for both Y and X group people are 10 dollars.

If Person Y decides to change his/her account balance by +4, say, person X's account changes by -4. The payoffs for this task will yield 14 dollars for Person Y and 6 dollars for Person X.

If Person Y decides to change his/her account balance by 0, person X's account does not change. The payoffs for this task will yield 10 dollars for Person Y and 10 dollars for Person X.

If Person Y decides to change his/her account balance by -6, person X's account changes by +18. The payoffs for this task will yield 4 dollars for Person Y and 28 dollars for Person X.

1.8.6 Green Task Decision Form for a Person from Group Y - Conditions CA and SA (role reversal)

You are matched with a different person than in the previous task. Your and your paired Group X's person initial account balance for this task is $10 each.

Please choose a column from the following table. Indicate your choice by drawing an arrow that points at the bottom of the column you have chosen.

	You can ***decrease*** the Other Person's Account as follows					You can ***increase*** the Other Person's Account as follows										
If you change your Account by	+5	+4	+3	+2	+1	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
Then the X person's Account changes by	-5	-4	-3	-2	-1	0	+3	+6	+9	+12	+15	+18	+21	+24	+27	+30
X person's Account Balance becomes	5	6	7	8	9	10	13	16	19	22	25	28	31	34	37	40
Your Account Balance becomes	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1.8.7 Orange Task Instructions - Conditions CB and SB

Decisions

You are matched with a different person than in the previous tasks. Each Group X person has a single decision to make. He/she can decide to change or not the dollar account balances of both people. The Group Y person has no decision to make. Hence, after the Group X person makes his/her decision, the task ends and the account balance of both persons for this task can not be changed any more.

Initial Account Balances

Each person in each group will be credited with $10 at the beginning of this task. The $10 credit will be in your dollar account.

What Happens if a Group X Person Decides to Decrease the Other's Account Balance?

If Person X decides to decrease the Y Person's account balance by $1 then the X person's account balance increases by $1. The Group X person cannot decrease the Y person's account balance by more than $5.

What Happens if a Group X Person Decides to Increase the Other's Account Balance?

If Person X decides to increase the Y Person's account balance by $3 then the X person's account balance decreases by $1. The Group X person cannot increase the other person's account balance by more than $30.

Review of the Decision Task of a Person from Group X

Each person in Group X will choose a column from the TABLE X. Each column summarizes how much both matched X and Y persons get or lose, and their resulting account balances.

TABLE X

	You can ***decrease*** the Other Person's Account as follows					You can ***increase*** the Other Person's Account as follows										
If you change your Account by	+5	+4	+3	+2	+1	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
Then the Y person's Account changes by	-5	-4	-3	-2	-1	0	+3	+6	+9	+12	+15	+18	+21	+24	+27	+30
Y person's Account Balance becomes	5	6	7	8	9	10	13	16	19	22	25	28	31	34	37	40
Your Account Balance becomes	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Review of the Group Y Decision Task

Group Y Persons have no decision to make. This means that their final account balance is determined by the Group X Persons.

1.8.8 Orange Task Decision Form for a Person from Group X - Conditions CB and SB

You are matched with a different person than in the previous tasks. The Group Y person you are paired with for this task has previously made the following decision as the first mover:

He/she changed his/her own account balance by ..... , therefore, changing the account balance of paired person by .....

Your and your paired Group Y's person initial account balance for this task is $10 each.

Please choose a column from the following table. Indicate your choice by drawing an arrow that points at the bottom of the column you have chosen.

	You can ***decrease*** the Other Person's Account as follows					You can ***increase*** the Other Person's Account as follows										
If you change your Account by	+5	+4	+3	+2	+1	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
Then the Y person's Account changes by	-5	-4	-3	-2	-1	0	+3	+6	+9	+12	+15	+18	+21	+24	+27	+30
Y person's Account Balance becomes	5	6	7	8	9	10	13	16	19	22	25	28	31	34	37	40
Your Account Balance becomes	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1.8.9 Yellow Task Decision Form for a Person from Group Y - Conditions CB and SB (role reversal)

Decisions

You are matched with a different person than in the previous tasks. Each Group Y person has a single decision to make. He/she can decide to change or not the dollar account balances of both people. The Group X person has no decision to make. Hence, after the Group Y person makes his/her decision, the task ends and the account balance of both persons for this task can not be changed any more.

Initial Account Balances

Each person in each group will be credited with $10 at the beginning of this task. The $10 credit will be in your dollar account.

What Happens if a Group Y Person Decides to Decrease the Other's Account Balance?

If Person Y decides to decrease the X Person's account balance by $1 then the Y person's account balance increases by $1. The Group Y person cannot decrease the X person's account balance by more than $5.

What Happens if a Group Y Person Decides to Increase the Other's Account Balance?

If Person Y decides to increase the X Person's account balance by $3 then the Y person's account balance decreases by $1. The Group Y person cannot increase the other person's account balance by more than $30.

Review of the Decision Task of a Person from Group Y

Each person in Group Y will choose a column from the TABLE Y. Each column summarizes how much both matched Y and X persons get or lose, and their resulting account balances.

TABLE Y

	You can ***decrease*** the Other Person's Account as follows					You can ***increase*** the Other Person's Account as follows										
If you change your Account by	+5	+4	+3	+2	+1	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
Then the X person's Account changes by	-5	-4	-3	-2	-1	0	+3	+6	+9	+12	+15	+18	+21	+24	+27	+30
X person's Account Balance becomes	5	6	7	8	9	10	13	16	19	22	25	28	31	34	37	40
Your Account Balance becomes	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Review of the Group X Decision Task

Group X Persons have no decision to make. This means that their final account balance is determined by the Group Y Persons.

1.8.10 Yellow Task Decision Form for a Person from Group Y - Conditions CB and SB (role reversal)

You are matched with a different person than in the previous tasks. The Group X person you are paired with for this task has previously made the following decision as the first mover:

He/she changed his/her own account balance by ..... , therefore, changing the account balance of paired person by .....

Your and your paired Group X's person initial account balance for this task is $10 each.

Please choose a column from the following table. Indicate your choice by drawing an arrow that points at the bottom of the column you have chosen.

	You can ***decrease*** the Other Person's Account as follows					You can ***increase*** the Other Person's Account as follows										
If you change your Account by	+5	+4	+3	+2	+1	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
Then the X person's Account changes by	-5	-4	-3	-2	-1	0	+3	+6	+9	+12	+15	+18	+21	+24	+27	+30
X person's Account Balance becomes	5	6	7	8	9	10	13	16	19	22	25	28	31	34	37	40
Your Account Balance becomes	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

1.8.11 Blue Task Instructions - Condition GA

Initial Account Balances

Each person in Group Y is credited with 0 (zero) experimental dollars. Each person in Group X is credited with 10 (ten) experimental dollars. As explained below, each Group X person will have a decision to make about what to do with her/his Blue Task endowment.

Decisions

Each Group X person has a single decision to make. He/she can decide to change or not the dollar account balances of both people. The Group Y person has no decision to make. Hence, after the Group X person makes his/her decision, the task ends and the account balance of both persons for this task cannot be changed any more.

The Group X Decision Task

Every dollar given by a person in Group X to a person in Group Y will be tripled by the experimenters. If Person X decides to increase the Y Person's account balance by $3 then the X person's account balance decreases by $1. The Group X person cannot increase the other person's account balance by more than $30. The following table shows how this works.

If the Group X **Person Gives**	**The Experimenters Triple the Amount**	And the Group Y **Total Payoff is**
0	$3 * 0$	0
1	$3 * 1$	3
2	$3 * 2$	6
3	$3 * 3$	9
4	$3 * 4$	12
5	$3 * 5$	15
6	$3 * 6$	18
7	$3 * 7$	21
8	$3 * 8$	24
9	$3 * 9$	27
10	$3 * 10$	30

Group Y Has No Decision to Make

The Group Y people do not have any decision to make in Blue Task. This means that they will keep all of the tripled amount sent to them by individuals in Group X.

Examples

- If Person X decides to change his/her account balance by -6, person Y's account changes by +18. The payoffs for this task will yield 4 dollars for Person X and 18 dollars for Person Y.
- If Person X decides to change his/her account balance by 0, person Y's account does not change. The payoffs for this task will yield 10 dollars for Person X and 0 dollars for Person Y.

1.8.12 Blue Task Decision Form for a Person from Group X - Condition GA

My initial account balance is $10. The paired person from group Y initial account balance is $0. Each dollar I give to the paired person is multiplied by 3 by the experimenter.

My decision is to give the following amount to the paired person. (Please circle one.)

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

1.8.13 Yellow Task Instructions - Condition GB

Initial Account Balances

Each person in Group X is credited with 0 (zero) experimental dollars. Each person in Group Y is credited with 10 (ten) experimental dollars. As explained below, each Group Y person will have a decision to make about what to do with her/his Yellow Task endowment.

Decisions

Each Group Y person has a single decision to make. He/she can decide to change or not the dollar account balances of both people. The Group X person has no decision to make. Hence, after the Group Y person makes his/her decision, the task ends and the account balance of both persons for this task cannot be changed any more.

The Group Y Decision Task

Every dollar given by a person in Group Y to a person in Group X will be tripled by the experimenters. If Person Y decides to increase the X Person's account balance by $3 then the Y person's account balance decreases by $1. The Group Y person cannot increase the other person's account balance by more than $30. The following table shows how this works.

If the Group Y **Person Gives**	**The Experimenters Triple the Amount**	And the Group X **Total Payoff is**
0	3 * 0	0
1	3 * 1	3
2	3 * 2	6
3	3 * 3	9
4	3 * 4	12
5	3 * 5	15
6	3 * 6	18
7	3 * 7	21
8	3 * 8	24
9	3 * 9	27
10	3 * 10	30

Group X Has No Decision to Make

The Group X people do not have any decision to make in Yellow Task. This means that they will keep all of the tripled amount sent to them by individuals in Group Y.

Examples

- If Person Y decides to change his/her account balance by 0, person X's account does not change. The payoffs for this task will yield 10 dollars for Person Y and 0 dollars for Person X.
- If Person Y decides to change his/her account balance by -6, person X's account changes by +18. The payoffs for this task will yield 4 dollars for Person Y and 18 dollars for Person X.

1.8.14 Yellow Task Decision Form for a Person from Group Y - Condition GB

Information

You are matched with a different person than in the previous task. The Group X person you are paired with for this task has previously made the following decision:

He/she changed his/her own account balance by ..... , therefore, changing the account balance of the paired person by .....

Decision

My initial account balance is $10. The paired person from group X initial account balance is $0. Each dollar I give to the paired person is multiplied by 3 by the experimenter.

My decision is to give the following amount to the paired person. (Please circle one.)

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

Chapter 2

Reputation vs. Social Influence: Which is Stronger?

2.1 Introduction

Social norms together with other-regarding preferences often govern subjects' decisions when making dictator allocations. This paper examines which incentives connected with the existence of social norms cause deviations from standard economic model predictions. More specifically, the experimental design separates three channels through which information about another person affects dictator's choices: reputation, social influence, and identifiability of the recipient. Consider the following situation as an example: Person Y observes a generous action of person X towards person Z. Now suppose that person Y has an opportunity to extend the same courtesy to person X. If Y indeed decides to treat X generously, Y's decision could be motivated by indirect reciprocity to reward generous actions or by social influence to behave in a way X did, thus conforming with social norms for giving. Also, Y might choose to be generous due to the mere fact that she is dealing with X and not some random stranger since the identification of a person can result in different behavior towards them. Lastly, Y might have unconditional preferences for altruism. For ease of exposition throughout the paper I will be referring to reputation, social influence, and identification effects. During the decision-making process these three channels introduce the considerations of indirect reciprocity, adherence to social norms, and cognitive attention given to a particular individual. The goal of the study is to increase our understanding of the ways in which information about others' actions affects one's own behavior in fairness games, and thus help to identify the mechanisms of social transmission of impulses towards selfish or generous behavior.

This paper builds on earlier work of three types: (a) research by Berg, Dickhaut, and McCabe [1995], Knez and Camerer [1995], and Cason and Mui [1998], and others that studies the effects of social history on behavior in fairness games; (b) research by Small and Loewenstein [2003] and others on identifiability, and (c) research by Servátka [2004] on the influence of within-experiment reputation on paired subjects' generosity in dictator games. Berg, Dickhaut, and McCabe [1995] investigate the social history in an investment game where they focus on internalization of social norms. The information about the use of trust within a group of subjects is used as a trust-encouraging factor. The social history treatment identifies conditions that strengthen the relationship between trust and reciprocity through the social influence argument. Knez and Camerer [1995] use a between-respondent comparison treatment in a three-player ultimatum game to explore the effect of outside options and social comparison. Their results show that the offers were affected by how much the other subjects in the experiment offered. Social influence has been studied experimentally by Cason and Mui [1998]. They note that a subject's belief about what corresponds to socially appropriate behavior is based mostly on personal characteristics. However,

> *"For those subjects who care both about their monetary earnings as well as what constitutes socially appropriate behavior, socially relevant information may affect their beliefs and change their behavior. In particular, if subjects believe that the choice made by another subject gives them useful information, then the availability of information regarding choice made by another subject may change their beliefs regarding what constitutes socially appropriate behavior. This can in turn change their choices."* (pp.252)

In Cason and Mui's sequential dictator game, framed as a market exchange, the dictator decides twice on an allocation of $40 between herself and two distinct anonymous and randomly paired recipients. Before making the second allocation the dictator learns about an allocation chosen by another dictator from the subject pool in

the relevant information treatment and about a birthday in the irrelevant information treatment. The data show mixed evidence for social influence. The differences in frequency of changes between the first and second decisions are statistically insignificant in the two treatments. However, Cason and Mui observe a statistically significant shift toward self-regarding choice in an irrelevant information treatment compared to no shift in a relevant information treatment, contrary to their expectations.

The mere fact of providing information about someone is a form of identification. Small and Loewenstein [2003] demonstrate that identifiability of a person increases caring. In their laboratory experiment, the subjects compensated others who lost money more when the loser had been identified than when they were not. In a field study, Small and Loewenstein compared altruism among people contributing to a charity. They find that people made bigger donations when their contributions would benefit a family that has been selected from a list than when they were told the family would be selected from a list. In the light of the literature on identifiability and dual-process models from social psychology, information about someone increases the likelihood of cognitive attention and thus deeper consideration.

The last line of research represents the exploration of reputation effects on indirect reciprocity by comparing the behavior towards strangers and towards people with an established reputation. Servátka [2004] uses a setup where the dictator is endowed with \$10. The dictator can send some or all of her endowment to an anonymous recipient. All the money sent is tripled by the experimenter. After all of the subjects make their allocations, they are rematched and participate in the next task. The design involves a role reversal in the second task: the recipients become dictators and vice versa. Before the new dictators make an allocation decision they receive information regarding the choice of their currently paired recipient in the first task. Servátka finds that the reputation of recipients triggered what would normally be interpreted as indirectly reciprocal behavior by dictators. As a result, the generosity of first dictators generated more generosity by the new ones.

After making this observation it is essential to ask: What caused the new dictators to give more than the first ones? The reputation not only informs about the type of a player but also carries two additional features. It provides information about the paired subject, therefore identifying him. Second, since the subjects are members of a bigger population, reputation can be seen as a signal of beliefs that the population holds regarding socially appropriate behavior, especially when the reputation is represented by a past decision of the subject. In that sense, a design examining reputation effects that takes the behavior towards a natural reference group of strangers as a baseline, tests a compound hypothesis. The compound hypothesis includes the hypotheses that reputation does not convey socially relevant information and that information about one's actions does not identify that person per se. The central idea of this paper is to discriminate behaviorally between the reputation, social influence, and identification and to directly confront their importance in decisionmaking. The results show that outside information about another subject's choice affects one's own decision mostly through two channels - by changing the beliefs about what is socially appropriate behavior and by active enforcement of the social norm via indirect reciprocity.

2.2 Experimental Design and Procedures

The experimental sessions took place in the Economic Science Laboratory at the University of Arizona with undergraduate students serving as subjects. In each session, the participants were randomly divided into group X and group Y. One subject was randomly selected to be a monitor. The monitor was in charge of distributing and collecting envelopes with decision forms. All subjects were then seated in cubicles, group X in the front of the room and group Y in the back. In the general instructions the subjects were told they would participate in a multiple task experiment without specifying the nature of each task up front. They were also informed about the random matching procedures for each task to create an environment where one-shot games are played in an ongoing social interaction. They were told that a single task would be selected randomly for payoffs at the end of the experiment to control for wealth and portfolio effects. Once the experiment started, a new set of individual instructions were provided for each subject upon completion of each task.

The experimental design[1] includes four conditions implemented in an across-subjects design. Their outline along with the mechanisms transmitting information is presented in Table 2.1. Each condition consists of two tasks and involves a role reversal: the subjects who were dictators in one task act as recipients in the second one and vice versa while always paired with a different participant. Therefore, every subject has made only one decision during the session he or she participated in. In each task the following game was played between the dictator and the recipient:[2] In the beginning the dictator was endowed with $10 and could choose to send any whole dollar amount between 0 and 10 to the paired recipient. Any amount sent was tripled by the experimenter. The recipient had no decision to make, thus the final alloca-

[1] I apply the idea of Cox's [2004] triadic design discriminating between actions motivated by preferences over the distribution of material outcomes and actions motivated by assignments of the intentions of others.

[2] For two surveys on the dictator game, see Camerer and Thaler [1995] and Roth [1995].

TABLE 2.1. Experimental Conditions

Conditions	Provided Info	Effects Caused by the Provided Info
Reputation	recipient's dictator choice	reputation, social influence, identification
Social Influence	different dictator's choice	social influence, identification
Birthday	recipient's birthday	identification
Stranger	no info	none

tion was entirely decided by the dictator. The use of the dictator game was crucial because the dictator did not have to be concerned with any within-game strategic interdependence of her monetary payoffs on the other subject's decision. The design also included use of a double blind payoff protocol in which a subject's decisions are never linked with the subject's identity, thus minimizing possible experimenter demand effects on fairness behavior.

The four conditions differed in the informational structure and implementation. In the *stranger condition*, ST, the dictator had no information about the paired recipient nor about any other subject participating in the experiment. In the *reputation condition*, R, the dictator was informed about the currently paired recipient's decision as a dictator in condition ST as follows:

> You are matched with a different person than in the previous task. The Group X person you are paired with for this task has previously made the following decision:
>
> He/she changed his/her own account balance by ..., therefore, changing the account balance of the paired person by ....

Conditions ST and R took place during the same session, ST as the first task, called blue and R as the second, called yellow.

On the other hand, all subjects in the *social influence condition*, SI, participated in the first task as recipients, half in the blue task and half in the yellow task. In the

second task of the session they were all dictators (i.e., if they were first assigned to the blue task, they were dictators in the yellow task and vice versa). The dictators were informed about a decision by a randomly chosen subject from condition ST in the following way:

> Below, you are provided with a decision of a randomly chosen person from group X. This Group X person has previously made the following decision:
>
> He/she changed his/her own account balance by ..., therefore, changing the account balance of the paired person by ....
>
> You are matched with a different person than in the previous task and with a different person than the one you have received information about.

The subjects were not told that the decisions were made by subjects who participated in the previous session. The fourth condition, called the *birthday condition*, BD, provided an irrelevant information about the birthday of the currently paired recipient to the dictators:

> You are matched with a different person than in the previous task. The Group X person you are paired with for this task has a birthday on the ... day of one of the 12 months.

The BD condition controlled for general effects on fairness behavior of personal information about the individual affected by the dictator's decision and for costs of mental processing of information.[3]

[3]Unlike the ST condition that might otherwise seem as a natural baseline.

2.3 Separating Reputation, Social Influence, and Identification Effects in Subjects' Behavior

2.3.1 Confounded and Pure Reputation Effects

Subjects' behavior from all four conditions is summarized in Table 2.2. The results from stranger and reputation conditions will be discussed together since they took place during the same session. Figure 1 shows the amounts sent by dictators in condition ST represented by the solid black bar for each subject pair. The subjects are portrayed as they were paired in condition R. The patterned bar represents the amounts sent by dictators in condition R after having observed choices of their paired recipients, i.e., the adjacent solid black bar. There were a total of 68 subjects participating in the two conditions; 34 subjects in condition ST and 34 subjects in condition R. The dictators in condition ST and R sent on average \$1.70 and \$3.03, respectively.

Seven subjects sent zero to strangers in ST. Thus the behavior of 20.5 % subjects in condition ST was consistent with the predictions for the self-regarding preferences model. Two dictators who observed such behavior also sent zero to selfish recipients, three sent \$2, one sent \$4, and one sent \$5. Seven other subjects sent \$1 to strangers. The paired dictators responded to this information as follows: two sent zero, one sent \$1, three sent \$3, and one sent \$4. Thirteen subjects in condition ST sent \$2. The dictators in R sent to them the amounts of zero (one subject), \$2 (one subject), \$2 (two subjects), \$3 (five subjects), \$5 (three subjects), and \$6 (one subject). There are four subjects who sent \$4 to strangers. Their paired dictators in R sent them \$2, \$3, \$4, and \$10. Another two subjects sent \$4 in ST and the dictators who observed their choices in R sent them \$1 and \$10. The last subject in condition ST sent \$5 to a stranger and his paired dictator sent him \$3 in condition R.

The reputation condition represents the compound hypothesis. If a dictator observes the recipient's reputation, her generous action towards the recipient can be mo-

TABLE 2.2. Treatment Results

Data Category	Mean Amount Sent	Median Amount Sent
Condition ST	1.70 [1.27]{34}	2
Condition R	3.03 [2.39]{34}	3
Condition SI	2.71 [3.12]{34}	1.5
Condition BD	2.03 [1.95]{35}	2

Standard deviations in brackets.
Number of subjects in braces.

tivated by reputation, social influence, identification effects, and/or altruism. Since altruism is a possible explanation of behavior in all four treatments and is not of a direct focus of this paper, it will be excluded from further exposition. A comparison of subjects' behavior in conditions R and ST is discussed in detail in Servátka [2004]. Parametric and nonparametric statistical tests in the first row of Table 2.2 test the joint effect of reputation, social influence, and identification effects. All of them report a statistically significant difference between the two conditions ($p<0.01$). Further analysis examines which of the three effects (or their combination) is responsible for this difference.

The correlation coefficient between amounts sent by dictators in condition R and the choices of their paired recipients that they observed prior to making a decision is equal to 0.36. (Table 2.5). The Spearman's rank correlation test rejects the null that choices in ST and R are independent. Seven subjects in condition R observed a reputation of zero. Two of them (28.6%) did not send any money to their paired players, while the other five sent positive amounts; on average \$2.14. Twenty-seven subjects in the same condition observed a reputation strictly greater than zero. The average positive reputation was \$3.26. Three out of the twenty-seven (11.1%) subjects did not send anything. The other twenty-four subjects sent positive amounts, with an average being \$3.67.

Table 2.3 summarizes the tested hypotheses and explains how pairwise comparison of the experimental conditions separate joint (rows 1, 2, and 4) and individual effects

TABLE 2.3. Tested Hypotheses

Hypothesis	Effects Tested	Significance?*
R > ST	reputation, social influence, identification	Yes
R > BD	reputation, social influence	Yes
R > SI	reputation	Yes
SI > ST	social influence, identification	No
SI > BD	social influence	No
BD > ST	identification	No

* Significance based on Mann-Whitney test, reported in Table 2.4.

(rows 3, 5, and 6) of reputation, social influence, and identification on subjects' behavior. For each row, the second column of the table lists the effects responsible for different behavior between two compared conditions. The significance for each hypothesis is based on the respective Mann-Whitney test, reported in Table 2.2.

To separate out the pure reputation effect, a comparison between dictators' behavior in conditions R and SI has to be made. A dictator's action in condition SI can be motivated by social influence, and/or identification. Thus, if a dictator behaves more generously in condition R, the change in behavior can be attributed to a reputation effect causing indirect reciprocity. However, it is important to note that neither the reputation effect nor the other considered effects are known to be additive and so the observed behavior could be caused by their interaction.

Thirty four subjects who participated in condition SI were given information about the decisions made by dictators in ST. In that sense, the population of subjects in SI have seen the same information as the population of subjects in R did. The SI subjects responded to the information as follows. From among those who observed \$0 two subjects also sent \$0, one sent \$1, one sent \$4, and three sent their whole endowments of \$10. There were seven subjects who learned that somebody else gave \$1. As a response, one subject sent \$0 and one sent \$2, and the remaining five subjects sent the same amount of \$1 to their paired recipients. From among the thirteen subjects who have seen a social influence information of \$2, three sent

TABLE 2.4. Tests for Reputation, Social Influence, and Identification Effects

Data	Means Test *	Mann-Whitney Test *	Median Test *
R vs. ST	$2.85_{(.003)}$	$2.70_{(.003)}$	$10.38_{(.001)\ (.001)}$†
R vs. BD	$1.90_{(.031)}$	$1.82_{(.034)}$	$3.25_{(.071)\ (.059)}$†
R vs. SI	$.48_{(.317)}$	$1.38_{(.084)}$	$3.78_{(.052)\ (.044)}$†
SI vs. ST	$1.73_{(.045)}$	$.47_{(.319)}$	$1.83_{(.177)\ (.140)}$†
SI vs. BD	$1.08_{(.143)}$	$.46_{(.323)}$	$.03_{(.873)\ (.536)}$†
BD vs. ST	$.82_{(.208)}$	$0.38_{(.351)}$	$2.30_{(.130)\ (.105)}$†

p-values in parentheses.
* one-tail test.
† Fisher's exact test.

zero, three gave \$1, three \$2, one \$3, one \$4, one \$5, and one subject gave the whole \$10. Four SI subjects learned about another dictator's allocation of \$3 to the stranger. These dictators also gave \$3 (one subject), \$4 (one subject), and \$5 (two subjects). Both dictators who received information that someone else gave \$4 sent zero to their recipients. The person who knew that another dictator gave \$5, gave only \$2 to the paired recipient. Figure 2 shows the amounts sent by dictators in condition SI (patterned bar) and the information each subject observed (solid black line). The dictators after learning an allocation made by somebody else, sent on average \$2.71. Figure 3 compares the number of dictators in conditions R and SI that sent amounts varying from \$0 to \$10. The condition R data are portrayed by the patterned bar and data from condition SI by a solid black bar. Is there a clear evidence for pure reputation effects? Row 3 of Table 2.4 reports that the mean amount sent in conditions R and SI are not statistically significantly different. This is due to the fact that there were four subjects in condition SI who gave \$10, compared to only two in condition R. However, the Mann-Whitney, median and Fisher's exact tests presented in the same row report that the presence of reputation effect in condition R made a significant difference on dictators' behavior.

The correlation between amounts sent by dictators in condition SI and the social

TABLE 2.5. Tests for Pairwise Correlation

Data	Correlation	Spearman's Test	Independence rejected?
R vs. ST	0.35	0.31	Yes
SI vs. ST	-0.20	-0.01	No
[a]SI_+ vs. ST_+	0.13	0.24	No

[a]SI_+ = positive social influence information.
ST_+ = amounts sent by dictators who observed positive social influence information.

influence information that they observed prior to making a decision is equal to -0.20. (Table 2.5). The Spearman's rank correlation test does not reject the null that choices in ST and SI are independent. The information about social influence came from the same sample as the reputation in condition R. For that reason also seven subjects in condition SI observed a social influence of zero. Two of them (28.6%) did not send any money to their recipients. The other five (71.4%) sent positive amounts that were on average equal to \$5.00 (!). Also twenty-seven subjects in condition observed a reputation strictly greater than zero. The average positive social influence was \$3.26. Three out of the twenty-seven subjects did not send anything. The other twenty-four subjects sent positive amounts, with an average of \$2.11. The correlation between the positive social influence information and the amounts sent by dictators who observed this positive social influence information was equal to 0.13. However, the Spearman's rank correlation test again does not reject the null that these two samples are independent.

The tobit analysis of pooled dictators' choices[4] based on the condition they participated in has the form:

$$Choice_t = \alpha + \beta_R T_{Rt} + \beta_{SI} T_{SIt} + \beta_{BD} T_{BDt} + \varepsilon_t \tag{2.1}$$

[4]Tobit is used here as an estimation technique dealing with restrictions on choices imposed by the experimental design, rather than a classical tobit model with a censored data, as for example, household income reported at some limit value. The controlled laboratory setting does not allow for possibilities such as that a subject gave \$15 but the experimenters only observed \$10.

TABLE 2.6. Tobit Analysis of the Dictators' Responses to Reputation, Social Influence, and Birthday Information

Data	$\hat{\alpha}$	$\hat{\beta}_{R_0}$	$\hat{\beta}_R$	$\hat{\beta}_{SI_0}$	$\hat{\beta}_{SI}$	$\hat{\beta}_{BD}$	LR test
Dummies	$1.31_{(.014)}$	-	$1.55_{(.037)}$	-	$1.12_{(.132)}$	$.06_{(.932)}$	$6.51_{(.099)}$
marginal	.98	-	1.16	-	.84	.05	-
R	$1.33_{(.109)}$	-	$.89_{(.025)}$	-	-	-	$5.37_{(.020)}$
marginal	1.14	-	.77	-	-	-	-
SI	$3.68_{(.009)}$	-	-	-	$-.83_{(.203)}$	-	$1.69_{(.193)}$
marginal	2.57	-	-	-	-.58	-	-
Pooled	$1.32_{(.010)}$	$-.04_{(0.968)}$	$.92_{(.025)}$	$2.29_{(.024)}$	$-.69_{(.098)}$	$.07_{(.918)}$	$14.33_{(.014)}$
marginal	1.00	-.03	.69	1.73	-.52	.06	-

Marginal effects are reported in a row below the estimated coefficients.
p-values in parentheses.

where T_R, T_{SI}, and T_{BD} represent dummies for respective conditions. The bounds for the tobit estimation were imposed by the experimental design:

$$Choice_t \in [0, 10] \tag{2.2}$$

The estimated coefficients are presented in the first row of Table 2.6. The estimated $\hat{\beta}_R$ is positive (1.55) and significant ($p = 0.037$). Note that the marginal effect of T_R is reported in a line below $\hat{\beta}_R$. The marginal effect of participating in the reputation condition is equal to 1.16. Table 2.6 in the seventh row also reports tobit estimates of the parameters for the pooled data of the following relation between amounts sent by dictators to recipients, $Choice_t$, treatment dummies, and the received information in condition R, $Information_{Rt}$, and in condition SI, $Information_{SIt}$:

$$Choice_t = \alpha + (\beta_{R_0} + \beta_R \cdot Information_{Rt}) \cdot T_{Rt} +$$

$$+(\beta_{SI_0} + \beta_{SI} \cdot Information_{SIt}) \cdot T_{SIt} + \beta_{BD} T_{BDt} + \epsilon_t \tag{2.3}$$

The estimated $\hat{\beta}_R$ for the pooled data from the above relation is also positive (0.92) and significant ($p = 0.025$). The marginal effect estimating the influence of

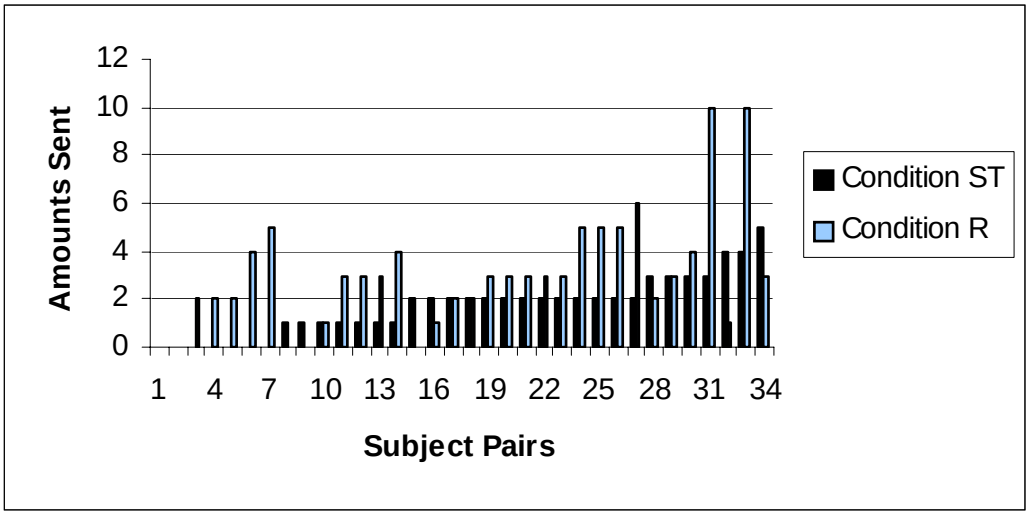
reputation information on amounts sent by dictators is equal to 0.69. The third and fourth row of Table 2.6 reports the Tobit estimates and the marginal of reputation effect for 34 subjects participating in condition R. The individual treatment data yield a similar result. Hence, the tobit estimation supports the conclusion that the reputation triggered indirect reciprocity.

2.3.2 Social Influence Effect

Does the statistical analysis support the existence of social influence effects in the data? To make that claim, one needs to compare the results from conditions SI and BD. In condition SI, subject's behavior could be motivated by social influence and/or identification effects. On the other hand, in condition BD only the identification effect is present. Thus, the difference in subjects' behavior between these two treatments could be attributed to social influence.

Thirty six subjects participated in condition BD. One subject marked two answers and was excluded from the data analysis. However, this person still served as a recipient in the other task, therefore allowing for an observation made by the paired player. Since the birthday is irrelevant information, I only present the distribution of choices in this condition. Twelve subjects out of thirty five sent zero, three subjects sent \$1, seven sent \$2, five \$3, three \$4, four \$5, and one subject sent \$7. On average the subjects in condition BD sent \$2.03. The behavior of dictators in conditions SI and BD is graphically compared in Figure 4. It shows the number of subjects in conditions SI and BD that sent amounts between \$0 and \$10. The social influence effect raised the average amount sent by dictators by \$0.68 more than in BD. The statistical analysis of data provides mixed evidence of social influence effects. The means test reported in Table 2.4 in row 5 does not detect a statistically significant difference and neither do the nonparametric tests. On the other hand, tobit estimate for social influence effect of information is negative and statistically significant for

FIGURE 2.1. Subjects' Behavior in Stranger and Reputation Conditions



the pooled data but insignificant for the dummy equation and individual SI-condition data as presented in Table 2.6 in rows seven, one, and five, respectively. The marginal effects of social influence are again reported in a line below the estimated coefficients.

2.3.3 Identification Effect

The identification effect can be separated from the data by comparing the behavior of subjects in conditions BD and ST. In BD the dictator's actions can be motivated by identification, whereas in ST there is no such effect since the dictators do not receive any type of information. Figure 5 shows the number of dictators in conditions BD and ST that sent amounts between \$0 and \$10. Providing irrelevant information about the recipients' birthday increased on average the amounts sent by dictators by \$0.33. This result goes against Cason and Mui's finding that an irrelevant information causes subjects to behave in a more self-regarding way. All tests presented in the last row of Table 2.4 reveal that the difference in behavior between conditions BD and ST is statistically insignificant, unlike in Small and Loewenstein's study. The conclusion

FIGURE 2.2. Subjects' Behavior in Stranger and Social Influence Conditions

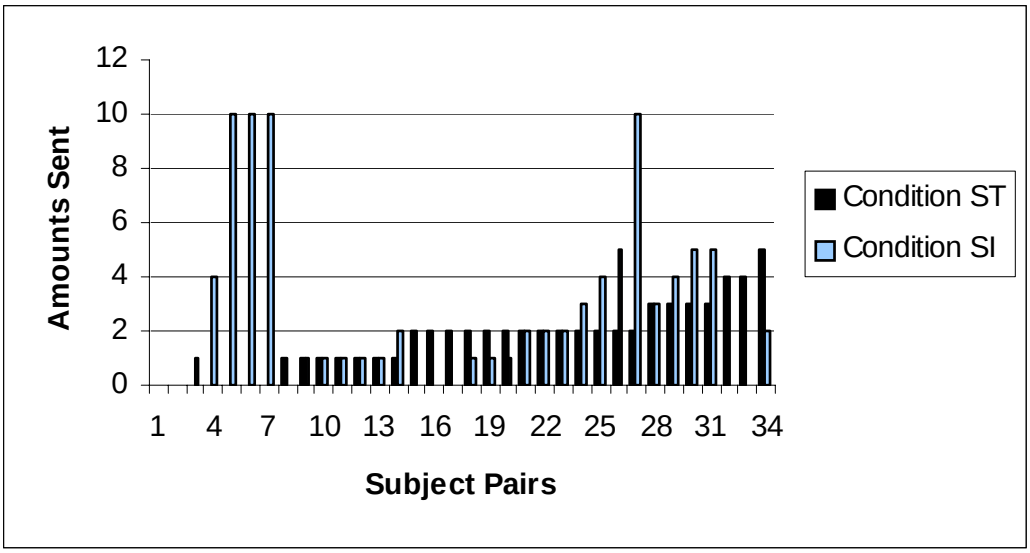


FIGURE 2.3. Subjects' Behavior in Reputation and Social Influence Conditions

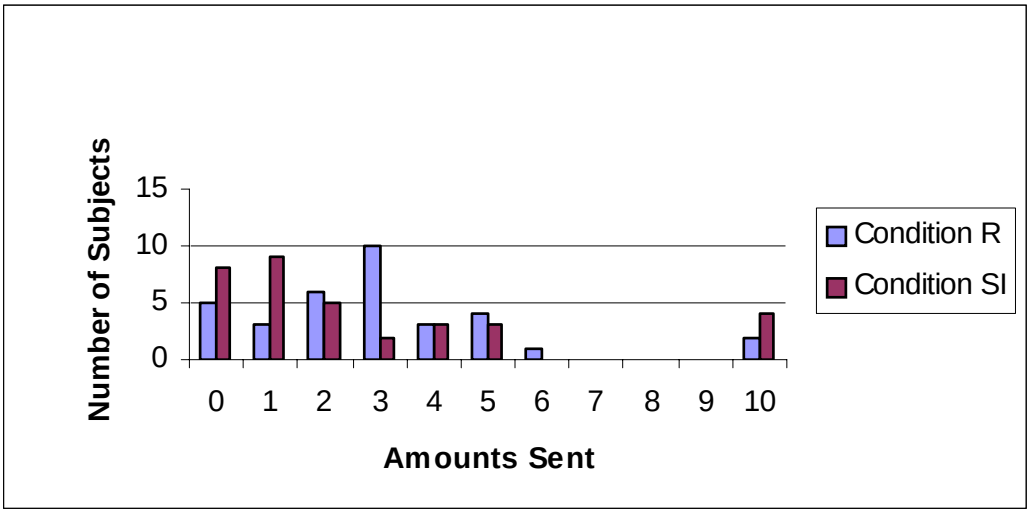


FIGURE 2.4. Subjects' Behavior in Social Influence and Birthday Conditions

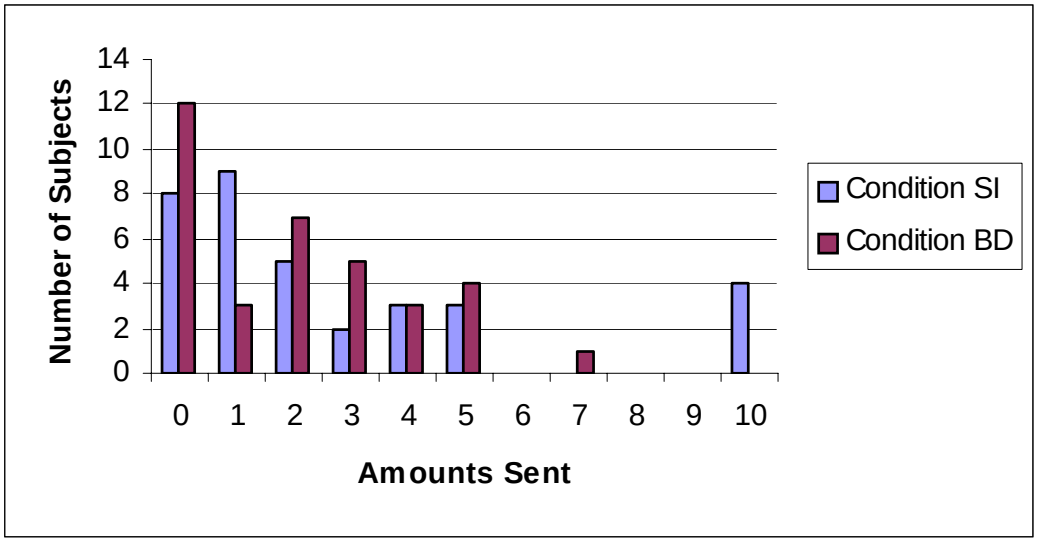
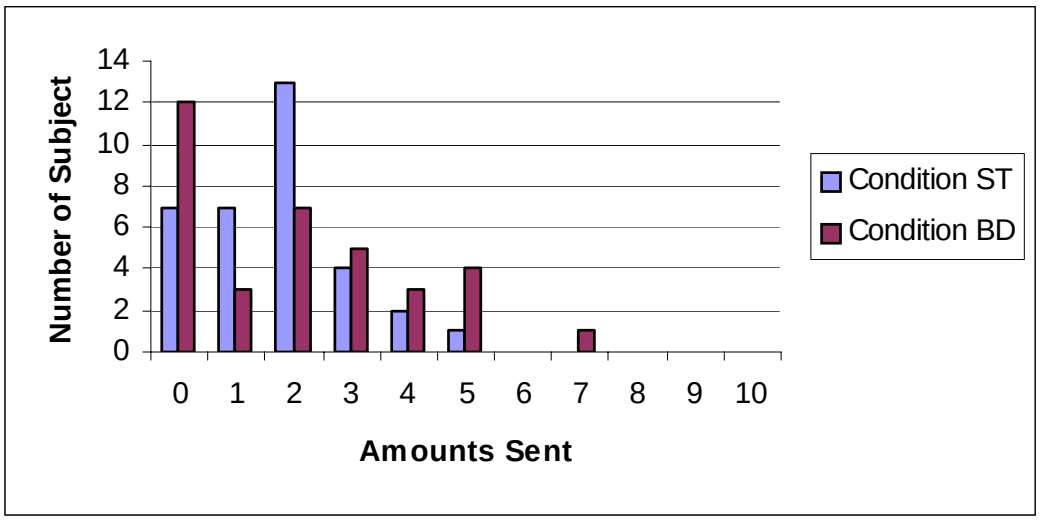


FIGURE 2.5. Subjects' Behavior in Stranger and Birthday Conditions



that identification effect increased the generosity of dictators is not supported by the estimates of the above tobit models either. The estimated coefficients on participation in condition BD reported in rows one and seven of Table 2.6 are highly insignificant.

.

2.4 Conclusion

This paper reports an experiment that separates the effects of reputation, social influence, and identification across four dictator games. The experimental conditions differ in the information provided to the decisionmakers. The data support the previous findings that reputation information triggers indirect reciprocity. The statistical analysis also reveals that the reputation has stronger effects on dictators than does social influence and identification. Based on the experimental results one can conjecture that an active participation in social norm creation and their enforcement governs people's behavior to a higher degree than does conformism. Taken together, this study increases our understanding of the ways in which information about others' actions affects people's own actions, and thus helps to identify the mechanisms of social transmission of impulses towards certain types of behavior.

2.5 Appendix

2.5.1 General Instructions - All Conditions

No Talking Allowed

Now that the experiment has begun, we ask that you do not talk or communicate any longer with each other. Because we will not be available to assist you, it will not be possible for you to ask questions. In case there is still something that you do not understand, you are kindly requested to read the instructions again.

Monitors and Two Groups

A monitor has been selected randomly from among those of you who came here today. The rest of you have been divided randomly into two groups, called Group X and Group Y. Group X people are seated in the front row A. Group Y people are asked to sit at the back of the room (row D).

Multiple Tasks

You will be asked to participate in multiple tasks during the experiment. The instructions for each task will be given to you after finishing the previous one. The end of the experiment will be announced to you after completing certain number of tasks.

Anonymity

Each person in Group X will be randomly matched with a person in Group Y. No one will learn the identity of the person she/he is matched with. In each task a person in Group X will be matched to a different person in Group Y. There is no chance of being matched with the same person more than once during the entire experiment.

Initial Account Balances

Each person in each group will be credited with 10 experimental dollars at the beginning of each experimental task.

Money Payoffs

The information about final account balances in each task will be recorded by the experimenters. At the end of the experiment a die will be rolled in front of you to decide the task for which you will be paid in cash. The remaining balance in your dollar account from the randomly selected task will be paid to you in cash at the rate of 1 U.S. dollar per 1 experimental dollar.

Complete Privacy

This experiment is structured so that no one, neither the experimenters nor the other subjects nor anyone else will ever know the personal decision of anyone in the experiment. This is accomplished by the following procedure. You will collect your money payoff contained in a sealed envelope, from a mailbox that only you can open (with your key). Your privacy is guaranteed because neither your name nor your student ID number will appear on any form that records your decisions in this experiment. The only identifying mark in all records will be your seat number and the number engraved on your key which is known only by you. However, although the experimenters will not know your identity, they have a way to map your decisions into your own payoff correctly. At the end of the experiment, you will walk one by one to the waiting room where the mailboxes are to collect your money payoff envelope. The key and mailbox are labeled with the same number. But you will be the only person in possession of that key and the only one who knows your key number. When collecting the envelope from your mailbox, you are kindly requested not to open it immediately. You should wait until you leave the building. After collecting the envelope, you must return your key by throwing it in a key-return box next to the waiting room door.

Your Private Label

At the end of the experiment you will be given a key in a sealed envelope. There will be a 5-digit number engraved on your key. The entered number will be used to select the box that your key can open, which will contain a sealed envelope with your

earnings inside.

The Role the Monitor

A monitor was randomly chosen from among the students who volunteered for today's experiment. The monitor will be in charge of distributing and collecting the envelopes with decision form sheets inside little boxes that contain the envelopes containing mailbox keys. The monitor will also be asked to watch and make sure that the experimenters actually follow the procedures that have been explained here.

Decision Forms

Prior to each task you will be given a decision form on a colored paper. After completing the task, please put the decision form in the enclosed envelope, seal it and give it to the monitor. If you did not get a decision form, you are not making a decision in that task. In such case, please return the empty envelope.

Please, read the instructions for each task very carefully.

2.5.2 Blue Task Instructions - Condition ST

Initial Account Balances

Each person in Group Y is credited with 0 (zero) experimental dollars. Each person in Group X is credited with 10 (ten) experimental dollars. As explained below, each Group X person will have a decision to make about what to do with her/his Blue Task endowment.

Decisions

Each Group X person has a single decision to make. He/she can decide to change or not the dollar account balances of both people. The Group Y person has no decision to make. Hence, after the Group X person makes his/her decision, the task ends and the account balance of both persons for this task cannot be changed any more.

The Group X Decision Task

Every dollar given by a person in Group X to a person in Group Y will be tripled by the experimenters. If Person X decides to increase the Y Person's account balance by $3 then the X person's account balance decreases by $1. The Group X person cannot increase the other person's account balance by more than $30. The following table shows how this works.

If the Group X **Person Gives**	**The Experimenters Triple the Amount**	And the Group Y **Total Payoff is**
0	$3 * 0$	0
1	$3 * 1$	3
2	$3 * 2$	6
3	$3 * 3$	9
4	$3 * 4$	12
5	$3 * 5$	15
6	$3 * 6$	18
7	$3 * 7$	21
8	$3 * 8$	24
9	$3 * 9$	27
10	$3 * 10$	30

Group Y Has No Decision to Make

The Group Y people do not have any decision to make in Blue Task. This means that they will keep all of the tripled amount sent to them by individuals in Group X.

Examples

- If Person X decides to change his/her account balance by -6, person Y's account changes by +18. The payoffs for this task will yield 4 dollars for Person X and 18 dollars for Person Y.
- If Person X decides to change his/her account balance by 0, person Y's account does not change. The payoffs for this task will yield 10 dollars for Person X and 0 dollars for Person Y.

2.5.3 Blue Task Decision Form for a Person from Group X - Condition ST

My initial account balance is $10. The paired person from group Y initial account balance is $0. Each dollar I give to the paired person is multiplied by 3 by the experimenter.

My decision is to give the following amount to the paired person. (Please circle one.)

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

2.5.4 Yellow Task Instructions - Conditions R, SI, and BD

Initial Account Balances

Each person in Group X is credited with 0 (zero) experimental dollars. Each person in Group Y is credited with 10 (ten) experimental dollars. As explained below, each Group Y person will have a decision to make about what to do with her/his Yellow Task endowment.

Decisions

Each Group Y person has a single decision to make. He/she can decide to change or not the dollar account balances of both people. The Group X person has no decision to make. Hence, after the Group Y person makes his/her decision, the task ends and the account balance of both persons for this task cannot be changed any more.

The Group Y Decision Task

Every dollar given by a person in Group Y to a person in Group X will be tripled by the experimenters. If Person Y decides to increase the X Person's account balance by $3 then the Y person's account balance decreases by $1. The Group Y person cannot increase the other person's account balance by more than $30. The following table shows how this works.

If the Group Y **Person Gives**	**The Experimenters Triple the Amount**	And the Group X **Total Payoff is**
0	3 * 0	0
1	3 * 1	3
2	3 * 2	6
3	3 * 3	9
4	3 * 4	12
5	3 * 5	15
6	3 * 6	18
7	3 * 7	21
8	3 * 8	24
9	3 * 9	27
10	3 * 10	30

Group X Has No Decision to Make

The Group X people do not have any decision to make in Yellow Task. This means that they will keep all of the tripled amount sent to them by individuals in Group Y.

Examples

- If Person Y decides to change his/her account balance by 0, person X's account does not change. The payoffs for this task will yield 10 dollars for Person Y and 0 dollars for Person X.
- If Person Y decides to change his/her account balance by -6, person X's account changes by +18. The payoffs for this task will yield 4 dollars for Person Y and 18 dollars for Person X.

2.5.5 Yellow Task Decision Form for a Person from Group Y - Condition R

Information

You are matched with a different person than in the previous task. The Group X person you are paired with for this task has previously made the following decision:

He/she changed his/her own account balance by ..... , therefore, changing the account balance of the paired person by .....

Decision

My initial account balance is $10. The paired person from group X initial account balance is $0. Each dollar I give to the paired person is multiplied by 3 by the experimenter.

My decision is to give the following amount to the paired person. (Please circle one.)

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

2.5.6 Yellow Task Decision Form for a Person from Group Y - Condition SI

Information

Below, you are provided with a decision of a randomly chosen person from group X. This Group Y person has previously made the following decision:

He/she changed his/her own account balance by ..... , therefore, changing the account balance of the paired person by .....

You are matched with a different person than in the previous task and a different person than the one you have received information about.

Decision

My initial account balance is \$10. The currently paired person from group X initial account balance is \$0. Each dollar I give to the paired person is multiplied by 3 by the experimenter.

My decision is to give the following amount to the paired person. (Please circle one.)

\$0 \$1 \$2 \$3 \$4 \$5 \$6 \$7 \$8 \$9 \$10

2.5.7 Yellow Task Decision Form for a Person from Group Y - Condition BD

Information

You are matched with a different person than in the previous task. The Group X person you are paired with for this task has a birthday on the ..... day of one of the 12 months.

Decision

My initial account balance is $10. The paired person from group X initial account balance is $0. Each dollar I give to the paired person is multiplied by 3 by the experimenter.

My decision is to give the following amount to the paired person. (Please circle one.)

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

Chapter 3

Shocks and Relationships[1]

3.1 Introduction

The efficiency wage theory is one of the foremost explanations for the existence of wage rigidity. The fair wage-effort version of the theory (Akerlof [1982, 1984], Akerlof and Yellen [1990]) based on psychological theories (Homans [1961] and Adams [1963]) claims that an increase in wages raises workers' effort if wages have been below a fair reference wage level. For this reason, paying wages above market clearing level might be profitable to the firm. It is well documented in interview labor market studies (Agell and Lundborg 1995, 1999, Bewley 1998, Blinder and Choi 1990, Campbell and Kamlani 1997, Kaufman 1984) that employers are reluctant to hire outside workers who offer their labor services below the prevailing wage. Employers recognize that the wage paid to workers is one of the factors influencing workers' morale. Workers receiving higher wages appreciate the generosity and respond by exerting a high effort in return. A low wage, on the other hand, might be perceived as a lack of trust of the employee or might signal a relatively low importance of the job, and thus workers might perform poorly. The fair wage-effort version of efficiency wage theory has received support in experimental works of Fehr, Kirchsteiger, and Riedl [1993, 1998]. The positive correlation between wage and effort in static conditions has been demonstrated in other experimental studies as well (Fehr, Gächter, and Kirchsteiger [1997], Fehr and Falk [1999], Brown, Falk, and Fehr [2004] and many others).

This study focuses on the question whether or not firms in long-term relationships are willing to continue paying high wages in order to keep workers when they face negative technological shocks and when their reputations are at stake. An en-

[1] This chapter is co-authored with Ninghua Du.

vironment with negative exogenous shocks is a more appropriate experimental test for the existence of wage-rigidity because it brings stronger incentives to decrease the wage than a setting when market conditions are relatively stable or improving. This work is intended to be a boundary experiment testing for the presence of downward wage-rigidity. Our objective is to shed more light on the increased complexity of decisions of labor market participants given the repeated interactions while increasing the proximity to market conditions.

We create a laboratory environment in which technological shocks take place. Firms engaging in long term relationships with workers can choose to react or not to react to such changes by decreasing wages or maintaining them at the current level and thus forgoing parts of their profits. A decrease in wages corresponds to a temporary transfer of the shock burden onto workers. The profit maximizing firm might be interested in a long-term relationship because of the idiosyncratic asset of the worker – the reputation with the firm. If the firm knows that the employee works hard then it might pay him a higher wage to induce higher effort and to keep him for future periods. Hiring a new worker from the market without an established reputation[2] with the firm brings uncertainty about his job-related characteristics. Even if the firm could hire a new worker and pay a lower wage, such decisions do not necessarily need to be optimal because of the nature of hidden action under the incomplete contract.

Falk and Fehr [1999] investigate whether the workers underbid prevailing wages if there is unemployment and whether firms take advantage of underbidding by lowering

[2]Throughout the paper we interchangeably use the words "effects of presence of relationship-specific asset" and "reputation effects". The rationale for this is as follows: A firm relies on worker's reputation of being hard-working. This reputation represents the relationship-specific asset, since the effort is not observable by the other participants of the market except for the contracting parties. The firm is concerned with its reputation of offering generous wages to the worker each period and worker is concerned with his/her reputation of exerting high effort levels to keep the relationship going in the long-run. The reason for willingness to engage in a long-term relationship is the presence of idiosyncratic asset, the reputation, that generates additional gains from trade. Also, the paper interchangeably uses the terms "preferences for fairness" and "other-regarding preferences".

wages. The results from a series of double auction market experiments show that underbidding is common but firms do not take advantage of the low offers. Instead, they pay generous wages. Underbidding has no impact on decreasing the wages under incomplete contracts.

Brown, Falk, and Fehr [2004] (henceforth BFF) set up a labor market with observable identification numbers (IDs) of players, thus allowing for reputation building and for the possibility of repeated interactions between firms and workers in incomplete contracts. The workers could choose any effort regardless of what was agreed upon in the contract. This treatment is contrasted with two other treatments: a complete contract condition with the effort level enforced by the experimenter and with a treatment which has random reassigning of IDs after each period to rule out the possibility of building a reputation. The results demonstrate that without third party enforcement the majority of trades are initiated by private offers by firms to the workers and the surplus is shared. The threat of relationship termination disciplines workers to exert high levels of effort throughout all the periods. Competition resulting from excess labor supply seems to have little impact on the contracts; both parties prefer to stay in a more profitable long lasting relationship. If contracts are third party enforceable, then most trades are one-shot and initiated through public offers. As a result, surplus sharing and long-term relations disappear.

In the current experiment, we alter the BFF design of incomplete contracts by incorporating technological shocks. The comparison of three experimental treatments enables us to identify the importance of the presence of an idiosyncratic asset, fairness/other-regarding preferences, and the firm's reputation. The conditions of negative technological shocks subject the fair wage-effort theory to further tests. In particular, it explores whether the wage rigidity stems from the long-term nature of relationships that creates additional gains from trade over one shot interactions even in the asymmetric information about the shocks scenario.

In our design a firm observes the realization of the technological shock at the

start of the period, a worker only after the period is over. The information about the shock can affect the players in two ways. First, if the worker does not know the realization of the shock, he has no means to evaluate whether the wage offered by the firm is either high enough or too low. Provided the firm is concerned with its reputation, the firm might want to offer a wage tied to the realization of the shock. Furthermore, if the firm is concerned with keeping the worker for the next period, it might decide to add a premium to the wage in case of a negative shock. Such a premium signals willingness to continue the relationship and encourages the worker to exert high effort. However, if the firm is not concerned with its reputation or reputation building is not feasible because of random assignment, and the firm is self-regarding, it will offer a low wage whenever the realization of the shock is negative. Also, since the worker does not know the information about the realization, the firm can pretend the realization was negative and offer a low wage, especially in a case in which the firm's reputation is not at stake. Similar aspects of behavior can be found in the experimental literature on ultimatum games. As Camerer [2003] notes, most studies investigating the asymmetry of information reveal that responders accept less in the condition with low information when they only know the distribution of possible pies or nothing at all. The proposers exploit this behavior and offer low shares even if the stake is high (see Camerer and Loewenstein [1993], Straub and Murnighan [1995], Croson [1996], Raporport, Sundali, and Potter [1996], and Gűth and Huck [1997]).

3.2 Experimental Design

We implement three experimental conditions: technological shocks with fixed IDs (condition SF), technological shocks with random IDs (condition SR), and a constant technology coefficient with fixed IDs (condition CF). The three conditions differ in aspects of technological shock and ability to identify the trading partner in future periods. As observed by BFF, repeated transactions with the same partner are possible and common because subjects had fixed ID numbers and therefore, the contracts could be offered to specific traders in each period. The presence of a shock changes a marginal revenue product of firms.

In all three experimental conditions, the material payoff of a firm is given by

$$\pi_f = \begin{cases} A \cdot e - w & \text{if a contract is concluded} \\ 0 & \text{if no contract is concluded} \end{cases}. \tag{3.1}$$

Where e is the effort level, w is the wage paid and A is the technology coefficient in the production function. A is a random variable exogenously drawn by nature.[3]

Workers receive a payoff

$$\pi_w = \begin{cases} w - c(e) & \text{if a contract is concluded} \\ 5 & \text{if no contract is concluded} \end{cases}. \tag{3.2}$$

Where c(e) is the cost of exerting effort. The reservation wage of a worker is 5 (i.e., the unemployment benefit of a worker who has no contract concluded is 5). The feasible set of effort is $\{1, 2, \ldots, 10\}$ and the feasible set of wage is $\{1, 2, \ldots, 100\}$. The cost schedule for the workers is presented in Table 3.2.

In each laboratory session, there are 17 subjects participating. 7 subjects play the role of firms and 10 subjects take the role of workers. A subject's role is fixed during

[3]It is important to note that the shocks in A can also be explained in other ways. One explanation is that firms face periodic shocks in revenue due to changes in market conditions, for example, shifts in demand. Since our research question is about how firms pay workers during the period that firms face negative shocks, exploring the reasons for shocks in A is not the focus of this paper.

TABLE 3.1. Experimental Conditions

Experimental Conditions		ID	
		Fixed	*Random*
Shock	*Yes*	SF	SR
	No	CF	ICR[4]

TABLE 3.2. Cost of Effort Schedule

Total Effort	1	2	3	4	5	6	7	8	9	10
Total Cost	0	1	2	4	6	8	10	12	15	18
Marginal Cost	0	1	1	2	2	2	2	2	3	3

the whole experiment. Identification numbers (IDs) 1, ...,7 are assigned to the firms and IDs 1,...,10 are assigned to the workers. There are 15 trading periods. Each period lasts 3 minutes. A firm can employ at most one worker and a worker can accept a maximum of one job offer per period. Therefore, there is always an excess supply of three workers. Once a worker accepts one of the offers, a contract is concluded and both the firm and the worker are removed from the market. The workers' payoff function (2), the number of firms and workers, the cost schedule c(e) and the length of the experiment being 15 trading periods is common knowledge among all subjects. All subjects know the format of the firms' payoff function (1). However, whether the technology coefficient A is observed by a market participant depends on the experimental conditions. The detailed description of the three conditions is as follows.

3.2.1 Experimental Conditions

Technological Shocks with Fixed IDs (SF)

In this condition, the market participants' IDs are fixed through all 15 trading periods and the firms face technological shocks. At the beginning of each trading period, the technology coefficient A is assigned to the firms. A is either equal to 10 or 7, with a 50/50 probability. There is a new drawing of A each period for each firm. This information is common knowledge among all firms and all workers. Each

firm observes its own technology coefficient as soon as A is assigned. However, a firm does not observe other firms' technology coefficients. A worker does not observe any firm's technology coefficient at this point.

A trading period has two stages. In the first stage, firms make contract offers to the workers. A worker can either accept one of the offers or deny them, in which case she earns 5 experimental dollars. A contract offer includes a wage w, a desired effort level and the firm's ID. Firms can either make private or public offers. For private offers, the firm specifies a worker's ID in the contract. Then only the worker whose ID is specified in the contract is informed about the offer and only that worker has the ability to accept the offer. For public offers, all workers are informed about the offer and as a consequence all workers can accept the offer. Firms always observe the workers in the market who have not yet accepted any offer. This is done to prevent firms from making private offers to the workers who are not available anymore.

During the trading period a firm can make as many private and public offers as it wants. However, as soon as a worker takes one of its offers, all its other standing offers will immediately disappear from the market. Then the firm is matched with that worker and the firm observes the worker's ID. If a firm and a worker conclude a contract, they will enter the second stage. In the second stage, the worker chooses the effort level e.

At the end of each trading period, payoffs are determined and each firm's technology coefficient A is revealed to all firms and all workers.

Technological Shocks with Random IDs (SR)

In this condition, all market participants' IDs are randomly assigned at the beginning of each trading period. For example, suppose a firm is assigned ID 6 in period 1. In period 2, this firm's ID could be 4. Except for the random ID assignment, the procedure of SR condition is identical to that of SF condition. The design of SR condition rules out the reputation and the long run relationship between the firms

and the workers.

Constant Technological Coefficient with Fixed IDs (CF)

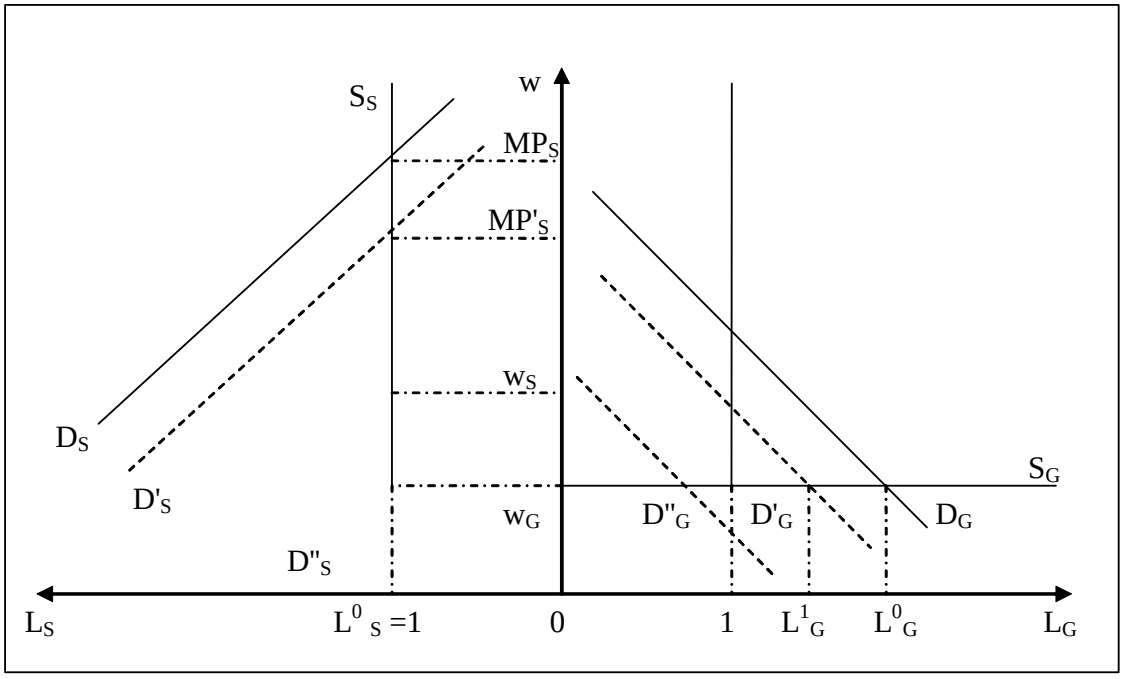
This condition is a replication of the ICF condition studied by BFF. In this condition, the market participants' IDs are fixed and there is no technological shock. The technology coefficient A is always fixed at 7 for all firms, representing a permanent negative shock.[5] A is common knowledge among all subjects. The procedure in the CF condition is identical to that of SF condition.

Figure 1 illustrates a more general interpretation of our experimental setup of the labor market. It is often the case that an experimental setup – especially when it models incentives – can represent more than the situation for which it was designed. In the experimental design section we describe the relationship-specific asset to be the reputation built up between the firm and the worker and maintained by high wages and high levels of effort. But the reputation that motivates our study is just one example of a relationship-specific asset. The application of the design is broader and it could represent any other asset or skill that is idiosyncratic to the firm, for example the ability to perform a certain task that only has value to the particular firm but has no use elsewhere.

If the firms are interested in hiring workers without job-specific skills, they hire them in the right-hand-side market in Figure 1 from the pool of workers with general skills. The general-skills labor market represents our condition with random IDs because of the inability of workers and firms to maintain long-term relationships. The value of a worker with general skills to the firm is given by DG. The wage wG represents a minimum wage needed for such a worker to accept the contract. In our design wG is equal to 6. At the wage level wG all general-skilled workers will

[5] BFF use a fixed coefficient A equal to 10. Thus, our CF condition tests for robustness with respect to the value of the technology parameter.

FIGURE 3.1. Labor Market with General and Relationship-Specific Human Capital



be willing to take the job because it pays more than the outside option. This is intuitive, since the market is characterized by involuntary unemployment that puts a downward pressure on the wages. Therefore, the labor supply curve, SG, is horizontal. Firm hires L0G workers with general skills. Suppose now a negative technological shock occurs and the demand for labor with general training shifts to D'G. The firm continues paying wG and employs L1G workers. The negative technological shock translates into layoffs. However, the specifications of our setup that each firm (and each worker) can only engage in a single contract impose a constraint on the level of employment. At LG = 1 the marginal product of the worker is equal to A*e. Thus the value of the marginal product of a worker to the firm depends on the realization of the shock. Assuming that the worker is self-regarding, he will exert an effort of 1. The firm knows that it cannot count on positively reciprocal behavior nor can it build a reputation with the worker. Thus, given our parameterization, it will offer a wage equal to 6 irrespective of the realization of the shock. In reality there are other possible outcomes that depend on the severity of the technological shock. For an illustration, consider D"G intersecting SG at LG smaller than 1. Then for such shocks, either permanent or temporary, the firm will choose not to hire the worker because it would result in a loss without any possible benefits in the future.

To contrast the different incentives the firm faces when dealing with a worker with job-specific skills, let us turn the attention to the left-hand-side market. We maintain the assumption that the worker is only concerned with maximizing his own payoffs.[6] Just like before, the value of a worker with specific to the firm is given by DS. However, there is only a single worker with an idiosyncratic skill to the firm, so the labor supply curve, SS, is horizontal. According to Becker [1975] the worker and the firm share the returns to specific investment in the following way: the wage, wS, is raised above what the worker could get elsewhere (wG) but below the marginal

[6] This assumption is not crucial but it simplifies the exposition. However, if the worker is characterized by other-regarding preferences and/or reciprocity, it only strengthens the above argument.

product so that the firm can collect some returns as well. Notice that the possibility of repeated interaction changes the incentives of a selfish worker – he can establish himself as hardworking and collect higher wages from the same employer over the course of a long lasting relationship. His other option is to accept a contract, exert the lowest level of effort, face the high probability of relationship termination and collect the outside option payoff in future periods with some probability of getting another offer. Based on BFF results, the first option, on average, yields higher payoffs. The workers recognize it and behave accordingly. Thus the opportunity for a long-term relationship at higher than market wages disciplines even the selfish workers.

Suppose again that a temporary technological shock occurs and the demand for workers with job-specific skills shifts to D'S. Since the value of marginal product is still above those workers with general skills, the firm has two options: either to continue paying wS and accept the lower profits for that period or to lower wS and possibly jeopardize the relationship. Our main research question examines the firms' choices and their consequences.

As in the general labor market, the technological shock can bring the demand down to D"S. In the case when the firm decided to keep the worker and continue paying wS, it would actually be making losses in such periods. However, a higher realization of A in the future can allow for a recuperation of losses through high value of marginal product of the worker with relationship-specific skills.[7] If the shock were permanent, like in condition CF, the firm would have no other choice than to lower the wage to the level guaranteeing nonnegative profits.

[7] An alternative way of designing our experiment would be to ask whether or not the firms are willing to incur short-term losses in real terms (not just relative to the previous period) to keep the relationships alive. But this approach brings additional concerns about subjects' behavior and creates possible confounds – how do subjects react to environment when they repeatedly suffer losses? One sensible response would be to remain idle and keep the experimental endowment that would have to be sufficiently high to insure nonnegative monetary payoff for participation in the session. However, such data would not provide us with any interesting information.

3.2.2 Predictions and Hypotheses tests

According to the cost schedule c(e) in Table 3.2, the marginal cost of effort is at most 3. According to the firm's payoff function, the coefficient A is the marginal revenue for a firm. Since A is either equal to 10 or 7, the efficient level of effort is e = 10. At e = 10, workers have opportunity costs of 5 + c (10) = 23. If the firm offers w > 23 and the worker chooses e = 10, then the total surplus is maximized. In this case, the firm gets profits 100 – w when A = 10, or 70 – w when A = 7; the worker gets w – 23 > 0.

Our experimental design has two features: incomplete contracts and excess labor supply. In theory, the existence of excess labor supply should drive the equilibrium price of labor down to the reservation wage because the unemployed workers are willing to work for wages below the prevailing level. Now let us take a look at incomplete contracts. If rationality and selfishness are common knowledge among all of the market participants, workers will choose the minimum effort e = 1, regardless of the wage w the firm offered. Therefore, contract offers with w = 6 are optimal for the firms, no matter whether A = 10 or A = 7. In this case, a worker with an offer gets surplus 6 – 5 = 1. A firm gets profit 10 – 6 = 4 when A = 10 and it gets profit 7 – 6 = 1 when A = 7. Again, the prevailing wage in the market is close to the workers' reservation wage.

To summarize, our research question is two-fold:

1. If the reputation during the long run relationship matters, are firms willing to pay high wages to keep those hard working workers when firms face negative technological shocks?

2. Do we observe a wage rigidity if negative technological shocks occur?

The assumption that reputation matters in long term relationships between workers and their employers is based on the results of previous studies. We make use of it

for the purpose of forming predictions. However, we will subject this assumption to further tests.

In real business practice, the negative technological shocks could either be temporary or be sustained in the long run. Firms may have an incentive to pay high wages to keep those hard working employees if firms are facing temporary fluctuations and believe that the bad period will be over soon. If the negative technological shock is sustained over a long period of time (e.g., a firm fails to adapt to a new technology), then firms have no such incentives. In the experimental condition CF, firms face permanent negative shocks and the technology coefficient A is always 7. In the experimental condition SF, firms face temporary negative shocks and the technology coefficient A is either 10 or 7 with a 50/50 probability. We compare the wages offered during the bad periods in the SF condition and the wages offered in the CF condition. Assuming that firms are profit-maximizing and that reputation does not matter, there should be no difference in behavior between CF and SF (i.e., there exists a unique equilibrium).

Hypothesis 1: Firms offer the same wages in bad periods in the SF condition as in CF condition.

We expect the job-specific reputation to play a role under technological shocks. As a consequence, we predict the wages offered during the bad periods in the SF condition will be significantly higher than the wages offered in the CF condition. In the presence of reputation there are multiple (infinitely many) equilibria due to repeated play (see BFF, pp. 748). If the hypothesis 1 is rejected, then firms are willing to pay high wages to keep the hard working employees when firms face negative revenue shocks. Also, we expect the number of private offers to increase relative to public offers as the time progresses in both CF and SF conditions (but not in the SR condition). Table 3.3 summarizes tested hypotheses and conditions presented in this section.

TABLE 3.3. Tested hypotheses and their economic implications

Tested Hypotheses	Implication	Null Rejected?
H1: Firms do not absorb shocks to keep the good workers	$w^{SF}_{A=7} = w^{CF}$	Yes, but $w^{SF}_{A=7} < w^{CF}$
H2: Relationship-specific reputation is not important to firms	$w^{SF}_{A=7} = w^{SR}_{A=7}$	Yes
H3: Firms are profit-maximizing and/or do not try to induce higher effort by high wages	$w^{SR}_{A=7} = 6$ $w^{SR}_{A=10} = 6$	Yes Yes
H4: Wage rigidity; More productive firms offer the same wages as less productive ones	$w^{SF}_{A=7} = w^{SF}_{A=10}$ $w^{SR}_{A=7} = w^{SR}_{A=10}$	Yes Yes
H5: Workers do not build relationship-specific reputation	$e^{CF} = e^{SR}$ $e^{SF} = e^{SR}$	Yes Yes
H6: Workers are not other-regarding and/or reciprocal	$e^{CF}_{t=15} = 1$ $e^{SF}_{t=15} = 1$ $e^{SR} = 1$	Yes Yes Yes
H7: No Efficiency wage in short-term (SR) and long-term relations (CF and SF)	$de/dw^{CF} = 0$ $de/dw^{SF} = 0$ $de/dw^{SR} = 0$	Yes Yes Yes

If a firm is characterized by other-regarding preferences and cares about fairness, it will offer generous wages in any circumstances, including those when it cannot derive any additional benefits from its reputation.[8] Thus such a fair firm will offer a generous wage in both SR and SF conditions also under negative technological shock. If a firm is concerned only about its reputation, because it generates gains from long-term contracts with its workers, it will offer a generous wage in a bad period of SF condition but not in the SR condition because its identity cannot be observed.

Hypothesis 2: Wages offered by firms in bad periods of the SF condition are equal to those in SR condition.

Does the presence of relationship-specific asset matter? If yes, then Hypothesis 2 should be rejected by the data. The higher wages paid during a firm's bad periods in the SF condition would be due to the firm's concern for its own reputation under technological shocks. If the firm cares about the relationship-specific asset, it means that in future periods it anticipates higher profits generated by a positive reciprocal behavior of the hardworking employee. The comparison of SF and SR conditions reveals its importance. The firm increases the wages to signal to the worker that it would like to continue the long-term relationship. Hypothesis 2 can also be seen as another test for robustness of BFF finding that a presence of an idiosyncratic asset enhances long-lasting relationships. Hypothesis 2 explores their results further to check whether the parties wish to remain in a common profitable cooperative endeavor in uncertain market conditions.

Is the behavior of firms characterized by other-regarding preferences even in the presence of technological shocks? To address this question we need to compare the

[8]For the ease of explanation, we do not directly mention the trust in positive reciprocity in a one-shot game as an alternative explanation for a generous wage offer. Its presence in the data does not change the results of decomposing the effects of reputation from other-regarding preferences (which would now include the trust effects as well).

wages offered by firms in the SR condition to the prediction for self-regarding preferences.

Hypothesis 3: Firms in SR condition offer wages equal to 6, irrespective of the realization of the shock.

Similar hypotheses could be constructed for SF and CF conditions. However, conducting such tests corresponds to testing compound hypotheses that firms have other-regarding preferences and are concerned about their reputation in order to maintain the long-term horizon of their relationship with workers. This is possible because all market participants have fixed IDs unlike in the SR condition. BFF find that the wages offered by firms in their incomplete contract condition with random ID's (ICR) were always at or below 25 after period 5. We also expect to see wages significantly higher than 6.

Our experimental design also explores the question of whether more productive firms are willing to pay their workers higher wages. The first two studies that produced evidence of higher wages offered in situations with a higher coefficient A were conducted by Fehr, Gächter and Kirchsteiger [1996] and Fehr, Kirchsteiger, and Riedl [1996]. The work tested the fair wage-effort version and shirking version of the efficiency wage theory, respectively.[9] Although both papers describe the changes in parameter as a change in redemption values (the profitability of an employed worker), it could also be interpreted as a change in technology.

[9]The shirking version of efficiency wage theory (Gintis [1976], Stoft [1982], Shapiro and Stiglitz [1984], Bowles [1985], Fehr [1984, 1986], MacLeod and Malcomson [1989, 1993, 1998], Malcomson [1999]) postulates that employers pay incentive compatible efficiency wages to prevent workers from shirking. MacLeod and Malcomson [1998] and Malcomson [1999] point out that if the presence of fairness considerations affects the beliefs of players, a non-Walrasian outcome will emerge. Fehr, Kirchsteiger, and Riedl [1996] have presented a simplified version of shirking efficiency wage model and tested it in the laboratory. Their data show that higher wages tend to cause a reduction in shirking and that firms offer contracts with wages above the minimum efficiency wage that are systematically different causing non-compensating wage differentials.

Hypothesis 4: The more productive (A=10) firms offer wages at the same level as the less productive firms (A=7) in both SF and SR conditions.

Based on the previous studies we expect to be able to reject Hypothesis 4.

Let's now turn our focus to workers. A vast amount of experimental literature shows that the behavior of workers in one-shot games is based on the perception of intentions and therefore is highly reciprocal. Workers who are offered a generous wage often respond by putting in a high effort that is costly to them but benefits the employer. The possibility of a repeated game, apart from other-regarding preferences (such as altruism or inequality aversion) and reciprocity, introduces additional incentives that might affect their choice of effort. The most interesting one is, as in the case of firms, the concern for one's own reputation. If reputation building is possible, the workers might reciprocate with exerting even higher effort. However, in the SR condition, the repeated game incentives are removed because neither the workers nor the firms can be identified. We predict that the workers exert higher effort in both SF and CF condition than in the SR condition, irrespective of the realization of the shock. We test the following hypothesis about the behavior of workers in CF, SF, and SR conditions:

Hypothesis 5: Workers exert the same level of effort in all three conditions, irrespective of the realization of the shock (if applicable).

The ranking of levels of effort in other experimental conditions under different shock realizations is conditional on wages offered and based on the hypotheses 1-4.

Next, we check whether the behavior of workers is characterized by other-regarding preferences in the presence of technological shocks. To address this question we need to compare the wages offered by firms in the SR condition to the prediction for self-regarding preferences. We also examine the level of effort in the last period of

conditions CF and SF when reputation building is not possible anymore. Based on the documented evidence for positive wage-effort correlation we expect to be able to reject the following hypotheses:

Hypothesis 6a: Workers in the last period in conditions CF exert effort equal to 1.

Hypothesis 6b: Workers in the last period in conditions SF exert effort equal to 1.

Hypothesis 6c: Workers in SR condition exert effort equal to 1.

Last, we verify the positive relationship between wage and effort in our data:

Hypothesis 7a: $de/dwCF = 0$

Hypothesis 7b: $de/dwSF = 0$

Hypothesis 7c: $de/dwSR = 0$.

3.3 Results

The experiment was computerized using the "z-tree" software (Fischbacher 1999).[10] We ran 4 SF, 3 SR, and 3 CF sessions in the Economic Science Laboratory, University of Arizona and 2 SF, 2 SR, and 3 CF sessions at SUFE Economics Lab in Shanghai, China in spring semester 2006. The recruited subjects were all undergraduate students from the respective universities. However, there were 4 sessions in Arizona (SFadd, SR2, SR3, and CF3) where less then 17 subjects showed up and several graduate students from Economics, Finance, and Accounting were asked to serve as subjects to fill in the empty spots. The average payoff in the sessions conducted in Arizona was 25 USD. The average payoff in the sessions conducted in Shanghai was 30 Yuan (8 Yuan = 1 USD) per person. In Shanghai, the average salary of a college graduate is about 12 Yuan per hour. The average salary of a University of Arizona student is 7 dollars per hour.

Before starting the experiment, the subjects were asked to read the hard copy of instructions (provided in appendix) and answer the questionnaire testing their understanding of the setup. The experimenters then displayed the correct answers and responded to subjects' questions (if any). Then a verbal part of the protocol followed. The experimenters read from a script that the show up fee would be credited to the payoff account at the beginning of the experiment. Any profits would be added to this amount and any losses would be subtracted from the show up fee. The script is available from the authors upon request.

The subjects then participated in two trial periods without monetary incentives to become familiar with the software, followed by 15 trading periods. One session lasted approximately 100 minutes. Each subject participated in only one session. The sessions were run under single-blind social distance protocol. The instructions and ex-

[10] Brown, Falk, and Fehr generously provided us with the software code, which was later modified by Ninghua Du to suit our purposes.

perimental design were framed as a market with buyers and sellers. We implemented an across-subjects design; that is, different subjects participated in the experimental market SF, SR and CF.

3.3.1 Wages

We start with the description of the data for the three conditions. The time series of average wages in each period that led to contracts are presented in Tables 3.4-3.6 in the appendix. For conditions with shocks (SF and SR) the tables report average wages offered by firms with coefficient equal to 7 separately from those firms for which the realization of coefficient was equal to 10 in any given period. Figure 2 illustrates average wages in the same way for data pooled across all the sessions.

In six CF sessions the lowest observed wage was 1 in period 11 of session CF4, the highest 60 in period 1 of session 5. The average wage across all periods of the CF six sessions was 26.94.

In six SF sessions the lowest wage was 1 and was observed twice - in periods 10 and 15 of session SF3. Both times it was offered by firm 6. In the first case the coefficient A was equal to 10; in the second case it was equal to 7. The highest wage was 100 offered also twice – in period 8 of session SF2 and in period 6 of session SF4. The realization of A was both time 7. The average wage offered in condition SF was 26.57 (24.06 for A=7 and 28.87 for A=10).

Finally, in five SR sessions the lowest wage was 0 and was observed twice – both times in session 3. The first time by a firm in period 10 with A=10 and the second time by the same firm in period 12 when A=7. The highest wage was 100 and was observed three times. The same firm offered a wage of 100 in periods 4 and 13 of session SR2. Both times its technology coefficient was equal to A=10. Another firm offered a wage of 100 in period 7 of session SR3 also with A=10. The average wage offered in condition SR was 17.84 (16.30 for A=7 and 19.22 for A=10).

TABLE 3.4. The time series of average wages that led to contracts - Condition CF

Session/period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CF1	24.57	26.57	30.57	31.29	24.57	27.29	23.43	28.83	32	26	23.86	25.89	24.29	26.71	23.43
CF2	20.29	19.14	19.29	22.14	19.14	19.43	21.71	20.57	22.43	25.86	28.14	25.29	24	25.71	23.42
CF3	26.14	26.29	31.29	28	26.86	28	28.43	28.71	29.14	28.43	29.43	29	29.14	29.14	29.14
CF4	18.57	17	22.67	18	21.43	22.57	23.17	19.57	17.43	18.43	18.43	21.14	19.57	20.71	17.71
CF5	38.57	30.71	29.86	25.2	29.86	29.29	32.57	37	34	34.57	30.57	35.86	36.29	30.71	26.71
CF6	26.29	29.5	26.43	24.57	29.29	30.14	32.57	38.17	36	35.86	35.86	36.29	36.43	36.57	30.86

TABLE 3.5. The time series of average wages that led to contracts - Condition SF

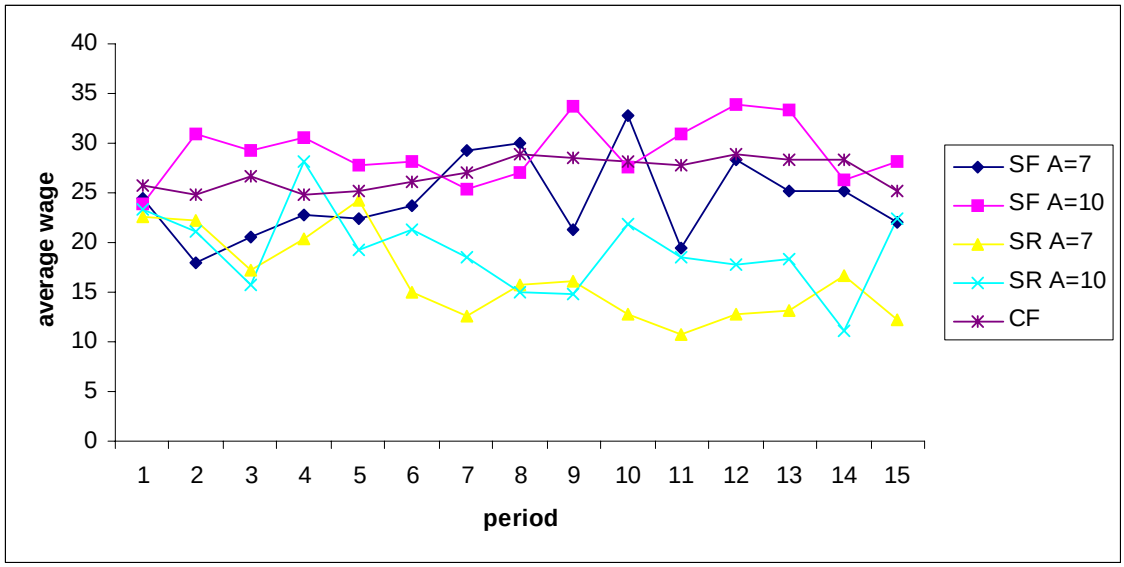
Session/period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SF1 (A=7)	28.33	27.5	30.4	48	30.6	11.25	30	12	9.5	23.25	18	22.8	27.25	27	25
SF1 (A=10)	38.25	41.8	12.5	22.25	27.5	41.66	24.5	28.6	38.25	35	37.75	24.5	16	32.2	35.75
SF2 (A=7)	28.33	12.67	10	16	7.67	7.5	30	52.5	40	7	14	42.5	35	14.67	16.67
SF2 (A=10)	17.5	33.33	19.33	13.33	27.5	40.67	29.33	18.6	29.5	47.8	34	21.67	24.67	17.67	24.67
SF3 (A=7)	20	18.43	25	33	7.5	15	52.5	29	2	42.5	15	32.67	12.5	30.25	17
SF3 (A=10)	26.5	-	25.5	9.5	31	20.17	18.2	22.75	38	13.67	25.67	26.25	37.4	19.67	45
SF4 (A=7)	20.5	20	20	38.67	32	53	33.33	33.25	31.33	42.5	25	17.5	27.5	41	19.4
SF4 (A=10)	30	31.25	43.75	31.25	40	36	33.25	41	36.75	26.75	36.17	43.6	38.67	25.75	37.5
SF5 (A=7)	23	17	20	12.75	21	16.75	13	19	11.5	16	16.75	16.4	15.8	12.67	18.67
SF5 (A=10)	20.2	22	25.67	24.33	18.83	13.67	19.5	18.2	22.33	18.6	16.67	27.5	25	22.5	21.25
SF6 (A=7)	35	23	46	27.5	32	26.33	38.75	40	38	42.75	34.25	53	40.5	35.25	38
SF6 (A=10)	33.25	42	31.4	56.4	44.75	44.75	34.67	41.67	47	38.67	51.67	48.67	55	53	59

One way of examining the wage rigidity under temporary negative technological shocks is to compare the wages that firms offer in condition SF when hit by the shock with wages offered in its absence. Firms engaged in a long term relationship with their workers face three types of incentives when their technology coefficient is decreased. First, they might be willing to lower the wages in order to transfer the burden (decrease workers' rent) onto workers. The finding that more productive firms offer higher wages has been documented in Fehr, Gächter and Kirchsteiger [1996] and Fehr, Kirchsteiger, and Riedl [1996]. Second, if the firms are aware of a positive correlation between wage and effort, they might be reluctant to lower the wages to prevent the effort from going down as in Fehr, Kirchsteiger, and Riedl [1993]. Third, BFF find that firms might be concerned that a lower wage could decrease the

TABLE 3.6. The time series of average wages that led to contracts - Condition SR

Session/period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
SR1 (A=7)	25	20.33	21.25	12.67	25	19.75	10	18.33	22.25	16.6	12	15.6	19.33	34.33	17.5
SR1 (A=10)	25.5	26.75	23	34.75	30.5	29.33	19.4	22.75	19.67	32	24.2	18	16.67	16.75	26.2
SR2 (A=7)	25	36.5	15	32.5	46.67	7.67	13.5	18.67	12	13.5	6	7.5	15	17.33	10.67
SR2 (A=10)	30	13.33	19.25	38	25	34.25	18.6	7.33	24	36.67	26	33.25	38.25	11.5	35.5
SR3 (A=7)	30	15.2	15.83	21.67	10	16	9.5	20	17.67	5.44	5	12.75	14.75	15	n/a
SR3 (A=10)	20	20	5	25	20.17	11	25.8	5.67	8.25	14	14.33	6	5.67	5.67	n/a
SR4 (A=7)	15	25	16.67	32.5	14	19	14.29	14.5	18	12.4	12.67	15.67	10.33	13.75	17
SR4 (A=10)	20	21.6	18.67	18.6	15.33	23.67	-	20	18	20.5	16	20.25	19.75	15	18.5
SR5 (A=7)	15.67	10.5	17.5	14.4	17.5	9.33	12	8.75	5.5	12.2	11.75	6	6	9.4	7.25
SR5 (A=10)	19	21.5	7.25	9	6.8	7.33	8.5	13.67	9.5	6.5	6	7.8	7.75	4	3.67

FIGURE 3.2. Average wage in conditions CF, SF, and SR.



probability of continuation of a successful relationship.

What do the data from condition SF say about wage rigidity? As can be seen from Figure 2, the average wage offered by firms who experienced a negative technological shock in a given period exceeds the average wage of firms which have not experienced it only in periods 1, 7, 8, and 10. We apply a nonparametric Mann-Whitney test (Table 3.7, row 5) to session averages as individual observations to test Hypothesis 4 that the wages are equal. The null is rejected at p=0.004. If we use the pooled data instead of session averages (row 6), the null is rejected at p=0.000. We conclude that under the negative technological shock the incentive to share the burden with workers is stronger than incentives for maintaining the wage at the no-shock level and hence we do not observe wage rigidity in our setting.

Another way of looking at wage rigidity and at the same time answering our main research question is to compare the wages in CF condition with those in SF condition

TABLE 3.7. Comparison of wages across conditions (Mann-Whitney test with session averages)

Null	Mann-Whitney Test	p-value	Rejected?
$H1: w^{SF}_{A=7} = w^{CF}$	Session Averages: -1.448	0.148	No
	Pooled Data: -3.533	0.000	Yes
$H2: w^{SF}_{A=7} = w^{SR}_{A=7}$	-5.476	0.000	Yes
	-6.981	0.000	Yes
$H4: w^{SF}_{A=7} = w^{SF}_{A=10}$	2.917	0.004	Yes
	4.218	0.000	Yes
$H4: w^{SR}_{A=7} = w^{SR}_{A=10}$	1.968	0.049	Yes
	1.331	0.038	Yes
$H4: w^{CF} = w^{SF}_{A=10}$	2.154	0.031	Yes
(interaction)	1.112	0.266	No

when a shock occurred. This corresponds to a comparison of wages offered under a permanent versus a temporary shock. It is obvious that if a shock is permanent, a profit maximizing firm would not be willing to incur per period losses just to keep the current workers because even in the long run there is no possibility of recouping the lost profits. Therefore, the wage level in CF constitutes a natural benchmark as to how low one would expect the wages to drop in a labor market with an idiosyncratic asset. Hypothesis 1 thus aims at a notion of wage rigidity of a particular type.[11] It tests whether the wages are sluggish to adjust to this natural benchmark level.

The firms in the SF condition are on average more productive (A equals to 7 or 10) than in the CF condition (A always equals to 7). We have previously concluded that the more productive firms in our experiment offer higher wages. Therefore, the firms in the SF condition should on average offer higher wages than in CF. The question is whether firms offer higher wages also in the bad periods of SF when the technology coefficient A is equal to 7 just like in CF. If the wages in condition SF do not fluctuate and are above the wage level in CF, then the data provide support for wage rigidity.

[11] Hypothesis 4 looks at a "standard" notion of wage rigidity: Do wages offered by the same firms change from period to period? Hypothesis 1, on the other hand, compares wages from two different samples in two different conditions. We describe the phenomenon as wage rigidity in this exposition as well because of its proximity to the "standard" view.

Such wage rigidity is caused by the employer's concern for long-term relationship.

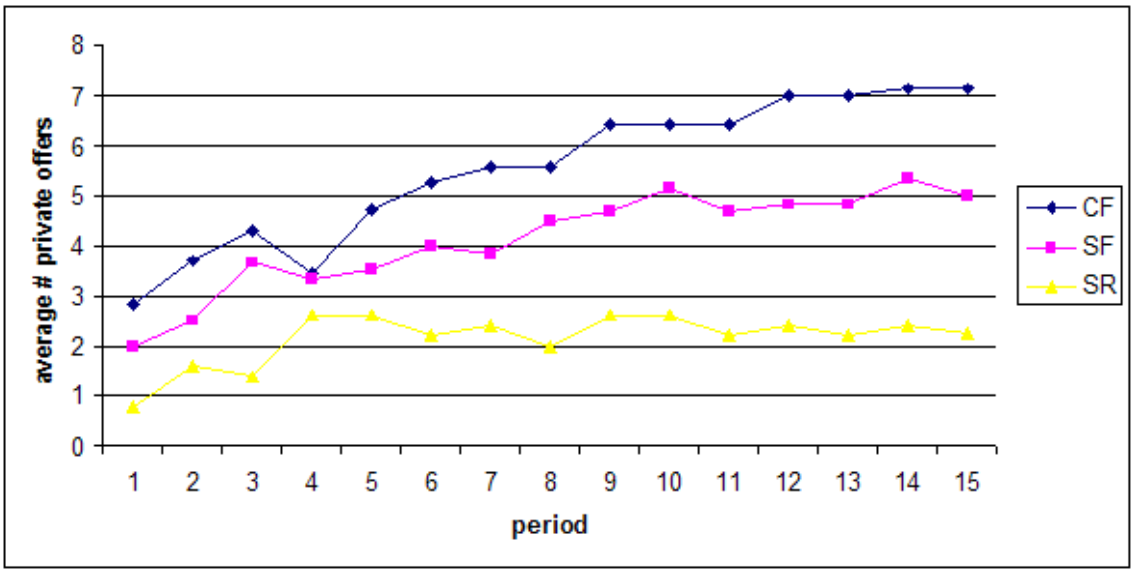
As can be seen in Figure 2, the average CF wage was higher than SF_7 in most of the periods with the exception of periods 7, 8, and 10. The average wage across all periods was higher in CF by 2.88 (26.94 versus 24.06). The Mann-Whitney test in row 1 in Table 3.7 with session averages as individual observations does not reject the null that the wages in the two samples are equal ($p = 0.148$), however the one in row 2 with pooled data does ($p<0.001$). The result that firms offer higher wages in CF than in SF_7 is opposite to our prediction that firms absorb shocks to keep the good workers (Table 3.3, row 1). It provides further evidence against the wage-rigidity in the boundary conditions of laboratory environment. It also demonstrates the BFF result on the strength of long-term relationships with an idiosyncratic asset not to be robust to negative technological shocks.

Based on the previous paragraph one might be tempted to make a conclusion about the importance of the idiosyncratic asset. Indeed, the presence of a temporary shock weakens its influence on the behavior of firms. However, a conclusion that the firms do not pay any attention to its presence when making decisions would be false. In order to shed more light on this issue we test Hypothesis 2 by comparing the wages offered by firms in bad periods in condition SF to those offered in bad periods in condition SR.

In all but period 2 and period 5 the average wage in SF is higher than in SR if the negative shock occurs (see Figure 2). The Mann-Whitney test in Table 3.7 with session averages indicates that this difference is significant at the $p = 0.000$ level. Thus, we reject the null that wages in bad periods of SF and SR are equal. We conclude that the firms recognize the benefits of a long-term relationship and in the presence of a temporary negative shock do not set wages as low as firms engaged in one-shot interaction would.

The previous statement is backed up by another observation. As time progresses, firms are making more and more private offers (that lead to contracts) in conditions

FIGURE 3.3. Average number of private offers leading to contracts



CF and SF, but not SR. Moreover, the vast majority of the private offers are to the same worker as in the preceding period. The firms and workers thus engage in a relationship lasting more than one period. Figure 3 portraits the average number of private offers made by firms in all three conditions. Note that the average number of contracts in SF is lower than in CF (p-value < 0.01), yet it is still increasing over time. Naturally, since the maximum number of contracts in each period is seven, the number of accepted public offers is decreasing in conditions CF and SF.

Next we turn our attention to the question whether or not the productive firms offer higher wages. Figure 2 reveals that the average per period wages in the SF condition in the absence of the negative technological shock (i.e., A=10) are most of the time higher than wages offered by the firms in the same condition when the negative technological shock is present (p-value $= 0.004$). Similarly, wages in the SR condition are on average higher in the absence of the negative technological shock than in its presence (p-value $= 0.049$). We reject Hypothesis 4 that the productivity of

TABLE 3.8. Comparison of wages against theoretical predictions (Kolmogorov-Smirnov test with session averages)

Null	K-S Test	p-value	Rejected?
$H3 : w^{SR}_{A=7} = 6$	0.723	0.000	Yes
	0.667^b	0.008	Yes
$H3 : w^{SR}_{A=10} = 6$	0.712	0.000	Yes
	0.563^b	0.011	Yes

^{b} period 15 data only

firms has no impact on wages they offer. This result is consistent with Fehr, Gächter and Kirchsteiger [1996] and Fehr, Kirchsteiger, and Riedl [1996].

We also report the outcome of the interaction between the effect of different productivity levels per se on wage determination and the asymmetric information about the technology coefficient. The last row in Table 3.7 presents Mann-Whitney test for comparison of wages in SF condition when A=10 and wages in CF (in which A=7 always). If we treat the session averages as individual data, then wages in the SF condition are on average higher in the absence of the negative technological shock than in the CF condition (p-value = 0.031). However, the tests using pooled data yield qualitatively different result (p=0.266). It is intuitive that the two effects work in the opposite direction as asymmetric information could allow the firms to decrease the wages pretending there was a shock. Unfortunately, our design does not enable us to judge the relative impact.

Finally, we test Hypothesis 3 exploring whether the behavior of firms is characterized by other-regarding preferences. The Kolmogorov-Smirnov test reported in Table 3.8 rejects the hypothesis that the firms offer minimum wage of 6 in condition SR for in the presence and in the absence of the negative technological shock as well. The rejection is also supported by the result of K-S test using period 15 data only.

TABLE 3.9. Wage-effort relationship

	CF		SF		SR	
Wage	Average effort	Median effort	Average effort	Median effort	Average effort	Median effort
0-10	1.72	1	1.84	1	1.28	1
11-20	3.91	4	3.38	3	3	3
21-30	5.9	6.5	5.46	6	4.2	4
31-40	8.87	9	6.52	7	4.64	5
41-50	9.45	10	8.47	9	5.16	6
51-60	10	10	9.4	10	7.87	8
61-100	-	-	8.125	9	6.1	7

TABLE 3.10. Wage-effort correlation

Cond.	Wage-effort correlation	Spearman's rho	p-value	Independence rejected?
CF	0.867	0.860	0.000	Yes
SF	0.744	0.760	0.000	Yes
SR	0.662	0.677	0.000	Yes

3.3.2 Wage-Effort Relation

In this section we check whether a higher wage induces a higher effort of workers in our data (Hypothesis 7). Table 3.9 presents the observed average and median effort levels in response to a wage within a certain interval for all three conditions irrespective of the realization of the shock. Both the average and median effort levels are increasing in wage.

The correlation between wage and effort is reported in Table 3.10. The correlation is highest in the condition CF and yields 0.867. The correlation in conditions SF and SR is equal to 0.744 and 0.662, respectively. In all three cases Spearman's correlation test rejects the independence of wage and effort (p=0.000).

In Table 3.11 we present the results of regression . The estimated coefficients are

TABLE 3.11. Results of regression effort=alpha+beta.wage+e

Condition	# obs	$\hat{\alpha}$	$t(\alpha)$	$p > \lvert t(\alpha) \rvert$	$(\hat{\beta})$	$t(\beta)$	$p > \lvert t(\beta) \rvert$	adj. R^2
CF	621	0.27	1.82	0.069	0.21	43.32	0.000	0.75
SF	619	1.19	7.45	0.000	0.14	27.63	0.000	0.55
SR	502	1.01	9.10	0.000	0.09	19.73	0.000	0.44

TABLE 3.12. Comparison of effort levels against theoretical predictions for self-regarding workers (Kolmogorov-Smirnov test with pooled data)

Null	K-S Test	p-value	Rejected?
$H6a : e^{CF}_{t=15} = 1$	0.544^b	0.000	Yes
$H6b : e^{SF}_{t=15} = 1$	0.525^b	0.000	Yes
$H6c : e^{SR} = 1$	0.496	0.000	Yes
	0.444^b	0.005	Yes

^{b} period 15 data only.

all positive and significant in all three conditions and provide a strong support for a fair wage-effort theory.

Last, we test Hypothesis 6 and check whether the effort level in the last periods of conditions CF and SF and in all the periods of SR is higher than the theoretical prediction for self-regarding workers in a one-shot game. Table 3.12 reports the Kolmogorov-Smirnov test for individual data against the prediction that effort is equal to 1. In all cases K-S tests reject the null.

3.3.3 Relationship Break-ups

In the previous sections we have demonstrated that the presence of negative technological shocks decreases wages and that lower wages result in lower effort levels. But what are the overall consequences of negative shocks to relationships? Are relationships stable in such conditions or do they break up?

First we analyze what happens in the condition SF when A drops from 10 to 7 between two consecutive periods. To analyze the relationships we focus our attention on the data where the firm made a private offer in the period with A = 10. One might argue that a relationship could be formed even through a public offer. However, including relationships which started up through public offers would include cases when a firm was just feeling out the workers and thus would provide a noisier measure of break ups.

If a firm made a private offer in the period when A=10 then there are three possibilities what could happen in the next period with A=7. The firm could make a private offer to the same worker; the firm could make a private offer to another worker; or the firm could offer a wage publicly. The first scenario indicates the firm wishes to continue the relationship, whereas the latter two indicate the opposite. Conditional on that the firm wishes to continue a relationship and offers privately to the same worker, the relationship can also be terminated if the worker declines the offer.

As A drops from 10 to 7 we observe a total of 92 accepted private offers in the "first" period. The firms that made these private offers on average lower the wage by 6 in the "second" period after their coefficient drops to 7.

The relationship breaks down a total of 40 times (43.5%). Out of the 40 discontinued relationships, 29 are terminated by firms that made either a public offer or a private offer to another worker; 11 times the offer is rejected by workers. There are 52 relationships that survived the negative shock. The lower wage offered by the firms after the shock had a negative impact on the effort level as the workers decreased their effort on average by 1.06.

Next we compare the relationships in which the firms offer a lower wage after the shock with those where firms offer the same wage or a higher wage. In 42 out of the 92 relationships we examine firms lowered the wage. There are 31 firms which did not change their wages and 19 firms that actually increased their wages as A dropped. Let's first consider the 42 relationships in which firms lowered the wage. Altogether

TABLE 3.13. Frequency of break ups caused by firms and workers

% relationships terminated by	Wage decreased	Wage constant or increased
Firm	69.6	76.5
Worker	30.4	23.5
Total	100	100

Fisher's exact test p-value = 0.426.

there are 23 relationships (54.8%) that got terminated. In 16 cases out of 23 (69.6%) it was the firm that decided to discontinue the cooperation and in the remaining 7 it was the worker (30.4%). The 19 workers who accepted contracts with lower wages responded with a 2.37 average decrease in the effort level.

On the other hand, significantly fewer relationships got broken up when the firms did not change the wage or even increased it. Out of the 50 such cases 17 resulted in a break up (34%). The firms did not make an offer to "their" worker 13 times (76.5%) and there were 4 workers (23.5%) who did not accept the new offer. The 33 workers who accepted contracts with the same or higher wage on average decreased their effort level by 0.3. Table 3.13 summarizes the frequencies of break ups depending on which party initiated it. Fisher's exact test does not reject the hypothesis that the composition of the two categories is the same.

Lastly, we explore the question whether firms exploit the asymmetry in information about the realization of the shock. Suppose a firm's coefficient in a given period is 10 and the firm does not face a shock in the next period either. Yet, the firm lowers the wage. We interpret such behavior as pretending there was a shock to increase own profits and ignore the explanation that the firm is "feeling out" the worker(s) about what the response will be to a drop in wage. In the SF data we observe a drop in wage 126 times. In 47 cases (37.3%) the firms' coefficient did not change but in 79 cases the firms faced a real drop in A. The frequency with which firms were pretending that there was a shock is statistically significantly different from zero. Hence, we conclude that a non-trivial fraction of subjects acting as firms exercises their power and takes

advantage of the asymmetry in information as noted by Camerer [2003].

3.4 Conclusions

We report the results of a laboratory experiment studying whether firms are willing to continue paying high wages to the workers when they face negative technological shocks. The shocks bring unfavorable conditions for maintaining the employer's reputation because firms have to decide whether to absorb their effects themselves or to transfer them on to the workers which might mean damaging their own reputation and perhaps decreasing the probability of the continuation of a successful relationship. We do not find support for downward wage rigidity in the data. Once the shocks occur, firms lower the wages and relationships often break down. The workers who accept a lower wage respond with exerting a lower effort. We conjecture that the subjects' behavior is driven by uncertainty about the technology coefficient and a perceived entitlement to profit similar to the one in previous period. Further exploration of reasons why relationships break down will give useful insight in regard to other major issues related to labor markets, such as the complexity of decisions of labor market participants given the repeated interactions, trust between two contracting parties, determinants of involuntary unemployment, and the importance of asymmetric information about the technological shocks. All the above are relevant for labor market policy implications.

3.5 Appendix

3.5.1 Instructions - Condition CF

Instructions for Buyers

You are now taking part in an economic experiment. Please read the following instructions carefully. Everything that you need to know in order to participate in this experiment is explained below. Should you have any difficulties in understanding these instructions please notify us. We will answer your questions at your cubicle.

At the beginning of the experiment you will receive an initial endowment of 5 US Dollars. During the course of the experiment you can earn a further amount of money by gaining points. The amount of points that you gain during the experiment depends on your decisions and the decisions of other participants.

All points that you gain during the course of the experiment will be exchanged into US Dollars at the end of the experiment. The exchange rate will be:

$$1\ point = 0.1\ US\ Dollars$$

At the end of the experiment you will receive the money that you earned during the experiment in addition to your endowment of 5 US Dollars.

The experiment is divided into periods. In each period you have to make decisions, which you will enter on a computer screen. There are 15 periods in all.

Please note that communication between participants is strictly prohibited during the experiment. In addition we would like to point out that you may only use the computer functions which are required for the experiment. Communication between

participants and unnecessary interference with computers will lead to the exclusion from the experiment. In case you have any questions don't hesitate to ask us.

Prior to the experiment the 17 participants were divided into 2 groups: buyers and sellers. In this experiment there are 10 sellers and 7 buyers.

You are a buyer throughout the whole experiment. All participants have received an identification number which they will keep for the entire experiment. Your identification number is stated on the documentation sheet in front of you.

An Overview of the Experimental Procedures

In each period of the experiment every buyer can buy a product from a seller. The seller earns a profit by trading if he sells the product at a price, which exceeds his production costs. The buyer earns a profit by trading if the price he pays for the product is less than what the product is worth to him. The production costs and the product's value for the buyer depend on the quality of the product.

The experiment lasts for 15 periods. In each period the procedures are as follows:

1. Each period starts with a trading phase which lasts for 3 minutes. During this phase buyers can submit offers, which can be accepted by sellers. When submitting an offer a buyer has to specify three things:

- which price he offers to pay,
- which product quality he desires,
- and finally, which seller he wants to submit the offer to. Buyers can submit two types of offers; private offers and public offers. Private offers are submitted to one seller only and can only be accepted by that seller. Public offers are submitted to all sellers and can be accepted by any seller.

As a buyer you can - in each period - submit as many offers as you like. Submitted offers can be accepted at any time during the trading phase. Each buyer and each

seller can at most conclude one trade in each period. As there are 10 sellers and 7 buyers, several sellers will not trade in each period.

2. Following the trading phase each seller who has concluded a trade determines which product quality he will supply. The seller is not obliged to supply the product quality desired by his buyer. Once every seller has chosen a product quality each participant's earnings in the current period are determined. After this the next period starts.

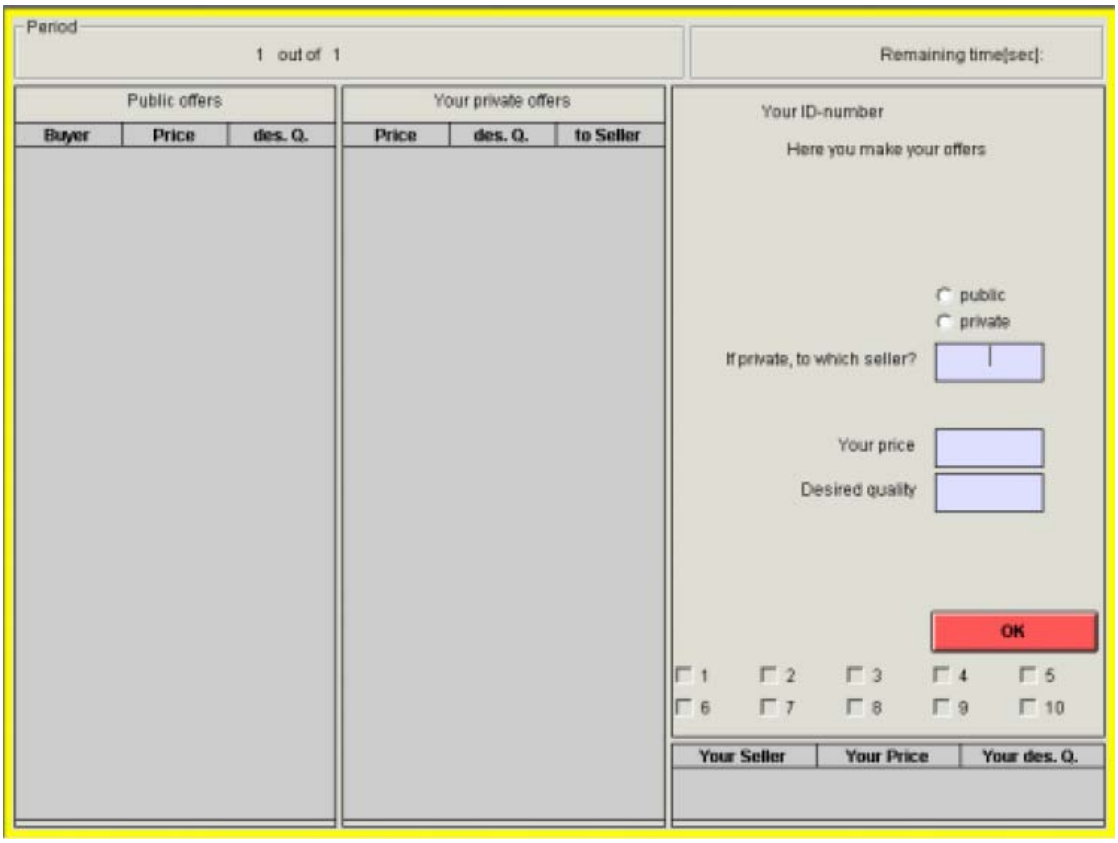
The points gained from all 15 periods will be summed up at the end of the experiment, exchanged into US Dollars and paid together with your endowment in cash.

The Experimental Procedures in Detail

There are 7 buyers and 10 sellers in the experiment. You are a buyer throughout the whole experiment. During the experiment you will enter your decisions on a computer screen. In the following we describe in detail how you can make your decisions in each period.

1. The Trading Phase

Each period starts with a trading phase. During the trading phase each buyer can conclude a trade with a seller. In order to do so each buyer can submit as many offers as he wishes. In each trading phase you will see the following screen:



- In the top left corner of the screen you see in which period of the experiment you are. In the top right corner of the screen you will see the time remaining in this trading phase, displayed in seconds. The trading phase in each period lasts 3 minutes (=180 seconds). When this time is up the trading phase is over. Hereafter, no further offers can be submitted or accepted in this period.
- Once the above screen is displayed the trading phase starts. As a buyer you now have the opportunity to submit offers to the sellers. In order to do so you have to enter three things on the right hand side of the screen:

a) First you have to specify whether you want to submit a public or a private offer:

- Public trade offers

Public offers will be communicated to all participants in the market. All sellers see all public offers on their screens. A public offer can therefore be accepted by any seller. As a buyer you will also see all public offers submitted by all buyers.

If you want to submit a public offer, click on the field "public", using the mouse.

- Private trade offers

A private offer is submitted to one seller only. Only this seller is informed about the offer and only this seller can accept the offer. No other seller or buyer will be informed about that offer.

If you want to submit a private offer, click on the field “private” using the mouse. After that you specify which seller you want to submit the offer to in the field below. Each of the 10 sellers has an identification number (seller 1, seller 2, ..., seller 10). Each seller keeps his identification number throughout the whole experiment. To submit an offer to a specific seller you enter the number of that seller (e.g., "4" for seller 4).

b) Once you have specified to whom you want to submit an offer, you must determine which price you offer. You enter this in the field "Your price". The price you offer is a number between 0 and 100:

$$0 \leq price\ offered \leq 100$$

c) Finally you have to specify which product quality you desire. You enter this in the field "Desired quality". Your desired quality is a number between 1 and 10:

$$1 \leq desired\ quality \leq 10$$

After you have completely specified your offer, you must click on the "OK" button to submit it. As long as you have not clicked "OK" you can change your offer. After

you click "OK" the offer will be displayed to all sellers you have submitted it to.

- On the left side of your screen you see the header "public offers". All public offers in the current trading phase are displayed here. Your public offers as well as those of all other buyers will be displayed. You can see which buyer submitted the offer, which price he offered and which quality he desired. All buyers also have an identification number, which they keep throughout the whole experiment.
- In the middle of your screen under the header "Your private offers". You see all private offers, which you have submitted in the current trading phase. You see which price you offered, which quality you desired and which seller you submitted an offer to.
- Each buyer can submit as many private and public offers as he wishes in each period. Each offer that you submit can be accepted at any time during the trading phase.
- In any given period each buyer can conclude at most one trade. Once one of your offers has been accepted you will be notified which seller accepted which of your offers. In the bottom right corner of your screen the identification number of the seller will be displayed as well as your offered price and your desired quality. As you can conclude only one trade in each period all your other offers will be automatically cancelled. Also, you will not be able to submit any further offers.

- In any given period each seller can conclude at most one trade. You will be continuously informed which sellers have not yet accepted an offer. On the right bottom of the screen you see 10 fields, each field for one of the ten sellers. Once a seller has accepted an offer a “x” will appear in the field next to the seller’s identification number. You cannot submit private offers to a seller who has already concluded a trade.

- Once all 7 buyers have concluded a trade or after 3 minutes have elapsed,

the trading phase is over.

- No buyer is obliged to submit offers, and no seller is obliged to accept an offer.

2. Determination of the Product Quality

- Following the trading phase, all sellers who have concluded a trade determine which product quality they supply to their respective buyers. The product quality, which you desired in your offer, is not binding for your seller. Your seller can choose the exact quality you desired, but he can also choose a higher or a lower product quality. The product quality which your seller chooses has to be between 1 and 10:

$$1 \leq product\ quality \leq 10$$

- While your seller determines the actual product quality, we ask you to specify which quality you expect him to supply on a separate screen. In addition we ask you to state how sure you are about this expectation.

How are the Incomes Calculated?

Your income:

- If you do not conclude a trade during a trading phase you receive an income of 0 points in that period.

- If one of your offers is accepted, your income depends on the price you offered and on the product quality. Your income is determined as follows:

$$Your\ income = 7 * product\ quality\ -\ price$$

- As you can see from the above formula your income is higher, the higher the product quality actually supplied by your seller. At the same time your income is higher, the lower the price you paid for the product.

Income of your seller:

- If a seller has not concluded a trade during a trading phase he gains an income of 5 points in that period.

- If a seller has accepted an offer his income equals the price he receives minus the production costs he incurs. The income of the seller is determined as follows:

$$Income\ of\ your\ seller = Price - production\ costs$$

- The production costs of a seller are higher, the higher the quality he chooses. The production costs for each product quality are displayed in the table below:

Product quality	1	2	3	4	5	6	7	8	9	10
Production Cost	0	1	2	4	6	8	10	12	15	18

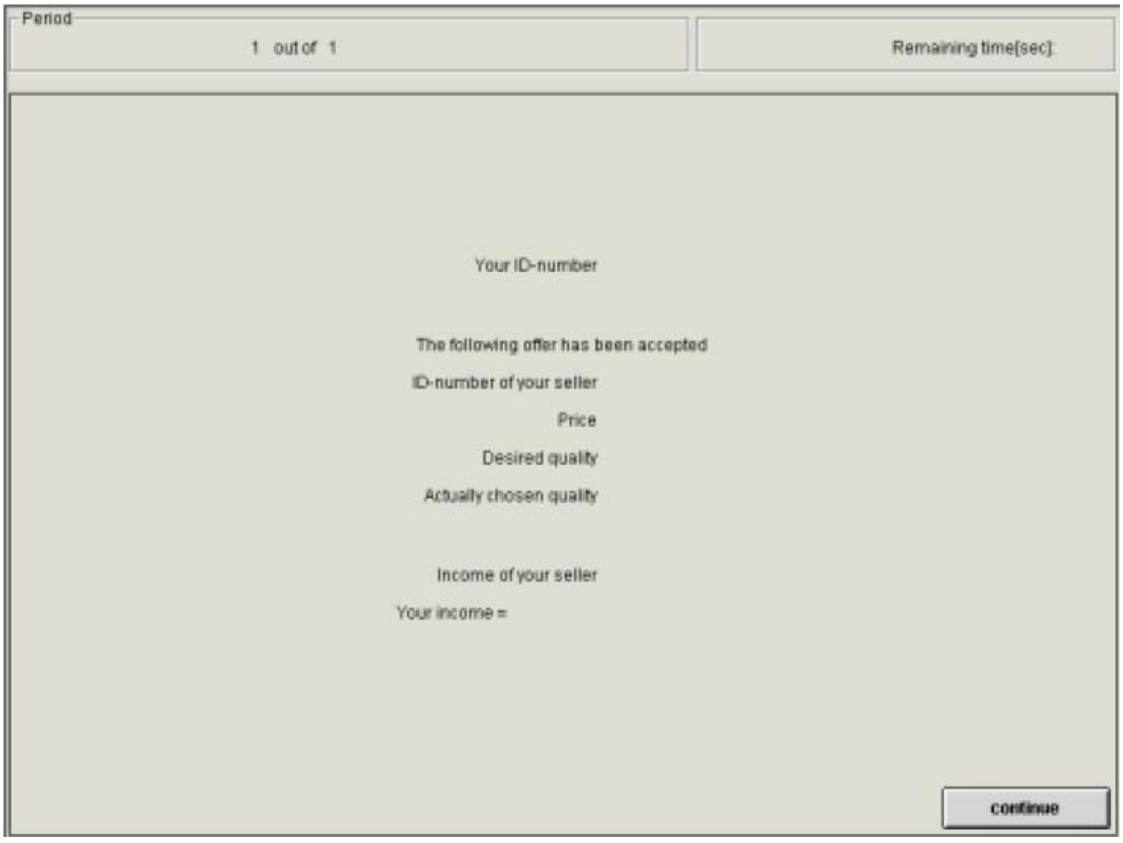
- The income of your seller is higher, the higher the price. Further, his income is higher, the lower the product quality he supplies.

The income of all buyers and sellers are determined in the way as described above. Each buyer can therefore calculate the income of his seller and each seller can calculate the income of his buyer. Further, each buyer and seller is informed about the identification number of his trading partner in each period.

Please note that buyers and sellers can incur losses in each period. These losses have to be paid from your initial endowment or from earnings made in other periods.

You will be informed about your income and the income of your seller on an "income screen". On the screen (see below) the following will be displayed:

- which seller you traded with
- which price you offered
- your desired quality
- the product quality actually chosen by your seller
- the income of your seller in this period
- your income in this period.



Please enter all the information in the documentation sheet supplied to you. After the income screen has been displayed, the period is over. Thereafter the trading phase

of the following period starts. Once you have finished studying the income screen please click on the "continue" button.

The sellers also see an income screen, which displays the above information. They see the ID of their trading partner, the price, desired and actually supplied product quality as well as both incomes.

The experiment will not start until all participants are completely familiar with all procedures. In order to secure that this is the case we kindly ask you to solve the exercises below.

In addition we will conduct 2 trials of the trading phase, so that you can get accustomed to the computer. During the trial phases no money can be earned. After the trial phases we will begin the experiment, which will last for 15 periods.

Control Questionnaire

Please solve the following exercises completely. If you have questions ask the experimenter.

Exercise 1

You did not make an offer during a trading phase. What is your income in this period?

Your income =

Exercise 2

You offered a price of 30 and indicated a desired quality of 9. A seller accepts your offer and actually chooses a quality of 8.

Your income =

Income of your seller =

Exercise 3

You offered a price of 60 and indicated a desired quality of 9. A seller accepts your offer and actually chooses a quality of 6.

Your income =

Income of your seller =

Exercise 4

You offered a price of 10 and indicated a desired quality of 2. A seller accepts your offer and actually chooses a quality of 5.

Your income =

Income of your seller =

Exercise 5

You offered a price of 10 and indicated a desired quality of 6. A seller accepts your offer and actually chooses a quality of 2.

Your income =

Income of your seller =

Exercise 6

A seller did not accept an offer during a trading phase. What is the income of this seller in this period?

Income of your seller =

Exercise 7

You made several offers during a trading phase. None of your offers has been accepted by a seller. What is your income in this period?

Your income =

If you have finished the exercises we recommend looking again at the exercises and the solutions provided. After this, please think about the decisions you want to make during the experiment.

Documentation sheet: Buyer

This documentation sheet is meant for your orientation. Please complete the respective row in each period.

Period	ID of Your Seller	Price	Desired Quality	Actual Quality	Income of Your Seller	Your Income
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

Instructions for Sellers

You are now taking part in an economic experiment. Please read the following instructions carefully. Everything that you need to know in order to participate in this experiment is explained below. Should you have any difficulties in understanding these instructions please notify us. We will answer your questions at your cubicle.

At the beginning of the experiment you will receive an initial endowment of 5 US Dollars. During the course of the experiment you can earn a further amount of money by gaining points. The amount of points that you gain during the experiment depends on your decisions and the decisions of other participants.

All points that you gain during the course of the experiment will be exchanged into US Dollars at the end of the experiment. The exchange rate will be:

$$1\ point = 0.1\ US\ Dollars$$

At the end of the experiment you will receive the money that you earned during the experiment in addition to your endowment of 5 US Dollars.

The experiment is divided into periods. In each period you have to make decisions which you will enter in a computer. In total there are 15 periods.

Please note that communication between participants is strictly prohibited during the experiment. In addition we would like to point out that you may only use the computer functions which are required for the experiment. Communication between participants and unnecessary interference with computers will lead to the exclusion from the experiment. In case you have any questions don't hesitate to ask us.

Prior to the experiment the 17 participants were divided into 2 groups: buyers and sellers. In this experiment there are 10 sellers and 7 buyers.

You are a seller throughout the whole experiment. All participants have received an identification number which they will keep for the entire experiment. Your identification number is stated on the documentation sheet in front of you.

An Overview of the Experimental Procedures

In each period of the experiment every buyer can buy a product from a seller. The seller earns a profit by trading if he sells the product at a price which exceeds his production costs. The buyer earns a profit by trading if the price he pays for the product is less than what the product is worth to him. The production costs and the product's value for the buyer depend on the quality of the product.

The experiment lasts 15 for periods. In each period the procedures are as follows:

1. Each period starts with a trading phase, which lasts for 3 minutes. During this phase buyers can submit trade offers which can be accepted by sellers. When submitting an offer a buyer has to specify three things:

- which price he offers to pay,
- which product quality he desires,
- and finally, which seller he wants to submit the offer to. Buyers can submit two types of offers; private offers and public offers. Private offers are submitted to one seller only and can only be accepted by that seller. Public offers are submitted to all sellers and can be accepted by any seller.

Buyers can - in each period - submit as many offers as they like. Submitted offers can be accepted at any time during the trading phase. Each buyer and each seller can only conclude one trade in each period. As there are 10 sellers and 7 buyers, several sellers will not trade in each period.

2. Following the trading phase each seller who has concluded a trade determines which product quality he will supply. The seller is not obliged to supply the product quality desired by his buyer. Once every seller has chosen a product quality each participant's earnings in the current period are determined. After this the next period starts.

The points gained from all 15 periods will be summed up at the end of the experiment, exchanged into US Dollars and paid together with your endowment in cash.

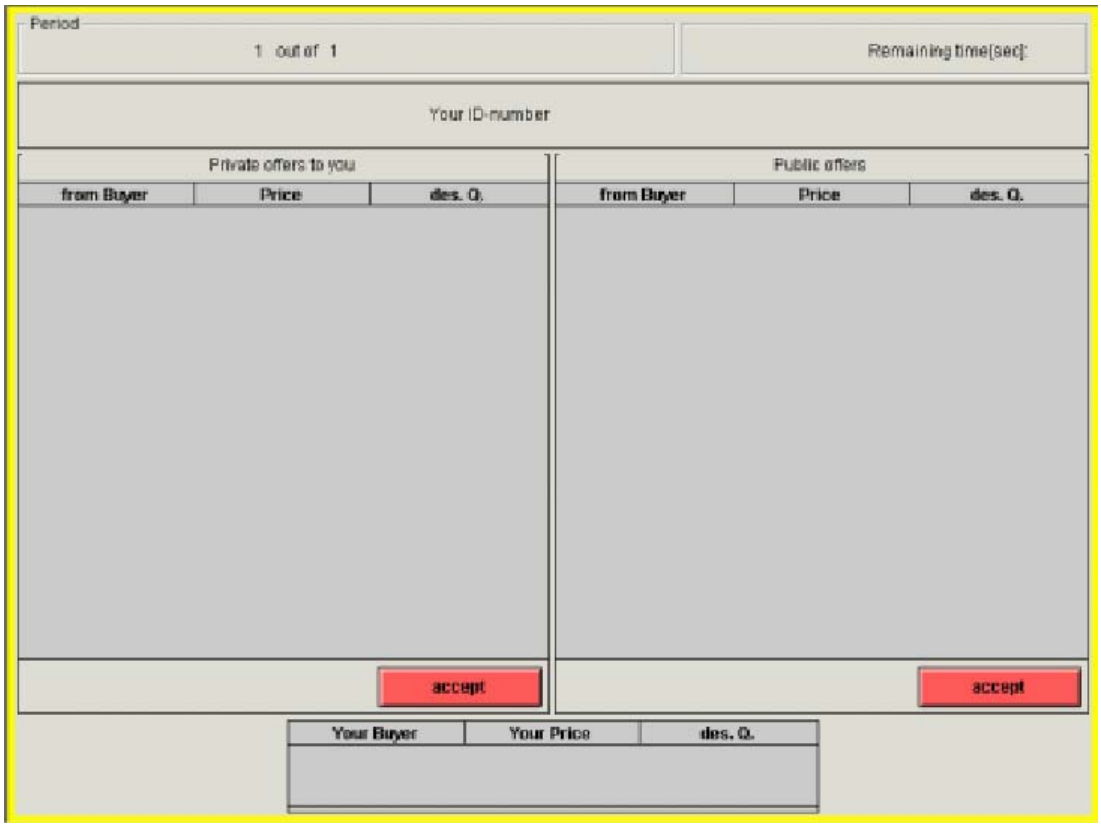
The Experimental Procedures in Detail

There are 7 buyers and 10 sellers in the experiment. You are a seller throughout the whole experiment. During the experiment you will enter your decisions on a

computer screen. In the following we describe in detail how you can make your decisions in each period.

1. The Trading Phase

Each period starts with a trading phase. During the trading phase each buyer can conclude a trade with a seller. In order to do this the buyers can submit offers to the sellers. As a seller you can - in each period - accept one of the offers. During the trading phase you will see the following screen:



- In the top left corner of the screen you see in which period of the experiment you are. In the top right corner of the screen you see the remaining time in the current trading phase, displayed in seconds. The trading phase in each period lasts 3 minutes

(=180 seconds). When this time is up the trading phase is over. Hereafter, no further offers can be submitted or accepted for this period.

- Once the above screen is displayed the trading phase starts. As a seller you can now accept offers submitted by the buyers. There are two types of offers which you can accept:

- Private offers to you

Each buyer has the opportunity to submit private offers to you. You alone will be informed about these offers and you alone can accept them. No other seller or buyer is informed about these offers. If you receive private offers, they will appear on the left side of your screen, below the header "Private offers to you". The offer of a buyer contains the following information: the identification number of the buyer who submitted the offer, the price which he offers for the product and which product quality he desires. If you want to accept a private offer, you click first on the respective row in which the offer is displayed. When you do this, the offer will be highlighted. If you are sure you want to accept the offer you then click on the button "accept" which you find at the bottom of the screen. As long as you do not click "accept" you can alter your choice.

- Public offers

Each buyer also has the possibility to submit public offers. All sellers are informed about these offers and any seller can accept them. If a buyer submits a public offer it appears on the right side of your screen, below the header "Public offers". The offer of a buyer again contains the identification number of the buyer who submitted the offer, the price which he offers for the product and which product quality he desires. This information is also displayed to all other sellers and all buyers. If you want to accept a public offer you follow the same procedures as with private offers. You click first on the respective row in which the offer is displayed. When you are sure that

you want to accept the offer you click on the button "accept" which you find at the bottom right corner of the screen. As long as you do not click "accept" you can alter your choice.

- As soon as you have pressed the “accept” button you will see which offer you have accepted in the bottom row of your screen.

- Each seller can conclude at most one trade in each period. Once you have accepted one offer you cannot accept any further offers.

All buyers have to observe the following rules when submitting trade offers:

- The price offered by the buyer must be between 0 and 100:

$$0 \leq price \leq 100$$

- The desired quality of the buyer must be between 1 and 10:

$$1 \leq desired\ quality \leq 10$$

- Each buyer can - in each period - submit as many private and public offers as he wishes. Each offer submitted by a buyer can be accepted at any time during the trading phase.

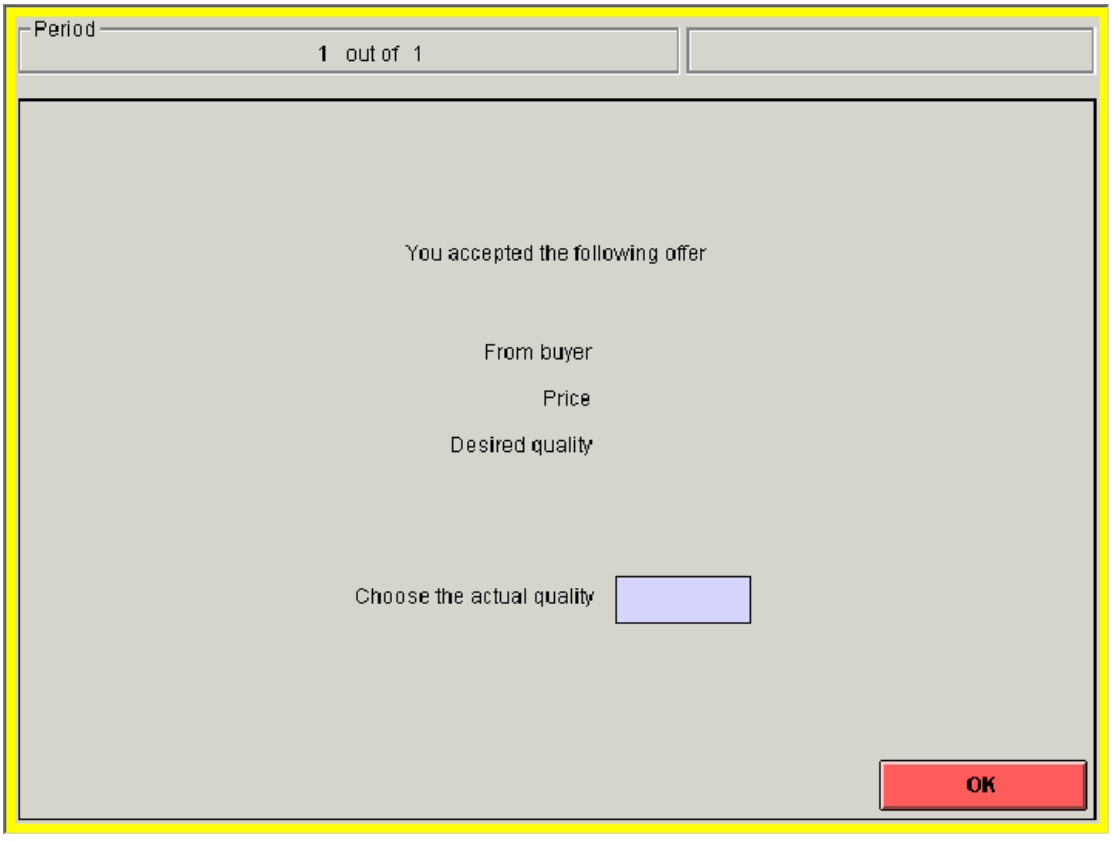
- Each buyer can conclude at most one trade in each period. Once an offer of a buyer has been accepted he will be informed about which seller accepted the offer. As each buyer can conclude only one trade in each period all other offers of the buyer will automatically be cancelled. Also, he cannot submit any further offers.

- Once all 7 buyers have concluded a trade or after 3 minutes have elapsed, the trading phase is over.

- No buyer is obliged to submit offers, and no seller is obliged to accept an offer.

2. Determination of the Actual Product Quality

- Following the trading phase, all sellers who have concluded a trade determine which product quality they supply to their buyers. The product quality desired by your buyer is not binding for you as a seller. You can exactly choose the quality desired by your buyer, but also a higher or lower product quality. If you have concluded a trade during a trading phase, the following screen will appear. Here, you have to enter the product quality:



In order to choose the actual product quality, you enter the value for the quality

in the field "Choose the actual quality" and press the "OK" button to confirm your choice. As long as you have not pressed "OK" you can alter your choice.

- The product quality you choose must be an integer between 1 and 10:

$$1 \leq product\ quality \leq 10$$

How are the Incomes calculated?

Your income:

- If you have not concluded a trade during a trading phase you receive an income of 5 points in that period.
- If you have accepted an offer your income depends on the price you accepted and the product quality you choose to deliver. Your income is calculated as follows:

$$Your\ income = Price - production\ costs$$

- Your production costs are higher, the higher the quality of the product you chose to deliver. The production costs for each product quality are displayed in the table below:

Product quality	1	2	3	4	5	6	7	8	9	10
Production Cost	0	1	2	4	6	8	10	12	15	18

- Your income is therefore higher, the lower the product quality. Further, your income is higher, the higher the price.

The income of your buyer:

- If a buyer does not conclude a trade during a trading phase he receives an income of 0 points in that period.

- If one of his offers is accepted, his income depends on the price he offered and the product quality. The income of your buyer will be determined as follows:

$$Income\ of\ your\ buyer = 7 * product\ quality\ -\ price$$

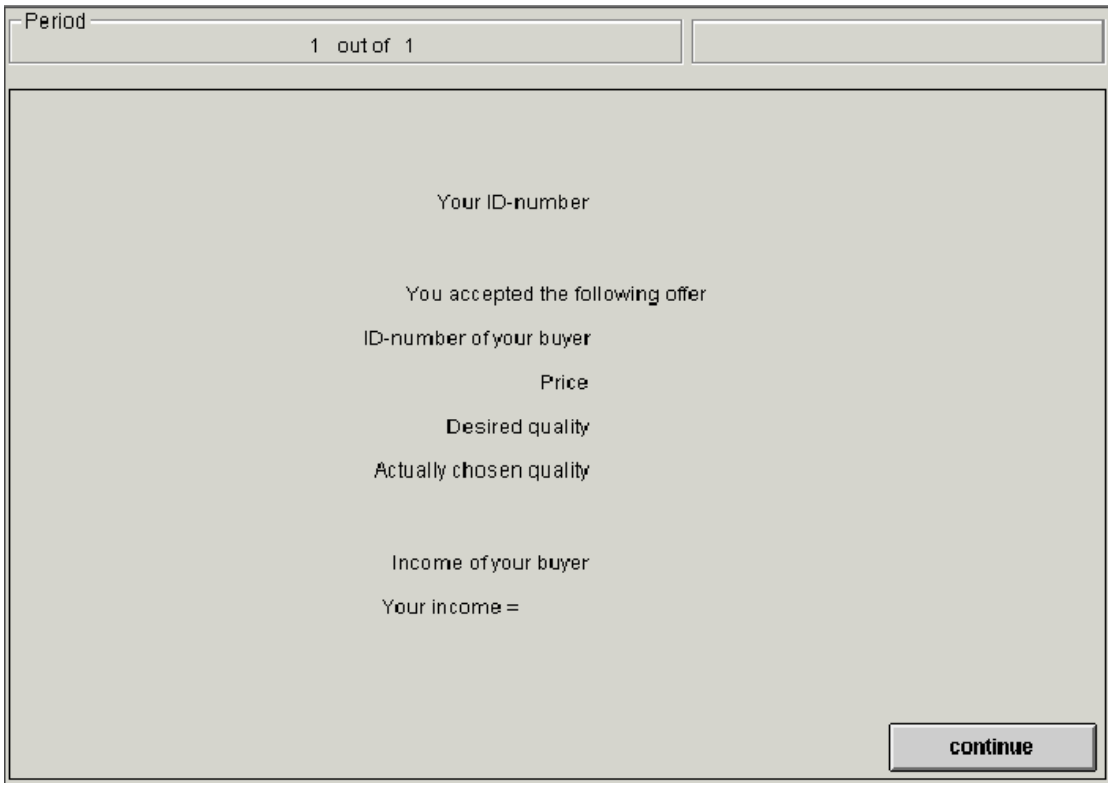
- As you can see from the above formula the income of your buyer is higher, the higher the product quality actually supplied by you. At the same time his income is higher, the lower the price he paid for the product.

The income of all buyers and sellers are determined in the way as described above. Each buyer can therefore calculate the income of his seller and each seller can calculate the income of his buyer. Further, each buyer and each seller is informed about the identification number of his trading partner in each period.

Please note that buyers and sellers can incur losses in each period. These losses have to be paid from the initial endowment or from earnings made in other periods.

You will be informed about your income and the income of your buyer on an "income screen". On the screen (see below) the following will be displayed:

- Which buyer you traded with
- Which price he offered
- The desired quality of your buyer
- The product quality actually chosen by you
- The income of your buyer in this period
- Your income in this period.



Please enter all the information in the documentation sheet supplied to you. After the income screen has been displayed, the period is over. Thereafter the trading phase of the following period starts. Once you have finished studying the income screen pleas click on the "continue" button.

The buyers also see an income screen, which displays the above information. They see the ID of their trading partner, the price, the desired and the supplied product quality as well as both incomes.

The experiment will not start until all participants are completely familiar with all procedures. In order to secure that this is the case we kindly ask you to solve the exercises below.

In addition we will conduct 2 trials of the trading phase, so that you can get

accustomed to the computer. During the trial phases no money can be earned. After the trial phases we will begin the experiment, which will last for 15 periods.

Control Questionnaire

Please solve the following exercises completely. If you have questions ask the experimenter.

Exercise 1

You did not accept an offer during a trading phase. What is your income in this period?

Your income =

Exercise 2

You accepted an offer with a price of 30 and a desired quality of 9. You supplied an actual quality of 8.

Your income =

Income of your buyer =

Exercise 3

You accepted an offer with a price of 60 and a desired quality of 9. You supplied an actual quality of 4.

Your income =

Income of your buyer =

Exercise 4

You accepted an offer with a price of 40 and a desired quality of 2. You supplied an actual quality of 5.

Your income =

Income of your buyer =

Exercise 5

You accepted an offer with a price of 30 and a desired quality of 6. You supplied an actual quality of 6.

Your income =

Income of your buyer =

Exercise 6

A buyer has made several offers during a trading phase. None of these offers has been accepted by a seller. What is the income of the buyer in this period?

Income of buyer =

If you have finished the exercises we recommend looking again at the exercises and the solutions provided. After this, please think about the decisions you want to make during the experiment.

Documentation sheet: Seller

This documentation sheet is meant for your orientation. Please complete the respective row in each period.

Period	ID of Your Buyer	Price	Desired Quality	Actual Quality	Income of Your Buyer	Your Income
1						
2						
3						
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5						
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3.5.2 Instructions - Condition SF

Instructions for Buyers

You are now taking part in an economic experiment. Please read the following instructions carefully. Everything that you need to know in order to participate in this experiment is explained below. Should you have any difficulties in understanding these instructions please notify us. We will answer your questions at your cubicle.

At the beginning of the experiment you will receive an initial endowment of 5 US Dollars. During the course of the experiment you can earn a further amount of money by gaining points. The amount of points that you gain during the experiment depends on your decisions and the decisions of other participants.

All points that you gain during the course of the experiment will be exchanged into US Dollars at the end of the experiment. The exchange rate will be:

$$1\ point = 0.1\ US\ Dollars$$

At the end of the experiment you will receive the money that you earned during the experiment in addition to your endowment of 5 US Dollars.

The experiment is divided into periods. In each period you have to make decisions, which you will enter on a computer screen. There are 15 periods in all.

Please note that communication between participants is strictly prohibited during the experiment. In addition we would like to point out that you may only use the computer functions which are required for the experiment. Communication between

participants and unnecessary interference with computers will lead to the exclusion from the experiment. In case you have any questions don't hesitate to ask us.

Prior to the experiment the 17 participants were divided into 2 groups: buyers and sellers. In this experiment there are 10 sellers and 7 buyers.

You are a buyer throughout the whole experiment. All participants have received an identification number which they will keep for the entire experiment. Your identification number is stated on the documentation sheet in front of you.

An Overview of the Experimental Procedures

In each period of the experiment every buyer can buy a product from a seller. The seller earns a profit by trading if he sells the product at a price, which exceeds his production costs. The buyer earns a profit by trading if the price he pays for the product is less than what the product is worth to him. The production costs and the product's value for the buyer depend on the quality of the product.

The experiment lasts for 15 periods. In each period the procedures are as follows:

1. Each period starts with a trading phase which lasts for 3 minutes. During this phase buyers can submit offers, which can be accepted by sellers. When submitting an offer a buyer has to specify three things:

- which price he offers to pay,
- which product quality he desires,
- and finally, which seller he wants to submit the offer to. Buyers can submit two types of offers; private offers and public offers. Private offers are submitted to one seller only and can only be accepted by that seller. Public offers are submitted to all sellers and can be accepted by any seller.

As a buyer you can - in each period - submit as many offers as you like. Submitted offers can be accepted at any time during the trading phase. Each buyer and each

seller can at most conclude one trade in each period. As there are 10 sellers and 7 buyers, several sellers will not trade in each period.

2. Following the trading phase each seller who has concluded a trade determines which product quality he will supply. The seller is not obliged to supply the product quality desired by his buyer. Once every seller has chosen a product quality each participant's earnings in the current period are determined. After this the next period starts.

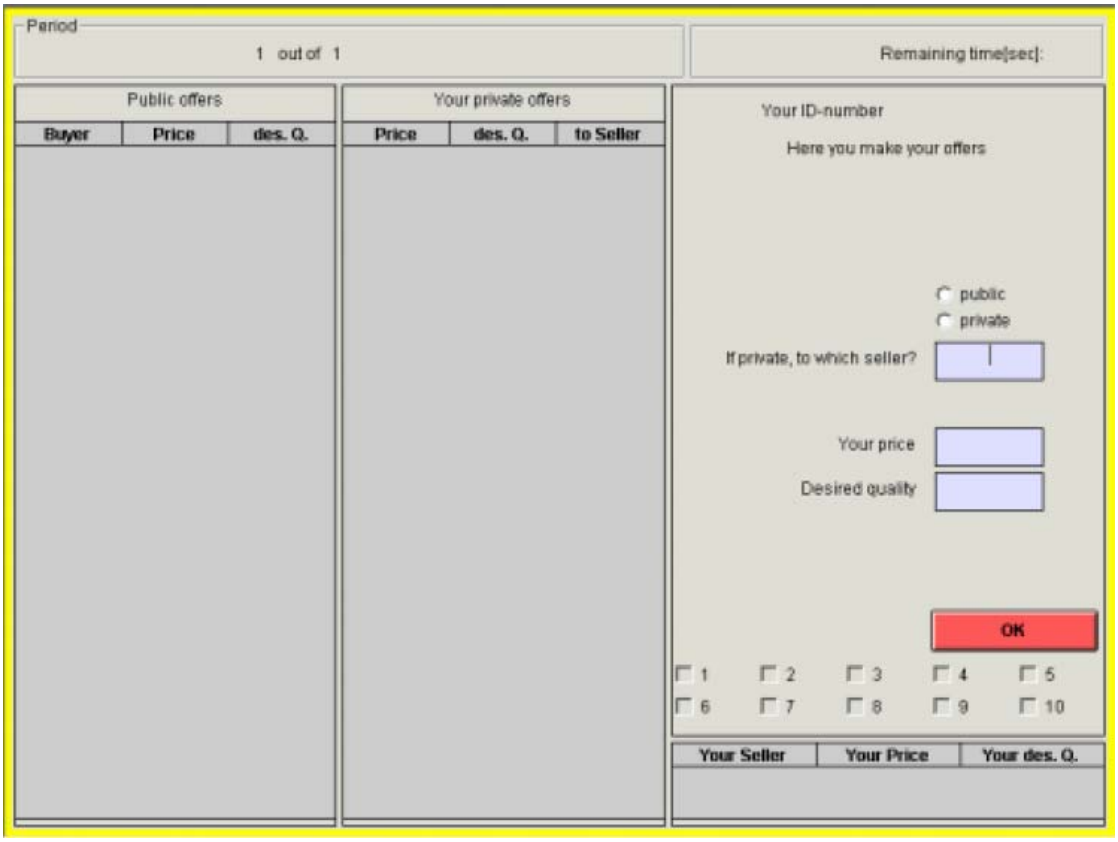
The points gained from all 15 periods will be summed up at the end of the experiment, exchanged into US Dollars and paid together with your endowment in cash.

The Experimental Procedures in Detail

There are 7 buyers and 10 sellers in the experiment. You are a buyer throughout the whole experiment. During the experiment you will enter your decisions on a computer screen. In the following we describe in detail how you can make your decisions in each period.

1. The Trading Phase

Each period starts with a trading phase. During the trading phase each buyer can conclude a trade with a seller. In order to do so each buyer can submit as many offers as he wishes. In each trading phase you will see the following screen:



- In the top left corner of the screen you see in which period of the experiment you are. In the top right corner of the screen you will see the time remaining in this trading phase, displayed in seconds. The trading phase in each period lasts 3 minutes (=180 seconds). When this time is up the trading phase is over. Hereafter, no further offers can be submitted or accepted in this period.
- Once the above screen is displayed the trading phase starts. As a buyer you now have the opportunity to submit offers to the sellers. In order to do so you have to enter three things on the right hand side of the screen:

a) First you have to specify whether you want to submit a public or a private offer:

- Public trade offers

Public offers will be communicated to all participants in the market. All sellers see all public offers on their screens. A public offer can therefore be accepted by any seller. As a buyer you will also see all public offers submitted by all buyers.

If you want to submit a public offer, click on the field "public", using the mouse.

- Private trade offers

A private offer is submitted to one seller only. Only this seller is informed about the offer and only this seller can accept the offer. No other seller or buyer will be informed about that offer.

If you want to submit a private offer, click on the field “private” using the mouse. After that you specify which seller you want to submit the offer to in the field below. Each of the 10 sellers has an identification number (seller 1, seller 2, ..., seller 10). Each seller keeps his identification number throughout the whole experiment. To submit an offer to a specific seller you enter the number of that seller (e.g., "4" for seller 4).

b) Once you have specified to whom you want to submit an offer, you must determine which price you offer. You enter this in the field "Your price". The price you offer is a number between 0 and 100:

$$0 \leq price\ offered \leq 100$$

c) Finally you have to specify which product quality you desire. You enter this in the field "Desired quality". Your desired quality is a number between 1 and 10:

$$1 \leq desired\ quality \leq 10$$

After you have completely specified your offer, you must click on the "OK" button to submit it. As long as you have not clicked "OK" you can change your offer. After

you click "OK" the offer will be displayed to all sellers you have submitted it to.

- On the left side of your screen you see the header "public offers". All public offers in the current trading phase are displayed here. Your public offers as well as those of all other buyers will be displayed. You can see which buyer submitted the offer, which price he offered and which quality he desired. All buyers also have an identification number, which they keep throughout the whole experiment.
- In the middle of your screen under the header "Your private offers". You see all private offers, which you have submitted in the current trading phase. You see which price you offered, which quality you desired and which seller you submitted an offer to.
- Each buyer can submit as many private and public offers as he wishes in each period. Each offer that you submit can be accepted at any time during the trading phase.
- In any given period each buyer can conclude at most one trade. Once one of your offers has been accepted you will be notified which seller accepted which of your offers. In the bottom right corner of your screen the identification number of the seller will be displayed as well as your offered price and your desired quality. As you can conclude only one trade in each period all your other offers will be automatically cancelled. Also, you will not be able to submit any further offers.

- In any given period each seller can conclude at most one trade. You will be continuously informed which sellers have not yet accepted an offer. On the right bottom of the screen you see 10 fields, each field for one of the ten sellers. Once a seller has accepted an offer a “x” will appear in the field next to the seller’s identification number. You cannot submit private offers to a seller who has already concluded a trade.

- Once all 7 buyers have concluded a trade or after 3 minutes have elapsed,

the trading phase is over.

- No buyer is obliged to submit offers, and no seller is obliged to accept an offer.

2. Determination of the Product Quality

- Following the trading phase, all sellers who have concluded a trade determine which product quality they supply to their respective buyers. The product quality, which you desired in your offer, is not binding for your seller. Your seller can choose the exact quality you desired, but he can also choose a higher or a lower product quality. The product quality which your seller chooses has to be between 1 and 10:

$$1 \leq product\ quality \leq 10$$

- While your seller determines the actual product quality, we ask you to specify which quality you expect him to supply on a separate screen. In addition we ask you to state how sure you are about this expectation.

How are the Incomes Calculated?

Your income:

- If you do not conclude a trade during a trading phase you receive an income of 0 points in that period.

- If one of your offers is accepted, your income depends on the price you offered and on the product quality. Your income is determined as follows:

$$Your\ income = A * product\ quality\ -\ price$$

In each period, with probability of 0.5 your coefficient A in the above equation is equal to 10, and A is equal to 7 with the same probability. The coefficient A is independent of the periods and A is also independent of the buyers. Your coefficient A is shown to you in the "trading phase screen" at the beginning of the period.

- As you can see from the above formula your income is higher, the higher the product quality actually supplied by your seller. At the same time your income is higher, the lower the price you paid for the product.

Income of your seller:

- If a seller has not concluded a trade during a trading phase he gains an income of 5 points in that period.

- If a seller has accepted an offer his income equals the price he receives minus the production costs he incurs. The income of the seller is determined as follows:

$$Income\ of\ your\ seller = Price - production\ costs$$

- The production costs of a seller are higher, the higher the quality he chooses. The production costs for each product quality are displayed in the table below:

Product quality	1	2	3	4	5	6	7	8	9	10
Production Cost	0	1	2	4	6	8	10	12	15	18

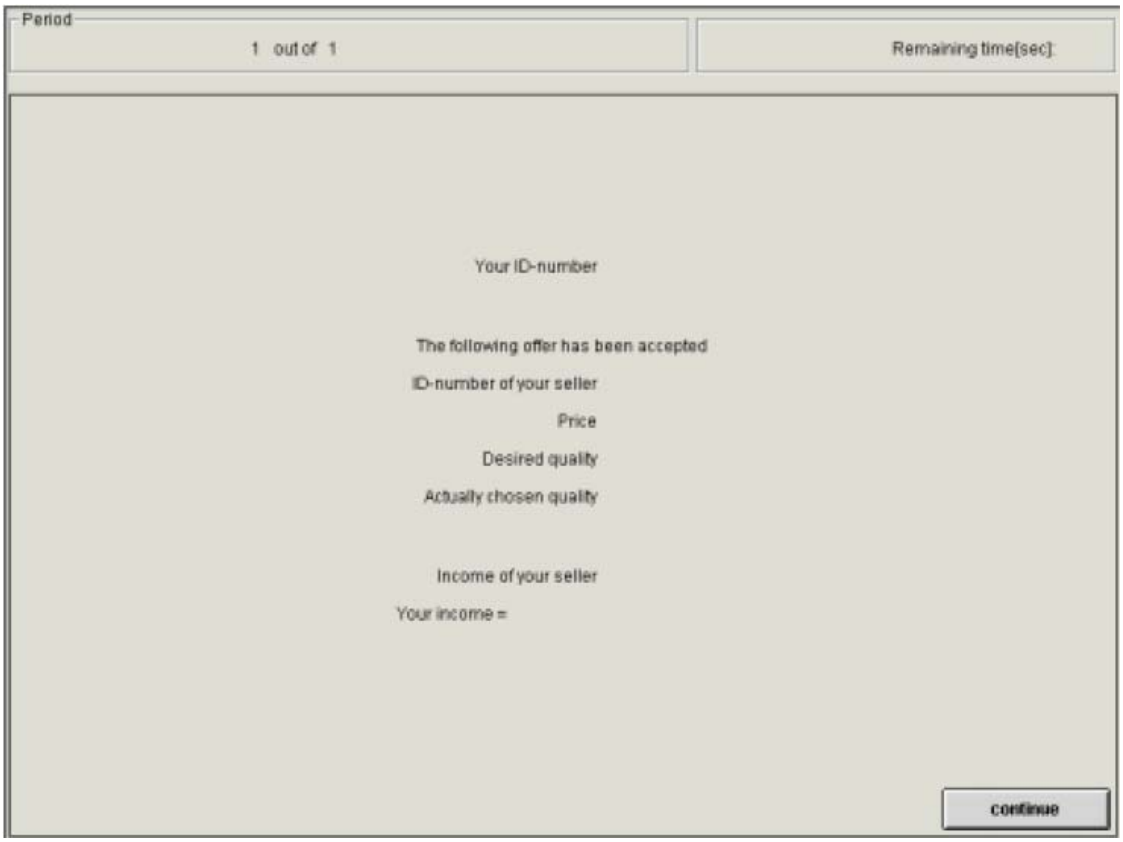
- The income of your seller is higher, the higher the price. Further, his income is higher, the lower the product quality he supplies.

The income of all buyers and sellers are determined in the way as described above. Each buyer can therefore calculate the income of his seller and each seller can calculate the income of his buyer. Further, each buyer and seller is informed about the identification number of his trading partner in each period.

Please note that buyers and sellers can incur losses in each period. These losses have to be paid from your initial endowment or from earnings made in other periods.

You will be informed about your income and the income of your seller on an "income screen". On the screen (see below) the following will be displayed:

- which seller you traded with
- which price you offered
- your desired quality
- the product quality actually chosen by your seller
- the income of your seller in this period
- your income in this period.



Please enter all the information in the documentation sheet supplied to you. After the income screen has been displayed, the period is over. Thereafter the trading phase of the following period starts. Once you have finished studying the income screen please click on the "continue" button.

The sellers also see an income screen, which displays the above information. They see the ID of their trading partner, the price, desired and actually supplied product quality as well as both incomes.

The experiment will not start until all participants are completely familiar with all procedures. In order to secure that this is the case we kindly ask you to solve the exercises below.

In addition we will conduct 2 trials of the trading phase, so that you can get accustomed to the computer. During the trial phases no money can be earned. After the trial phases we will begin the experiment, which will last for 15 periods.

Control Questionnaire

Please solve the following exercises completely. If you have questions ask the experimenter.

Exercise 1

You did not make an offer during a trading phase. What is your income in this period?

Your income =

Exercise 2

Your coefficient A is equal to 10. You offered a price of 30 and indicated a desired quality of 9. A seller accepts your offer and actually chooses a quality of 8.

Your income =

Income of your seller =

Exercise 3

Your coefficient A is equal to 7. You offered a price of 60 and indicated a desired quality of 9. A seller accepts your offer and actually chooses a quality of 6.

Your income =

Income of your seller =

Exercise 4

Your coefficient A is equal to 7. You offered a price of 10 and indicated a desired quality of 2. A seller accepts your offer and actually chooses a quality of 5.

Your income =

Income of your seller =

Exercise 5

Your coefficient A is equal to 10. You offered a price of 10 and indicated a desired quality of 6. A seller accepts your offer and actually chooses a quality of 2.

Your income =

Income of your seller =

Exercise 6

A seller did not accept an offer during a trading phase. What is the income of this seller in this period?

Income of your seller =

Exercise 7

You made several offers during a trading phase. None of your offers has been accepted by a seller. What is your income in this period?

Your income =

If you have finished the exercises we recommend looking again at the exercises and the solutions provided. After this, please think about the decisions you want to make during the experiment.

Documentation sheet: Buyer

This documentation sheet is meant for your orientation. Please complete the respective row in each period.

Period	ID of Your Seller	Price	Desired Quality	Actual Quality	Income of Your Seller	Your Income
1						
2						
3						
4						
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Instructions for Sellers

You are now taking part in an economic experiment. Please read the following instructions carefully. Everything that you need to know in order to participate in this experiment is explained below. Should you have any difficulties in understanding these instructions please notify us. We will answer your questions at your cubicle.

At the beginning of the experiment you will receive an initial endowment of 5 US Dollars. During the course of the experiment you can earn a further amount of money by gaining points. The amount of points that you gain during the experiment depends on your decisions and the decisions of other participants.

All points that you gain during the course of the experiment will be exchanged into US Dollars at the end of the experiment. The exchange rate will be:

$$1\ point = 0.1\ US\ Dollars$$

At the end of the experiment you will receive the money that you earned during the experiment in addition to your endowment of 5 US Dollars.

The experiment is divided into periods. In each period you have to make decisions which you will enter in a computer. In total there are 15 periods.

Please note that communication between participants is strictly prohibited during the experiment. In addition we would like to point out that you may only use the computer functions which are required for the experiment. Communication between participants and unnecessary interference with computers will lead to the exclusion from the experiment. In case you have any questions don't hesitate to ask us.

Prior to the experiment the 17 participants were divided into 2 groups: buyers and sellers. In this experiment there are 10 sellers and 7 buyers.

You are a seller throughout the whole experiment. All participants have received an identification number which they will keep for the entire experiment. Your identification number is stated on the documentation sheet in front of you.

An Overview of the Experimental Procedures

In each period of the experiment every buyer can buy a product from a seller. The seller earns a profit by trading if he sells the product at a price which exceeds his production costs. The buyer earns a profit by trading if the price he pays for the product is less than what the product is worth to him. The production costs and the product's value for the buyer depend on the quality of the product.

The experiment lasts 15 for periods. In each period the procedures are as follows:

1. Each period starts with a trading phase, which lasts for 3 minutes. During this phase buyers can submit trade offers which can be accepted by sellers. When submitting an offer a buyer has to specify three things:

- which price he offers to pay,
- which product quality he desires,
- and finally, which seller he wants to submit the offer to. Buyers can submit two types of offers; private offers and public offers. Private offers are submitted to one seller only and can only be accepted by that seller. Public offers are submitted to all sellers and can be accepted by any seller.

Buyers can - in each period - submit as many offers as they like. Submitted offers can be accepted at any time during the trading phase. Each buyer and each seller can only conclude one trade in each period. As there are 10 sellers and 7 buyers, several sellers will not trade in each period.

2. Following the trading phase each seller who has concluded a trade determines which product quality he will supply. The seller is not obliged to supply the product quality desired by his buyer. Once every seller has chosen a product quality each participant's earnings in the current period are determined. After this the next period starts.

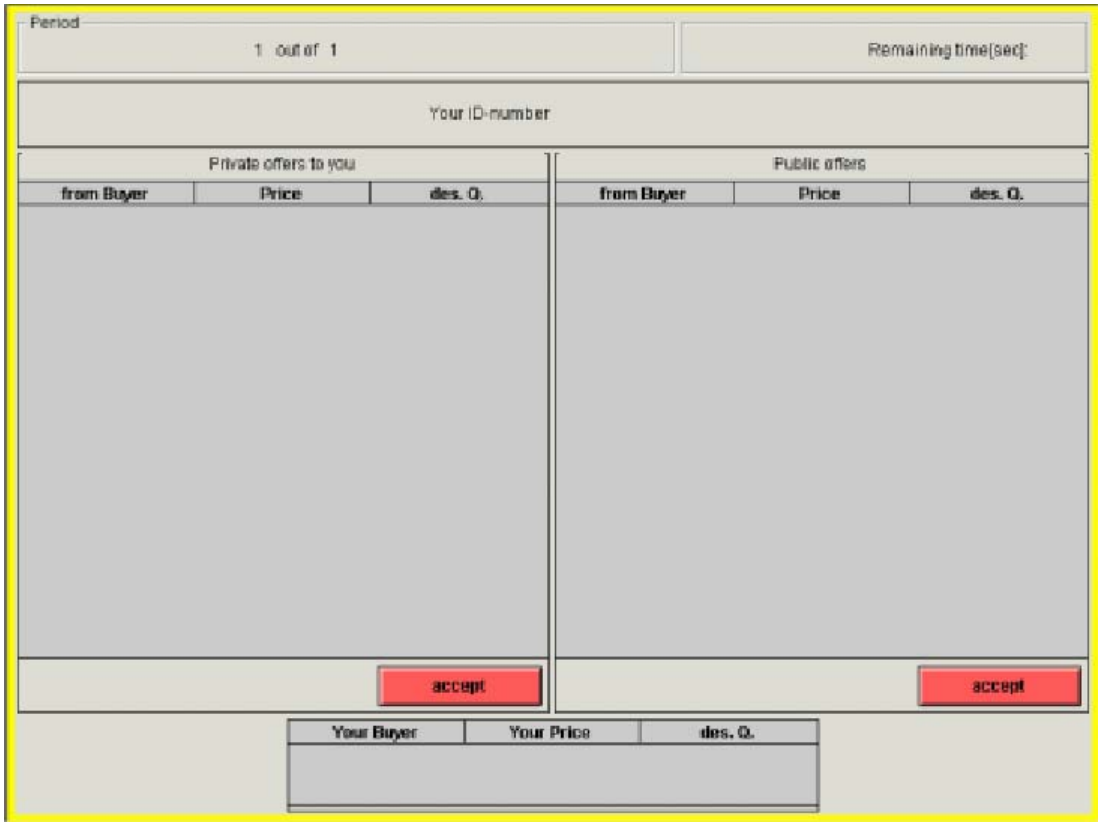
The points gained from all 15 periods will be summed up at the end of the experiment, exchanged into US Dollars and paid together with your endowment in cash.

The Experimental Procedures in Detail

There are 7 buyers and 10 sellers in the experiment. You are a seller throughout the whole experiment. During the experiment you will enter your decisions on a computer screen. In the following we describe in detail how you can make your decisions in each period.

1. The Trading Phase

Each period starts with a trading phase. During the trading phase each buyer can conclude a trade with a seller. In order to do this the buyers can submit offers to the sellers. As a seller you can - in each period - accept one of the offers. During the trading phase you will see the following screen:



- In the top left corner of the screen you see in which period of the experiment you are. In the top right corner of the screen you see the remaining time in the current trading phase, displayed in seconds. The trading phase in each period lasts 3 minutes (=180 seconds). When this time is up the trading phase is over. Hereafter, no further offers can be submitted or accepted for this period.

- Once the above screen is displayed the trading phase starts. As a seller you can now accept offers submitted by the buyers. There are two types of offers which you can accept:

- Private offers to you

Each buyer has the opportunity to submit private offers to you. You alone will be informed about these offers and you alone can accept them. No other seller or buyer is informed about these offers. If you receive private offers, they will appear on the left side of your screen, below the header "Private offers to you". The offer of a buyer contains the following information: the identification number of the buyer who submitted the offer, the price which he offers for the product and which product quality he desires. If you want to accept a private offer, you click first on the respective row in which the offer is displayed. When you do this, the offer will be highlighted. If you are sure you want to accept the offer you then click on the button "accept" which you find at the bottom of the screen. As long as you do not click "accept" you can alter your choice.

- Public offers

Each buyer also has the possibility to submit public offers. All sellers are informed about these offers and any seller can accept them. If a buyer submits a public offer it appears on the right side of your screen, below the header "Public offers". The offer of a buyer again contains the identification number of the buyer who submitted the offer, the price which he offers for the product and which product quality he desires.

This information is also displayed to all other sellers and all buyers. If you want to accept a public offer you follow the same procedures as with private offers. You click first on the respective row in which the offer is displayed. When you are sure that you want to accept the offer you click on the button "accept" which you find at the bottom right corner of the screen. As long as you do not click "accept" you can alter your choice.

- As soon as you have pressed the “accept” button you will see which offer you have accepted in the bottom row of your screen.

- Each seller can conclude at most one trade in each period. Once you have accepted one offer you cannot accept any further offers.

All buyers have to observe the following rules when submitting trade offers:

- The price offered by the buyer must be between 0 and 100:

$$0 \leq price \leq 100$$

- The desired quality of the buyer must be between 1 and 10:

$$1 \leq desired\ quality \leq 10$$

- Each buyer can - in each period - submit as many private and public offers as he wishes. Each offer submitted by a buyer can be accepted at any time during the trading phase.

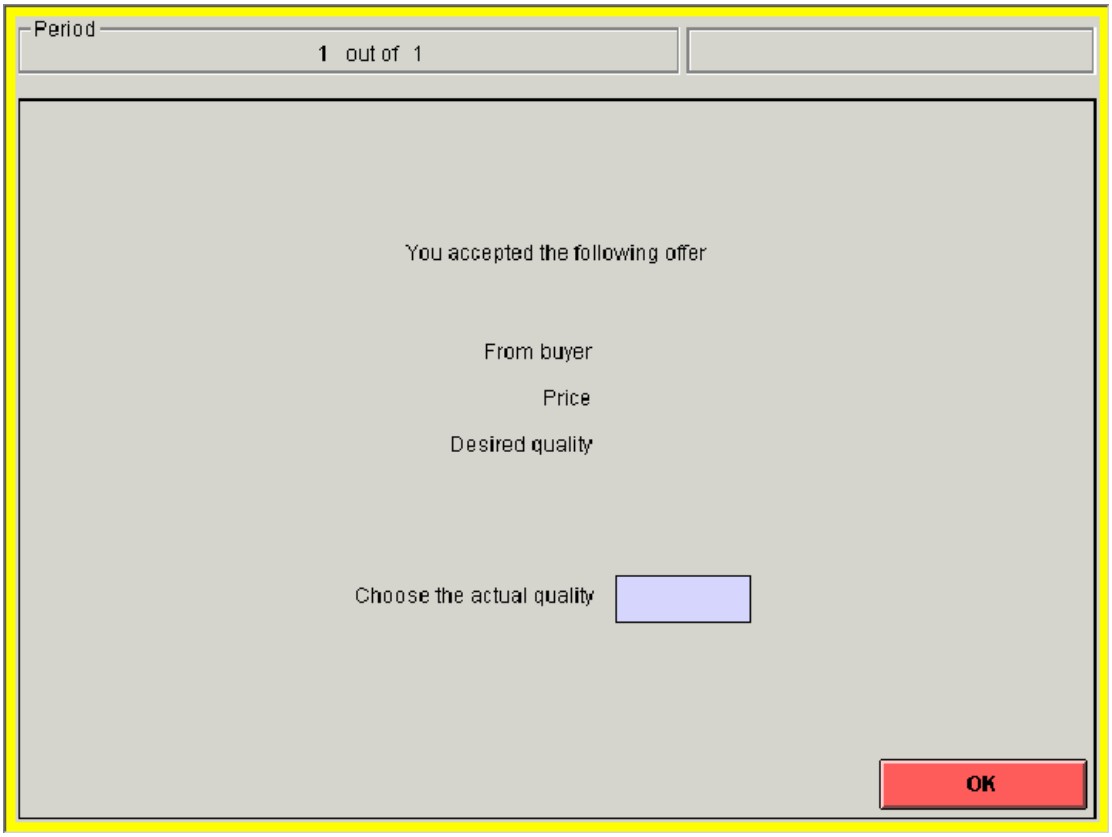
- Each buyer can conclude at most one trade in each period. Once an offer of a buyer has been accepted he will be informed about which seller accepted the offer. As each buyer can conclude only one trade in each period all other offers of the buyer will automatically be cancelled. Also, he cannot submit any further offers.

- Once all 7 buyers have concluded a trade or after 3 minutes have elapsed, the trading phase is over.

- No buyer is obliged to submit offers, and no seller is obliged to accept an offer.

2. Determination of the Actual Product Quality

- Following the trading phase, all sellers who have concluded a trade determine which product quality they supply to their buyers. The product quality desired by your buyer is not binding for you as a seller. You can exactly choose the quality desired by your buyer, but also a higher or lower product quality. If you have concluded a trade during a trading phase, the following screen will appear. Here, you have to enter the product quality:



In order to choose the actual product quality, you enter the value for the quality in the field "Choose the actual quality" and press the "OK" button to confirm your choice. As long as you have not pressed "OK" you can alter your choice.

- The product quality you choose must be an integer between 1 and 10:

$$1 \leq product\ quality \leq 10$$

How are the Incomes calculated?

Your income:

- If you have not concluded a trade during a trading phase you receive an income of 5 points in that period.
- If you have accepted an offer your income depends on the price you accepted and the product quality you choose to deliver. Your income is calculated as follows:

$$Your\ income = Price - production\ costs$$

- Your production costs are higher, the higher the quality of the product you chose to deliver. The production costs for each product quality are displayed in the table below:

Product quality	1	2	3	4	5	6	7	8	9	10
Production Cost	0	1	2	4	6	8	10	12	15	18

- Your income is therefore higher, the lower the product quality. Further, your income is higher, the higher the price.

The income of your buyer:

- If a buyer does not conclude a trade during a trading phase he receives an income of 0 points in that period.
- If one of his offers is accepted, his income depends on the price he offered and the product quality. The income of your buyer will be determined as follows:

$$Income\ of\ your\ buyer = A * product\ quality\ -\ price$$

In each period, with probability of 0.5 your buyer's coefficient A in the above equation is equal to 10, and A is equal to 7 with the same probability. Your buyer's coefficient A is independent of the periods and A is also independent of the other buyers. Your buyer's coefficient A is shown to you in the "income screen" at the end of the period.

- As you can see from the above formula the income of your buyer is higher, the higher the product quality actually supplied by you. At the same time his income is higher, the lower the price he paid for the product.

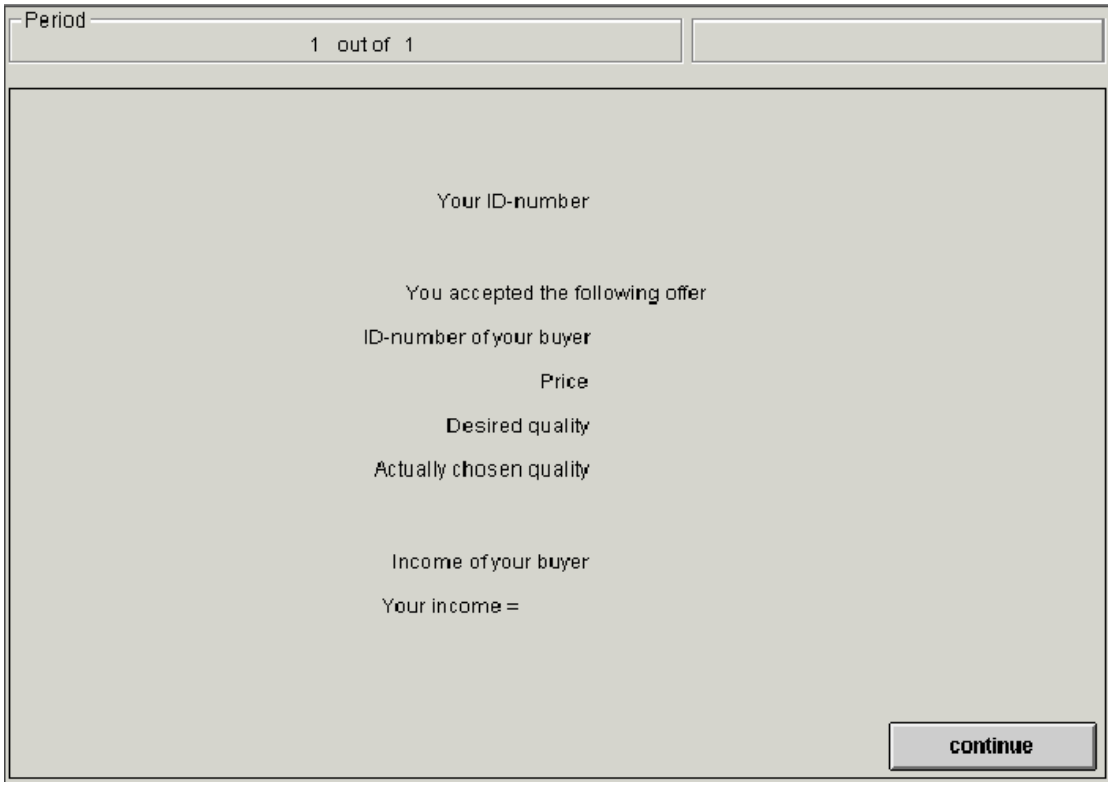
The income of all buyers and sellers are determined in the way as described above. Each buyer can therefore calculate the income of his seller and each seller can calculate the income of his buyer. Further, each buyer and each seller is informed about the identification number of his trading partner in each period.

Please note that buyers and sellers can incur losses in each period. These losses have to be paid from the initial endowment or from earnings made in other periods.

You will be informed about your income and the income of your buyer on an "income screen". On the screen (see below) the following will be displayed:

- Which buyer you traded with
- Your buyer's coefficient A

- Which price he offered
- The desired quality of your buyer
- The product quality actually chosen by you
- The income of your buyer in this period
- Your income in this period.



Please enter all the information in the documentation sheet supplied to you. After the income screen has been displayed, the period is over. Thereafter the trading phase of the following period starts. Once you have finished studying the income screen pleas click on the "continue" button.

The buyers also see an income screen, which displays the above information. They see the ID of their trading partner, the price, the desired and the supplied product

quality as well as both incomes.

The experiment will not start until all participants are completely familiar with all procedures. In order to secure that this is the case we kindly ask you to solve the exercises below.

In addition we will conduct 2 trials of the trading phase, so that you can get accustomed to the computer. During the trial phases no money can be earned. After the trial phases we will begin the experiment, which will last for 15 periods.

Control Questionnaire

Please solve the following exercises completely. If you have questions ask the experimenter.

Exercise 1

You did not accept an offer during a trading phase. What is your income in this period?

Your income =

Exercise 2

You accepted an offer with a price of 30 and a desired quality of 9. You supplied an actual quality of 8.

Your income =

Income of your buyer =

Exercise 3

You accepted an offer with a price of 60 and a desired quality of 9. You supplied an actual quality of 4.

Your income =

Income of your buyer =

Exercise 4

You accepted an offer with a price of 40 and a desired quality of 2. You supplied an actual quality of 5.

Your income =

Income of your buyer =

Exercise 5

You accepted an offer with a price of 30 and a desired quality of 6. You supplied an actual quality of 6.

Your income =

Income of your buyer =

Exercise 6

A buyer has made several offers during a trading phase. None of these offers has been accepted by a seller. What is the income of the buyer in this period?

Income of buyer =

If you have finished the exercises we recommend looking again at the exercises and the solutions provided. After this, please think about the decisions you want to make during the experiment.

Documentation sheet: Seller

This documentation sheet is meant for your orientation. Please complete the respective row in each period.

Period	ID of Your Buyer	Price	Desired Quality	Actual Quality	Income of Your Buyer	Your Income
1						
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3.5.3 Instructions - Condition SR

Instructions for Buyers

You are now taking part in an economic experiment. Please read the following instructions carefully. Everything that you need to know in order to participate in this experiment is explained below. Should you have any difficulties in understanding these instructions please notify us. We will answer your questions at your cubicle.

At the beginning of the experiment you will receive an initial endowment of 5 US Dollars. During the course of the experiment you can earn a further amount of money by gaining points. The amount of points that you gain during the experiment depends on your decisions and the decisions of other participants.

All points that you gain during the course of the experiment will be exchanged into US Dollars at the end of the experiment. The exchange rate will be:

$$1\ point = 0.1\ US\ Dollars$$

At the end of the experiment you will receive the money that you earned during the experiment in addition to your endowment of 5 US Dollars.

The experiment is divided into periods. In each period you have to make decisions, which you will enter on a computer screen. There are 15 periods in all.

Please note that communication between participants is strictly prohibited during the experiment. In addition we would like to point out that you may only use the computer functions which are required for the experiment. Communication between participants and unnecessary interference with computers will lead to the exclusion from the experiment. In case you have any questions don't hesitate to ask us.

Prior to the experiment the 17 participants were divided into 2 groups: buyers and sellers. In this experiment there are 10 sellers and 7 buyers.

You are a buyer throughout the whole experiment. All participants receive an identification number which changes throughout the experiment. A new identification number will be randomly assigned for each period. Your identification number for a particular period will be stated on your computer screen.

An Overview of the Experimental Procedures

In each period of the experiment every buyer can buy a product from a seller. The seller earns a profit by trading if he sells the product at a price, which exceeds his production costs. The buyer earns a profit by trading if the price he pays for the product is less than what the product is worth to him. The production costs and the product's value for the buyer depend on the quality of the product.

The experiment lasts for 15 periods. In each period the procedures are as follows:

1. Each period starts with a trading phase which lasts for 3 minutes. During this phase buyers can submit offers, which can be accepted by sellers. When submitting an offer a buyer has to specify three things:

- which price he offers to pay,
- which product quality he desires,
- and finally, which seller he wants to submit the offer to. Buyers can submit two types of offers; private offers and public offers. Private offers are submitted to one seller only and can only be accepted by that seller. Public offers are submitted to all sellers and can be accepted by any seller.

As a buyer you can - in each period - submit as many offers as you like. Submitted offers can be accepted at any time during the trading phase. Each buyer and each seller can at most conclude one trade in each period. As there are 10 sellers and 7 buyers, several sellers will not trade in each period.

2. Following the trading phase each seller who has concluded a trade determines which product quality he will supply. The seller is not obliged to supply the product quality desired by his buyer. Once every seller has chosen a product quality each participant's earnings in the current period are determined. After this the next period starts.

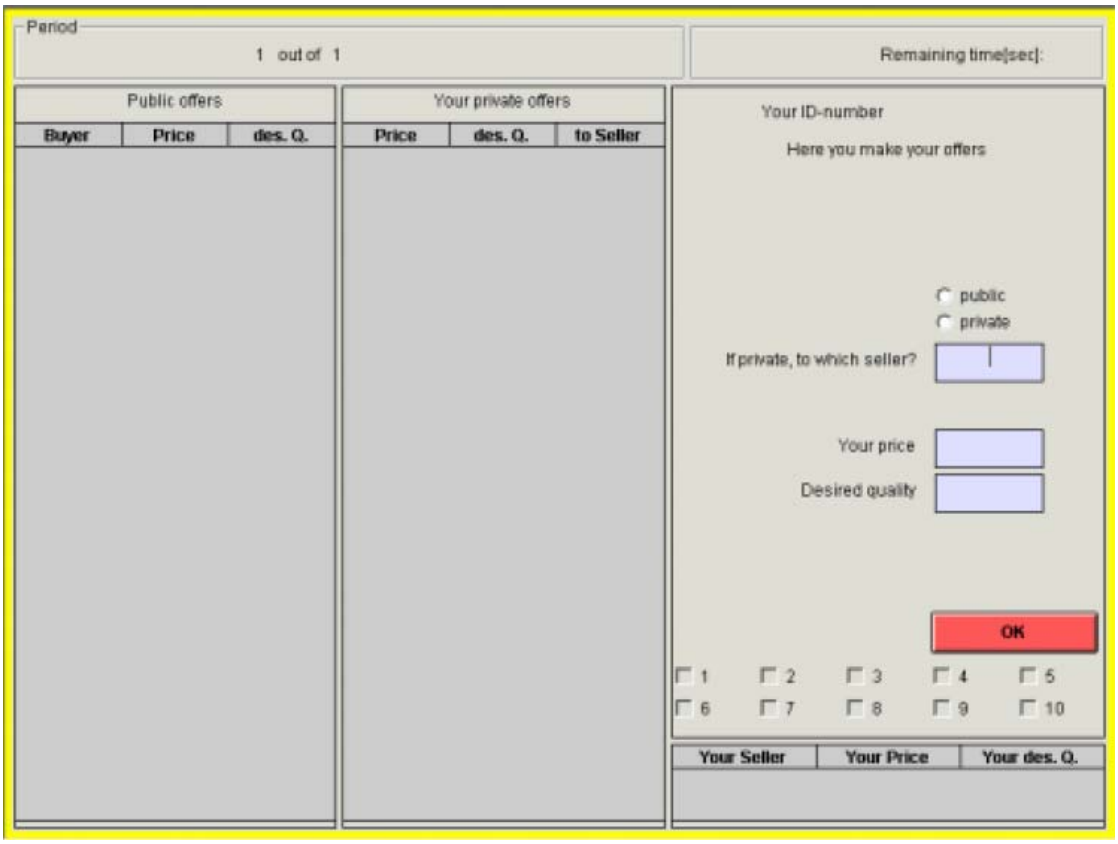
The points gained from all 15 periods will be summed up at the end of the experiment, exchanged into US Dollars and paid together with your endowment in cash.

The Experimental Procedures in Detail

There are 7 buyers and 10 sellers in the experiment. You are a buyer throughout the whole experiment. During the experiment you will enter your decisions on a computer screen. In the following we describe in detail how you can make your decisions in each period.

1. The Trading Phase

Each period starts with a trading phase. During the trading phase each buyer can conclude a trade with a seller. In order to do so each buyer can submit as many offers as he wishes. In each trading phase you will see the following screen:



- In the top left corner of the screen you see in which period of the experiment you are. In the top right corner of the screen you will see the time remaining in this trading phase, displayed in seconds. The trading phase in each period lasts 3 minutes (=180 seconds). When this time is up the trading phase is over. Hereafter, no further offers can be submitted or accepted in this period.
- On the right hand side of the screen you can see your ID number and your

“coefficient A.” The detailed description of the coefficient A and how A is related to your income will be discussed in the section “how are the incomes calculated.”

- Once the above screen is displayed the trading phase starts. As a buyer you now have the opportunity to submit offers to the sellers. In order to do so you have to enter three things on the right hand side of the screen:

a) First you have to specify whether you want to submit a public or a private offer:

- Public trade offers

Public offers will be communicated to all participants in the market. All sellers see all public offers on their screens. A public offer can therefore be accepted by any seller. As a buyer you will also see all public offers submitted by all buyers.

If you want to submit a public offer, click on the field "public", using the mouse.

- Private trade offers

A private offer is submitted to one seller only. Only this seller is informed about the offer and only this seller can accept the offer. No other seller or buyer will be informed about that offer.

If you want to submit a private offer, click on the field “private” using the mouse. After that you specify which seller you want to submit the offer to in the field below. Each of the 10 sellers has an identification number (seller 1, seller 2, ..., seller 10). The identification number of the sellers randomly changes each period.

To submit an offer to a specific seller you enter the number of that seller (e.g., "4" for seller 4).

b) Once you have specified to whom you want to submit an offer, you must determine which price you offer. You enter this in the field "Your price". The price you offer is a number between 0 and 100:

$$0 \leq price\ offered \leq 100$$

c) Finally you have to specify which product quality you desire. You enter this in the field "Desired quality". Your desired quality is a number between 1 and 10:

$$1 \leq desired\ quality \leq 10$$

After you have completely specified your offer, you must click on the "OK" button to submit it. As long as you have not clicked "OK" you can change your offer. After you click "OK" the offer will be displayed to all sellers you have submitted it to.

- On the left side of your screen you see the header "public offers". All public offers in the current trading phase are displayed here. Your public offers as well as those of all other buyers will be displayed. You can see which buyer submitted the offer, which price he offered and which quality he desired. All buyers also have an identification number, which they keep throughout the whole experiment.
- In the middle of your screen under the header "Your private offers". You see all private offers, which you have submitted in the current trading phase. You see which price you offered, which quality you desired and which seller you submitted an offer to.
- Each buyer can submit as many private and public offers as he wishes in each period. Each offer that you submit can be accepted at any time during the trading phase.
- In any given period each buyer can conclude at most one trade. Once one of your offers has been accepted you will be notified which seller accepted which of your offers. In the bottom right corner of your screen the identification number of the seller will be displayed as well as your offered price and your desired quality. As you

can conclude only one trade in each period all your other offers will be automatically cancelled. Also, you will not be able to submit any further offers.

- In any given period each seller can conclude at most one trade. You will be continuously informed which sellers have not yet accepted an offer. On the right bottom of the screen you see 10 fields, each field for one of the ten sellers. Once a seller has accepted an offer a "x" will appear in the field next to the seller's identification number. You cannot submit private offers to a seller who has already concluded a trade.

- Once all 7 buyers have concluded a trade or after 3 minutes have elapsed, the trading phase is over.

- No buyer is obliged to submit offers, and no seller is obliged to accept an offer.

2. Determination of the Product Quality

- Following the trading phase, all sellers who have concluded a trade determine which product quality they supply to their respective buyers. The product quality, which you desired in your offer, is not binding for your seller. Your seller can choose the exact quality you desired, but he can also choose a higher or a lower product quality. The product quality which your seller chooses has to be between 1 and 10:

$$1 \leq \textit{product quality} \leq 10$$

- While your seller determines the actual product quality, we ask you to specify which quality you expect him to supply on a separate screen. In addition we ask you to state how sure you are about this expectation.

How are the Incomes Calculated?

Your income:

- If you do not conclude a trade during a trading phase you receive an income of 0 points in that period.

- If one of your offers is accepted, your income depends on the price you offered and on the product quality. Your income is determined as follows:

$$Your\ income = A * product\ quality\ -\ price$$

In each period, with probability of 0.5 your coefficient A in the above equation is equal to 10, and A is equal to 7 with the same probability. The coefficient A is independent of the periods and A is also independent of the buyers. Your coefficient A is shown to you in the "trading phase screen" at the beginning of the period.

- As you can see from the above formula your income is higher, the higher the product quality actually supplied by your seller. At the same time your income is higher, the lower the price you paid for the product.

Income of your seller:

- If a seller has not concluded a trade during a trading phase he gains an income of 5 points in that period.

- If a seller has accepted an offer his income equals the price he receives minus the production costs he incurs. The income of the seller is determined as follows:

$$Income\ of\ your\ seller = Price - production\ costs$$

- The production costs of a seller are higher, the higher the quality he chooses. The production costs for each product quality are displayed in the table below:

Product quality	1	2	3	4	5	6	7	8	9	10
Production Cost	0	1	2	4	6	8	10	12	15	18

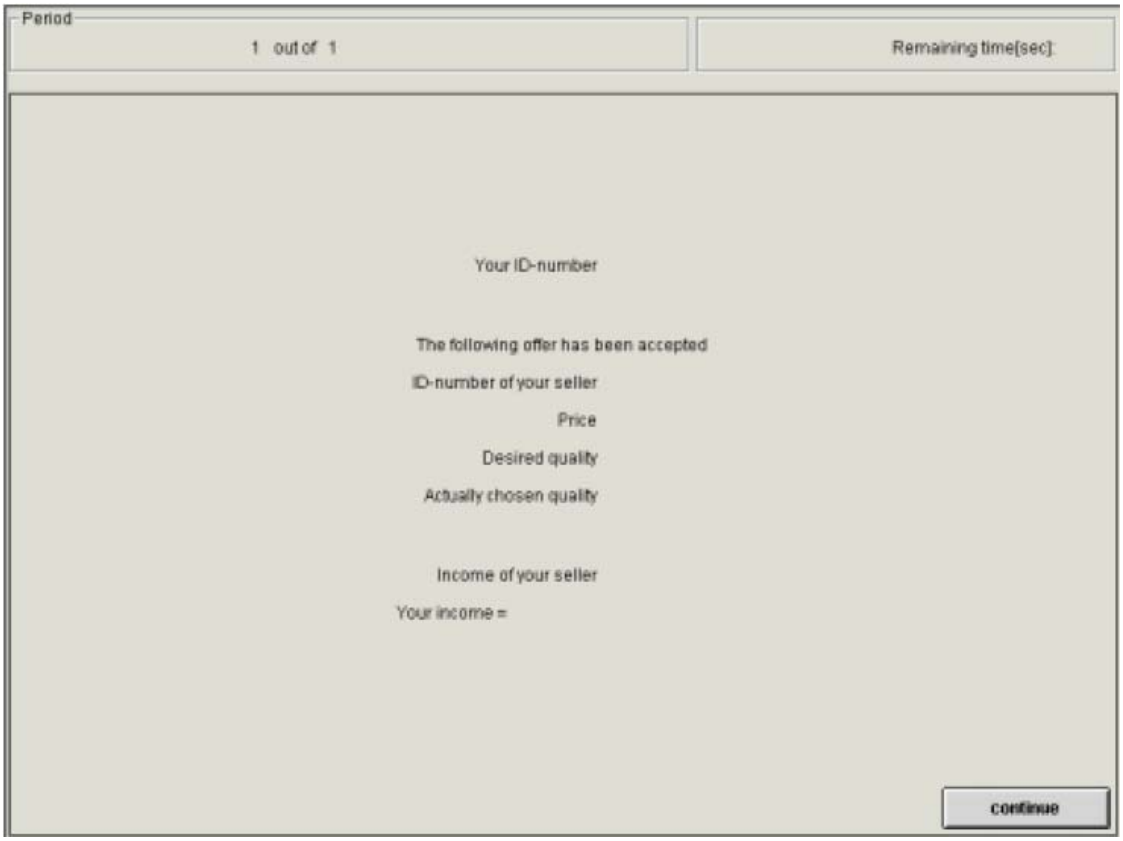
- The income of your seller is higher, the higher the price. Further, his income is higher, the lower the product quality he supplies.

The income of all buyers and sellers are determined in the way as described above. Each buyer can therefore calculate the income of his seller and each seller can calculate the income of his buyer. Each buyer and seller is informed about the identification number of his trading partner only for the current period.

Please note that buyers and sellers can incur losses in each period. These losses have to be paid from your initial endowment or from earnings made in other periods.

You will be informed about your income and the income of your seller on an "income screen". On the screen (see below) the following will be displayed:

- which seller you traded with
- which price you offered
- your desired quality
- the product quality actually chosen by your seller
- the income of your seller in this period
- your income in this period.



Please enter all the information in the documentation sheet supplied to you. After the income screen has been displayed, the period is over. Thereafter the trading phase of the following period starts. Once you have finished studying the income screen please click on the "continue" button.

The sellers also see an income screen, which displays the above information. They see the ID of their trading partner, the price, desired and actually supplied product quality as well as both incomes.

The experiment will not start until all participants are completely familiar with all procedures. In order to secure that this is the case we kindly ask you to solve the exercises below.

In addition we will conduct 2 trials of the trading phase, so that you can get accustomed to the computer. During the trial phases no money can be earned. After the trial phases we will begin the experiment, which will last for 15 periods.

Control Questionnaire

Please solve the following exercises completely. If you have questions ask the experimenter.

Exercise 1

You did not make an offer during a trading phase. What is your income in this period?

Your income =

Exercise 2

Your coefficient A is equal to 10. You offered a price of 30 and indicated a desired quality of 9. A seller accepts your offer and actually chooses a quality of 8.

Your income =

Income of your seller =

Exercise 3

Your coefficient A is equal to 7. You offered a price of 60 and indicated a desired quality of 9. A seller accepts your offer and actually chooses a quality of 6.

Your income =

Income of your seller =

Exercise 4

Your coefficient A is equal to 7. You offered a price of 10 and indicated a desired quality of 2. A seller accepts your offer and actually chooses a quality of 5.

Your income =

Income of your seller =

Exercise 5

Your coefficient A is equal to 10. You offered a price of 10 and indicated a desired quality of 6. A seller accepts your offer and actually chooses a quality of 2.

Your income =

Income of your seller =

Exercise 6

A seller did not accept an offer during a trading phase. What is the income of this seller in this period?

Income of your seller =

Exercise 7

You made several offers during a trading phase. None of your offers has been accepted by a seller. What is your income in this period?

Your income =

If you have finished the exercises we recommend looking again at the exercises and the solutions provided. After this, please think about the decisions you want to make during the experiment.

Documentation sheet: Buyer

This documentation sheet is meant for your orientation. Please complete the respective row in each period.

Period	ID of Your Seller	Price	Desired Quality	Actual Quality	Income of Your Seller	Your Income
1						
2						
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Instructions for Sellers

You are now taking part in an economic experiment. Please read the following instructions carefully. Everything that you need to know in order to participate in this experiment is explained below. Should you have any difficulties in understanding these instructions please notify us. We will answer your questions at your cubicle.

At the beginning of the experiment you will receive an initial endowment of 5 US Dollars. During the course of the experiment you can earn a further amount of money by gaining points. The amount of points that you gain during the experiment depends on your decisions and the decisions of other participants.

All points that you gain during the course of the experiment will be exchanged into US Dollars at the end of the experiment. The exchange rate will be:

$$1\ point = 0.1\ US\ Dollars$$

At the end of the experiment you will receive the money that you earned during the experiment in addition to your endowment of 5 US Dollars.

The experiment is divided into periods. In each period you have to make decisions which you will enter in a computer. In total there are 15 periods.

Please note that communication between participants is strictly prohibited during the experiment. In addition we would like to point out that you may only use the computer functions which are required for the experiment. Communication between participants and unnecessary interference with computers will lead to the exclusion from the experiment. In case you have any questions don't hesitate to ask us.

Prior to the experiment the 17 participants were divided into 2 groups: buyers and sellers. In this experiment there are 10 sellers and 7 buyers.

You are a seller throughout the whole experiment. All participants receive an identification number which changes throughout the experiment. A new identification number will be randomly assigned for each period. Your identification number for a particular period will be stated on your computer screen.

An Overview of the Experimental Procedures

In each period of the experiment every buyer can buy a product from a seller. The seller earns a profit by trading if he sells the product at a price which exceeds his production costs. The buyer earns a profit by trading if the price he pays for the product is less than what the product is worth to him. The production costs and the product's value for the buyer depend on the quality of the product.

The experiment lasts 15 for periods. In each period the procedures are as follows:

1. Each period starts with a trading phase, which lasts for 3 minutes. During this phase buyers can submit trade offers which can be accepted by sellers. When submitting an offer a buyer has to specify three things:

- which price he offers to pay,
- which product quality he desires,
- and finally, which seller he wants to submit the offer to. Buyers can submit two types of offers; private offers and public offers. Private offers are submitted to one seller only and can only be accepted by that seller. Public offers are submitted to all sellers and can be accepted by any seller.

Buyers can - in each period - submit as many offers as they like. Submitted offers can be accepted at any time during the trading phase. Each buyer and each seller can only conclude one trade in each period. As there are 10 sellers and 7 buyers, several sellers will not trade in each period.

2. Following the trading phase each seller who has concluded a trade determines which product quality he will supply. The seller is not obliged to supply the product quality desired by his buyer. Once every seller has chosen a product quality each participant's earnings in the current period are determined. After this the next period starts.

The points gained from all 15 periods will be summed up at the end of the experiment, exchanged into US Dollars and paid together with your endowment in cash.

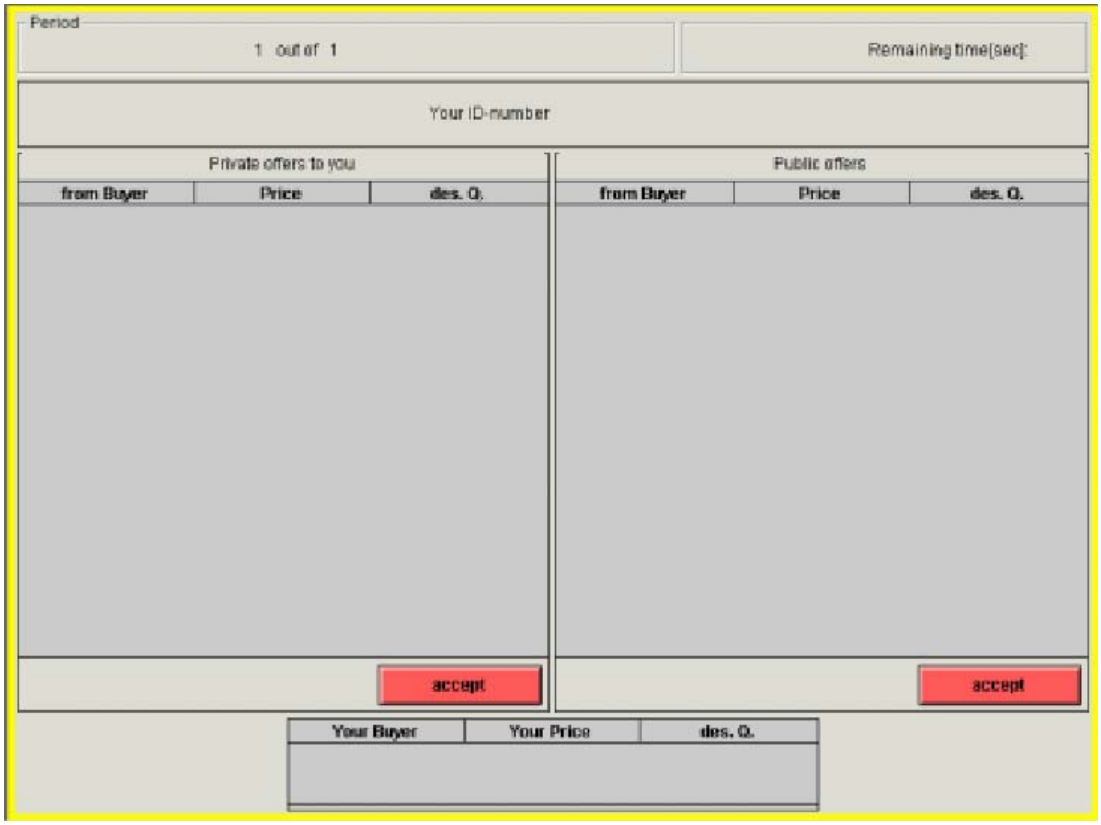
The Experimental Procedures in Detail

There are 7 buyers and 10 sellers in the experiment. You are a seller throughout the whole experiment. During the experiment you will enter your decisions on a computer screen. In the following we describe in detail how you can make your decisions in each period.

1. The Trading Phase

Each period starts with a trading phase. During the trading phase each buyer can conclude a trade with a seller. In order to do this the buyers can submit offers

to the sellers. As a seller you can - in each period - accept one of the offers. During the trading phase you will see the following screen:



- In the top left corner of the screen you see in which period of the experiment you are. In the top right corner of the screen you see the remaining time in the current trading phase, displayed in seconds. The trading phase in each period lasts 3 minutes (=180 seconds). When this time is up the trading phase is over. Hereafter, no further offers can be submitted or accepted for this period.

- Once the above screen is displayed the trading phase starts. As a seller you can now accept offers submitted by the buyers. There are two types of offers which you can accept:

- Private offers to you

Each buyer has the opportunity to submit private offers to you. You alone will be informed about these offers and you alone can accept them. No other seller or buyer is informed about these offers. If you receive private offers, they will appear on the left side of your screen, below the header "Private offers to you". The offer of a buyer contains the following information: the identification number of the buyer who submitted the offer, the price which he offers for the product and which product quality he desires. If you want to accept a private offer, you click first on the respective row in which the offer is displayed. When you do this, the offer will be highlighted. If you are sure you want to accept the offer you then click on the button "accept" which you find at the bottom of the screen. As long as you do not click "accept" you can alter your choice.

- Public offers

Each buyer also has the possibility to submit public offers. All sellers are informed about these offers and any seller can accept them. If a buyer submits a public offer it appears on the right side of your screen, below the header "Public offers". The offer of a buyer again contains the identification number of the buyer who submitted the offer, the price which he offers for the product and which product quality he desires. This information is also displayed to all other sellers and all buyers. If you want to accept a public offer you follow the same procedures as with private offers. You click first on the respective row in which the offer is displayed. When you are sure that you want to accept the offer you click on the button "accept" which you find at the bottom right corner of the screen. As long as you do not click "accept" you can alter your choice.

- As soon as you have pressed the “accept” button you will see which offer you have accepted in the bottom row of your screen.

- Each seller can conclude at most one trade in each period. Once you have

accepted one offer you cannot accept any further offers.

All buyers have to observe the following rules when submitting trade offers:

- The price offered by the buyer must be between 0 and 100:

$$0 \leq price \leq 100$$

- The desired quality of the buyer must be between 1 and 10:

$$1 \leq desired\ quality \leq 10$$

- Each buyer can - in each period - submit as many private and public offers as he wishes. Each offer submitted by a buyer can be accepted at any time during the trading phase.

- Each buyer can conclude at most one trade in each period. Once an offer of a buyer has been accepted he will be informed about which seller accepted the offer. As each buyer can conclude only one trade in each period all other offers of the buyer will automatically be cancelled. Also, he cannot submit any further offers.

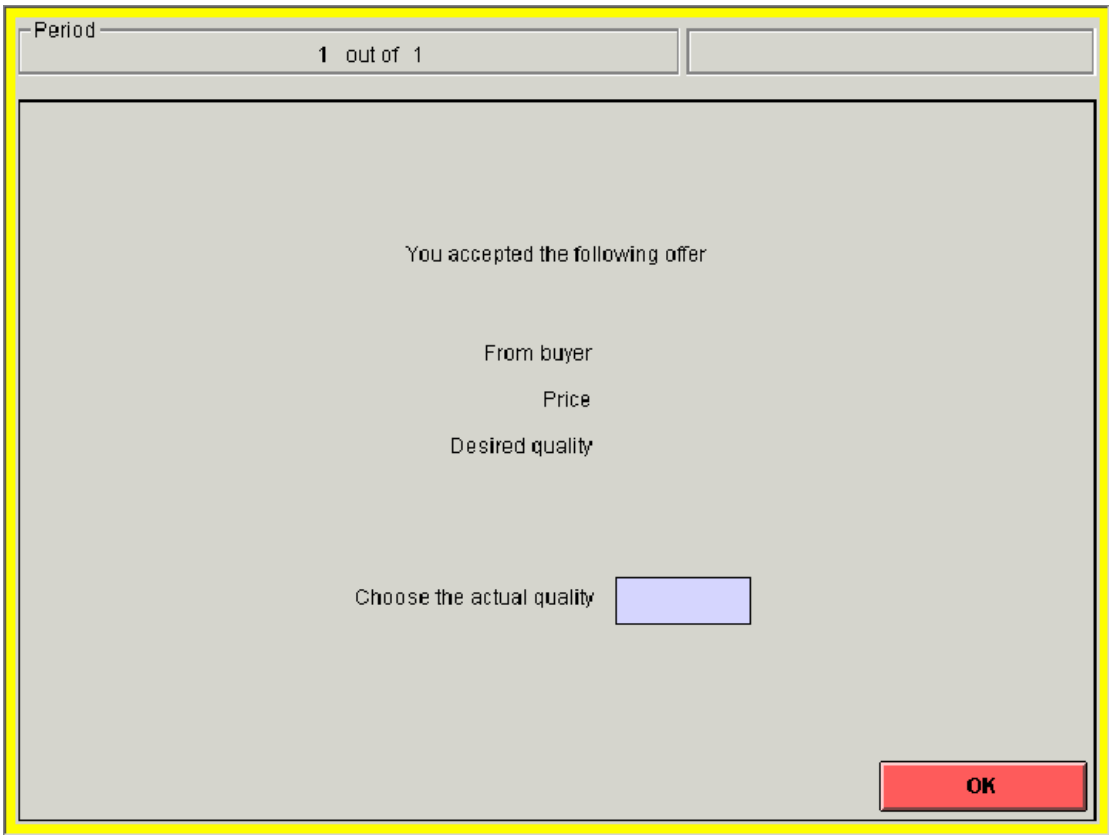
- Once all 7 buyers have concluded a trade or after 3 minutes have elapsed, the trading phase is over.

- No buyer is obliged to submit offers, and no seller is obliged to accept an offer.

2. Determination of the Actual Product Quality

- Following the trading phase, all sellers who have concluded a trade determine which product quality they supply to their buyers. The product quality desired by

your buyer is not binding for you as a seller. You can exactly choose the quality desired by your buyer, but also a higher or lower product quality. If you have concluded a trade during a trading phase, the following screen will appear. Here, you have to enter the product quality:



In order to choose the actual product quality, you enter the value for the quality in the field "Choose the actual quality" and press the "OK" button to confirm your choice. As long as you have not pressed "OK" you can alter your choice.

- The product quality you choose must be an integer between 1 and 10:

$$1 \leq \textit{product quality} \leq 10$$

How are the Incomes calculated?

Your income:

- If you have not concluded a trade during a trading phase you receive an income of 5 points in that period.
- If you have accepted an offer your income depends on the price you accepted and the product quality you choose to deliver. Your income is calculated as follows:

$$Your\ income = Price - production\ costs$$

- Your production costs are higher, the higher the quality of the product you chose to deliver. The production costs for each product quality are displayed in the table below:

Product quality	1	2	3	4	5	6	7	8	9	10
Production Cost	0	1	2	4	6	8	10	12	15	18

- Your income is therefore higher, the lower the product quality. Further, your income is higher, the higher the price.

The income of your buyer:

- If a buyer does not conclude a trade during a trading phase he receives an income of 0 points in that period.
- If one of his offers is accepted, his income depends on the price he offered and the product quality. The income of your buyer will be determined as follows:

$$Income\ of\ your\ buyer = A * product\ quality\ -\ price$$

In each period, with probability of 0.5 your buyer's coefficient A in the above equation is equal to 10, and A is equal to 7 with the same probability. Your buyer's

coefficient A is independent of the periods and A is also independent of the other buyers. Your buyer's coefficient A is shown to you in the "income screen" at the end of the period.

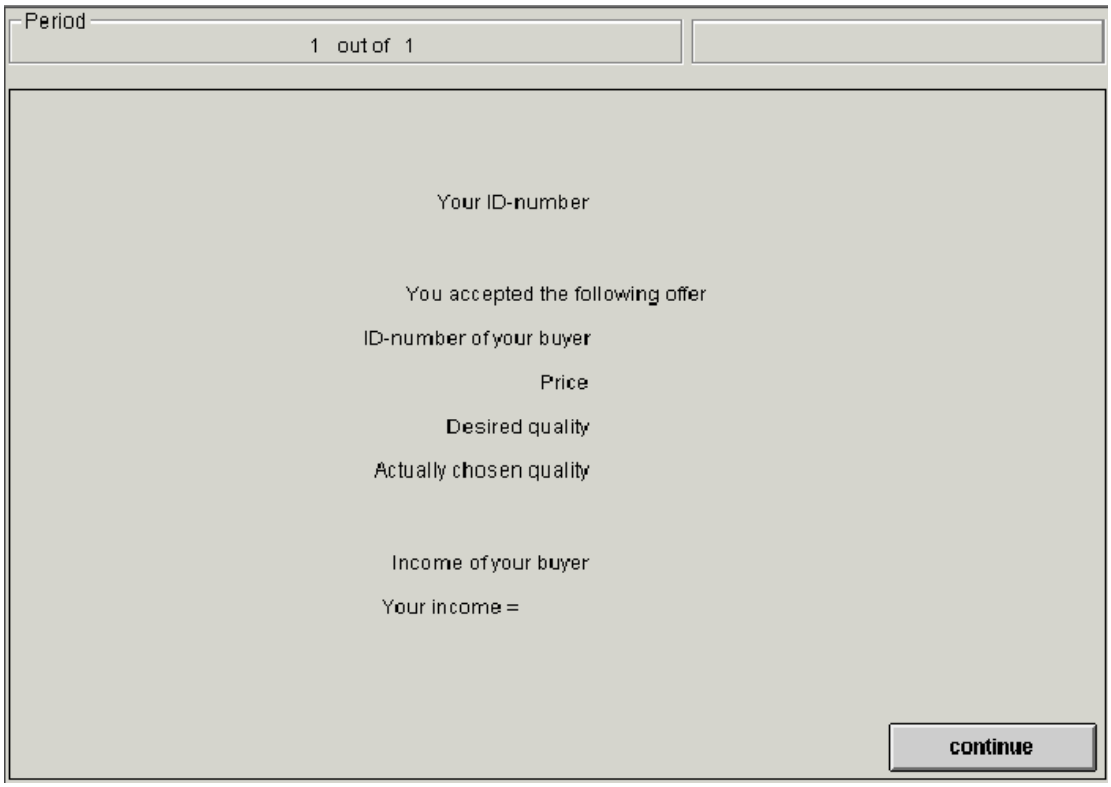
- As you can see from the above formula the income of your buyer is higher, the higher the product quality actually supplied by you. At the same time his income is higher, the lower the price he paid for the product.

The income of all buyers and sellers are determined in the way as described above. Each buyer can therefore calculate the income of his seller and each seller can calculate the income of his buyer. Each buyer and seller is informed about the identification number of his trading partner only for the current period as the identification numbers of all participants randomly change each period.

Please note that buyers and sellers can incur losses in each period. These losses have to be paid from the initial endowment or from earnings made in other periods.

You will be informed about your income and the income of your buyer on an "income screen". On the screen (see below) the following will be displayed:

- Which buyer you traded with
- Your buyer's coefficient A
- Which price he offered
- The desired quality of your buyer
- The product quality actually chosen by you
- The income of your buyer in this period
- Your income in this period.



Please enter all the information in the documentation sheet supplied to you. After the income screen has been displayed, the period is over. Thereafter the trading phase of the following period starts. Once you have finished studying the income screen pleas click on the "continue" button.

The buyers also see an income screen, which displays the above information. They see the ID of their trading partner, the price, the desired and the supplied product quality as well as both incomes.

The experiment will not start until all participants are completely familiar with all procedures. In order to secure that this is the case we kindly ask you to solve the exercises below.

In addition we will conduct 2 trials of the trading phase, so that you can get

accustomed to the computer. During the trial phases no money can be earned. After the trial phases we will begin the experiment, which will last for 15 periods.

Control Questionnaire

Please solve the following exercises completely. If you have questions ask the experimenter.

Exercise 1

You did not accept an offer during a trading phase. What is your income in this period?

Your income =

Exercise 2

You accepted an offer with a price of 30 and a desired quality of 9. You supplied an actual quality of 8.

Your income =

Income of your buyer =

Exercise 3

You accepted an offer with a price of 60 and a desired quality of 9. You supplied an actual quality of 4.

Your income =

Income of your buyer =

Exercise 4

You accepted an offer with a price of 40 and a desired quality of 2. You supplied an actual quality of 5.

Your income =

Income of your buyer =

Exercise 5

You accepted an offer with a price of 30 and a desired quality of 6. You supplied an actual quality of 6.

Your income =

Income of your buyer =

Exercise 6

A buyer has made several offers during a trading phase. None of these offers has been accepted by a seller. What is the income of the buyer in this period?

Income of buyer =

If you have finished the exercises we recommend looking again at the exercises and the solutions provided. After this, please think about the decisions you want to make during the experiment.

Documentation sheet: Seller

This documentation sheet is meant for your orientation. Please complete the respective row in each period.

Period	ID of Your Buyer	Price	Desired Quality	Actual Quality	Income of Your Buyer	Your Income
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

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