

Information and Communication in Sequential Bargaining

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Abstract

In experimental bargaining with incomplete information, we vary the information distribution (symmetric and asymmetric), the direction of electronic pre-play communication (no, one-way, and two-way), and the electronic communication medium (email and video). Bargaining outcomes are influenced by the information and communication configurations, but not by the communication medium. In particular, sellers earn more when being informed about buyers' reservation prices (though they are willing to allocate more to buyers than theoretically predicted), but less when communication opportunities are provided.

Keywords: sequential bargaining, incomplete information, communication, experiment

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1 Introduction

In this paper we experimentally study sequential bargaining with incomplete information, varying the information about buyer characteristics available to the seller and the communication opportunity available to the bargaining partners. Our experiments throw light on issues that are particularly relevant to electronic commerce.

First, in e-commerce information about consumer characteristics can easily be gathered and mined. Sellers can use this information to apply various forms of price discrimination that are often not available in offline markets and that tend to favor the sellers' profits on the expense of the consumers' payoffs (Varian, 2001).¹ Krugman (2000) mentions that such price discrimination on the Internet is "*undeniably unfair: some people pay more just because of who they are. ... One thing is clear: The next battle in the eternal conflict between equity and efficiency may well be in cyberspace.*"

Recent experiments on sealed-bid double auctions by Daniel et al. (1998), Rapoport et al. (1998), and Seale et al. (2001) seem to confirm this suggestion. They even show that those subjects, who are favored by the information asymmetry, receive a significantly larger share of the realized gains from trade than that predicted by theory. This result is driven by both, the more aggressive bidding by better informed subjects and the more cautious bidding by worse informed subjects (relative to their Bayesian Nash linear equilibrium strategies). Given that many online transactions are run sequentially, however, it is important to know whether these effects also apply to similar sequential settings. Our experiments indicate that, in line with economic theory, sellers profit from improved information, but also that fairness is a constraint on profit seeking.

Second, electronic commerce allows sellers to actively influence their communication opportunities. Not only can a seller choose the medium of communication (e.g., email or video-conferencing system), he can also determine the direction of communication, that is, whether to allow two-way pre-trade communication (both buyers and sellers can exchange messages), one-way communication (only sellers can send messages), or not to allow any pre-trade communication. That providing opportunities for pre-play communication can effectively al-

¹ In a well-publicized anecdote, in 2000 online-retailer Amazon charged different customers different prices for the same item. While the company insisted that the price differentials were random in order to determine "the right balance between how much Amazon could charge and still maintain a good sales volume," many customers accused Amazon of basing their prices on billing information and purchasing history obtained by earlier software interaction.

ter subjects' bargaining behavior has been shown in a number of experimental studies. However, previous research lacks of a systematic investigation of the impact of different electronic communication media and different directions of communication in different information environments.² Including these analyses in our sequential bargaining experiment, it turns out that communication tends to reduce the sellers' share of the gains from trade. The extend of this communication effect depends only on the information structure and the direction of communication, but not on the medium selected for communication.

2 The experimental bargaining game

In all experimental treatments we play a sequential two-person bargaining game with incomplete information. On the first stage, the seller submits an ask s for a (fictitious) good, and the buyer, informed about s , submits a bid b on the second stage. If the buyer's bid exceeds the seller's ask, i.e., if $b \geq s$, trade occurs at price p , which is halfway between the two: $p = (b + s)/2$. If $b < s$, no trade occurs. Let v denote the buyer's reservation value (in the experiment, v is the amount of money the buyer receives from the experimenter when he buys the good), and let c denote the seller's cost (which is the amount of money the seller has to pay to the experimenter if he sells the good). If trade occurs, the buyer's profit is $v - p$, and the seller's profit is $p - c$. Otherwise, both traders' profit is zero.

In order to determine values and costs, two numbers are randomly and independently drawn from a uniform distribution [DM 0, DM 100]. The lower of the two numbers is the seller's costs c , and the higher value is the buyer's reservation value v . This procedure ensures that the seller's costs are never higher than the buyer's reservation value and that, therefore, the gain from trade is never negative. In the *symmetric* information condition, costs and reservation value are private information, while in the *asymmetric* information condition, only the costs parameter is private information, i.e., the seller is informed about both, his costs and the buyer's reservation value.

Assuming that the seller is risk neutral, the seller's subgame-perfect equilibrium strategy $s^*(c)$ in the symmetric information condition is to submit $s^*(c) = (100 + c)/2$, whereas the buyer's

² While there are some studies that report a significant communication effect in bargaining games with one-sided incomplete information (Valley et al. 1998, Boles et al. 2000), and with two-sided incomplete information (Radner and Schotter 1989, Valley et al. 2002, Croson et al. 2003), none of these experiments directly compared the influences of communication between both information environments. Similarly, while experimental analyses on coordination games suggest that there are differences regarding the effects of one-way and two-way communication (Cooper et al. 1989, 1992), there exists no such study on bargaining games.

subgame-perfect equilibrium strategy $b^*(s;v)$ is to bid s , if $v \geq s$, and to bid some $b^* < s$, if $v < s$. In the asymmetric information condition, the subgame-perfect equilibrium strategy $s^*(v)$ for the seller is to choose $s^*(v) = v$. The buyer's equilibrium strategy does not depend on the information condition.³

3 The experimental design

In total, we ran 10 treatments using a $2 \times 2 \times 3(-2)$ matrix design with the treatment variables information structure (symmetric and asymmetric), communication medium (email and video), and direction of communication (no, one-way, and two-way).⁴ In each treatment we had 10 buyers and 10 sellers, making a total of 200 subjects. Each subject played two bargaining games, each of the sort described above, in the same treatment and in the same, randomly assigned player role, but with different bargaining partners. Before the first session, we randomly determined the seller's costs and the buyer's reservation values for the 2 rounds of bargaining using the procedure described above (and in the instructions).⁵ To facilitate statistical analyses and to make the data across treatments straightforwardly comparable, the same costs (DM 23 in the first round and DM 55 in the second round) and reservation values (DM 65 for the first round and DM 77 for the second round) were used in all sessions and treatments.

In the *two-way communication treatments* (email and video), the seller and the buyer were given the opportunity to communicate with each other before making their decisions. Subjects could use their communication phase for making proposals regarding their bids, but they were not permitted to reveal any personal information like their names, addresses, and telephone numbers. While in the video treatment, subjects were allowed to communicate for a maximum of 10 minutes via a video-conferencing system, in the email treatment, they were allowed to exchange email messages for a maximum of 15 minutes via the computer system.

³ The equilibria abstract away from the integer restriction associated with strictly positive monetary payoff units. Taking these into account, however, would not meaningfully change the set of equilibria. Note also that the asymmetric information condition creates a situation similar to the ultimatum game. In this sequential bargaining game a certain amount of money is divided to two players. The first mover suggests a division and the second mover either accepts or rejects the offer. In the former case the proposed division is realized while in the latter case both players receive nothing. The experimental literature on the ultimatum game originates with Güth et al. (1982). Overviews have been provided by Güth (1995) and by Roth (1995).

⁴ Of course, when there is no communication allowed, we do not distinguish between one- and two-way.

⁵ Instructions including bargaining examples can be found in Appendix B.

In the *one-way communication treatments* (email and video), only the seller was given the opportunity to communicate, i.e., to send a message to the buyer. This message was transferred to the buyer together with the decision formula filled in with the seller's ask. Like in the two-way communication conditions, the seller could use the message to make proposals regarding the buyer's bid, but was not permitted to reveal any personal information. In the email treatment, sellers were allowed to send an email message via the computer system, not exceeding 20 lines on the computer screen. In the video treatment, sellers were allowed to send a video message not exceeding 5 minutes via a video-conferencing system.

After the communication phase (if available), the seller wrote his ask price down on a decision form that was handed to the buyer, who then wrote his bid down on the same form. This was then collected by the experimenter, and the second round began. After completing both negotiation rounds, one of the rounds was randomly selected, and the earnings made in the selected round were privately paid off together with a DM 10 show-up fee. Overall, average payoffs were about DM 25 (approx. \$12).⁶

4 Data analysis

4.1 Values and costs

An elementary theoretical prediction is that sellers charge higher prices in round 2, when costs are higher, and that buyers never reject a favorable offer. These predictions find strong support. All but one seller demanded more in round 2,⁷ and only 7% of the buyers rejected a favorable offer. This does not imply, however, that sellers and buyers closely followed the theoretical predictions. As we will see in the next section, sellers ask for considerably less than predicted, and those buyers who accept the offer bid considerably more than what would have been profit-maximizing.

⁶ All sessions were run at the *Laboratory for Experimental Economics in Magdeburg* (MaxLab). In order to minimize reputation effects, we tried to ensure that subjects were not acquainted with their game partners and had no contact with them either before or after the experiment. Therefore, in addition to their registration, subjects had to sign a form, stating that they will inform the experimenter when they notice that an acquaintance will take part at the same session. For the experiment each subject was assigned a different room. Having arrived at their rooms, subjects were led one by one to a soundproof cabin where they had to stay for the whole session. Subjects were at no time informed about the payoffs, identity, or private information relating to other subjects.

⁷ In some treatments, there is an indication of learning effects across rounds. In particular, deviations from the theoretically predicted values (under the assumption of risk neutrality) tend to be higher in the first than in the second round ($p < 0.05$, except for the symmetric treatments with no and with two-way video-communication, two-tailed Wilcoxon test).

4.2 Information

Aggregating over both rounds of bargaining, Figure 1 shows the average asks of sellers as a percentage of the theoretically predicted values under the assumption of risk neutrality (the predictions are 61.5 in round 1 and 77.5 in round 2).⁸

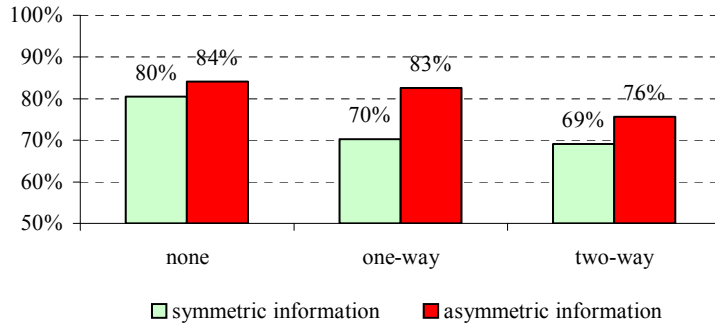


Figure 1: Average sellers' asks as a percentage of the theoretically predicted values

In all treatments the average sellers' asks are significantly lower than those predicted by theory ($p < 0.003$, two-tailed one-sample t-test). This is in line with risk aversion: risk-averse sellers would reduce their asks to decrease the probability of overbidding the buyers' reservation values. But risk aversion cannot fully explain this effect because there are also significant deviations in the asymmetric information condition where, in equilibrium, nobody faces any risks.

The cumulative distributions in Figure 2 reveal that the asks of informed sellers are concentrated between the equal split of the total gain from trade ("equa") and the buyer's reservation value ("value").⁹ This gives rise to the conclusion that sellers are willing to allocate a certain proportion of the total gain from trade to the buyers, even though they know that the buyers are not informed about the exact size of the pie.¹⁰

⁸ Because there are no significant differences between the sellers' asks with email and video communication ($p > 0.314$ for each of the information/communication opportunity conditions, two-tailed Mann-Whitney U test), we aggregated the data over the different media.

⁹ Because sellers neither underbid their cost nor overbid the buyer's reservation value (except for one seller who slightly overbid the buyer's reservation value by 0.5), we normalized the sellers' asks for each round on the interval: 0 = seller's cost, 1 = buyer's reservation value.

¹⁰ Similar observations were made by Güth et al. (2001), among others. A possible explanation for this behavior is inequity aversion. In fact, recent theoretical and experimental studies (see Bolton and Ockenfels, 2000, and Fehr and Schmidt, 1999, for theories and the references cited therein for empirical support) suggest that inequity aversion is a major motive in bargaining games similar to the one studied here. Note that, in equilibrium of our sequential bargaining game, the seller collects the whole (expected) gain from trade, regardless of the information and communication scenario. Since an inequity-averse seller is willing to allocate a larger share to the

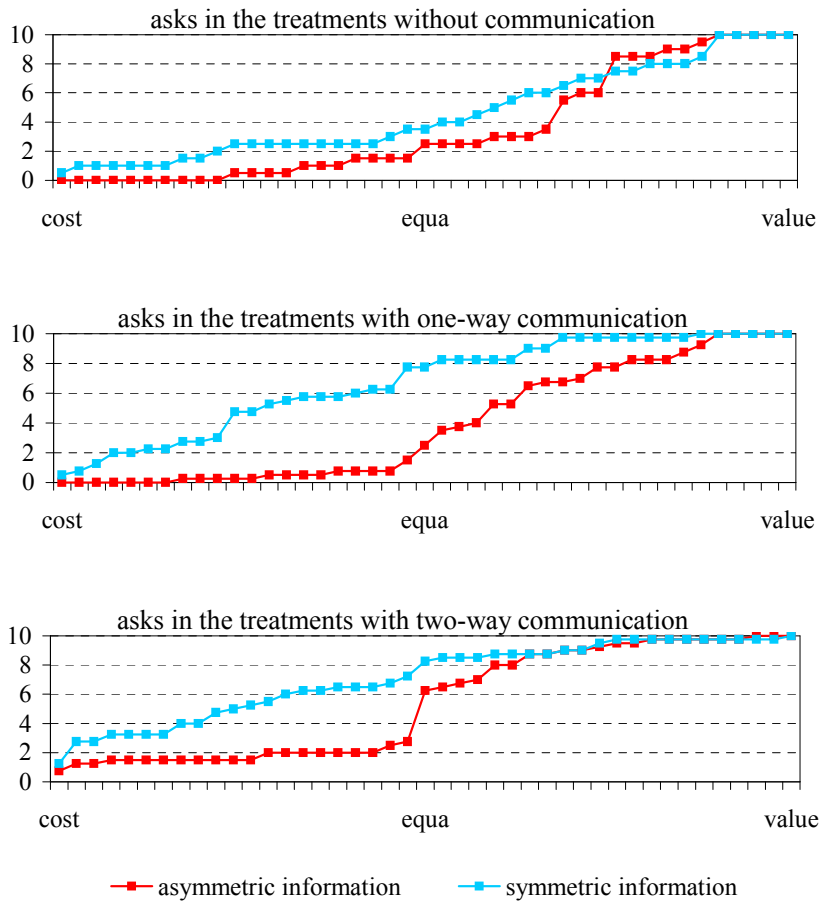


Figure 2: Normalized cumulative distribution of the sellers' asks

As theoretically predicted, there is no detectable difference in buyers' behavior across information treatments. We note, however, that about 28 percent of those buyers who accepted the offer on average bid an amount that is higher than predicted, and that about 7 percent of the favorable offers are rejected.¹¹

buyer than a selfish seller, inequity aversion can explain the systematic deviations from theory in favor of the buyers irrespective of the information scenario. Moreover, models of inequity aversion predict that in the asymmetric information case the distributions are mainly concentrated between the equal split of the total gain from trade and the buyer's reservation value, which is indeed the case: Unlike in the symmetric information conditions, the distributions of sellers' asks in the asymmetric information conditions with none, one-way and two-way communication are significantly different from the uniform distribution ($p < 0.06$, two-tailed Kolmogorov-Smirnov test).

¹¹ In total, the frequency of buyers whose bids are fully in line with the theoretical prediction is significantly lower than 100 percent for all information/communication opportunity treatments ($p = 0.000$, one-tailed binomial test).

4.3 Communication

The medium used for communication neither significantly influenced the sellers' average asking prices ($p > 0.314$ for all information/communication opportunity treatments, two-tailed Mann-Whitney U test) nor the buyers' response to the sellers' asks ($p > 0.178$ for all information/communication opportunity treatments regarding the number of buyers choosing the subgame perfect bid, rejecting or overbidding the sellers' offers, two-tailed exact χ^2 test). The subsequent section, therefore, concentrates on the analysis of the communication configurations.¹²

The opportunity to communicate leads the sellers to reduce their asks. Uninformed sellers submit significantly lower asks with one-way and two-way communication, and informed sellers significantly reduce their asks with two-way communication ($p < 0.018$, two-tailed Mann-Whitney U test, see Figure 3).¹³ Thus, communication could not be used by sellers to increase profits but, quite to the contrary, even one-way communication makes a seller eventually worse off with respect to pecuniary gains. It seems conceivable that fairness motives are more salient when subjects can communicate (Bohnet 1996, Brosig et al., forthcoming).

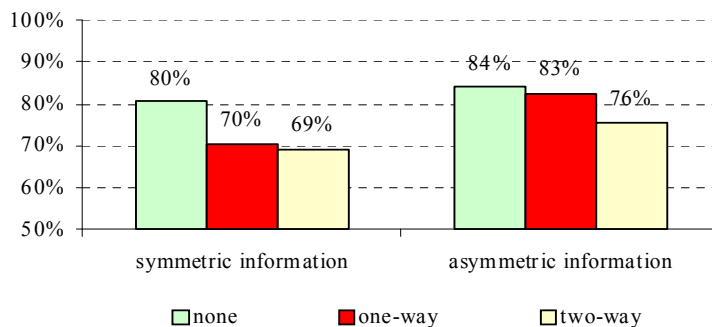


Figure 3: Average sellers' asks as a percentage of the theoretically predicted values

We can learn more about the differences of one- and two-way opportunities by looking at the number of buyers and sellers who obviously decided on the equal split of the gains from trade. The equal split can most easily be realized by following one of two methods. First, both traders can exactly bid their costs and reservation value, respectively (letting the experimenter

¹² Since there are no statistically detectable differences across communication media and configurations with respect to buyer behavior, we focus on seller behavior here.

¹³ Only in the latter information condition, we observe significant differences between the one-way and the two-way communication treatment ($p = 0.013$, two-tailed Mann-Whitney U test).

calculate the equal split price), and, second, both can directly bid the equal split price. Our data show that only two-way communication had a significant impact on the number of asks and bids that follow one of these strategies. That is, only with two-way communication significantly more buyers and significantly more sellers wanted to realize the equal split than without communication ($p < 0.018$) or with one-way communication ($p < 0.002$, two-tailed exact χ^2 test).¹⁴

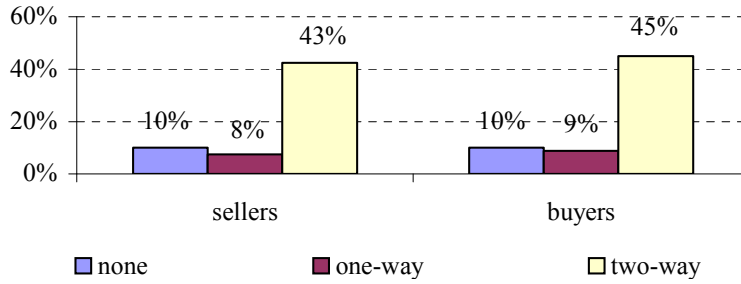


Figure 4: *Percentage of sellers and buyers whose decisions mirror an intention for the equal split of the total gain from trade*

4.4 Profits

As predicted by theory, in all treatments giving sellers additional information about the buyer’s reservation value significantly increases their average relative share of the realized total gain from trade ($p < 0.015$, two-tailed Mann-Whitney U test, Figure 5).

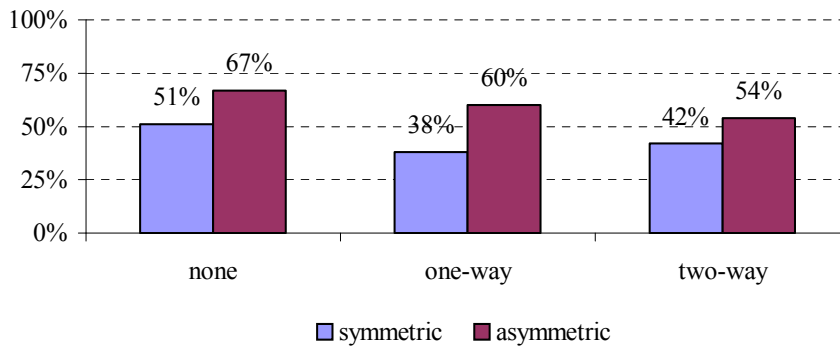


Figure 5: *Sellers’ profits as average percentage of the realized total gain from trade (information treatments)*

¹⁴ Because there were no significant differences between the communication medium treatments and between the information conditions ($p > 0.340$, two-tailed exact χ^2 test), we summarized our data across these treatments.

However, communication in general negatively affects the sellers' relative profit. In particular, uninformed sellers who are given the opportunity for one-way communication receive a significantly lower share of the total gain from trade than sellers who are not given this communication opportunity ($p < 0.041$, two-tailed Mann-Whitney U test, Figure 6). Informed sellers' relative profits are significantly reduced with both one-way and two-way communication ($p < 0.024$), whereby the reduction with two-way communication is somewhat larger than that with one-way communication ($p < 0.090$, two-tailed Mann-Whitney U test). But, even with two-way communication, the informed sellers' average profits are not significantly lower than 50 percent ($p > 0.281$, two-tailed one-sample t test). It rather seems that, particularly in this information condition, communication reduces the inequality between the buyers' and the sellers' profits. Obviously both, communication and the certain knowledge of the equal split price by the seller, favor the realization of the equal split.

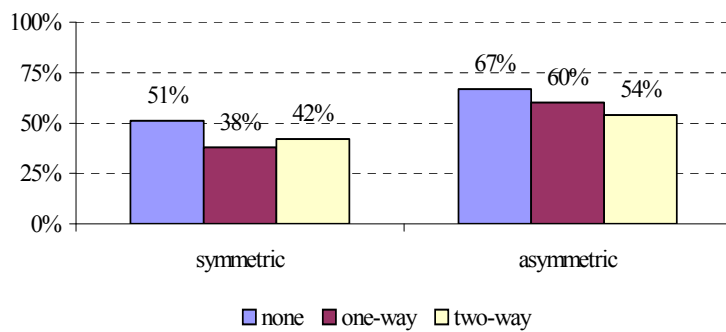


Figure 6: Sellers' profits as average percentage of the realized total gain from trade (communication treatments)

5 Summary and discussion

We investigated the effects of information and communication in a sequential bilateral bargaining game with incomplete information. Both treatment variables had a stronger effect on the sellers' than on the buyers' behavior. Particularly, we find that giving sellers additional information about the buyer's reservation value increases their asking prices as well as their share of the total gains from trade. This increase cannot be fully explained by risk aversion, since even the informed sellers' asks and profits are significantly lower than those predicted

by theory. This implies that, even though buyers do not know the exact amount of the seller's cost, sellers are willing to allocate some money from the total gain from trade to the buyers.¹⁵

While information helps the seller, communication hurts him with respect to profits. Sellers who are given the opportunity for communication reduce their asking prices and, as a result, receive lower profits than sellers who are not given this opportunity. This decrease of the sellers' profits reflects a reduction of the inequality between the buyers' and the sellers' share of the total gains from trade, which is particularly obvious in the treatments with informed sellers and which is particularly strong with two-way communication. This observation is supported by the finding that only two-way communication significantly increases the number of subjects whose bids show an intention for the exact equal split of the total gain from trade.¹⁶

Contrary to our expectations, we find no significant effects of the communication medium either with regard to the subjects' bids or with regard to their profits. Although recent studies on two-way communication revealed that the communication medium could strongly affect the subjects' behavior (see e.g. the prisoner's dilemma experiments by Frohlich and Oppenheimer 1998, the incomplete information bargaining game experiments by Valley et al. 1998, and the complete information bargaining game experiments by Brosig et al. 2002), we cannot replicate these results in our study.¹⁷

Gelöscht: —Seitenumbruch—

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¹⁵ This observation corresponds to those made in the ultimatum game with asymmetric information. Although in this game only the proposer knows the exact size of the pie, he allocates on average a positive amount to the receiver. See for example the experimental studies by Mitzkewitz and Nagel (1993), Croson (1996) and Kagel et al. (1996). Nonetheless, the given amounts in ultimatum games with asymmetric information are, on average, lower than those allocated in ultimatum games with complete information.

¹⁶ Similar results of two-way communication are reported in the bargaining experiments by Roth (1995), Valley et al. (1998) and Brosig et al. (2002).

¹⁷ It is interesting to note, however, that the communication medium seems to affect the way equal splits are realized. For asymmetric information and two-way communication, all fair-minded subjects directly bid the equal split price with email communication, while with video communication, some subjects also bid their costs and values, respectively. Since bidding values and costs can more easily be exploited than bidding equal split prices, this suggests that video conferences establish more trust and trustworthiness than email communication. However, our sample sizes are too small to support this observation statistically.

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Appendix A: Data

pair	round 1		round 2	
	seller	buyer	seller	buyer
bids in the treatment with symmetric information and no communication				
1	45	55	75	74
2	50	50	55	65
3	30	30	60	60
4	47	50	65	65
5	53	53	70	50
6	23	23	75	0,01
7	49	55	68	68
8	42	45	75	77
9	55	55	59	59
10	59,5	59,5	73	27
bids in the treatment with asymmetric information and no communication				
11	44	44	75	77
12	51	64	72	72
13	58	58	70	70
14	55	55	68	68
15	37	37	66	66
16	40	45	60	60
17	53	60	72	72
18	55	55	70	70
19	59,99	60	70	70
20	55	55	70	70
bids in the treatment with symmetric information and one-way email communication				
21	23	23	56	76
22	50	55	56	56
23	35	35	65	65
24	40	60	62	65
25	33	35	55	56
26	35	50	60	60
27	33	33	65	65
28	50	50	65	66
29	36	50	70	70
30	30	30	65	65
bids in the treatment with asymmetric information and one-way email communication				
31	45	45	66	66
32	30	35	65	65
33	60	60	74	73
34	50	50	75	75
35	50	50	69	69
36	45	47	65,5	70
37	59	50	65	65
38	35	35	66,5	66,5
39	56	56	71	71
40	48	48	65	67
bids in the treatment with symmetric information and one-way video communication				
41	25	65	60	60
42	60	50	57	57
43	23	65	60	60
44	45	45	70	70
45	50	50	60	60
46	32	35	64	64
47	45	45	65	65
48	43	43	70	70
49	25	25	56	58
50	30	30	60	60

pair	round 1	round 2	pair	round 1
	seller	buyer		seller
bids in the treatment with asymmetric information and one-way video communication				
51	53	53	68	68
52	54	54	74,5	60
53	45	45	66	66
54	47	47	68	0
55	60	60	75	73
56	54	60	68	66
57	56	64	62,5	63
58	45	49	69	69,5
59	51	51	68	78
60	50	65	66	66
bids in the treatment with symmetric information and two-way email communication				
61	34	34	66	66
62	55	55	58,5	58,5
63	45	45	57,5	57,5
64	30	30	60	10
65	35	36	58	58
66	42	42	62	66
67	35,75	35,75	77,5	77
68	23	65	68	68
69	31,15	31,15	64,11	64,11
70	23	65	55	77
bids in the treatment with asymmetric information and two-way email communication				
71	50	50	66	66
72	44	44	65	77
73	35	35	56	56
74	62,5	62,5	68,2	68,2
75	55	55	73	73
76	50	50	66	66
77	47	47	66	66
78	44	44	66	66
79	42	42	66	66
80	44	44	66	66
bids in the treatment with symmetric information and two-way video communication				
81	54	54	56	56
82	39	39	56	56
83	44	44	66	66
84	52	52	58,5	56,5
85	23	65	55	77
86	23	65	55	77
87	54	54	55	77
88	23	65	55	77
89	36	36	55	65
90	44	44	65	65
bids in the treatment with asymmetric information and two-way video communication				
91	23	65	55	55
92	48	48	66	66
93	44	44	66	66
94	48	48	67	67
95	23	65	61	77
96	42	42	55	77
97	52	52	71	71
98	23	65	66	66
99	45	45	66	66
100	47,5	47,5	68	68

Appendix B: Instructions, examples, and decision form

Instructions for the symmetric / [asymmetric] information treatments

Preliminary remarks:

You are participating in an experimental analysis of individual decision making. During the session you will attend to two negotiations. In doing so, you will earn money. The exact amount will depend on the decisions of all negotiators. At the end of the session, one of the two negotiations will be selected randomly, and your earnings from the selected negotiation will be paid off together with a 10 DM show-up fee.

Please closely read the following instructions. If you have any questions, you are allowed to give a signal at any time during the session by switching on the camera on the monitor. We will come to you and answer the questions.

Negotiation:

In each of the two negotiations you are attending, there are a buyer and a seller who bargain over the price of a (fictitious) commodity. If they obtain an agreement, the buyer has to pay the negotiated price to the seller. The buyer's profit is his value of the commodity (which will be assigned to him) minus the price, and the seller's profit is the price minus his costs (which will be assigned to him). In the negotiation, neither the buyer knows the seller's costs, nor the seller knows the buyer's value. [In the negotiation, the buyer does not know the seller's costs, but the seller knows the buyer's value.]

In a moment, you will learn whether you are the buyer or the seller. You will keep the same role in both negotiations. However, your (anonymous) partner will change after the first negotiation. Similarly, the costs and values will be newly determined in the second negotiation.

Assignment of values and costs:

For every negotiation, two amounts are determined randomly and independently from each other, ranging from 0,00 DM – 100,00 DM. Each amount within this range can be selected with the same probability. The higher of the two amounts will be assigned as value to the buyer. The lower of the two amounts will be assigned as costs to the seller. This implies that the seller's costs are never higher than the buyer's value of the good. That is, if both negotiators reach an agreement, they can realize a total profit of between 0 DM and 100 DM. The trading price determines how this gain is distributed between the two negotiators.

How is the trading price determined?:

The seller makes an offer to the buyer, who then makes his bid. Both negotiators reach an agreement only if the buyer's bid is higher or equal to the seller's asking price (if it is not, the profit of both negotiators is zero). In the case of a mutual agreement, the following applies:

$$\text{trading price} = (\text{seller's ask} + \text{buyer's bid})/2,$$

i.e., the price at which the commodity is traded is determined as the midpoint of the seller's ask and the buyer's bid. From this it follows that (see also the examples given at the end of the instructions):

- if the seller exactly asks his costs and the buyer exactly bids his value, the total profit of their agreement is equally distributed between both negotiators;
- if the buyer exactly bids the seller's asking price, the trading price equals the buyer's bid and the seller's ask;
- if the buyer's bid is lower than the seller's asking price, both negotiators miss out.

Please note that the buyer makes a loss if the trading price is higher than the value which is assigned to him. The seller makes a loss if the trading price is lower than the costs which are assigned to him.

(One-way communication treatments): Negotiation rules:

Every seller will receive a decision form as well as a piece of paper with his costs [and the value assigned to the buyer]. [That is, the seller knows the buyer's value if he makes his offer.] The seller has to fill in the decision form with his offer.

Email treatment: Moreover, the seller is given the opportunity to send an email message to the buyer. This message can be used to make proposals regarding the bid and ask. The seller is not allowed to reveal personal information like name, address, telephone number, etc. If the seller does not abide by these rules, we have to suspend him from the experiment. That is, he will not receive any payment at the end of the session. The length of the message must not exceed 20 lines, but may be shorter.

Video treatment: Moreover, the seller is given the opportunity to send a video message to the buyer. This message can be used to make proposals regarding the bid and ask. The seller is not allowed to reveal personal information like name, address, telephone number, etc. If the seller does not abide by these rules, we have to suspend him from the experiment. That is, he will not receive any payment at the end of the session. The duration of the message must not exceed 5 minutes, but may be shorter.

Every buyer receives his seller's decision form as well as a piece of paper with his value. That is, the buyers know their seller's asking price if they make their bid.

Email treatment: Before the buyer makes his bid, he is shown the email message of his seller on the computer.

Video treatment: Before the buyer makes his bid, he is shown the video message of his seller.

After the buyers have made their bids, the decision forms are collected.

Then the second negotiation begins under the same rules (but with new values, new costs, and a new negotiation partner).

(Two-way communication treatments): Negotiation rules:

Every seller will receive a piece of paper with his costs [and the value assigned to the buyer]. Every buyer will receive a piece of paper with his value.

Email treatment: After having read the papers, both negotiators are given the opportunity to communicate per email messages. (Note that the papers are collected before communication starts, but that you are allowed to take notes.) Communication can be used to make proposals regarding the bid and ask. Neither the buyer nor the seller are allowed to reveal personal information like name, address, telephone number, etc. Anyone not abiding by these rules will be suspended from the experiment. That is, they will not receive any payment at the end of the session. Communication must not exceed 15 minutes, but you are free to finish earlier.

Video treatment: After having read the papers, both negotiators are given the opportunity to communicate via a video-conferencing system. (Note that the papers are recollected before communication starts, but that you are allowed to take notes.) Communication can be used to make proposals regarding the bid and ask. Neither the buyer nor the seller are allowed to reveal personal information like name, address, telephone number, etc. Anyone not abiding by these rules will be suspended from the experiment. That is, they will not receive any payment at the end of the session. Communication must not exceed 10 minutes, but you are free to finish earlier.

After communication every seller receives a decision form that he has to fill in with his ask (in DM). This decision form will be handed to the buyer. That is, the buyer knows his seller's asking price if he makes his bid. After the buyer has made his bid, the decision form is collected.

Then the second negotiation begins under the same rules (but with new values, new costs, and a new negotiation partner).

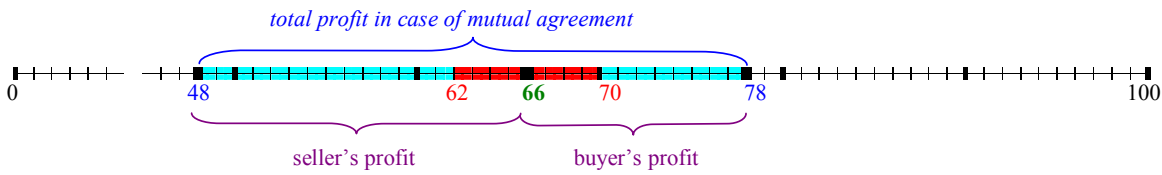
Payment:

After both negotiations one of the two negotiations is randomly selected, and the profit you made in this selected negotiation is paid out in confidence. Nobody will be informed about your payoff, your costs or your identity.

Some Examples

Example 1

seller's costs: 48 DM buyer's value: 78 DM
 seller's ask: 62 DM (> seller's costs) buyer's bid: 70 DM (< buyer's value)



bid ≥ ask, i.e., the commodity is traded → trading price: $(62 \text{ DM} + 70 \text{ DM})/2 = 66 \text{ DM}$

seller's profit (trading price – seller's costs): 66 DM – 48 DM = 18 DM
 buyer's profit (buyer's value – trading price): 78 DM – 66 DM = 12 DM

Example 2

seller's costs: 24 DM buyer's value: 52 DM
 seller's ask: 24 DM (=seller's costs) buyer's bid: 52 DM (=buyer's value)



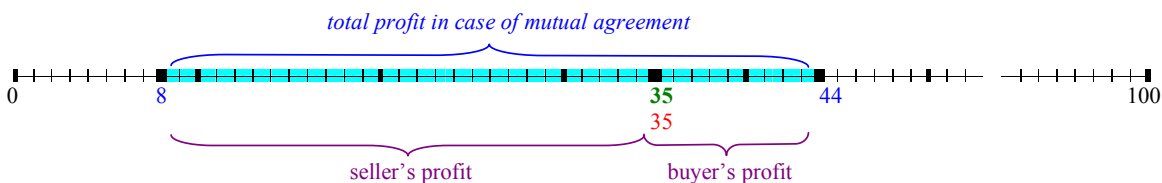
bid ≥ ask, i.e., the commodity is traded → trading price: $(24 \text{ DM} + 52 \text{ DM})/2 = 38 \text{ DM}$

seller's profit (trading price – seller's costs): 52 DM – 38 DM = 14 DM
 = buyer's profit (buyer's value – trading price): 38 DM – 24 DM = 14 DM

↙ That is, if seller and buyer bid their true costs and true values, respectively, the total profit is equally distributed between both actors.

Example 3

seller's costs: 8 DM buyer's value: 44 DM
 seller's ask: 35 DM (> seller's costs) buyer's bid: 35 DM (< buyer's value)

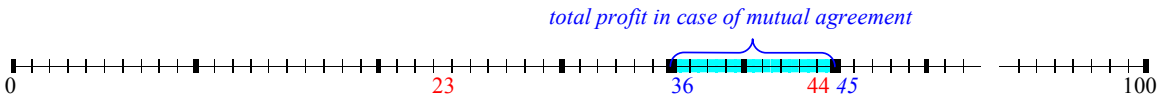


bid = ask, i.e., the commodity is traded → trading price: $(35 \text{ DM} + 35 \text{ DM})/2 = 35 \text{ DM} = \text{seller's ask} = \text{buyer's bid}$

seller's profit (trading price – seller's costs): 35 DM – 8 DM = 27 DM
 buyer's profit (buyer's value – trading price): 44 DM – 35 DM = 9 DM

Example 3

seller's costs: 36 DM buyer's value: 45 DM
 seller's ask: 44 DM (> seller's costs) buyer's bid: 23 DM (< buyer's value)

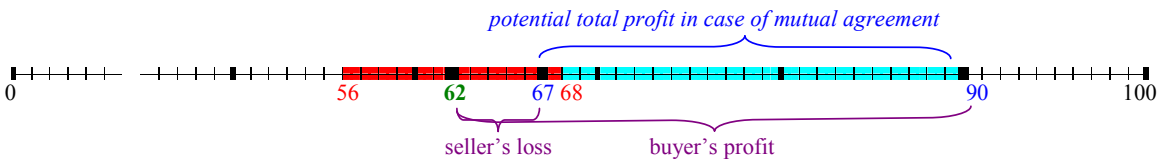


bid < ask, i.e., the commodity is not traded

seller's profit: 0 DM
 buyer's profit: 0 DM

Example 4

seller's costs: 67 DM buyer's value: 90 DM
 seller's ask: 56 DM (< seller's costs!) buyer's bid: 68 DM (< buyer's value)



bid > ask, i.e., the commodity is traded → trading price: $(56 \text{ DM} + 68 \text{ DM})/2 = 62 \text{ DM}$

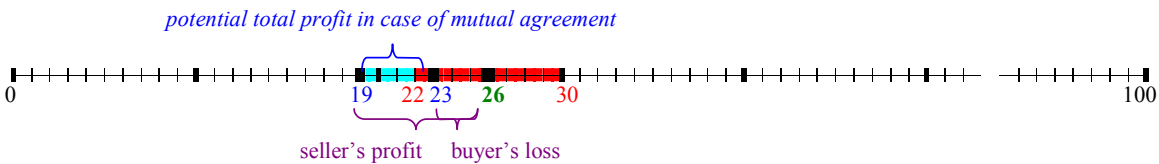
seller's profit (trading price – seller's costs): 62 DM – 67 DM = – 5 DM

The loss only occurs because the seller's ask is lower than his costs.

buyer's profit (buyer's value – trading price): 90 DM – 62 DM = 28 DM

Example 5

seller's costs: 19 DM buyer's value: 23 DM
 seller's ask: 22 DM (> seller's costs) buyer's bid: 30 DM (> buyer's value!)



bid > ask, i.e., the commodity is traded → trading price: $(22 \text{ DM} + 30 \text{ DM})/2 = 26 \text{ DM}$

seller's profit (trading price – seller's costs): 26 DM – 19 DM = 7 DM

buyer's profit (buyer's value – trading price): 23 DM – 26 DM = – 3 DM

The loss only occurs because the buyer's bid is higher than his value.

You are the buyer:

Your value of the commodity in the x round is: x DM

(Please note that the amounts are randomly determined, ranging from 0 DM - 100,00 DM, and are then rounded up to the next integer. However, you are free to make your bid in decimal amounts.)

You are the seller:

Your costs of the commodity in the x round are: x DM

(Please note that the amounts are randomly determined, ranging from 0 DM - 100,00 DM, and are then rounded up to the next integer. However, you are free to make your ask in decimal amounts.)

Decision Form

SELLER:

Please fill in your ask here: DM

BUYER:

The seller has decided for this ask. _____

Please fill in your bid here: DM