Promises and Social Distance in Buyer-Determined Procurement Auctions

A Test with Laboratory and Field Data

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This study is the first to explore the effects of communication and its interaction with reputation information. Our focus is on buyer-determined procurement auctions with moral hazard in which buyers can select a bidder based on prices and all other information available. The results of our controlled laboratory experiment demonstrate that – in contrast to reputation information – communication only slightly increases market efficiency. If reputation information is available, communication has no additional efficiency effect. Buyers' choice of a bidder is influenced by both, reputation information and the content of communication. Specifically, buyers prefer bidders with a good reputation and bidders who promise them a specific profit. If this kind of promise is infeasible – as it is often the case in real auctions, buyers prefer bidders whose arguments reduce social distance. Unspecific promises have no significant effect. Using a unique set of field data, we compare observed buyer choices with those in the field and find a choice pattern that is consistent with our lab data. High reputation bidders and bidders reducing social distance by initiating communication through additional channels are more likely to be selected as auction winners.

Keywords: procurement auctions, communication, moral hazard, promises, social distance, reputation

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1 Introduction

Procurement transactions require a certain degree of trust as defining complete contingent contracts for the delivery of goods or services is usually infeasible (see, e.g. Lyons, 1996, Macaulay, 1993). This issue is exacerbated by the fact that more and more transactions are conducted online and with geographically distant strangers (see, e.g., Cutcheon & Stuart, 2000, MacLeod, 2007). In these situations most decision-makers do not solely rely on prices, but often turn to communication next to reputation to gather information before selecting suppliers (see, e.g., Gattiker er al., 2007, Spagnolo, 2012).

This study focuses on a highly structured method of buying: buyer-determined procurement auctions. In these auctions buyers can freely choose between bidders based on prices and all other information available. We ask how messages by bidders influence behavior in a market with moral hazard as messages often accompany bids in the field. Even though communication between buyers and bidders is widespread its effects on buyers' choices as well as their interaction with reputation information have been largely ignored in theoretical and empirical research. Therefore, we first analyze experimentally how market outcomes are affected by the possibility to communicate and how this effect interacts with the availability of a reputation mechanism. Then we investigate what message content affects buyers' choices. To this end we compare the experimental communication to a unique data set of messages from procurement auctions in the field. Based on previous evidence (see the overview below) we focus on two pieces of communication content: promises and attempts to reduce social distance.

From a game-theoretic point of view, communication is cheap talk and does not influence behavior whenever the interests of agents are opposed. If their interests are similar, communication can influence outcomes by helping agents to coordinate (see Crawford, 1998, for a summary). Starting with experimental work on social dilemmas, namely the prisoner's dilemma and public good games, cheap talk communication has nevertheless been shown to influence human behavior in a variety of games. Communication usually increases the efficiency or equality of outcomes (see Brosig, 2006, and Sally, 1995, for overviews). During the last decades several potential explanations for the influence of cheap talk have emerged. One popular explanation is that communication allows agents to reduce social distance thereby making the opponent's payoff more salient or allowing for reputation building. Social distance is put forward, for example, to explain varying donations in dictator games (see Bohnet & Frey, 1999, and Hoffman et al., 1996). Another prominent explanation is based on evidence for the impact of promises on behavior. In trust games, for example, trustees' promises to return money increases investments by first-movers. This effect can be attributed to guilt aversion or a preference for promise keeping *per se* (see Charness & Dufwenberg, 2006, and Varnberg, 2008).

Our results suggest that bidders' specific profit promises trump attempts to reduce social distance in the anonymous setting of the laboratory while unspecific promises do not influence choices. This observation is made in markets with and without reputation mechanisms. However, once communication is restricted and specific promises are excluded from the message space, buyers prefer bidders whose arguments reduce social distance while unspecific promises remain ineffective.

2 Related literature

Buyer-determined procurement auctions

Including the seminal work by Vickrey (1961), economic research on auctions has always considered procurement auctions (or "tenders") next to standard auctions. Buyer-determined procurement auctions are procurement auctions in which buyers can freely select the winner from among the bidders. These auctions are typically applied when the procured goods and services can vary across bidders. For example, the effort exerted when providing a service may differ or the lead time necessary for delivering a product. In these cases bid attributes other than price can considerably affect the buyer's profit from the transaction. If these attributes can be easily quantified, scoring auctions can be used instead. In these auctions bidders bid along several dimensions and the winner is determined based on the overall score (see, e.g., Che, 1993, and Asker & Cantillon, 2008). Nevertheless, as Jap (2002) and Haruvy & Katok (2013) point out, in most applications procurement auctions are buyer-determined. For example, important attributes such as reputation or quality may be difficult to quantify or buyers may find it impossible to commit credibly to a scoring rule ex ante.

Accordingly, a growing literature in economics and management science covers behavior in buyer-determined procurement auctions. Engelbrecht-Wiggans et al. (2007), Shachat & Swarthout (2010) and Fugger et al. (2013) compare behavior in buyer-determined auctions theoretically and experimentally to behavior in price-based mechanisms. These studies consider a setting with exogenously determined quality where buyers can choose based on quality and prices. A first laboratory experiment on reputation in buyer-determined auctions is presented by Brosig-Koch & Heinrich (2012) who consider a setting with moral hazard. In their setting quality cannot be contracted upon and bidders can endogenously choose how much costly quality to deliver. Brosig-Koch & Heinrich (2012) observe much higher market efficiency in buyer-determined auctions with reputation than in price-based auctions where buyers cannot consider reputation but are bound to buy from the lowest bidder.[1] Heinrich (2012) and Yoganarasimhan (2013) consider reputation in buyer-determined auctions for services in the field. Both find that improving reputation increases a bidder's probability of being selected as a supplier. Heinrich (2012) additionally analyzes the influence of communication on buyer choices observing that sending one or more messages increases a bidder's probability of winning. This study does not consider communication content, however.

Social distance

In experimental economics the term "social distance", originally coined by sociologists and psychologists, is used in connection with a range of experimental variations.[2] Several studies analyze the role of social distance in the *dictator game* by varying the degree of anonymity between subjects and the experimenter (see, e.g., Hoffman et al. 1994, 1996) or by revealing personal information about each other to players (see, e.g., Bohnet and Frey, 1999, Burnham, 2003, Charness and Gneezy, 2008). These studies provide evidence that smaller social distance can lead to higher donations.[3] Further studies focus on the relationship between dictators and receivers in existing social networks. Brañas-Garza et al. (2010), Goeree et al. (2010) and Leider et al. (2009) observe that altruistic behavior diminishes with increasing social distance. In these latter studies social distance refers to the length of the path that connects both players within the network.

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[1] A review on recent research on reputation in public procurement is provided by Spagnolo (2012).

[2] According to Liberman et al. (2007) psychological distance refers to the degree in which objects and events are present in an individual's direct experience of reality. Social distance is a form of psychological distance that measures the distance towards other people. Akerlof (1997) presents an example on how to incorporate social distance into an economic model of behavior.

[3] Note that there are also studies which do not find an effect of experimenter-subject anonymity (see, e.g., Bolton und Zwick, 1995). Dufwenberg & Muren (2006) observe less generosity in dictator games if dictators are paid publicly and not privately. They provide a discussion on the problems of organizing these experimental results in terms of anonymity.

Another stream of the literature examines social distance in *trust games*. Glaeser et al. (2000) and Binzel & Fehr (2013), for example, find that in trust games people's behavior is influenced by their relative position in their social network. In their experiment, Glaeser et al (2000) allow subjects who arrive together for the experiment to play the trust game with each other. They observe that the number of friends two players have in common and the duration of their acquaintanceship are positively associated with trust and trustworthiness. Binzel & Fehr (2013) observe that friends are trusted more and behave more trustworthy than strangers. Other studies vary social distance in trust game by creating artificial groups of subjects (see, e.g,. Buchan et al, 2006) or varying the physical distance between players (see, e.g., Charness et al., 2007).

Most closely related to our work are studies on partner selection in trust games. In these studies first-movers can choose between potential trustees. Eckel & Wilson (2000), for example, find that first-movers prefer to play with second-movers that are labeled with a friendly facial icon. Players marked with a neutral or unfriendly icon are less likely to be selected. More recently, Fiedler et al. (2010) study partner selection in the laboratory as well as in a virtual community. In both settings they let the first-mover communicate with one of two potential second-movers before the game. The other second-mover cannot participate in the chat but the money he returns is multiplied with the larger multiplier. In the laboratory as well in the virtual community first-movers are more likely to select the communication partner as the second-mover. In the virtual environment the number of emoticons and acronyms used in the pre-game chat is positively associated with the probability of choosing the communication partner and with the amount sent to him. The amount returned by the second-mover is not mediated by communication content, though.[4]

Promises

Messages containing promises have been found to influence behavior across a range of experimental settings, for example, in public good games (Ostrom, 1998), in sequential bargaining (Brosig et al., 2004), or the hold-up problem (Ellingsen & Johannesson, 2004). Yet, a stream of

[4] Derks et al. (2008) summarize research that compares the transmissions of emotions in face-to-face and text-based computer mediated communication. They conclude that emotions are expressed as frequently in online communication as in offline communication because people use emoticons or by verbalize their emotions. According to Fischer & Manstead (2008) emotions in humans serve an affiliation function as well as a social distancing function in social survival (i.e. the capacity to build social bonds and to address social problems).

recent research on non-binding promises has been sparked by the work of Charness & Dufwenberg (2006). In their study of a trust game with moral hazard they observe more efficient outcomes in a treatment with communication than in a treatment without. Within the communication treatment promises by second-movers lead to more trusting and trustworthy behavior.[5] Charness & Dufwenberg (2006) propose an explanation based on guilt aversion. According to this explanation players feel guilty if they fail to fulfill another person's expectations. In the trust game a second-mover who promises to be trustworthy can shape the first-mover's believe thereby making trustworthy behavior less costly for himself. In a follow-up study Vanberg (2008) compares this expectation-based explanation to a commitment-based explanation. This explanation, which is favored by his experimental evidence, instead posits a preference for keeping one's word *per se*.[6]

Charness & Dufwenberg (2011) extend the trust game of their previous study to analyze communication in a setting with adverse selection. Also in this setting communication increases efficiency of outcomes. Goeree & Zhang (2013) successfully replicate their results and extend the game by introducing competition between second-movers based on their messages sent to first-movers. With respect to efficiency they observe that communication and competition act as substitutes. In their competitive setting communication decreases efficiency.

3 Experimental design

Our experiment follows the basic set up of Brosig-Koch & Heinrich (2012). It employs variants of buyer-determined auctions, more precisely buyer-determined procurement auctions with sealed-bids, independent private values and two bidders. Subjects face a human opponent as well as a human buyer in a series of these auctions. Before participating in buyer-determined auctions all subjects play a series of first-price sealed-bid procurement auctions bidding against a computerized bidder. This training stage familiarizes subjects with the competitive bidding environment and is similar to many standard auction experiments. Behavior in this part can therefore serve as a benchmark for the behavior in the second part of the experiment. It can also be readily compared

[5] However, there is conflicting evidence. Deck et al. (2012) replicate the study by Charness & Dufwenberg (2006) under single- and double-blind conditions and find no influence of communication on behavior. The authors explain this by the high baseline trustworthiness already observed without communication.
[6] See also the models by Kartik et al. (2007), Chen et al. (2008), Kartik (2009), and Saran (2011), which are based on the assumption that individuals face a (psychological) lying cost when misreporting their private information.

to the body of experimental auction research.[7] In the following we will refer to the training stage as part I and to the main treatments as part II. Before we describe the treatments of part II, we will present the games that subjects play repeatedly in both parts.

The auction games

The first-price sealed-bid procurement auction used in part I is analogous to a standard first-price sealed-bid auction with symmetric independent private values without reserve price (for surveys see Krishna, 2002, McAfee & McMillan, 1987, Menezes & Monteiro, 2004, Wolfstetter, 1995; on competitive bidding with private costs see Cohen & Loeb, 1990, and Holt, 1980). Two bidders i = 1, 2 compete for a project. First bidders learn about their costs for completing the project. Bidders know that these costs c_i are independently drawn from a uniform distribution with support [100, 500] and that they cannot bid above 500. (We interpret this maximum bid as the buyer's valuation of the project v.) Then both bidders bid a price for which they are willing to execute the project. The bidder offering the lowest price wins the contract. Ties are broken randomly. In this auction the symmetric risk-neutral Nash-equilibrium bidding function depending on the cost realization c_i is given by

$$\beta^I(c_i) = 250+c_i/2.$$

The winning bidder becomes the seller and earns a profit of $\pi_S = \beta^I$-c_i from completing the project. The losing bidder is paid nothing.

For part II we modified the simple auction game described above to accommodate the situation of moral hazard commonly faced in procurement environments. After securing the project the seller can reduce his cost at the expense of the buyer, for example, by providing lower effort or by choosing a lower quality. To account for this possibility, we introduce a quality factor q_i that is chosen by the seller from the interval [0.5, 1]. It is multiplied with the seller's cost c_i and with the buyer's valuation v. As above, the two bidders know that their costs c_i are independently drawn from a uniform distribution with support [100, 500] and that they cannot bid above 500. The

[7] A preceding training stage is commonly employed in experimental auction research (see, e.g., Brosig & Reiß, 2007, Brosig-Koch & Heinrich, 2012, or Brunner, Goeree, Holt, Ledyard, 2010). Brosig & Reiß (2007) find that behavior in sequential procurement games is not influenced by whether subjects have participated in single first-price procurement auctions before. The single auctions in their experiment were equivalent to the ones used in the present study.

winning bidder choosing a bid b_i earns a profit of $\pi_S = b_i$-$q_i c_i$ while the losing bidder earns a profit of zero. The buyer earns $\pi_B = q_i v$-b_i.

The buyer-determined procurement auctions used in our experiment allow the buyer to freely choose between bidders. In all treatments the buyer can decide based on the prices demanded by bidders. Yet, depending on the treatment, additional information can be available to buyers:

(i) In treatments with *reputation* information buyers learn about bidders' quality choices in previous periods. In this case, the buyer is informed about the average quality $\overline{q}_i$ supplied in all previous auctions and the quality choice made in the last auction $q_i^{t\text{-}1}$.

(ii) In treatments with *communication* buyers may receive messages from bidders. All communication is unilateral, i.e. only bidders can send a message that accompanies their bid. We only differentiate regarding bidders' message space either allowing specific profit promises or not. In the latter treatment instructions included an additional sentence that forbade bidders to mention any specific quality, cost, or profit values. This designs accounts for the fact that in many real-life procurement auctions neither costs nor qualities or even profits can be reliably quantified *before* the trade takes place.

In a finite game with complete information and common knowledge of rationality and selfishness, none of the bidders will choose a quality factor q_i above 0.5 in the last auction. Buyers will ignore messages and select the lowest bidder. By backward induction the 0.5 quality level will be chosen in all previous auctions and the risk-neutral Nash-equilibrium bidding function is given by

$$\beta^{II}(c_i) = 125+c_i/4.$$

Buyer and seller earn a profit of $\pi_B = \pi_S = 125$-$c_i/4$ per auction. If we relax the assumptions of rationality and selfishness, several reputation equilibria may emerge, in which subjects choose above minimum quality.

Experimental procedure

Our design to study the influence of reputation and unilateral communication in buyer-determined auctions of part II is summarized in Table 1. (See the Appendix for the instructions.) The buyer-determined auction in which buyers can only decide based on prices serves as **Baseline** treatment. This treatment is strategically equivalent to a price-based auction. To the **Baseline** treatment we added reputation information in the reputation treatment **R** and seller messages in the communication treatment **C**. In the **C-L** treatment the message space was limited and could not include specific quality, cost, or profit values. In the **C-R** treatment reputation information as well as (unrestricted) seller messages were available.[8] All messages exchanged in the communication treatments had to preserve anonymity between subjects, i.e. subjects were not allowed to reveal any personal information. Messages were restricted to 420 characters.

The buyer-determined auctions of part II were repeated over 18 periods. The 72 subjects in each treatment were divided into 8 matching groups yielding 8 independent observations per treatment. Within a matching group 3 subjects took the role of buyers and 6 subjects acted as bidders. Subjects were randomly re-matched every period. In one period a buyer faced two bidders and knew that he would never meet the same pair of bidders in two consecutive periods.

Part II was preceded by the training stage in part I. It consisted of six first-price sealed-bid procurement auctions, in which all subjects acted as bidders and bid against a computerized opponent. In order to increase the comparability of bidding behavior between both parts of the experiment, subjects did not receive any feedback on the opponent's behavior, neither in the course of part I nor after its completion. Subjects were informed accordingly. Before the start of part II subjects received new instructions and a computerized test of understanding followed. In this test we asked subjects to determine buyer and seller profits in an example, in which they first had to choose three numbers representing the cost, the quality and the price. At the end of part II subjects were informed about their payoff in part I as well as about the outcomes of the 18 auctions in part II. The experiment concluded with a short questionnaire. Subjects received the money they earned in the auctions as well as a show-up fee in cash after completing the questionnaire.

Note that in part I we drew one series of costs for all subjects and another for the computerized bidder. This way all subjects faced the same behavior and the same costs in part I. In part II we drew six series of costs: One for each bidder of each matching group. In part II all matching groups therefore faced the same costs. This was done to make the behavioral observations straightforwardly comparable across treatments. The average payoff was 16 Euro plus show-up fee. Sessions were conducted with a total of 360 participants in the Essen Laboratory for Experi-

[8] We chose not to run a **C-L-R** treatment since forbidding specific promises in this treatment would be a much bigger intervention than in treatment **C-L**. Among others, we have to exclude any reference to behavior in previous periods because this is potentially a specific promise as the buyer learns about the reputation score.

mental Economics (elfe) using zTree (Fischbacher, 2007). Participants were students of different subjects. We balanced majors so that roughly half of the subjects in every matching group studied business or economics. They were recruited using ORSEE (Greiner, 2003).

Table 1 – Treatments

Treatment	Part I	Part II			
	Auction Type	Auction Type	Reputation Information	Communication	Number of Subjects
Baseline	First-price auctions	Buyer-determined auctions	-	-	72
R	First-price auctions	Buyer-determined auctions	Average quality & last period's quality	-	72
C	First-price auctions	Buyer-determined auctions	-	Bidder messages	72
C-L	First-price auctions	Buyer-determined auctions	-	Limited bidder messages	72
C-R	First-price auctions	Buyer-determined auctions	Average quality & last period's quality	Bidder messages	72

4 Experimental results

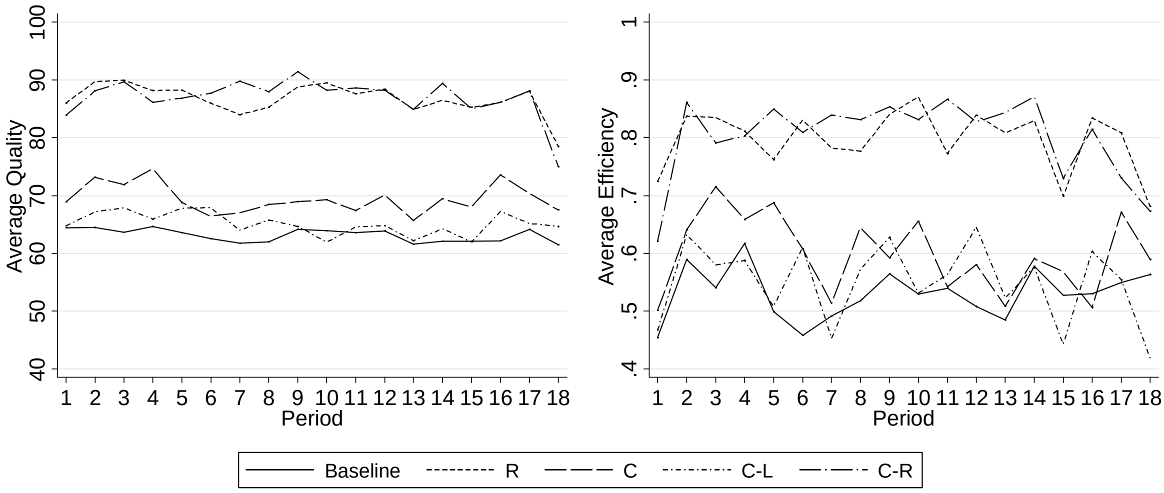
Market outcome

Before studying the role of communication in more detail, we ask how reputation and communication in general influence the market outcome in the buyer-determined procurement auctions of part II.[9] A comparison of the **Baseline** treatment with the reputation treatment **R** allows us to identify the pure influence of reputation information on behavior. A comparison of the **Baseline** treatment with the communication treatment **C** allows us to identify the pure influence of bidder messages.The **C-R** treatment in which buyers receive bidders' messages *and* information about bidders' average quality choices and their last period's quality choices, sheds light on the interaction of both modifications to the **Baseline** treatment. Finally, comparing the **C-L** to the **C** treatment allows isolating the effect of possible profit promises.

[9] We do not study the behavior in part I further. It reveals a pattern of overly aggressive bidding common in standard first-price sealed-bid auctions (see Kagel & Levin, 2008) and their procurement auction equivalent (Brosig and Reiß, 2007, Brosig-Koch and Heinrich, 2012).

The left side of Figure 1 displays the quality choices of bidders over the 18 periods in the four treatments. The right side shows the market efficiency that results from buyers' choices between bidders and bidders' delivered qualities. A market outcome is fully efficient if the buyer trades with the low cost bidder and receives a quality of 100 percent. Bidders in the **Baseline** treatment pick a quality of 63 percent on average, which is higher than the minimum quality of 50 percent, but much less than what would be efficient. In treatment **R**, i.e. if buyers are given the opportunity to pick a bidder based on his reputation, average quality starkly increases to 87 percent. The difference is significant (exact two-sided Mann-Whitney-*U* tests based on independent matching groups, *p*=0.000) and translate into significantly higher market efficiencies in both treatments (*p*=0.000).

Figure 1 – Quality and Efficiency



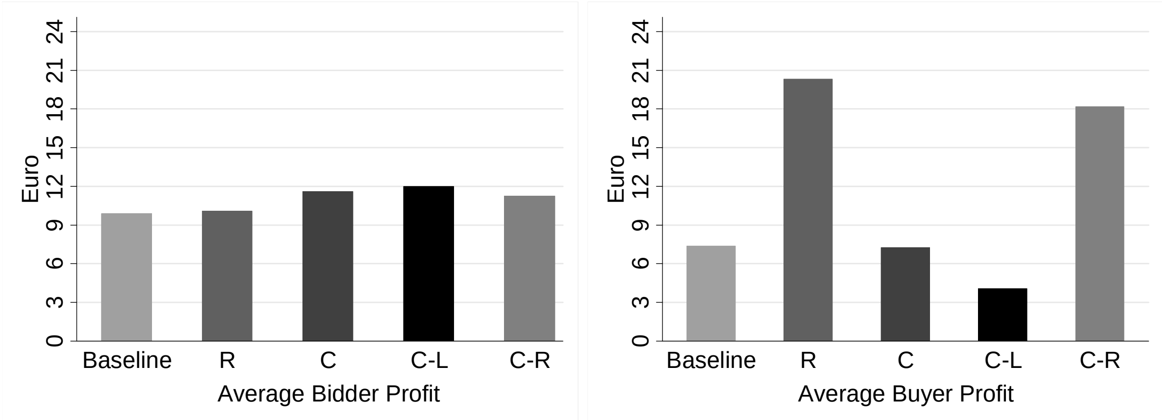
How does communication contribute to mitigating problems of moral hazard? Figure 1 reveals that the influence of communication in isolation is small, but leads to a higher quality of 69 percent in treatment **C** and, also, to a higher efficiency. The difference between treatments **C** and **Baseline** is weakly significant with respect to quality (*p*=0.065) and efficiency (*p*=0.065). Limiting the message space, communication no longer significantly affects market outcomes compared to the **Baseline** treatment. Bidders in treatment **C-L** choose an average of quality of 65 percent which is not significantly different from that in the **Baseline** treatment (*p*=0.574) and that in the **C** treatment (*p*=0.130). Also, the resulting market efficiency of 55 percent does not differ significantly from the 53 percent reached in the **Baseline** treatment (p=0.234) – but it is significantly lower than the 60 percent without restrictions in the **C** treatment (p=0.028).

Giving buyers an opportunity to pick a bidder based on both, their messages and their reputation information, has a stark effect on average quality in treatment **C-R**. It is 24 percentage points higher than in the **Baseline** treatment and 18 percentage points higher than in the treatments with communication alone (**C** and **C-L**). The differences are significant (p=0.002) and, accordingly, lead to a significantly higher market efficiency in this treatment ($p \leq 0.003$) which amounts to 80 percent. However, the outcomes in treatments **R** and **C-R** do not differ from each other with respect to quality (p=0.721) and efficiency (p=0.799). In other words: Reputation increases delivered quality and resulting efficiency, but the seller's ability to communicate with the buyer does not yield an additional gain (but also no loss).

In our experiment the winning bidder's quality choice and her cost determine the size of the cake that is to be distributed between her and the buyer. Her bid determines how exactly the cake is split up. Figure 2 displays the average profits of buyers and sellers that result from the buyers' selections, the bidders' qualities and bids. Bidder profits vary from 9.87 Euro in the **Baseline** treatment to 12.00 Euro in the **C-L** treatment. These differences are rather small, but they suggest that bidders can sometimes profit from their opportunity to send a message to the buyer while reputation information alone, or in addition to communication, has no effect. In particular, bidder profits in the **R** treatment do not significantly differ from those in the **Baseline** treatment (p=0.959) and bidder profits in the **C-R** treatment do not significantly differ from those in the **C** treatment (p=0.879). However, bidder profits positively respond to the communication opportunity if reputation is absent, i.e. they are significantly higher in **C** than in the **Baseline** treatment (p=0.038). Whether the message space is limited or not has no significant effect on bidder profits.

The differences in buyer profits are more pronounced and highlight the importance of reputation. Buyers earn 20.34 Euro in the **R** and 19.20 Euro in the **C-R** treatment while making less than 7.50 Euro in the **Baseline, C** and **C-L** treatment. This difference with respect to reputation is significant in all comparisons ($p \leq 0.005$). Both treatments with reputation do not differ significantly from each other in buyer profits (p=0.505). The same holds when comparing the three treatments without reputation ($p \leq 0.328$). So buyers profit from reputation information, but not from the opportunity to receive messages from the bidders.

Figure 2 – Bidder and Buyer Profits



Buyer choices

Buyer-determined auctions differ from regular auctions as the buyer's own choice and not a predefined mechanism determines how much of the offered profit she realizes. In terms of efficiency, the bidders' quality choices determine the size of two potential cakes and their prices the distribution of these cakes. The buyer's choice determines which of the two cakes represents the market outcome. Studying buyer choices allows us to shed light on the roles reputation, communication, and the content of communication play in determining these outcomes. For this purpose, we analyze the free-form messages in the communication treatments **C, C-L** and **C-R**. We select the following categories for classifying their content:

(i) Empty messages (*e*): This category identifies occasions in which no message is sent.

(ii) Social proximity (*s*): This category identifies messages that reduce social distance in the anonymous environment of the laboratory. By our definition a message falls into this category if it contains emoticons, i.e. the use of typed symbols to express emotions, typically resembling facial expressions, such as the smiley ":-)" (Rivera et al., 1996, Kasper-Fuehrer & Ashkanasy, 2001). A message also falls into this category if it addresses the buyer informally, i.e. by the use of the informal second-person pronoun "Du" in German.[10]

[10] See also footnote 5. As Kretzenbacher et al. (2006) observe, social distance appears to be the overriding factor in selecting formal or informal second-person pronouns in German.

(iii) Unspecific promise (u): This category identifies messages that contain an unspecific promise. All messages that claim that the accompanying bid offers a "low price", "high quality" or a "high profit" without allowing the quantification of the associated buyer profit belong to this category. This category also includes messages that include general praise like "This is a great offer".

(iv) Profit promise (p): This category identifies messages that contain specific profit promises. All messages that contain quantifiable information about the profit the bidder claims to deliver (directly by referring to the buyer's profit or indirectly by referring to the delivered quality) are classified accordingly. This category does not exist in treatment **C-L**.

Two research assistants coded all messages of this experiment independently. After we defined the classification scheme, they were trained on a random subsample of 90 messages. Based on this subsample questions about the classification scheme were discussed in a joint meeting. Additionally, examples for each category were selected. These examples served coders as a reference during the classification of the complete data set.

Table 2 summarizes the resulting content classification. To check the inter-coder reliability we calculated Krippendorf's Alpha. Reliability scores of the three categories pass the 0.70 cutoff value (Krippendorf, 1980). Table 2 also shows the share of messages falling into the four categories. If coders disagreed, we used the arithmetic mean of their classification in further analyses. Interestingly, the pattern of communication does not differ much between the two communication treatments **C** and **C-R**. There appear to be more empty messages when reputation is available but none of the shares differs significantly between treatments (two-sided Mann-Whitney-*U* tests based on independent matching groups, $p \geq 0.462$). The presence of a reputation mechanism does not appear to influence the way messages are used with respect to promises and social distance. Limiting the message space does not significantly change the share of empty messages (p=0.674), but obviously the message content: Messages aiming to increase social proximity make up 25 percent of messages in the **C-L** treatment. This is a weakly significant increase from the 18 percent in **C** (p=0.083). The share of messages including unspecific promises, however, becomes even larger. It increases significantly from 28 percent in **C** to 47 percent in **Control** (p=0.008).

Table 2 – Messages across Content Categories in Treatments **C** and **C-R**

	Empty Message *e*	Content Categories: Social Proximity *s*	Unspecific Promise *u*	Profit Promise *p*
Treatment **C**				
Share	0.297	0.181	0.270	0.275
Krippendorf's Alpha	-	0.875	0.841	0.980
Treatment **C-R**				
Share	0.372	0.164	0.256	0.278
Krippendorf's Alpha	-	0.962	0.818	0.983
Treatment **C-L**				
Share	0.264	0.247	0.473	-
Krippendorf's Alpha	-	0.909	0.836	-

To study the influence on buyers' choices we ran separate conditional logit regressions for the five treatments based on the information available to buyers. We assume an underlying random utility model where buyers j select the bid i offering the highest expected utility in period t given by

$$U_{ijt} = \beta_1 Bid_{ijt} + \beta_2 Lowest_{ijt} + \beta_3 \overline{q}_{ijt} + \beta_4 q_{ijt}^{t\text{-}1} + \beta_5 e_{ijt} + \beta_6 s_{ijt} + \beta_7 u_{ijt} + \beta_8 p_{ijt} + \varepsilon_{ijt}, \qquad (1)$$

where Bid_{ijt} represents the bid price, $Lowest_{ijt}$ a dummy that indicates the lowest bid, $\overline{q}_{ijt}$ the bidder's average quality over all previous periods and $q_{ijt}^{t\text{-}1}$ the bidder's quality in the last period. As the last variable does not become available until the second period, we only consider periods t = 2,..,18. Message content is considered by four additional independent variables: First, a dummy variable e_{ijt} that takes the value 1 if a message is empty and 0 otherwise; second, variables s_{ijt}, u_{ijt} and p_{ijt} that indicate the classification into the three content categories taking the values 0, 0.5 and 1. The unobserved error term is denoted by ε_{ijt}. It is assumed to be independently identically distributed with the type 1 extreme value distribution. The results are shown in Table 3.

Not surprisingly, higher prices have a negative impact on the probability of a bid being selected across treatments. If rationality and selfishness were common knowledge, this would be the only aspect of a bid buyers should consider. We already learned that reputation is important: Bidders provide higher qualities in the two reputation treatments **R** and **C-R**. Now the regression results reveal that buyers also prefer bidders with a history of high quality. They take into account the average quality as well as the quality of the last period.

Bidders' messages should not contain information that is relevant to buyers unless messages include a credible signal indicating quality. With respect to the communication treatments **C** and **C-R**, buyers in fact prefer bidders who make specific promises about the profit the buyer will make from selecting their bid. Unspecific promises and attempts to increase social proximity do not generate a significant advantage in these treatments. The baseline category is made up by bids that are accompanied by a non-empty message that does not contain content falling into any of the three categories. Bids that do not fall into any of the categories are not treated significantly different from bids with empty messages (as indicated by the insignificance of the "empty message" dummy) .In treatment **C-L** in which no specific promises are possible we observe a significantly positive effect of social proximity, however. Apparently, social proximity influences buyers' decisions in situations where profit promises are not feasible. Similar to the other two communication treatments, making an unspecific promise does not significantly affect buyers' choices in **C-L**.

The average probability of winning for bidders offering the lower price is 73 percent in **R** and **C-R** and 81 percent in **C** and **C-L**. For the bidders offering the higher price these values are 25 percent in **R** and **C-R** and 17 percent in **C** and **C-L**. Also, we calculate average marginal effects separately for lower and higher price bidders. More precisely, we calculate the changes of the probability of winning that result from a one-percent increase in previously delivered quality or a one-unit increase for the communication content indicators. In the reputation treatments an additional percent of average delivered quality increases the probability of winning by 0.5 percentage points for low and high bidders in **R**. In **C-R** it leads to a 0.9 increase for high bidders and a 0.8 increase for low bidders. An additional percent of quality delivered in the last period leads to an increase by 0.7 percentage points in **R** and by 0.4 percentage points in **C-R** for both groups of bidders.

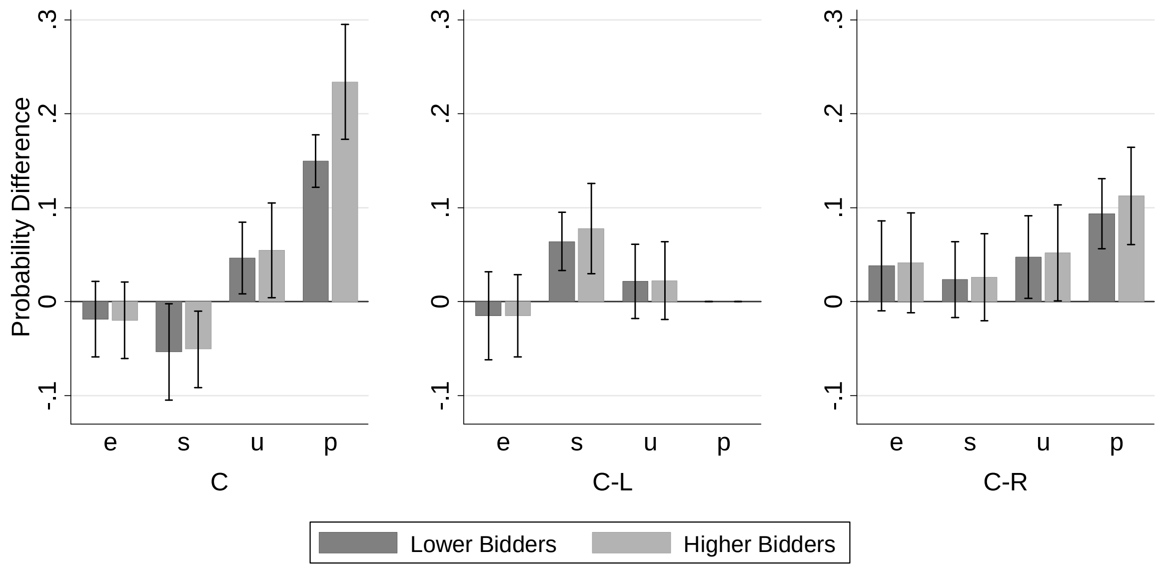
Table 3 – Conditional Logit Regressions on Buyer Choices

	Treatments				
Independent Variables	**Baseline**	**R**	**C**	**C-L**	**C-R**
Bid	-0.009***	-0.023***	-0.011***	-0.009***	-0.021***
	(0.002)	(0.003)	(0.003)	(0.002)	(0.004)
Lowest Bid	0.888***	0.259	0.917***	0.836***	0.761**
	(0.237)	(0.253)	(0.242)	(0.230)	(0.306)
Average Quality ($\overline{q}_{ijt}$)		0.045***			0.091***
		(0.015)			(0.016)
Quality Last Period (q_{ijt}^{t-1})		0.066***			0.040***
		(0.011)			(0.010)
Empty Message (*e*)			-0.167	-0.115	0.415
			(0.321)	(0.280)	(0.435)
Social Proximity (*s*)			-0.451	0.548**	0.257
			(0.297)	(0.239)	(0.345)
Unspecific Promise (*u*)			0.439	0.170	0.515
			(0.307)	(0.248)	(0.410)
Profit Promise (*p*)			1.662***		1.056***
			(0.312)		(0.384)
McFadden's R^2	0.412	0.507	0.440	0.382	0.540
N	816	816	816	816	816

Standard errors are given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Results for the communication variables are displayed in Figure 3 along with 95-percent confidence intervals (CI) resulting from 1,000 bootstrap replications. Specific profit promises increase a bidder's likelihood to be selected by the buyer. Their influence is most pronounced in the absence of reputation, however. They increase the probability of winning by 23.4 percentage points for higher bidders in **C** and by 11.2 percentage points in **C-R**. For the lower price bidders these changes are smaller in absolute and relative terms: In **C** a profit promise increases their probability of winning by 15.0 percentage points; in **C-R** by 9.4 percentage points. In treatment **C-L**, social proximity raises bidders' likelihood to be the auction winner. Higher price bidders can raise their winning probability by 7.8 percentage points by creating social proximity. If lower price bidders pair their bid with an appropriate message this probability increases by 6.4 percentage points.

Figure 3 – Average Marginal Effects Communication (Bootstrapped 95-percent CIs)



4 Buyer choices in the field

Field data

We complement the experimental analysis of buyer choices by analyzing data from a large European procurement platform that facilitates the online procurement of a variety of services such as paintwork, transportation, and moving or web development. At the platform's web site buyers post a project description in the respective category and select a starting price. Interested bidders are then able to place a price for which they are willing to supply the service as a bid. At the end of the auction buyers choose their preferred supplier and assign the contract. The platform collects a percentage of the final price as a fee.

Trade via the platform is not only based on project descriptions and prices. First, bidders can create a profile page on which they describe themselves. Bidder profiles also include information such as number of employees, held insurances, and postal code. Second, the platform has a reputation system similar to Ebay's that distributes information about past behavior among market participants. After a trade took place, buyers and seller can rate their behavior as "positive", "neutral", or "negative". Third, bidders and buyers can communicate using an auction-specific message board.

The platform granted us access to their database. This way we are able to include all information into our analyses that was available to the market participants at the time of the auction. We additionally have access to non-public information that allowed us to determine whether an auction resulted in a trade and was actually billed by the platform. We focus on projects of this kind that had at least two bidders and were posted in the transportation and moving category. This was the most active category in the time span under consideration. Further, we apply the following restrictions:

(i) The data set is limited to auctions by first-time buyers in order to avoid repeated interaction between sellers and buyers and learning effects.

(ii) To limit potential endogeneity of message contents, only auctions in which buyers sent no message and bidders sent at most one were selected (see also Heinrich, 2012).

(iii) As an additional measure to limit potential endogeneity, only auctions are included that did not contain a personal message in the buyers' project description.

Restrictions (i) and (ii) exclude about 51 percent of the auctions from the initial data set. From the remaining 6,171 auctions, 1,701 auctions were randomly selected for content analysis. Restriction (iii) applies to 316 of these auctions. The final data set covers 1,385 auctions and 7,523 bids with a trade volume of about Euro 650,000.

Buyer choices

The field data allows us to study the buyer choices along dimensions that are similar to the bid characteristics observed in the laboratory. Bidder profiles can be used to identify the influence of reputation on buyer choices while controlling for other characteristics. Additionally, the messages can be classified to identify the relationship of choices with social distance and promises. It is important to point out, that the decision situation in the field not only takes place under much less controlled conditions than in the laboratory. The reputation mechanism in the field is also less informative than in the lab as it is based on subjective ratings from former buyers and most ratings are positive. Less than 4 percent of ratings bidders have received are neutral or negative. Clearly, the decision situation also differs along theoretical dimensions. For example, bidders' costs are not symmetric independent private values, bids are not submitted simultaneously and adverse selection problems exist next to moral hazard. Nevertheless, we believe that the analysis of this data provides a first simple but nevertheless important check for the external validity of our results.

Communication in the field is richer and less controlled than in the laboratory. Bidders are not anonymous and not necessarily restricted to text messages in their communication. Therefore, we add two content categories regarding social proximity to account for the larger message space. Profit promises are not possible in the field, so this category is not included. Using the same procedure as for the experimental communication, messages were classified as follows:

(i) Empty messages (*e*): This category identifies occasions in which no message is sent.

(ii) Social proximity: Laboratory (*s*): This category identifies messages that reduce social distance in the same way that we observe in the laboratory. That means, by the use of emoticons or by addressing the buyer informally.

(iii) Social proximity: Names (*n*): This new category identifies messages that contain the name of the buyer or the bidder. More specifically, to fall into this category a message has to include at least the buyer's company or username or a bidder's real name.[11] (The bidder's user or company name is displaced automatically with all messages. Bidders only know the buyer's user name.)

(iv) Social proximity: Additional channel (*c*): This new category identifies messages that initiate communication through an additional communication channel, e.g. by asking for a call, an email or a meeting.

(v) Unspecific promise (*u*): Again this category identifies messages that contain an unspecific promise. In the field these are messages that offer a "low price" or mention positive traits that are associated with high quality work such as "reliability" or "timeliness". As in the experiment, this category includes messages that include general praise like "This is a great offer".

The resulting classification is summarized in Table 4. First of all, the content across the four categories was reliably identified by the two coders as indicated by Krippendorf's Alpha. In our field data more than half of the bidders choose not to pair their bid with a written message. Less than one percent of the messages include content that aims to reduce social distance by the means

[11] See Charness & Gneezy (2008) on the importance of names.

that were possible in the laboratory. Instead social proximity is increased by initiating further communication (7 percent) or including names (19 percent).

Table 4 – Share of Messages across Content Categories in the Field Data

		Content Categories			
		Social Proximity			
	Empty Message *e*	Laboratory *s*	Names *n*	Additional Channel *c*	Unspecific Promise *u*
Share	0.527	0.004	0.194	0.071	0.130
Krippendorf's Alpha	-	0.899	0.809	0.849	0.753

In order to identify the influence of these messages as well as of prices and reputation we estimate conditional logit models as we did for the buyers in the experiment. We assume that the buyer in auction j selects the bid i offering the highest expected utility given by

$$U_{ij} = \beta_1 \ln(Bid_{ij}) + \beta_2 Lowest_{ij} + \beta_3 Positive1_{ij} + \beta_4 Positive2_{ij} + \beta_5 Positive3_{ij} + \beta_6 Positive4_{ij} + \beta_7 ShareProblematic_{ij} + \beta_8 e_{ij} + \beta_9 s_{ijt} + \beta_{10} n_{ijt} + \beta_{11} c_{ijt} + \beta_{12} u_{ijt} + \gamma' x_{ij} + \varepsilon_{ijt}. \quad (2)$$

To account for the skewed distribution of bids in the field we now include the logarithm of the bid. A bidder's reputation is captured by the dummies $Positive1_{ij}$ to $Positive4_{ij}$ that indicate the quartile a bidder falls in with respect to the number of positive ratings he has gained in previous auctions. The baseline category is zero positive ratings. *Positive1* represents 1 to 4 positive ratings, *Positive2* 5 to 13 ratings, *Positive3* 14 to 32 ratings and *Positive4* for 33 to 178 ratings. $ShareProblematic_{ij}$ represents the share of ratings that were neutral or negative. The message content is captured by the dummy for empty messages e_{ij}, and the content variables s_{ij}, n_{ij}, c_{ij} and u_{ij}. We include additional information about the buyers included in their profile in the vector x_{ij}.

Table 5 displays the regression results. Model (1) only includes the price variables. In model (2) the reputation variables are added. Model (3) also includes the communication content indicators as shown in equation (2). Higher prices decrease the probability of winning across the three model specifications. Additional positive ratings increase the probability of winning while a larger share of negative or neutral ratings decreases it. As shown by model (3), communication is also associated with the probability of winning. Bidders not using the available communication channel are less likely to win than those who send at least one message. Those reducing social distance by initiating communication through an additional communication channel are even more likely to win. However, buyers are not more likely to pick bidders who reduce social distance in ways possible in the laboratory or by mentioning names. Neither do unspecific promises yield an advantage.

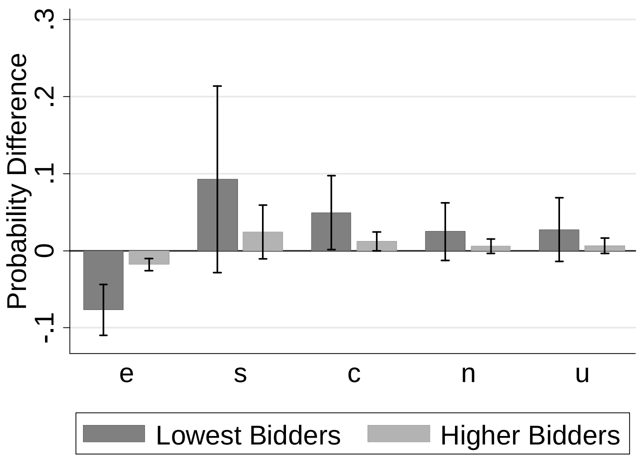
Table 5 – Conditional Logit Regressions on Buyer Choices in the Field

	Models		
Independent Variables	(1)	(2)	(3)
Ln(*Bid*)	-7.749***	-8.953***	-8.940***
	(0.506)	(0.547)	(0.553)
Lowest Bid	0.728***	0.875***	0.918***
	(0.082)	(0.088)	(0.090)
Positive1		0.551***	0.433***
		(0.127)	(0.130)
Positive2		1.104***	0.976***
		(0.134)	(0.137)
Positive3		1.411***	1.263***
		(0.143)	(0.146)
Positive4		1.693***	1.586***
		(0.148)	(0.151)
ShareProblematic		-2.705***	-2.958**
		(0.745)	(0.770)
Empty Message (*e*)			-0.492***
			(0.114)
Social Proximity: Laboratory (*s*)			0.644
			(0.627)
Social Proximity: Names (*n*)			0.163
			(0.124)
Social Proximity: Additional Channel (*c*)			0.329**
			(0.163)
Unspecific Promise (*u*)			0.179
			(0.137)
McFadden's R^2	0.396	0.439	0.455
N	7,523	7,523	7,523

Standard errors are given in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

On average the bidders offering the lowest price have a probability of winning of 65 percent. The probability for the remaining bidders is 7 percent. Figure 4 displays how these probabilities vary with the communication content variables. Not sending any message lowers the probability of winning by 7.7 percentage points for lowest bidders and by 1.8 percentage points for higher bidders. Initiating communication through additional channels increases the probability of winning for lowest bidders by 4.9 percentage points. For the remaining bidders it increases by 1.2 percentage points. For lowest bidders these changes are larger in absolute terms. However, they are much larger in relative terms for the remaining bidders due to their low baseline probability of winning.

Figure 4 – Average Marginal Effects Communication (Bootstrapped 95-percent CIs) in the Field



5 Conclusion

In this study we aim to identify the role communication plays in buyer-determined procurement auctions with moral hazard and its interaction with reputation. The results of our experiment demonstrate that the availability of reputation information leads to a large increase in market efficiency in these auctions, while communication yields no additional efficiency gains. In the absence of reputation mechanisms communication slightly increases market efficiency.

Analyzing the experimental communication in more detail, we find that buyers not only prefer bidders with lower prices. They also value a good reputation and, maybe even more interestingly, communication in the form of promises. Bidders who promise them a specific profit are between

9.4 and 23.4 percentage points more likely to win an auction. This result is in line with the experimental literature that finds promises to influence behavior even when they are cheap talk. This effect is typically explained by a preference for promise-keeping or by guilt aversion.

A large body of literature points out that social distance affects behavior in similar situations. Yet, in our experiment buyers do not consider unspecific promises nor messages that reduce social distance by addressing the buyer informally and sending emoticons. Our treatment **C-L** reveals that the influence of social distance on behavior is mediated through the message space available to bidders. In **C-L** bidders are not allowed to make any profit promises. In this case, buyers prefer bidders who reduce social distance. The comparison with treatment **C** also reveals that the efficiency enhancing effect of communication is driven by allowing promises to be specific.

We also compare the choice patterns observed in the laboratory to buyer choices that take place in the field. Our data consists of buyer choices on a large platform for the procurement of services. In this setting delivered qualities and profit can hardly be quantified and therefore profit promises are impossible. In this setting we observe a pattern of buyer choices that is consistent with the one observed in the **C-L** treatment. Addressing the buyer informally or including a smiley has no effect in the field. In this professional environment less than one percent of messages fall into this category. In the field buyers prefer bidders who reduce social distance by initiating communication through additional channels, i.e. by face-to-face meetings, email or telephone.

It is important to note that our findings are not in conflict with previous work on social distance or promises as this research does not focus on the interaction of both. In the current analysis of communication we have focused on buyer’s choices. We leave the detailed analysis of bidder behavior for future studies.

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Appendix: Instructions

Welcome to the experiment!

Preface

You are taking part in an experiment about decision making in the field of experimental economics. During the experiment you and the other participants will be asked to make decisions. By doing so, you can earn money. How much you are about to earn depends on your decisions. After the experiment you will receive your earnings in cash.

The experiment is split into two different parts. Each of these parts is introduced by detailed instructions.

All participants will receive exactly the same instructions.

Please keep in mind that decisions you make in one of the two parts of the experiment do not have any influence on the other part of the experiment.

None of the participants will receive any information concerning the identity of other participants during the experiment.

Part 1

Please read the following instructions. Five minutes after you have received the instructions, we will come to your desk to answer remaining questions. Whenever you have questions during the experiment, please put up your hand or open the door to your cabin. We will come to your desk then.

During the first part of the experiment you will participate in 6 auction rounds.

Description of the auction rounds

In each of the 6 auction rounds you participate in, one project will be sold. There are exactly two bidders (= potential sellers), you and another bidder.

Procedure:

The bidders want to conduct the project. For each auction round and for both bidders, we have drawn the costs for conducting the project randomly and independently of each other from the range between 100 and 500 euro cents. All sums of this range could be realized with equal probability. Each of the two bidders will only be informed about his own costs for conducting the project.

At the beginning of each auction round, each of the two bidders can decide how much he wants to bid for the project. The bid is set to a maximum of 500 euro cents.

> The bidder who puts in the lowest bid wins the auction. His earnings in this round are equal to the difference between his bid and his costs for conducting the project.
>
> The bidder who puts in the highest bid loses the auction. In this case, his earnings in this round are equal to zero.
>
> If both bids are equal, the winner will be determined randomly (i.e. each bidder wins the auction with a probability of 50%).

Your fellow bidder:

Your fellow bidder is a computer in each of the 6 auction rounds. The computer is programmed to maximize its expected earnings in each auction round (in fact, it is bidding in every auction round according to the symmetric Nash equilibrium strategy under risk neutrality). The computer expects that you behave in the same way. The computer expects that your costs for conducting the project are drawn randomly and independently of each other out of the range from 100 to 500 euro cents and that all values of this range could be realized with equal probability.

Pay-out

The pay-out of all your earnings of the 6 auction rounds will take place at the end of the whole experiment.

Please keep in mind that none of the participants will receive any information about his earnings per round during the first part of the experiment.

Moreover, none of the participants will receive any information about the bidding behavior and the earnings of the other participants in part 1 during the whole experiment.

<u>Screen in Part 1</u>

Round 1 out of 6

Remaining time (for orientation):
Please decide now!

Round 1:
You are participant number 1 and bidder in all following auctions.

Auction:
In round 1 your costs to conduct the project amount to 200 euro cents.
Please enter your bid.
Your bid is:

Confirm bid

Please keep in mind: If you win the auction your earnings in this round = your bid - 200.

Part 2

Please read the following instructions. Ten minutes after you have received the instructions, we will come to your desk to answer remaining questions. Whenever you have questions during the experiment, please put up your hand or open the door to your cabin. We will come to your desk then.

During the second part of the experiment you will participate in 18 auction rounds.

Description of the auction rounds

In each of the 18 auction rounds you participate in, one project will be sold. There are exactly two bidders (= potential sellers) and one buyer.

You will be informed at the beginning of the first auction round whether you decide in the role of a bidder or in the role of a buyer during the 18 auction rounds. You will maintain this role in all of the 18 auction rounds.

In each of the 18 rounds, the other two participants will be assigned to you randomly, so every time a buyer and two bidders interact. It is guaranteed that you will not meet the same group of participants in two consecutive rounds.

Procedure:

The buyer wants to have the project conducted. His valuation for a conducted project (with a quality of 100%, see below) is 500 euro cents in every auction round. The valuation determines how valuable the project is for the buyer at a 100% quality rate.

The bidders want to conduct the project. For each auction round and for both bidders we have drawn the costs for conducting the project (with a quality of 100%) randomly and independently of each other from the range between 100 and 500 euro cents. All values of this range could be realized with equal probability. Each bidder will only be informed about his own costs for conducting the project. The buyer does not receive any information concerning the costs. [**C**, **C-R**, **C-L***:* During each auction round, each bidder can send a message to the buyer.]

Each auction round comprises three stages: In the "auction phase" both bidders bid for conducting the project. In the "buyer choice phase", the buyer chooses a winner (= seller) based on the bids [**C-R***:* the messages] [**R**, **C-R***:* and the information he has concerning the previous bidder's choice of quality] [**C, C-L***:* and the messages]. In the "quality choice phase", both bidders decide about the quality they conduct the project with, in case they should win the auction and are paid their bid by the buyer. The three stages are described in more detail below.

Auction Phase:

At the beginning of the auction phase, each of the two bidders can decide which bid he wants to make for conducting the project. The maximum bid is 500 euro cents.

The earnings per round are determined based on the choices made in the "seller choice phase" and the "quality choice phase" (see below).

Seller Choice Phase:

In the seller choice phase, the buyer decides about the winner (= seller). [**R, C, C-R, C-L:** For this he receives the following information about each bidder:] [**R, C-R:** his bid, [**C-R:** his message,] his quality decision in the previous round and the average of his quality decisions in all previous rounds.] [**C, C-L:** his bid and his message.] [**Baseline:** For this, he receives his bid as information about each bidder.]

Quality Choice Phase:

In the quality choice phase, the bidders decide about the quality they conduct the project with, in case they should win the auction and are paid their bid by the buyer.

The quality rate has to be set between 50% and 100%. Each percent of quality costs the winner of the auction (= seller) one percent of the costs for conducting the project that were drawn for him in the corresponding round. Therefore, the seller's costs for conducting the project with 100% quality correspond to his costs and the costs for conducting the project with 50% quality correspond to half of his costs.

Winner's earnings per round = bid - quality [%]*costs for conducting the project

The buyer's valuation of the project decreases with each percent less quality by one percent (i.e. by 5 euro cents). Therefore the buyer's valuation for the project at a quality of 100% is equal to 500 euro cents. At a quality of 50% it is equal to 250 euro cents.

Buyer's earnings per round = quality [%]*500 - auction's price

<u>Pay-out</u>

After the 18 auction rounds the sum of your earnings per round together with your earnings of the first part of the experiment will be paid out in cash.

[C, C-L, C-R: <u>Note about the messages</u>

Basically, the content of the messages is left up to you. But it is not allowed to give personal details about oneself e.g. name, age, address, subject. [**C-L:** <u>Furthermore, if you are a bidder, you are not allowed to give further details about your costs for conducting the project, your quality decision or the resulting buyer's earnings in this round.</u>] In case you violate the rules of communication, you will be expelled from the experiment and won't be paid out. Each message comprises a maximum of 420 signs (about 2 lines). Please note: to send a message, you have to press the Enter-key.]

Before we start with the second part of the experiment in a few moments, we ask you to fill out a test of understanding on the computer.

<u>Screens for bidders (= potential sellers) in part 2</u>

[**Baseline, R:**]
Auction and quality choice phase:

Round
2 out of 18

Remaining time (for orientation):
Please decide now!

You are participant No 1 and bidder in all following auctions.

AUCTION:

In round 2 your costs for conducting the project are 200 euro cents at a quality rate of 100%.

AUCTION PHASE:

Please decide on the bid.

Your bid is:

QUALITY CHOICE PHASE:

Please decide on the quality.

Your quality is:

[**R:** The buyer in this round receives the following information about you:

The bidder's quality was 100 in the previous round.

The average bidder's quality in the previous auctions was 100.]

Please keep in mind: If you win an auction your earnings in this round = your bid - quality [%]*200 [euro cents].

Confirm price and quality

[**C, C-L, C-R:**]
Auction and quality choice phase:

Round

2 out of 18

Remaining time (for orientation):
Please decide now!

You are participant No 1 and bidder in all following auctions.

AUCTION:

In round 2, your costs for conducting the project are 200 euro cents at a quality rate of 100%.

AUCTION PHASE:

Please decide on the bid.

Your bid is:

QUALITY CHOICE PHASE:

Please decide on the quality.

Your quality is:

[**C-R:** The buyer in this round receives the following information about you:

The bidder's quality was 100 in the previous round.

The average bidder's quality in the previous auctions was 100.]

MESSAGE:

Please enter a message that is shown to the buyer in the seller choice phase in the field below.

Your message will be sent by pressing the Enter-key.
The message comprises a maximum of 420 signs (about 2 lines).

Please keep in mind: If you win an auction, your earnings in this round = your bid - quality [%]*200 [euro cents].

Confirm price and quality

<u>Screens for buyer in part 2</u>

[**Baseline, R:**]
Seller choice phase:

Round
2 out of 18

Remaining time (for orientation):
Please decide now!

You are participant No 3 and buyer in all following auctions.

SELLER CHOICE PHASE:

BIDDER A:

Bidder A, who you are randomly matched with in this round, bids a price of 300 euro cents.

[**R:** The bidder's quality in the previous round was 100.

The bidder's average quality was 100.

BIDDER B:

Bidder B, who you are randomly matched with in this round, bids a price of 200 euro cents.

The bidder's quality in the previous round was 50.

The bidder's average quality was 50.]

Please keep in mind: your earnings in this round = quality [%]*500 [euro cents] - bid

Please decide between the bidders:

Bidder A
Bidder B

OK

[**C, C-L, C-R**]
Seller choice phase:

Round
2 out of 18

Remaining time (for orientation):
Please decide now!

You are participant No 3 and buyer in all following auctions.

SELLER CHOICE PHASE:

BIDDER A:

Bidder A, who you are randomly matched with in this round, bids a price of 300 euro cents.

[**C-R:** The bidder's quality in the previous round was100

The bidder's average quality was100.

Bidder A's message is:

[BIDDER A'S MESSAGE]

BIDDER B:

Bidder B, who you are randomly matched with in this round, bids a price of 200 euro cents.

The bidder's quality in the previous round was 50.

The bidder's average quality was 50.]

Bidder B's message is:

[BIDDER B'S MESSAGE]

Please keep in mind: your earnings in this round = quality [%]*500[euro cents] - bid

Please decide between the bidders:
Bidder A
Bidder B

OK