Supplementary online material accompanying “The Economics of Credence Goods – An Experiment on the Role of Liability, Verifiability, Reputation and Competition”

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The supplementary material includes more detailed predictions (that work backwards through the game tree of Figure 1) and the proofs thereof, and the experimental instructions for treatment **CR/LV**.

Supplement S1. Detailed predictions and proofs

In the following we provide more detailed predictions than presented in the main paper. Note that the more detailed predictions listed here are condensed in the predictions included in the main paper. After listing the detailed predictions for each stage of the game we proceed with the proofs.

Throughout we assume that both sellers and consumers are rational, risk-neutral and only interested in their own monetary payoff, and that this fact is common information. We also assume that a consumer who is indifferent between trading with a seller and not trading decides for a trade, and that a consumer who is indifferent between two or more sellers randomizes (with equal probability) among them. The equilibrium concept we apply is Perfect Bayesian Equilibrium (PBE). Our main focus is on symmetric equilibria.

On the Role of Liability and Verifiability (Set B)

Note that in set **B** (with random matching and anonymity) the predictions for the finitely repeated game are the same as the predictions for the underlying stage game. For the following analysis we define the following types of price-vectors:

- an *equal mark-up price-vector* is defined as one that satisfies $p^h - p^l = c^h - c^l = 4$.
- an *undertreatment price-vector* satisfies $p^h - p^l < c^h - c^l = 4$.
- an *overtreatment price-vector* is characterized by $p^h - p^l > c^h - c^l = 4$.

Prediction *B1* (Provision and Charging Policy of Seller).

(i) In **B/N** sellers provide the low, but charge for the high quality under each price-vector.

(ii) In **B/L** sellers provide the appropriate quality[1] and charge for the high quality under each price-vector.

(iii) In **B/V** sellers provide the appropriate quality under equal mark-up vectors, but always the low (high) quality under undertreatment (overtreatment) price-vectors.

(iv) In **B/LV** sellers provide the appropriate quality under equal mark-up and undertreatment price-vectors, but only the high quality under overtreatment vectors.

Prediction *B2* (Market Entry of Consumer). Anticipating sellers' behavior according to prediction ***B1***, market entry of consumers depends exclusively on p^h, but not on p^l, when **V** is violated. When **V** holds, market entry depends both on p^h and p^l.

(i) In **B/N** consumers enter the market if and only if (iff) $p^h \leq 3$.

(ii) In **B/L** consumers enter the market iff $p^h \leq 8$.

(iii) In **B/V** consumers enter the market iff an equal mark-up vector satisfies $p^h \leq 10$ or iff an undertreatment vector has $p^l \leq 3$, or iff an overtreatment vector satisfies $p^h \leq 8$.

(iv) In **B/LV** consumers enter the market iff an equal mark-up or an undertreatment vector satisfy $(p^l + p^h)/2 \leq 8$, while an overtreatment vector has to satisfy $p^h \leq 8$ for the consumer to enter the market.

Prediction *B3* (Price Vector of Seller and Trade). Trade always takes place if either **L** or **V** (or both) holds; otherwise the market breaks down. With trade, prices are such that sellers are induced to provide the appropriate quality and that the gains from trade accrue to the sellers.

(i) In **B/N** the market breaks down.

(ii) In **B/L** sellers post a price-vector with $p^h = 8$, p^l is indeterminate.

(iii) In **B/V** sellers post the equal mark-up vector $\{6, 10\}$.

[1] Here and throughout the paper *appropriate quality* refers to providing q^h if the consumer needs the high quality and providing q^l if the consumer needs the low quality; *undertreatment* refers to providing q^l when the consumer needs q^h; *overtreatment* refers to providing q^h when the consumer needs q^l.

(iv) In **B/LV** sellers post an equal mark-up or an undertreatment vector with $p^l + p^h = 16$.

Summarizing the standard predictions for set **B** we observe that if both liability and verifiability are violated, then the market breaks down. The reason is that in **B/N** sellers cannot be induced to provide the high quality and that always providing the low quality generates expected gains from trade of only 3 (= $(1 - h)v - c^l$) which is less than the sum of two outside options ($2o = 3.2$). Thus, there exists no price where both trading parties get at least their outside option. As soon as either **L** or **V** (or both) apply, however, sellers have an incentive to post prices which induce them to provide the appropriate quality, making it profitable for consumers to enter the market in **B/L**, **B/V**, and **B/LV**. This yields full efficiency then.

On the Role of Reputation-Building and Competition (Sets R, C and CR)

The Effects of Reputation

Reputation-building itself does not change any of the predictions for set **B** since the stage game has a unique equilibrium and the repeated game a fixed, commonly known end date.

Predictions *R1* to *R3*. Reputation itself does not affect the predicted behavior of sellers and consumers. Hence, predictions ***B1*** to ***B3*** also apply to set **R**.

The Effects of Competition

The main effect of competition is on the pricing policy and the frequency of trade, while provision and charging policy are the same as in set **B**.

Prediction *C1* (Provision and Charging Policy of Seller). Competition itself does not affect the sellers' provision and charging policy. Hence, prediction ***B1*** also applies to set **C**.

In set **B** the matching between consumers and sellers is exogenous and the consumers' only decision is to enter the market or not. While in set **B** a consumer decides whether to accept a price vector of a particular seller, with competition consumers have to choose from a set of four price vectors. To identify choice behavior, we will refer to price-vectors $\underline{\Delta}^e$, $\underline{\Delta}^u$, $\underline{\Delta}^o$

and $\underline{\Delta}^{eu}$. Among all equal mark-up vectors offered by the four sellers, $\underline{\Delta}^{e}$ is the one with the lowest $\Delta^{e} = p^{h} - c^{h} = p^{l} - c^{l}$.[2] Similarly, among all undertreatment (overtreatment) vectors, $\underline{\Delta}^{u}$ ($\underline{\Delta}^{o}$) is the one with the lowest $\Delta^{u} = p^{l} - c^{l}$ ($\Delta^{o} = p^{h} - c^{h}$). Finally, among all equal mark-up and all undertreatment vectors, $\underline{\Delta}^{eu}$ is the one with the lowest $\Delta^{eu} = (p^{h} - c^{h} + p^{l} - c^{l})/2$.[3]

Prediction *C2* (Market Entry of Consumer). When **V** is violated, a consumer's market entry decision depends only on p^{h}, but not on p^{l}. When **V** holds, market entry is influenced both by p^{l} and p^{h}.

(i) In **C/N** consumers trade with the seller (or one of the sellers) with the lowest p^{h} iff $p^{h} \leq 3$. Otherwise consumers do not enter the market.

(ii) In **C/L** consumers trade with the seller with the lowest p^{h} iff $p^{h} \leq 8$. Otherwise consumers do not trade.

(iii) In **C/V** the following applies:

- If $\underline{\Delta}^{e} \leq \min\{\underline{\Delta}^{u} + 3, \underline{\Delta}^{o} + 2\}$ consumers trade with the seller (or one of the sellers) who posts $\underline{\Delta}^{e}$, provided $\underline{\Delta}^{e} \leq 4$. Otherwise consumers abstain from trade.
- If $\underline{\Delta}^{o} \leq \min\{\underline{\Delta}^{u} + 1, \underline{\Delta}^{e} - 3\}$ consumers trade with the seller (or one of the sellers) who posts $\underline{\Delta}^{o}$, provided $\underline{\Delta}^{o} \leq 2$. Otherwise there is no trade.
- if $\underline{\Delta}^{u} \leq \min\{\underline{\Delta}^{e} - 4, \underline{\Delta}^{o} - 2\}$ consumers trade with the seller (or one of the sellers) who posts $\underline{\Delta}^{u}$, provided $\underline{\Delta}^{u} \leq 1$. Otherwise consumers do not enter the market.

(iv) In **C/LV** the following applies:

- If $\underline{\Delta}^{eu} \leq \underline{\Delta}^{o} + 2$ consumers trade with the seller (or one of the sellers) who posts $\underline{\Delta}^{eu}$, provided $\underline{\Delta}^{eu} \leq 4$. Otherwise consumers abstain from trade.
- If $\underline{\Delta}^{eu} > \underline{\Delta}^{o} + 2$ consumers trade with the seller (or one of the sellers) who posts $\underline{\Delta}^{o}$, provided $\underline{\Delta}^{o} \leq 2$. Otherwise consumers do not enter the market.

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[2] For convenience we denote not only a specific price-vector but also the implied mark-up by Δ.

[3] To be precise if $\{p_i^{l}, p_i^{h}\}$ denote the prices posted by seller i then $\underline{\Delta}^{e}=\min_i\{p_i^{h}-c^{h} \mid p_i^{h}-c^{h} = p_i^{l}-c^{l}\}$, $\underline{\Delta}^{u}=\min_i\{p_i^{l}-c^{l} \mid p_i^{h}-c^{h} < p_i^{l}-c^{l}\}$, $\underline{\Delta}^{o}=\min_i\{p_i^{h}-c^{h} \mid p_i^{h}-c^{h} > p_i^{l}-c^{l}\}$, and $\underline{\Delta}^{eu}=\min_i\{(p_i^{h}-c^{h}+p_i^{l}-c^{l})/2 \mid p_i^{h}-c^{h} \leq p_i^{l}-c^{l}\}$.

Prediction *C3* (Price Vector of Seller and Trade). Trade (almost) always takes place even in **C/N**, although sellers provide only the low quality there. In conditions **C/L**, **C/V** and **C/LV** prices are chosen such that sellers are induced to provide the appropriate quality. In all conditions of set **C** the total gains from trade accrue to consumers.[4]

(i) In **C/N** each seller posts {n.d, 3}[5] with probability $x = 0.844$ and a price-vector which is unattractive for consumers (due to $p^h>3$) with probability 1-x.[6] If at least one seller posts {n.d, 3} then all consumers are (under-)treated, otherwise (with probability $(1-x)^4 = 0.06\%$) there is no trade. Each seller's profit in equilibrium is 1.6.

(ii) In **C/L** each seller posts {n.d., 5} with probability $x = 0.839$ and {n.d., 6} with probability 1-x. Trade always takes place and sellers provide the appropriate quality. Each seller's profit in equilibrium is 1.604.

(iii) In **C/V** each seller posts {3, 7} with probability $x = 0.839$ and {4, 8} with probability 1-x. Trade always takes place and sellers provide the appropriate quality. Each seller's profit in equilibrium is 1.604.

(iv) In **C/LV** each seller posts either {4, 5} or {3, 6} with probability $x = 0.132$, either {5, 5}, or {4, 6}, or {3, 7} with probability $y = 0.280$, and either {5, 6} or {4, 7} with probability $1 - x - y$.[7] Trade always takes place and sellers provide the appropriate quality. Each seller's profit in equilibrium is 1.683.

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[4] Here we focus on symmetric equilibria. Note that in the price-posting stage of set **C** there are also asymmetric equilibria. Because there is no obvious way for sellers to coordinate on a specific asymmetric equilibrium we regard such equilibria as less plausible, and thus mention them only here in a footnote. Using similar techniques as in the proof of Prediction ***C3*** it can be shown that the following are asymmetric equilibria (and in fact the unique equilibria in pure strategies): In **C/N** three sellers post {n.d, 3} and one seller posts a price-vector which is unattractive for consumers (with $p^h>3$); the three sellers who post {n.d, 3} earn 1.6493 in expectation, the forth seller gets 1.6 for sure. In **C/L** (**C/V**, respectively) three sellers post {n.d., 5} ({3, 7}, respectively) and one seller posts a price-vector that is less attractive for consumers; equilibrium profits are as in **C/N**. In **C/LV** one seller posts {4, 5} or {3, 6} and three sellers post price-vectors that are less attractive for consumers; the seller posting the attractive price-vector earns 2 for sure, the other three sellers get the outside option.

[5] The abbreviation "n.d." means theoretically not determined. Yet, p^l has to satisfy $p^l \leq p^h$, nevertheless.

[6] We round the probabilities of interaction to three decimals here.

[7] Note that within the three sets of price-vectors, both sellers and consumers are indifferent which price-vector is accepted.

The intuition for (almost) maximal trade in **C/N** runs as follows. Although sellers can still not be induced to provide the high quality, each seller can now serve more than one consumer. The latter fact implies that there is now room for prices that are profitable for both parties of the interaction. Note, however, that the increase in the frequency of trade translates only in a minor increase in efficiency (less than a 1/7 of the potential gains from trade are realized), as consumers are always undertreated in equilibrium.

The Combined Effects of Reputation and Competition

The main effect of combining competition with reputation arises in the **N-**condition. In **CR/N**, competition increases the frequency of trade (in comparison to **B/N** and **R/N**) and reputation increases the efficiency of trade (in comparison to **C/N)** by supporting equilibria with maximal trade and the provision of the appropriate quality in early periods. The reason is that consumers can now costlessly reward a seller who has treated them appropriately in the past, simply by buying from this (and not from another) seller again even in the last periods of the experiment where sellers are expected to act opportunistically in any case. Since **L** and/or **V** are already sufficient to yield full efficiency, we should find an effect of combining reputation and competition on efficiency only in set **N**:

Predictions *CR1* to *CR3*. Predictions ***C1*** to ***C3*** remain equilibrium predictions also in set **CR.** In **CR/N**, there are additional equilibria where (some) sellers post {n.d, 5} in the first 9 periods and in which consumers enter the market, because they anticipate (correctly) that they will get the appropriate quality with sufficiently high probability.

Summarizing the predictions, we observe that either liability or verifiability or both lead to full efficiency while the absence of both leads to severe welfare losses. An opportunity for reputation building might substantially reduce the welfare losses, but only when combined with competition. Competition alone increases the frequency of trade (without substantially increasing efficiency) if neither liability nor verifiability applies, but it has only redistribution effects (shifting the gains from trade from sellers to consumers) in all other cases.

Proofs of predictions

Predictions ***B1*** to ***B3*** as well as predictions ***C1*** and ***C2*** follow from Dulleck and Kerschbamer (2006), and predictions ***R1*** to ***R3*** follow from the arguments put forward when presenting predictions ***R1*** to ***R3***. Here we prove the rest of the predictions.

Proof of Prediction *C3*: Suppose *a* (=1, 2, 3, 4) sellers post price-vectors among which consumers are indifferent while the other 4 – *a* sellers post price-vectors that are less attractive for consumers. Then the probability that one of the *a* sellers gets exactly *b* (=0, 1, 2, 3, 4) consumers to trade with is given by

$$P(b|a) = \binom{4}{b}\left(\frac{a-1}{a}\right)^{4-b}\left(\frac{1}{a}\right)^{b}$$

Consider condition **C/N** and therein seller *i.* Suppose the other three sellers behave as specified in the prediction. Then, from *i's* perspective, the probability that exactly *c* (=0, 1, 2, 3) of the other three sellers post {n.d, 3} is given by

$$W(c) = \binom{3}{c}(x)^{3-c}(1-x)^{c}.$$

In equilibrium, seller *i* is indifferent between offering a price-vector that is unattractive for consumers (which gives him a payoff of 1.6 for sure) and posting {n.d, 3} which generates an expected payoff of

$$\sum_{c=0}^{3} W(c)\left[\sum_{b=1}^{4} P(b|c+1)*b + P(0|c+1)*1.6\right] \qquad \text{(A1)}$$

Thus, setting (A1) equal to 1.6 and solving for *x* gives the *x*-part of the result, the rest is obvious. The argument for conditions **C/L** and **C/V** is similar, the only difference being that in those conditions the less attractive price-vector (with a mark-up of 2) also potentially attracts consumers[8] thereby increasing the expected payoff of a seller who posts the unattractive price-vector from 1.6 (the value of the outside option) to

$$(1 - W(0))*1.6 + W(0)*\left(\Sigma^{4}_{b=1} P(b|4)*2b\right) + P(0|4)*1.6 > 1.6. \qquad \text{(A2)}$$

Thus, in conditions **C/L** and **C/V** setting (A1) equal to (A2) and solving for *x* gives the *x*-part of the result and inserting *x* into (A1) (or into (A2)) gives equilibrium profits. Condition **C/LV** is slightly more complicated. In that condition three different classes of price-vectors are potential candidates for equilibrium price-vectors. Vectors in class 1 (consisting of {4, 5}

[8] The high price offer {n.d., 6} ({4, 8}, respectively) attracts consumers if no seller posts {n.d., 5} ({3, 7}, respectively).

and {3, 6}) yield an expected profit of 0.5 per customer, vectors in class 2 (comprising {5, 5}, {4, 6} and {3, 7}) yield 1 per customer, and vectors in class 3 (i.e., {5, 6} and {4, 7}) yield 1.5 per customer.[9] Using similar techniques as before it is (burdensome but) straightforward to show that there is no symmetric equilibrium in which sellers place strictly positive probability only on vectors in a single class or on vectors in two different classes and that there is a unique symmetric mixed strategy equilibrium in which sellers randomize among vectors in all three classes. All vectors in the support of the mixed strategy must attract the same expected profit; this determines x, y and equilibrium profits. ■

Proof of Predictions *CR1* to *CR3*: Consider the following strategies and beliefs:

Consumers' Beliefs: Each consumer believes that each seller always charges p^h independently of the price-vector under which he is served. He believes to be served efficiently iff (a) he is treated under a {n.d, 5} price-vector and the seller has at least two customers; (b) the seller has either never undertreated him before or has only undertreated him in a situation where all sellers had exactly one customer; and (c) the game is in any of the rounds 1-9.[10] If at least one of (a)-(c) is not fulfilled, the consumer believes to always get the low quality.

Consumers' Strategy: In round 1 consumers randomize with equal probability among sellers who have posted {n.d, 5}. If no seller has posted {n.d, 5}, they randomize with equal probability among sellers who have posted {n.d, 3}. If there is neither a seller who has posted {n.d, 5} nor a seller who has posted {n.d, 3} then they refrain from trade. *In rounds 2 to 9*, among the sellers who are expected to serve efficiently, the consumer chooses the one with strictly the most customers in the previous round; if no seller had strictly the most customers in the previous round (i.e. in the case where each seller had exactly one customer or where two sellers had two customers each) consumers randomize with equal probability among sellers who are expected to serve efficiently. If no seller is expected to serve efficiently, the consumer randomizes with equal probability among sellers who have posted {n.d, 3}. If there is neither a seller who is expected to serve efficiently nor a seller who has posted {n.d, 3} then the consumer refrains from trade. *In rounds 10-16* consumers buy from sellers offering {n.d, 3}. If there is more than one such seller they choose the one that served most customers in round 9 unless they were undertreated in any of rounds 1-9 by this seller in a situation where

[9] Notice that vectors in a given class are exchangeable from both the consumers' and the sellers' perspective because the ex ante expected price and the ex ante expected profit is the same for all vectors in a class.

[10] When a consumer decides which seller (if any) to visit, he does not know whether a seller will serve two or more customers, of course.

the seller had more than one customer. In the latter case they randomize among the remaining sellers offering {n.d, 3}. If there is no seller who offers {n.d, 3} they refrain from trade.

Sellers' Strategy: In rounds 1-9: All sellers post {n.d., 5}; they serve customers efficiently if they have two or more customers and provide low quality otherwise. *In rounds 10-16:* If one seller had strictly the most customers in round 9, all sellers post {n.d., 3} and always deliver low quality; otherwise, i.e. if each seller had exactly one customer or two sellers had two customers each, then all sellers play the mixed equilibrium as outlined in Prediction ***C3*** (i).

We now verify that these strategies and beliefs form a PBE. First notice that *consumers' beliefs* reflect sellers' strategy. Next consider *consumers' strategy*. In *rounds 1-9* consumers' strategy is rational, because the minimum expected payoff from interacting in these rounds at prices {n.d., 5} is larger than the outside option: The only case where a consumer may be undertreated is if he ends up as a single customer with a seller. This is only possible if the game is in round 1 or no seller had strictly the most customers in the previous round. In this case each consumer has an incentive to participate because the payoff from using a random seller in the current round is $[0.5 + 0.5*(1 - 0.75^3)]*5 - 0.5*0.75^3*5 = 2.8906 > 1.6$ – where the term in square brackets is the probability that a consumer is efficiently treated - i.e. he needs q^l, or he needs q^h and at least one other consumer visits the same seller.[11] In *rounds 10-16* a consumer's behavior is rational either because he is undertreated under {n.d, 3} (yielding an expected payoff of 2) or because he is not served at all (yielding the outside option). Finally consider *sellers' strategies*: We start with the behavior in *rounds 10-16.* Two events are to be considered: a) One Seller had strictly the most customers in round 9. In that case that seller has all the customers from round 10 onwards provided she did not deliver q^l to a customer who needed q^h in round 9. Given that future customer behavior is not affected, always delivering low quality is a dominant strategy for this seller. The other three sellers have no possibility of getting more than the outside option, thus their behavior is optimal too. b) No seller had a strict majority of customers in round 9. In this case the reasoning of the proof of prediction ***C3*** (i) applies. Next consider *round 9.* Three cases are to be considered. a) One seller has 3 or 4 customers in this round, i.e. a certain strict majority of consumers. In that case serving all customers efficiently guarantees a maximum additional future payoff of 16.8 (= 7*2.4) in rounds 10-16 which is strictly more than the maximum additional current

[11] If in a previous round one seller had strictly the most customers, all customers are treated efficiently for sure, ie. the payoff is 5.

payoff from deviating (which is equal to 16 – in the case that the seller serves four consumers who all need t^h).[12] b) A seller has exactly two customers in this round. Given the behavior of consumers, the conditional probability that she is the seller with a strict majority of customers given that she has exactly two customers is equal to (3*1/3*2/3) / [3*(1/3)^2 + (3*1/3*2/3)] = 2/3. Thus, the expected additional future payoff from treating efficiently is 16.8*2/3 = 11.2 which is strictly more than 8, the maximum additional current payoff from deviating (if both consumers need q^h).[13] c) If a seller has only one customer in round 9 there is no additional future payoff from treating efficiently and she will therefore cheat. The arguments for *rounds 1-8* are similar to those for round 9, the main difference being that the additional expected future payoff from treating efficiently is higher, the incentives to deviate therefore lower. ■

[12] Mistreating only one of the customers yields an additional current profit of 4 and a loss in future profit of 7, mistreating two of the customers yields an additional current profit of 8 and a loss in future profit of 14, etc.

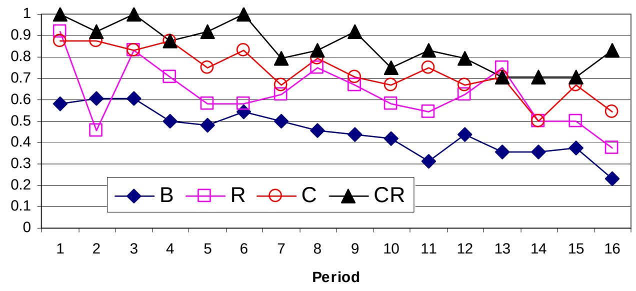
[13] Here notice that there is no additional expected future payoff from treating efficiently if exactly two sellers have two customers each in round 9.

Supplement S2. Development of key variables across periods

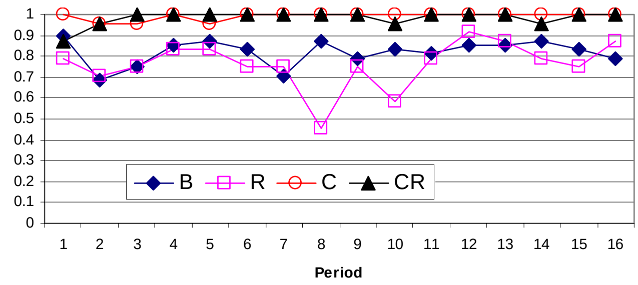
Figure S1. Development of Behavior Across All Conditions

A. Relative frequency of trade on consumer side

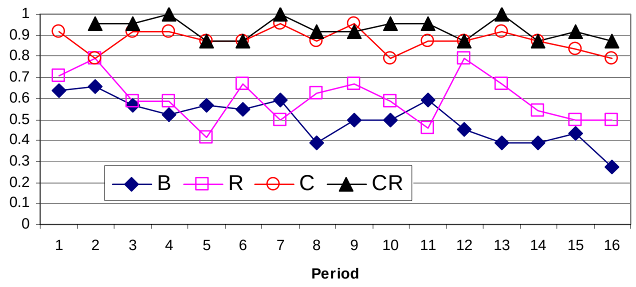
Set N (No Liability / No Verifiability)



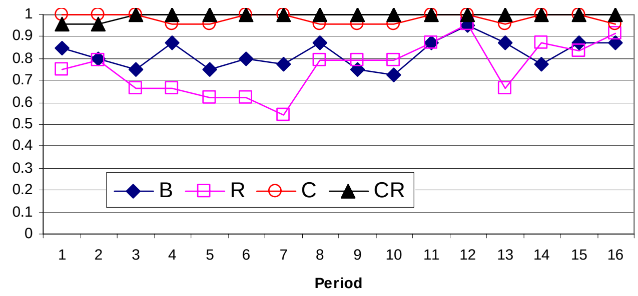
Set L (Liability / No Verifiability)



Set V (No Liability / Verifiability)

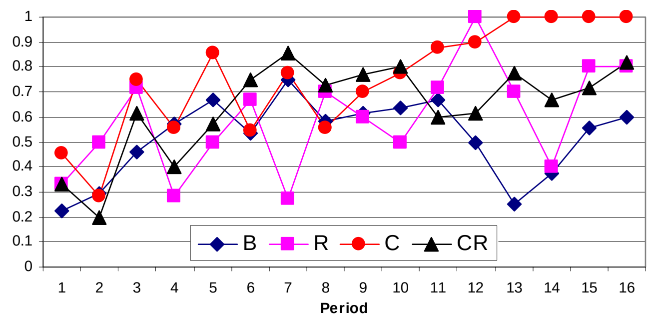


Set LV (Liability / Verifiability)



B. Relative frequency of undertreatment

Set N (No Liability / No Verifiability)



Set V (No Liability / Verifiability)

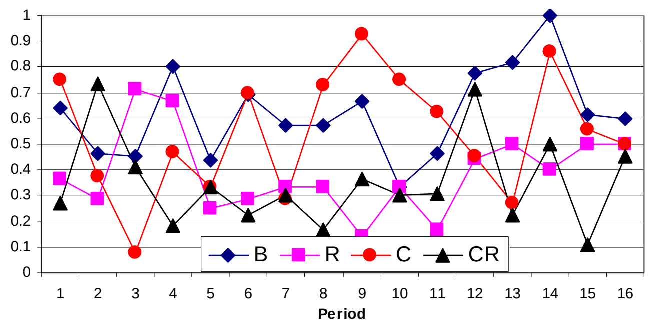
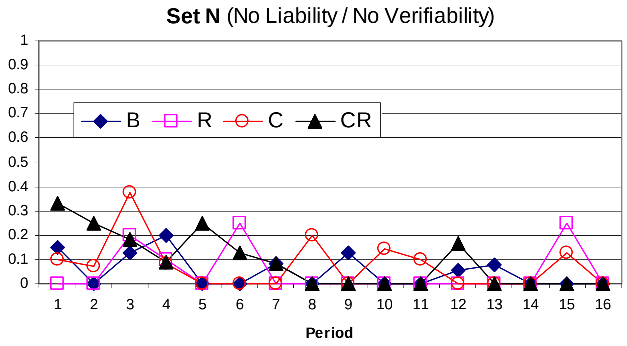
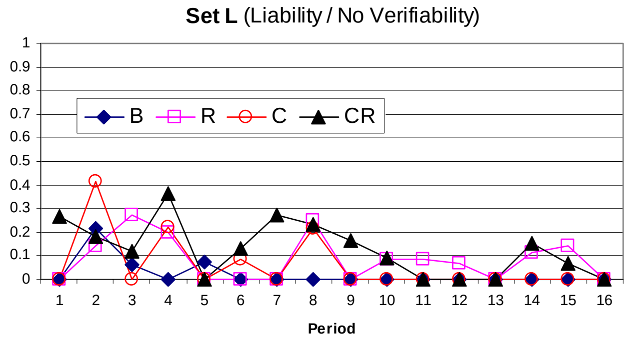
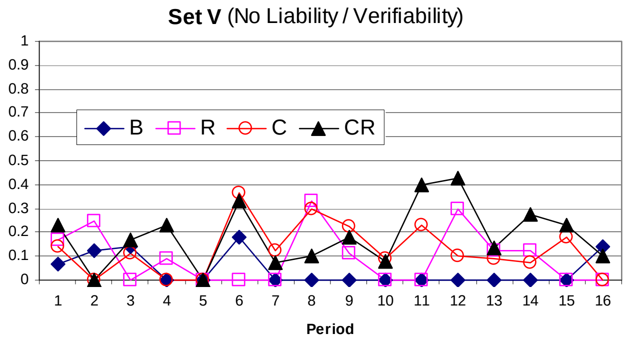


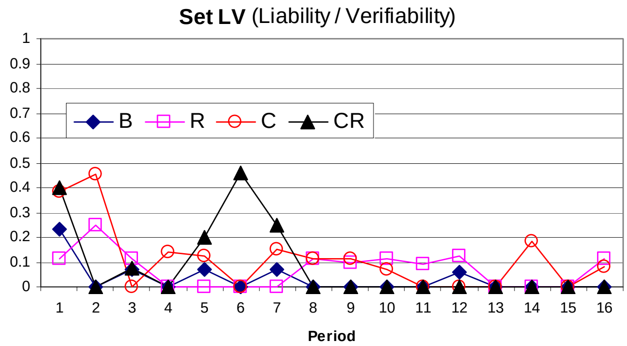
Figure S1 - continued

C. Relative frequency of overtreatment

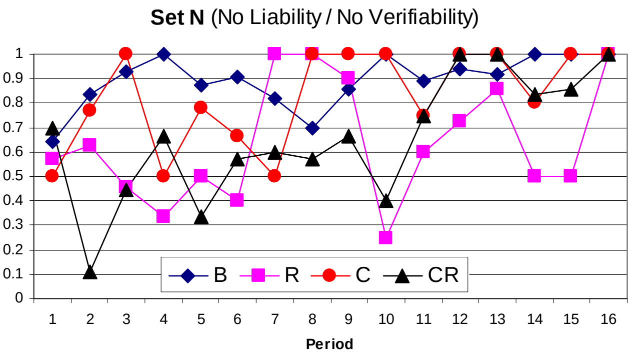








D. Relative frequency of overcharging



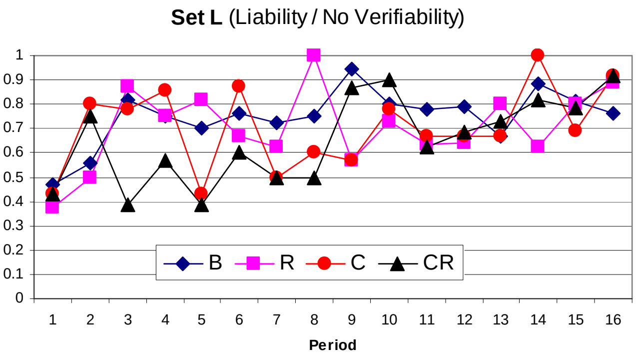
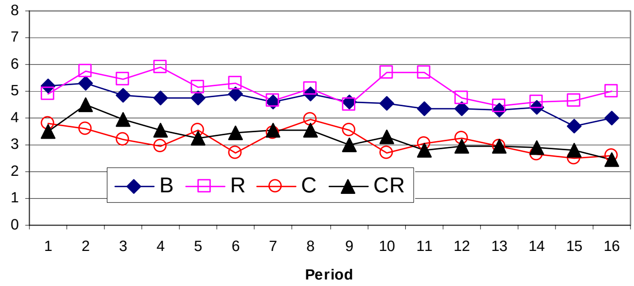


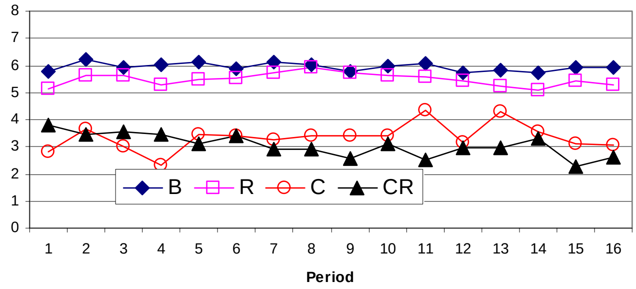
Figure S1 - continued

E. Accepted price p^l

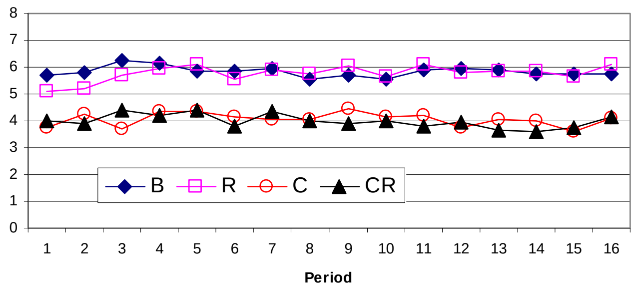
Set N (No Liability / No Verifiability)



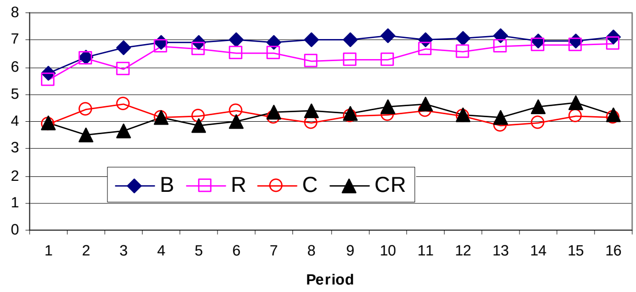
Set L (Liability / No Verifiability)



Set V (No Liability / Verifiability)

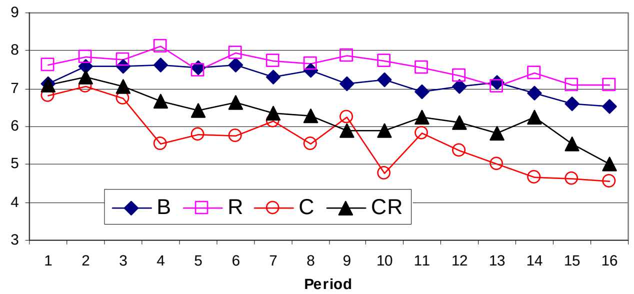


Set LV (Liability / Verifiability)

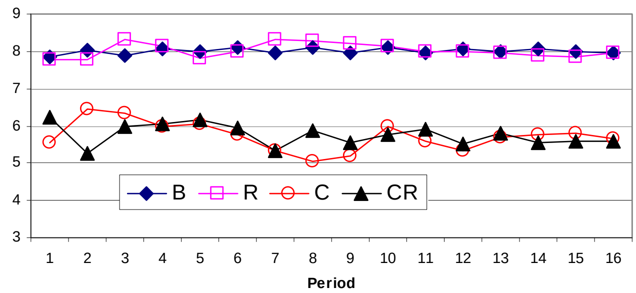


F. Accepted price p^h

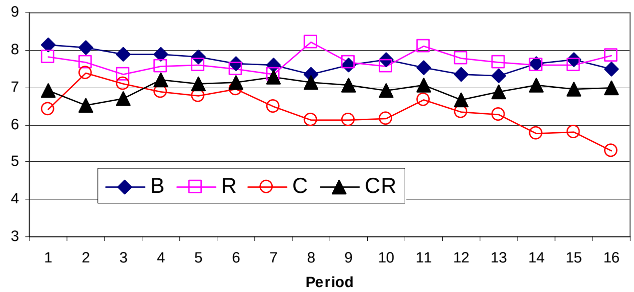
Set N (No Liability / No Verifiability)



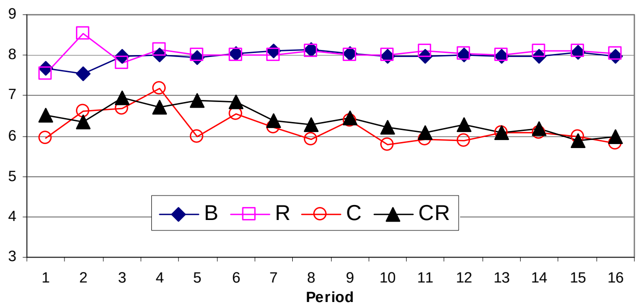
Set L (Liability / No Verifiability)



Set V (No Liability / Verifiability)



Set LV (Liability / Verifiability)



Supplement S3. Experimental Instructions (for treatment CR/LV – translated from German; instructions for the other treatments are analogous. Note that the experimental software (using zTree by Fischbacher, 2007) that is provided in the online material of this article is in German.**)**

INSTRUCTIONS FOR THE EXPERIMENT

Thank you for participating in this experiment. Please do not to talk to any other participant until the experiment is over.

2 Roles and 16 Rounds

This experiment consists of **16 rounds,** each of which consists of the same sequence of decisions. This sequence of decisions is explained in detail below.

There are 2 kinds of roles in this experiment: **player A** and **player B**. At the beginning of the experiment you will be randomly assigned to one of these two roles. On the first screen of the experiment you will see which role you are assigned to. Your role remains the same throughout the experiment.

In your group there are 4 players A and 4 players B. The players of each role get a number. If you are a player B your potential interaction partners are the players A1, A2, A3 and A4. In case you are a player A your potential interaction partners are the players B1, B2, B3 and B4.

Attention: The numbers of all **players A** are **fixed**, i.e. the same number always represents the same person, e.g. “A1”.

But: The numbers of all **players B** are **not fixed**, i.e. the number representing a given person might change (the probability that a number is represented by the same person as in the previous round is exactly 25%).

All participants get the same information on the rules of the game, including the costs and payoffs of both players.

Overview of the Sequence of Decisions in a Round

Each round consists of a maximum of 4 decisions which are made consecutively. Decisions 1, 3 and 4 are made by player A, decision 2 is made by player B.

Short Overview of the Sequence of Decisions in a Round

1. Player A chooses one price for action 1 and one price for action 2.
2. Player B gets to know the prices chosen by the 4 players A (A1 to A4). Then player B decides whether he/she wants to interact with one of the players A. If not, this round ends for him/her.
3. Each player A gets to know which players B decided to interact with him/her. A maximum of all 4 players B can interact with a particular player A. Then each player A is informed about the types of all players B who decided to interact with him/her. There are two possible types of player B: he/she is of either type 1 or type 2. This type is not necessarily identical for all players B. Player A has to choose an action for each player interacting with him: either action 1 or action 2.
4. Player B has to pay the price specified by his/her player A in decision 1 for the action chosen by his/her player A in decision 3.

Detailed Illustration of the Decisions and Their Consequences Regarding Payoffs

Decision 1

In case of an interaction each **player A** has to choose between 2 actions (action 1 and action 2) at decision 3. Each chosen action causes costs which are as follows:

Action 1 costs player A **2 points** (= currency of the experiment).

Action 2 costs player A **6 points**.

Player A can charge prices for these actions from all those players B who decide to interact with him/her. At **decision 1** each Player A has to set the **prices for both actions**. Only (strictly) positive integer numbers are possible, i.e., only 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11 are valid prices. Note that the price for action 1 must not exceed the price for action 2.

Decision 2

Player B gets to know the prices set by each of the four players A for the two actions at decision 1. Then player B decides whether he/she wants to interact with one of the players A and (if he/she wants to do so) with which one.

If he/she wants to do so, player A can choose an action at decision 3 and charge a price for that action at decision 4 (see below).

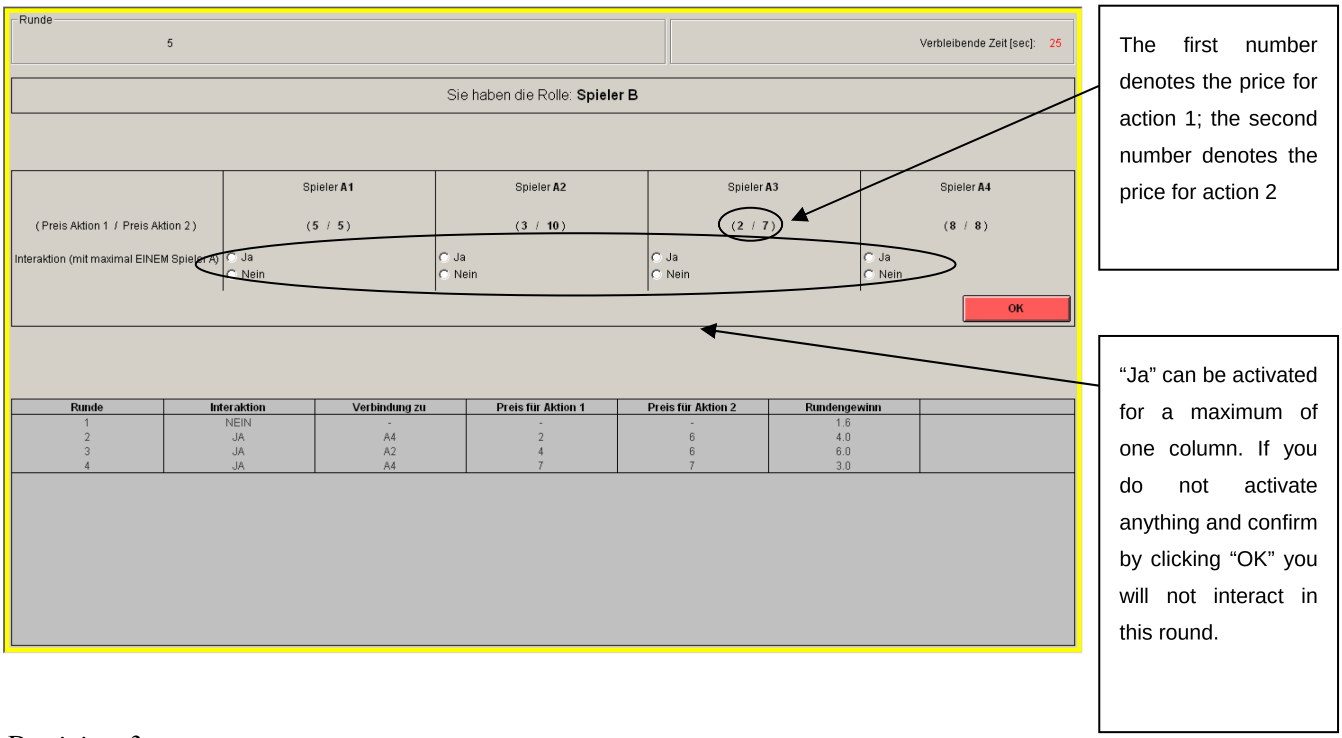
If he/she doesn't want to interact, this round **ends** for this player B and he/she gets a **payoff of 1.6 points for this round**.

In case **none of the players B** wants to interact with a certain **player A**, this player A gets a **payoff of 1.6** points **for this round** as well.

Below is an **exemplary screen** which shows decision 2. In case you wish to interact with a certain player A please click "Ja" (Yes) in the corresponding column and confirm your entry by clicking "OK" (you don't have to click "Nein" (No) for the other players A). If you don't want any interaction at all, you just have to click "OK" (you don't have to click "Nein" for all players A). See explanation on the screen.

In the lower half of the screen you can see all previous rounds (on the exemplary screen round 5 is ongoing). The columns are defined as follows:

- "Runde": The round, in which something happened
- "Interaktion": Shows if you had an interaction with a player A (here: rounds 2-4)
- "Verbindung zu": Shows with which player A you interacted (here: in rounds 2 and 4 with player A4)
- "Preis für Aktion 1": Price which was set by player A for action 1 (in case you didn't have an interaction this field shows "-", like here in round 1)
- "Preis für Aktion 2": Price which was set by player A for action 2
- "Rundengewinn": Your earnings in each particular round denoted in points (the calculation is explained below)



Decision 3

Before decision 3 is made (in case player B chose “Yes” at decision 2) a type is randomly assigned to player B. **Player B** can be one of the two types: **type 1** or **type 2**. This type is determined for each player B in **each new round**. The determination is random and **independent of the other players’ types**. With **a probability of 50%** player B is of **type 1**, and with a **probability of 50%** he/she is of **type 2**. Imagine that a coin is tossed for each player B in each round. If the result is e.g. “heads”, player B is of type 1, if the result is “tails” he/she is of type 2.

Every player A gets to know the **types of all players B** who interact with him/her *before* he makes his decision 3. Then player A chooses an action for each player B, either action 1 or action 2. In case he interacts with more than one player B these actions are allowed to differ.

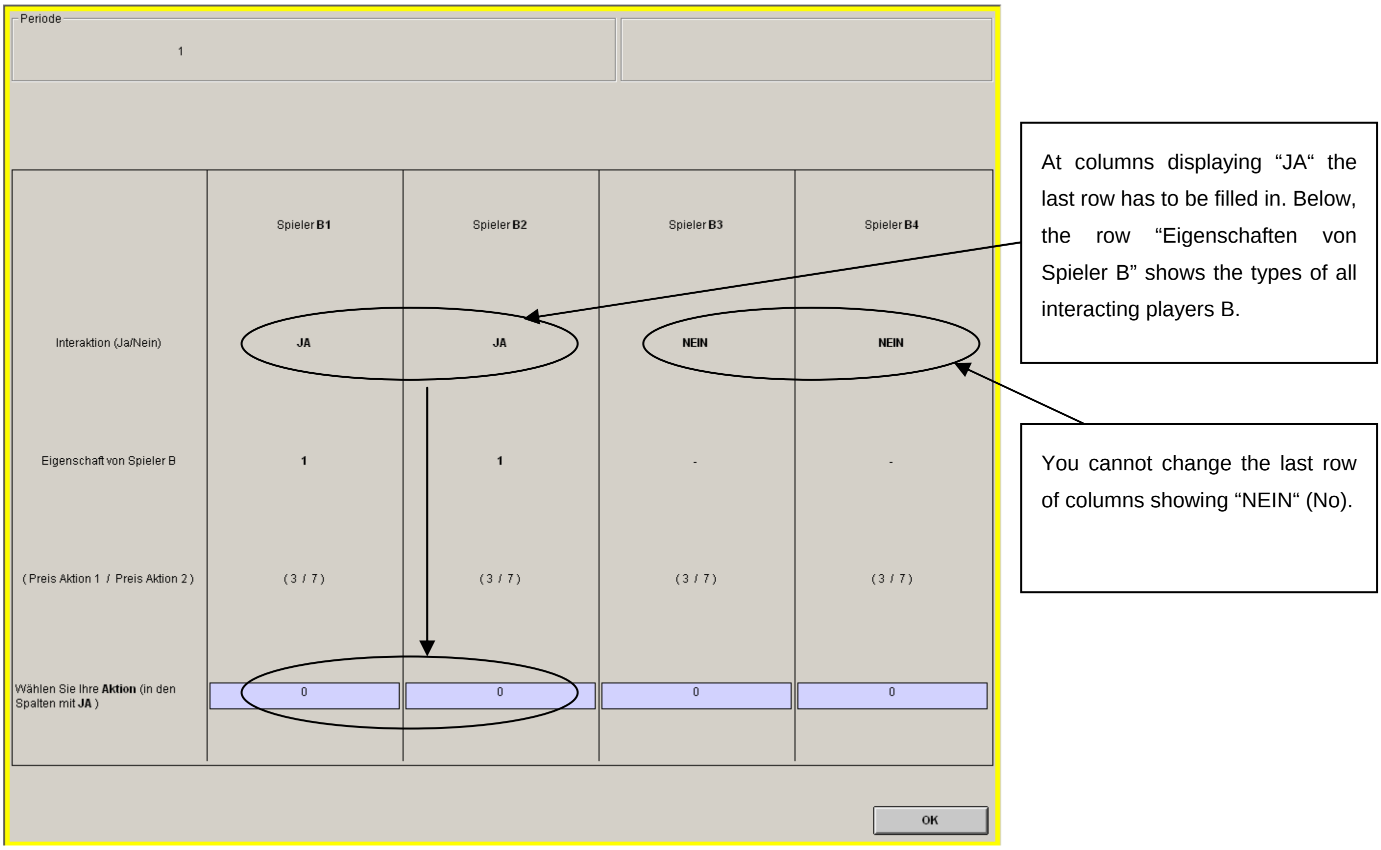
There are two possibilities a player A can have during choosing his action:

a) In case player B is a type 1 player, player A can chose either action 1 or action 2.
b) In case player B is a type 2 player, player A has to choose action 2.

At no time player B will be informed whether he/she is of type 1 or a type 2 player. Player B will also not be informed about the total number of players B player A interacted with.

Below there is an exemplary screen which shows decision 3. Player A gets to know which of the 4 players B decided to interact with him and which didn’t (first row). If a player B

interacts with the player A under consideration then the type of player B is displayed in the corresponding column. The two prices which player A set at his decision 1 are shown.
The last row has to be filled out for each player who agreed to interact (the row "Interaktion" shows "JA" (Yes)). For each of these interacting players B an action has to be chosen (1 or 2). On the exemplary screen the players B1 and B2 decided to interact with player A, hence player A needs to enter the actions for these players (i.e. replace the "0").



Decision 4

Player A **charges** the **price** (which he determined at decision 1) for the action he chose at his decision 3 from each player B.

Payoffs

No Interaction

If player B chose not to interact with any of the players A (*decision "No" for all 4 players A*) he/she gets **1.6 points** for this particular round. If no player B decided to interact with a certain **player A** this player A gets **1.6 points** for this particular round as well.

Otherwise (*decision "Yes" by player B*) the payoffs are as follows:

Interaction

For each player B he/she interacts with, **player A** receives the according **price** (denoted in points) he/she charged at his/her decision 4 **less the costs** for the action chosen at decision 3, i.e. the payoff of a player A consists of all interactions he/she had within this round.

Player B gets **10 points less** the price charged at decision 4 for the action chosen at decision 3.

At the beginning of the experiment you receive an initial **endowment of 6 points**. In addition you received 2 Euro (equals **8 points**) for filling out the questionnaire. With this endowment you are able to cover losses that might occur in some rounds. Losses can also be compensated by gains in other rounds. If your total payoff sums up to a loss at the end of the experiment you will have to pay this amount to the supervisor of the experiment. By participating in this experiment you agree to this term. Please note that there is **always** a possibility to avoid losses in this experiment.

To calculate the final payoff the initial endowment and the profits of all rounds are added up. This sum is then converted into cash using the following exchange rate:

1 point = 25 Euro-cents

(i.e. 4 points = 1 Euro)