APPENDICES FOR ONLINE PUBLICATION AS SUPPLEMENTARY MATERIAL

Appendix A. Laboratory experiment instructions

Welcome and thank you for participating in this experiment. In this experiment you can earn money. The specific amount depends on your decisions and the decisions of other participants. From now on until the end of the experiment, please do not communicate with other participants. If you have any questions, please raise your hand. An experimenter will come to your place and answer your question privately. In the experiment we use ECU (Experimental Currency Unit) as the monetary unit. 200 ECUs are worth 1 Euro.

At the beginning of the experiment all participants are endowed with an amount of 1000 ECU. Profits during the experiment will be added to this account, losses will be deducted. At the end of the experiment, the balance of the account will be converted from ECUs into Euros according to the conversion rate announced above, and paid out in cash.

The experiment lasts for 60 rounds. In each round, participants will be matched into groups of four participants. One of these participants is the *seller*, the other three participants are *buyers*. The composition of the group, and in which rounds you are a seller and in which rounds you are a buyer will be randomly determined by the computer. The seller offers one good which, if produced in 100% quality, costs him 100 ECUs to produce. Each of the potential buyers is assigned a valuation for the good, which lies between 100 and 300 ECUs. The valuation represents the value of the good for the buyer if he receives it in 100% quality (more about quality will be said below). The valuations of the three buyers will be newly randomly drawn in each round. When drawing a valuation, every integer value between 100 and 300 has the same probability to be selected.

Each round consists of three steps: in the "auction stage" the three potential buyers may bid for the item offered by the seller. In the "transaction stage" the seller receives the price which has to be paid by the auction winner, and decides about the quality of the good he will deliver. In the "feedback stage" both buyer and seller may give feedback on the transaction, which is then made available to traders in later rounds. In the following we explain the procedures of the three stages in detail.

Auction stage. In the first stage in each round, each of the potential buyers may submit a maximum bid for the good:

1. Your maximum bid is the maximum amount you'd be willing to pay for winning the auction. If you do not want to participate in the auction, submit a maximum bid of 0. If you want to participate, submit a maximum bid of at least 100 ECUs, which is the minimum price. (Your maximum bid must not exceed the current amount on your account.)
2. The bidder who submits the highest maximum bid wins the auction. The price is equal to the second highest bid plus 1 ECU. Exceptions: The price is equal to 100 ECU if only one potential buyer submits a bid. The price is equal to the maximum bid of the auction winner, if the two highest maximum bids are the same (in this case, the bidder who has submitted his bid first wins the auction).
3. You may think of the bidding system as standing in for you as a bidder at a live auction. That is, the system places bids for you up to your maximum bid, but using only as much of your bid as is necessary to maintain your highest bid position. For this reason, the price cannot exceed the second highest bid plus 1 ECU.

The winner of the auction must pay the price to the seller and proceeds to the transaction stage. All other potential buyers earn an income of 0 ECU in this round.

Transaction stage. The seller receives the price and then determines the quality of the good. The quality must be between 0% and 100%. Each quality percent costs the seller 1 ECU. Thus, the costs for the seller for selling the good are 0 ECU if the quality is 0%, and 100 ECU if the quality is 100%. The value of the good for the buyer who has won the auction equals the quality of the good times his valuation for the good. Thus the value of the good for the buyer is 0 ECU if the quality is 0%, and equal to his valuation if the quality is 100%.

In equations:

The payoff for the Seller in this round equals: Auction price – Quality [%] * 100
The payoff for the auction winner in this round is: Quality [%] * Valuation – Auction price

Feedback stage

Baseline {The feedback stage consists of one or two steps: After the transaction both the buyer and the seller decide whether or not they want to submit a feedback on the transaction. Submitting a feedback costs 1 ECU. The feedback can be either "negative", "neutral", or "positive". If both transaction partners submit feedback, or none of them submits feedback, then the feedback stage ends at this point.

If only one transaction partner submits feedback, then the other transaction partner is informed about this feedback. The transaction partner who has not submitted feedback yet has another chance to submit feedback. Again, submitting feedback costs 1 ECU, and the feedback can be either "negative", "neutral", or "positive".

After the feedback stage the round ends. If a participant becomes a seller in one of the following rounds, the feedbacks he received in earlier rounds as a buyer or a seller will be presented in the following way: "YY (XX%)", where YY is equal to the number of positive feedbacks minus the number of negative feedbacks, and XX is the share (in percent) of positive feedbacks in all feedbacks. **}**

Blind {After the transaction both the buyer and the seller decide whether or not they want to submit a feedback on the transaction. Submitting a feedback costs 1 ECU. The feedback can be either "negative", "neutral", or "positive". The feedback giving of buyer and seller takes place simultaneously.

After the feedback stage the round ends. If a participant becomes a seller in one of the following rounds, the feedbacks he received in earlier rounds as a buyer or a seller will be presented in the following way: "YY (XX%)", where YY is equal to the number of positive feedbacks minus the number of negative feedbacks, and XX is the share (in percent) of positive feedbacks in all feedbacks.**}**

DSR: { The feedback stage consists of one or two steps: After the transaction both the buyer and the seller decide whether or not they want to submit a feedback on the transaction. Submitting a feedback costs 1 ECU. The feedback can be either "negative", "neutral", or "positive". Additionally, the buyer (and only the buyer) may submit an additional rating. (This is only possible if he also submits a normal feedback. The additional rating allows the buyer to give feedback on the following scale:

The quality was satisfactory.

I strongly disagree	I disagree	Undecided	I agree	I strongly agree
(1)	(2)	(3)	(4)	(5)

There are no additional costs for the additional rating. If both transaction partners submit feedback, or none of them submits feedback, then the feedback stage ends at this point. If only one transaction partner submits feedback, then the other transaction partner is informed about the "negative"/"neutral"/"positive" feedback; but the seller is *not* informed about the content of the additional rating submitted by the buyer. The transaction partner who has not submitted feedback yet has another chance to submit feedback. Again, submitting feedback costs 1 ECU, and the feedback can be either "negative", "neutral", or "positive".

After the feedback stage the round ends. If a participant becomes a seller in one of the following rounds, the feedbacks he received in earlier rounds as a buyer or a seller will be presented in the following way: "YY (XX%)", where YY is equal to the number of positive feedbacks minus the number of negative feedbacks, and XX is the share (in percent) of positive feedbacks in all feedbacks. The additional ratings which a participant received as a seller in earlier rounds will be presented in the following form: "on average X.X, based on XXX additional ratings".**}**

Before you start with the experiment you will take part in two trial rounds. In the first trial round you are a buyer, in the second trial round you are a seller. The other buyers/the seller will be simulated by the computer in these trial rounds. The trial rounds have no consequences for your earnings.

Appendix B. An illustration of how reciprocal feedback may affect market outcomes

To fix ideas (and extending the notation established in Section VI.1), suppose that a seller's reputation is given by a feedback score r_s, which we normalize to be between [0,1]. In our laboratory private-value auction context, a rational, risk-neutral bidder i then bids $b_i = q^e(r_s)v_i$, where $q^e(r_s)$ is the expected quality given the seller's feedback score r_s.

For simplicity, we assume that, after all sales, the seller chooses the same quality (so we ignore endgame effects). Then the question for the seller is to set the optimal (stationary) shipping policy, q_s. Define 'perfectly discriminative' scoring as a strictly monotonic relationship between r_s and q_s, so that a score reveals a seller's shipping policy; e.g., $q^e(r_s(q_s)) = q_s$. Under perfectly discriminative scoring with n bidders, with normalized private values $[0,v_H]$, and cost cq_s to ship quality q_s, a profit-maximizing seller chooses q_s to maximize

$$((n-1)/(n+1))\, q^e(r_s(q_s))\, v_H - cq_s = ((n-1)/(n+1))\, q_s\, v_H - cq_s.$$

Inspection shows that, for c not too high, a seller's optimal choice is full quality, $q_s = 1$. That is, a feedback system that generates perfectly discriminative scores can effectively cope with moral hazard and adverse selection problems.[48]

Reciprocal feedback in our context implies that the reputation score tends to be biased upwards. The simplest way to capture this distortion, is to write the relationship between r_s and q_s as

$$r_s(q_s) = a + ((1-a)/(1-b))\, q_s \text{ for } q_s < 1-b \text{ and some } a,\ b \in (0,1), \text{ and 1 otherwise.}$$

Both a and b measure the distortion of the reputation score that comes with reciprocity compared to a perfect score that directly reflects quality ($a = b = 0$). More specifically, the parameter b describes the length of the interval of qualities that now all yield the maximum reputation score ($r_s = 1$), the idea being that buyers are not willing to take the risk of retaliatory feedback if the quality reduction is sufficiently small.[49] The parameter a measures the 'compression' of the overall range of feedback due to reciprocity. In our simple model, however, only the distortion that comes with b affects the economic performance of the market (see below), while a downscales scores without affecting the monotonic relationship between r_s and q_s.

Returning to the seller's choice optimization problem, inspection shows that with reciprocal feedback, the optimal choice(s) for those who choose a quality level below $1-b$ remain(s) unchanged compared to a system yielding perfectly discriminative scores. However, all qualities above $1-b$ are 'squeezed' at $q_s = 1-b$. Consequently, the bigger the distortion b induced by reciprocity, the lower quality shipped, the lower bids, the lower prices, and the lower market efficiency. As shown in the main text, the lab data can be partly organized by the model's basic predictions and mechanisms.[50]

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[48] Moral hazard is important when choosing the quality level. Adverse selection problems may arise because of heterogeneity in traders' costs or (social) preferences (not being explicitly modeled here). Kennes and Schiff (2007) study reputation systems in a model of a search market with asymmetric information.

[49] The fact that a large majority of eBay traders accumulated only positives (Section II) seems to support the hypothesis that there is too little discrimination among those with maximum scores.

[50] In our model, a reputation score gained in a system with reciprocal feedback is less informative in the sense that it does not discriminate between qualities above a certain threshold, and therefore, in equilibrium there is no uncertainty about a seller's quality level given the reputation score. Some potential model features which might be more realistic are discussed in the conclusions.

Appendix C. Additional tables and figures

TABLE 8: DETERMINANTS OF FEEDBACK GIVING, PROBIT COEFFICIENT ESTIMATES (ROBUST STANDARD ERRORS CLUSTERED ON MATCHING GROUP, ROUNDS 1 TO 50)

Dep var	Buyer gave feedback	
	Coeff	(StdErr)
Constant	1.50 ***	(0.227)
Blind	-0.296 **	(0.131)
DSR	0.012	(0.157)
Round	-0.008 **	(0.004)
Price	-0.001	(0.001)
Quality	-0.006 ***	(0.002)
S FScore	0.120 *	(0.011)
N	2283	
Restricted LL	-1226.2	

Note: *, **, and *** indicate significance at the 10%, 5% and 1% level, respectively. S FScore stands for the feedback score of the seller.

TABLE 9: CONTENT AND TIMING OF MUTUAL FEEDBACK IN EXPERIMENTAL *BASELINE* TREATMENT

Mutually positive feedback

		Seller gave in stage	
		1	2
Buyer gave in stage	1	137	79
	2	16	

Only seller gave problematic FB

		Seller gave in stage	
		1	2
Buyer gave in stage	1	7	6
	2		

Only buyer gave problematic FB

		Seller gave in stage	
		1	2
Buyer gave in stage	1	59	3
	2	11	

Mutually problematic feedback

		Seller gave in stage	
		1	2
Buyer gave in stage	1	24	108
	2	8	

Note: Numbers in cells represent absolute numbers of observations in treatment *Baseline*. 'Problematic' includes negative and neutral feedback.

TABLE 10: BUYER'S DETAILED SELLER RATINGS (DSR) CONDITIONAL ON BUYER'S CONVENTIONAL FEEDBACK (CF) UNDER FEEDBACK 2.0 [%]

Buyer's CF	DSR Category	DSR given	DSR Score				
			1	2	3	4	5
Negative (1.9%)	Description	67.2	58.7	15.4	11.9	7.4	6.6
	Communication	71.3	70.9	11.7	10.1	5.0	2.3
	Shipping time	63.8	47.4	8.5	17.6	15.8	10.8
	Shipping costs	64.5	39.1	10.5	26.6	16.1	7.6
Neutral (1.2%)	Description	78.7	11.6	20.0	25.5	20.8	22.0
	Communication	79.2	16.3	16.2	27.9	24.6	14.9
	Shipping time	77.2	20.1	13.1	20.4	22.2	24.3
	Shipping costs	77.5	9.7	10.3	31.1	30.8	18.2
Positive (96.8%)	Description	72.4	0.4	0.8	3.3	14.0	81.5
	Communication	71.8	0.6	0.9	4.1	16.3	78.2
	Shipping time	71.6	0.9	1.7	5.7	15.3	76.4
	Shipping costs	71.3	0.8	1.9	8.5	23.3	65.5

FIGURE 8: SCREENSHOT OF NEW FEEDBACK SUBMISSION PAGE ON EBAY

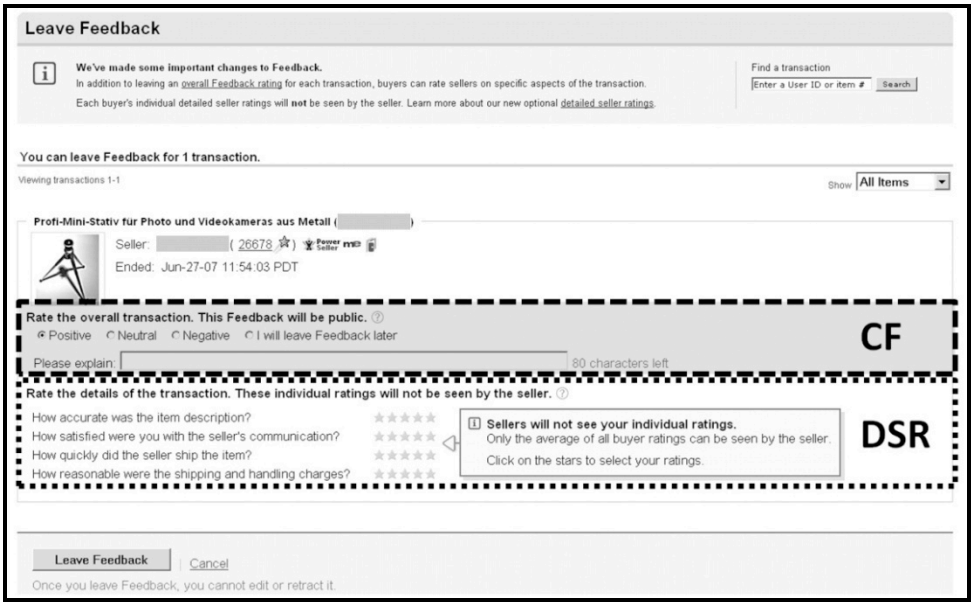

FIGURE 9: SCREENSHOT OF NEW FEEDBACK PROFILE PAGE ON EBAY