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Abstract

Sellers in real-estate markets, on internet platforms, in auction houses, and so forth, routinely pose non-binding price requests. Using a laboratory experiment, we examine how competition moderates the way such cheap-talk communication affects trade between buyers and sellers. For bilateral trade, the literature has identified efficiency, anchoring, and granularity effects of cheap-talk communication on negotiation outcomes. Our results show that most of these effects survive with competition, although some of them become weaker. Our main findings are the following: (i) The ability of sellers to make non-binding price requests has a positive effect on efficiency in that it helps trading partners close marginal deals both in bilateral bargaining and in competition; (ii) Competition reduces the informativeness of the price requests and weakens the anchoring effect of the level of the price request; (iii) Sellers communicating more granular price requests attract more granular buyer bids; (iv) The granularity of the seller's price request does not impact the selling price.

Keywords: Cheap-talk communication, efficiency, anchoring, price granulatiry, laboratory experiment

JEL: C72, C92, D91

1 Introduction

Sellers in real-estate markets, on internet platforms, in auction houses, and so forth, routinely communicate price requests. Such communication can be often considered cheap talk in the sense of Crawford and Sobel (1982) in that it only contains non-binding promises and threats about one's own future actions — e.g., sellers stating non-negotiable prices while bargaining. Whereas much is known about how sellers' cheap talk affects buyers' reactions in non-competitive settings, little experimental evidence exists on the causal mechanisms linking sellers' cheap talk and buyers' reactions in competitive settings. Here, we extend the analysis of cheap-talk effects to competition and test whether established effects, such as cheap-talk communication enhancing efficiency, final prices being anchored to initial offers, and final pricing being affected by the granularity of the initial offer, survive the introduction of competitive pressure.

In a game theoretic sense, sellers' non-binding asking prices are inconsequential — they should neither contain information about the reservation value of the seller nor influence the behavior of the buyer. However, evidence from behavioral economics, marketing, and consumer psychology suggests that cheap-talk communication does have an impact on the transaction outcomes in the case of bilateral bargaining. For instance, buyers and sellers reach higher levels of efficiency when they can send cheap-talk messages to each other compared to when they cannot (an *efficiency effect*) (Radner and Schotter, 1989; Valley et al., 2002). The content of the message has been shown to influence the bargaining outcomes as well. For example, higher initial offers by sellers are associated with higher final selling prices (an *anchoring effect*) (Galinsky and Mussweiler, 2001); and when sellers announce more granular asking prices (i.e., prices containing fewer consecutive zeroes at the end) they receive more attractive bids from potential buyers, *ceteris paribus* (known as a price-precision effect or an *granularity effect*) (Janiszewski and Uy, 2008; Loschelder et al., 2014; Backus et al., 2019).

In this paper, we address the question: How does the effect on bargaining outcomes of the *presence* of cheap-talk communication — i.e., the possibility to send cheap-talk requests — and the effect of the *nature* of cheap-talk communication — i.e., the content of the cheap-talk requests — change when competition is introduced? Understanding the impact of competition on sellers' cheap talk and buyer's responses to such cheap talk is important given the numerous competitive settings in which sellers pose asking prices to which buyers react. Such settings include real-estate markets (Leib et al., 2020) with annual transactions around the globe estimated at 3.69 trillion US Dollars in 2021,[1] internet platforms like eBay (Backus et al., 2019)

[1] https://www.grandviewresearch.com/industry-analysis/real-estate-market (accessed on June 8, 2023)

with a gross merchandise volume of around 18.4 billion US Dollars in Q1 2023,[2] and auction houses announcing low- and high-price estimates for art being put up for auction (Beggs and Graddy, 2009) with annual revenues estimated at 16.5 billion US Dollars in 2022.[3]

We contribute to the literature by exploring an experimental framework that allows us to identify cheap-talk effects for a large variety of buyer and seller values. We use this framework to experimentally test whether (i) the efficiency improvements caused by the introduction of cheap-talk opportunities are robust to competitive pressure on the side of the buyers and (ii) competition impacts buyers' likelihood to be influenced by the aforementioned anchoring and granularity effects.

Our results reveal that the anchoring effects documented in the bilateral-bargaining literature extend to competitive settings and that the support for granularity effects are mixed both with and without competition. We find that the presence of cheap-talk requests helps trading partners close marginal deals in bilateral bargaining and in competition. However, competition reduces the informativeness of the request and weakens the anchoring effect of the level of the request. Both with and without competition, sellers that communicate more granular requests attract more granular bids from the buyers, but, in contrast to what is found in the existing literature, the granularity of the seller's request does not impact the selling price.

The set-up of the remainder of this study is as follows: in Section 2, we discuss the related literature on cheap-talk communication, including the efficiency, anchoring, and granularity effects. Section 3 contains the design of the experiment and outlines our hypotheses. We present the results in Section 4. Section 5 discusses implications and limitations, and concludes.

2 State of the art

This section contains a review of the literature studying the effect of cheap-talk communication on bargaining outcomes. We start by discussing the impact of the presence of cheap-talk opportunities on efficiency. Then, we discuss effects of the nature of the cheap-talk messages by focusing primarily on how posted prices and first offers impact the final outcome in negotiations. The effect of the presence of cheap-talk opportunities has been studied within a large range of settings in economics. Results show that the opportunity to communicate helps to boost

[2]https://investors.ebayinc.com/fast-facts/default.aspx (accessed on June 8, 2023)

[3]https://www.artprice.com/artprice-reports/the-art-market-in-2022/key-figures-for-2022 (accessed on June 8, 2023)

cooperation in the prisoner's dilemma and other social dilemmas (see the meta analysis by Balliet, 2010); to foster trust through cheap-talk promises (Charness and Dufwenberg, 2006); and to sustain collusion in oligopoly markets (Fonseca and Normann, 2012; Gomez-Martinez et al., 2016).

As mentioned before, cheap-talk communication enhances efficiency in bilateral trade. While outcomes in the sealed-bid double auctions with two-sided private information (Chatterjee and Samuelson, 1983) are in line with theoretical predictions when communication is not allowed, efficiency improves consistently when communication is possible, with a higher fraction of profitable deals getting closed (Radner and Schotter, 1989; Valley et al., 2002). Cheap-talk communication turns out to facilitate the closing of the marginal deals, i.e., the ones with a small surplus, thanks to sellers and buyers truthfully revealing their reservation values and coordinating on a one-price strategy (Valley et al., 2002). Similar positive effects of the presence of cheap-talk opportunities have been observed in a simpler bargaining game with one-sided private information (Lundquist et al., 2009). In the game, which is framed as an hiring task, sellers have private information about their skill and can communicate with the buyers before the latter make the hiring choice. Also in this case, cheap-talk communication increases efficiency because of the high rate of truthful revelation. These results show that the presence of cheap-talk opportunities increase the possibility to close profitable deals in bilateral bargaining mostly because of truthful revelation of private information.[4] The existing literature, however, leaves open the question whether this property of cheap talk is retained when competitive pressure is introduced. The aim of the current paper is to fill this gap.

The nature of the cheap-talk communication, i.e., the content of the messages exchanged between trading partners, has been shown to matter as well. In a simultaneous-move ultimatum game where the sender can make a pre-play non-binding statement about the offer, higher announced offers get rewarded with a higher likelihood of acceptance. This effect emerges despite the fact that the announced offers are exaggerated compared to the actual offer (Anbarcı et al., 2015). Similarly, in ultimatum games with two-sided imperfect information and open-form written messages, lies and non-credible threats led to more attractive offers by the other player in the short run (Croson et al., 2003). These results suggest that cheap-talk statements

[4] Rankin (2003) study the effect of cheap talk using ultimatum bargaining *without* private information. The game is a standard ultimatum game where, in one treatment, the recipient (seller) can make a cheap-talk request for the minimum acceptable offer. In this setting, the presence of cheap talk is harmful to efficiency, leading to lower offers and a higher rate of rejection. Conditional on sending a request, there is a positive correlation between offers and requests, suggesting that sellers requests influence the offers of the buyer.

are not disregarded by who receives them, which can benefit their senders.[5]

The literature has identified an anchoring effect explaining why the nature of cheap talk matters. In negotiations, first offers serve as an anchor for counteroffers and influence final selling prices in bilateral bargaining, with higher first offers leading to higher counteroffers and, in turn, to higher final prices (Galinsky and Mussweiler, 2001).[6] An anchoring effect is identified because a signal chosen by the bargaining counterpart has a similar effect on offers as a randomly-determined signal (de Haan and Linde, 2022). This led to the conclusion that, in negotiations, there is a first-mover advantage. This advantage, however, has been shown to be moderated by perspective taking. Indeed, the effect is significantly reduced when the second mover takes the perspective of the first mover by thinking about the opponent's outside option and/or the opponent's goal (Galinsky and Mussweiler, 2001). This may suggests that, when multiple buyers compete for the product, like in our experiment, they need to take into account multiple others' perspectives, which could weaken the anchoring effect.

Other findings also suggest that anchoring to the first offer may vanish or even reverse when moving from bilateral negotiation to competitive settings, such as auctions, where multiple competing parties are involved (Ku et al., 2006; Galinsky et al., 2009). The intuition is that lower initial prices can attract more buyers who, in turn, start a bidding war that can lead to higher final offers. However, the question is still open what causes the reversal: increased competition among the incumbents or the higher number of buyers. The literature on anchoring effects in competitive settings suggests that the latter effects dominates because, if anything, low-valued anchors reduce competition in an exogenously fixed pool of buyers. Uninformative anchors have a positive effects on bids in auctions where the number of bidders is fixed (Ariely et al., 2003; Ivanova-Stenzel and Seres, 2021). Similarly, the price paid in an auction for a painting influences the prices of paintings in future auctions, even when controlling for the hedonic value of the painting and current market conditions (Beggs and Graddy, 2009). Moreover, higher "buy now" prices on the auction platform Bidz.com are associated with higher winning bids for

[5] Somehow related to the content of cheap talk, a comparison of the effect of different communication media in a negotiation exercise shows that face-to-face communication leads to more truthful revelation, an increases in mutually beneficial outcomes, and a reduction of the number of impasses compared to written or telephonic communication (Valley et al., 1998). This suggests that the nature of cheap talk and its effects are dependent on the communication technology.

[6] In this literature the term anchoring departs from the classic concept used in judgment and decision making, where anchors are irrelevant and uninformative. The anchoring effect as a judgment bias has been extensively documented outside negotiations. Evidence shows that in evaluation exercises, uninformative numeric values such as a randomly drawn number strongly bend evaluations in the direction of the presented value (Tversky and Kahneman, 1974; Ariely et al., 2003; Furnham and Boo, 2011).

the same products (Dodonova and Khoroshilov, 2004).

Another line of research identifies a granularity effect of first offers: 'round' first offers lead to bigger adjustment of the counteroffer relative to the first offer. Specifically, the more granular asking prices are — i.e., the smaller the number of trailing zeros they have — the more granular the counteroffers they attract, (Janiszewski and Uy, 2008; Loschelder et al., 2017) and the closer counteroffers and final prices are to the asking price (Janiszewski and Uy, 2008; Loschelder et al., 2014). In negotiations, such effect is usually considered beneficial for sellers who seek to sell at a price as close as possible to their asking price. As for the cause of this effect, two mechanism has been proposed to explain how the granularity of offers influences counteroffers: (i) the "scale-granularity hypothesis" (Janiszewski and Uy, 2008), which states that the effect is mostly cognitive, with more granular offers triggering a smaller adjustment scale for the counteroffer; (ii) the "attribution of competence" hypothesis, which states more granular offers trigger the belief that the counterpart is competent, i.e., he/she is knowledgeable about the product (Loschelder et al., 2016, 2017). This effect, however, seems to be non-linear, with experts believing that competent negotiators would not set too-granular prices (Loschelder et al., 2016; Frech et al., 2019). A simultaneous test of the competing explanations supports the conclusion that they both contribute to the effect of anchor precision in negotiations (Frech et al., 2020).

An extension of the analysis to competitive market settings shows that granularity may act as a barrier-to-entry, with parties less likely to enter the transactions when seeing very granular first offers (Lee et al., 2018). Potential buyers perceive a granular first offer as a signal that the seller is unwilling to negotiate about the final price. Support for this conjecture comes from evidence of the use of granularity as a signalling strategy on ebay (Backus et al., 2019). There the granularity of the posted price is linked to a trade-off between the likelihood to sell and the final price, with items listed at multiples of $100 having a higher likelihood to sell but receiving offers that are lower. Supporting the idea that this relationship comes from the seller willing to signal a preference to sell either fast or for a high price, sellers posting round prices are more likely to accept a similarly sized offer. Moreover, suggesting awareness, buyers are more likely to investigate the listings with round prices compared to listings with granular ones. Our paper contributes to this literature by examining how granularity effects interact with competition in a new experimental bargaining paradigm.

3 Experimental design and hypotheses

This section introduces the design used in the experiment and derives hypotheses about the effect of cheap talk. Specifically, it first describes the bargaining protocol, then it presents the experimental procedures, and finally it formulates research hypotheses about the effect of cheap talk from a game theoretic viewpoint and alternative hypotheses based on the literature discussed in the previous section.

3.1 Experimental design

The experiment employs a 2 (*Bargaining* vs. *Auction*) x 2 (*Request* vs. *No request*) between-subjects design. The first dimension of the design manipulates the number n of buyers ($n = 1$ and $n = 2$ respectively) and the second dimension refers to whether or not the seller can post a price request before the buyers submit their bid. Table 1 provides an overview of the experimental design. Instructions of the experiment can be found in Appendix A.

In each session, participants are assigned to the same treatment and interact for 25 periods in matching groups of 6. In each period, participants belonging to the same matching group are randomly and anonymously matched in groups of two (*Bargaining* treatments) or three (*Auction* treatments) participants. One of the participants in the group is randomly assigned to the role of seller and the other(s) to the role of the buyer(s).

Table 1: Overview of the experimental design

Treatment	# subjects	Matching groups	# buyers	Seller request?
Bargaining-Request	60	10	1	Yes
Auction-Request	66	11	2	Yes
Bargaining-No request	60	10	1	No
Auction-No request	60	10	2	No

Our experimental game hosts a large variety of reservations values for the buyers and the sellers, which allows us to study the scope of the effects observed.[7] All reservation values are expressed in ECU (Experimental Currency Units). Sellers' values are drawn from the uniform distribution over the integers in the interval $[0, 100000]$ ECU and buyers' values are drawn from the uniform distribution over the integers in the interval $[50000, 150000]$ ECU. All values are drawn independently. We label a seller's value as the production cost. To increase comparability between treatments, we keep value draws constant across *Request* and *No request* conditions.

[7]See (de Haan and Linde, 2022) for a similar experimental paradigm.

The bargaining procedure is the same in each period and it is as follows:

1. The computer independently draws the production cost c for each seller and the reservation value v_i for each buyer i, $i = 1, ..., n$, where $n = 1, 2$ represents the number of buyers.

2. The seller is privately informed about his/her production cost c and each buyer i is privately informed about his/her reservation value v_i.

3. In the *Request* treatments, the seller posts a price request for the good that is communicated to the buyer(s).

4. Each buyer submits a bid (an integer between 0 and 150,000 ECU); the seller is informed about the bid(s).

5. The seller has two choices:

   - Reject the bid(s) — in this case the good is not sold, both the seller and the buyer obtain a payoff of 0 ECU;

   - Accept the bid/one of the bids — in this case the good is sold at the price bid by the (selected) buyer, the buyer pays the price bid and obtains his/her reservation value for the good, the seller pays the production cost and cashes the price paid by the buyer; for the *Auction* treatments, the buyer not buying obtains a payoff of 0 ECU.

3.2 Procedures

The experiment was conducted at the CREED lab of the University of Amsterdam and computerized using zTree (Fischbacher, 2007). Data has been collected in 15 sessions run between Nov. 2019 and Feb. 2020. At the end of each session, we randomly selected 6 periods for payoffs. The total amount of ECU earned by the subject in these periods was converted in Euros at the rate of €1 for every 10,000 ECUs and it is added to a show-up fee of €7. Earnings were privately paid to each participant in cash at the end of the experiment. Each sessions lasted for about 90 minutes and participant earned €20.6 on average.

3.3 Hypotheses

Our research hypotheses, which we pre-registered (https://osf.io/t35m9), are based on the equilibrium predictions derived in Appendix B. According to the predictions, the price request posted by the seller does not contain information about the seller's valuation and it does not affect the outcomes of the negotiation. Alternative hypotheses, instead, are based on the results discussed in the literature-review section.

Starting from the effect of the presence of cheap-talk opportunities, we test the following hypotheses *1a* and *1b*.

Hypothesis 1 (Effects of the opportunity to announce the price request) *The presence of cheap-talk opportunities.*

1a. The opportunity for sellers to announce price requests does not affect the buyers' bids.

1b. The opportunity for sellers to announce price requests does not affect efficiency.

As for *hypothesis 1a*, we cannot draw a directional alternative. Previous results showed that when opportunities to communicate are present, messages can contain information on the reservation values and that this help achieving higher levels of efficiency (Radner and Schotter, 1989; Valley et al., 2002). If sellers disclose information with the request and buyers tailor their bids to it, one could observe lower (higher) bids for low (high) requests compared to when cheap-talk opportunities are not present. Therefore, in the *Bargaining* treatment the average bid with cheap-talk opportunities could be either higher or lower than the average bid without opportunities depending on how much sellers overstate or reveal their costs and on the bid level without cheap talk. Similar considerations applies to the *Auction* treatment, where previous results do not provide guidance on the effect of the presence of cheap-talk opportunities. Here we speculate that competition with another buyer weakens the importance of the seller's request compared to the case where competition is not present.

For the alternative *hypothesis 1b* we predict that the fraction of closed deals in *Bargaining* is higher when there is the opportunity to announce the price request compared to when the opportunity is absent. This is based on the fact that, in bilateral bargaining, cheap-talk opportunities increase efficiency because of a higher likelihood to close marginal deals due to the truthful revelation of the reservation values (Radner and Schotter, 1989; Valley et al., 2002). The driving force is the request containing information about the sellers' cost, which we will test using our experimental data. As for *Auction*, we cannot draw clear-cut alternative hypotheses from the literature. However, we argue that, if requests contain information about the cost, they can still help increasing efficiency above the level obtained without cheap talk. This novel result would extend the effect of the presence of cheap-talk opportunities to competitive settings.

Moving to the effect of the nature of cheap talk, i.e., the content of the messages, we test hypotheses *2* and *3*.

Hypothesis 2 (Effects of the level of the price request) *The level of the seller's price requests does not affect the buyers' bids.*

An alternative for *hypothesis 2* is that the seller's price request serves as an anchor for the buyers' bids in bilateral bargaining (Galinsky and Mussweiler, 2001). Therefore, in *Bargaining* we expect that, *ceteris paribus*, higher requests from the sellers trigger higher bids form the buyers, which, in turn, translates into a higher payoff for the seller. As for *Auction*, the literature does not provide clear-cut predictions when competition is present. Some argue that competition may reverse the effect because lower prices attract more bidders (Ku et al., 2006), others show that, when the number of bidders is fixed, bids are influenced by either external anchors (Ariely et al., 2003; Ivanova-Stenzel and Seres, 2021) or by the original request (Beggs and Graddy, 2009; Dodonova and Khoroshilov, 2004). Since we keep the number of bidders fixed, we argue that the anchoring effect would hold when competition is present as well.

Our design allows us to compare the strength of anchoring effect with and without competition while keeping the bargaining structures as similar as possible. Therefore, we can add to the literature providing new insights on whether competition weakens the anchoring effect.

Hypothesis 3 (Effects of the granularity of the price request) *The level of granularity of the seller's price request does not affect the buyers' bids.*

In this hypothesis, the term "granularity" refers to the number of consecutive zeroes at the end of the request or at the end of the bid. A *higher* number of zeroes means that the request (bid) has a *lower* granularity. So granularity measures the opposite of the number's "roundness", with rounder numbers having a lower index of granularity.

An alternative for *hypothesis 3*, based on results in the negotiation literature, is the hypothesis that the granularity of the seller's price request affects the buyers' bids in bilateral bargaining in that more granular price requests attract more granular bids (Janiszewski and Uy, 2008; Loschelder et al., 2017). This literature also suggests a second hypothesis predicting that the more granular the seller's price request, the lower (higher) is a buyer's bid conditional on her bid being higher (lower) than the seller's price request (Loschelder et al., 2014; Leib et al., 2020).

As said, these granularity effects may come from two distinct channels: a cognitive channel — for which granular offer trigger a smaller adjustment scale for the counteroffers — or an attribution of competence channel — for which more precise offers are believed to signal higher competence of the seller (Loschelder et al., 2017; Frech et al., 2020). In our experiment, we neutralize the attribution of competence channel: We have an abstract good, described only by reservation values, for which it makes little sense to speak of competence or knowledge. So, the only channel through which granularity can have an effect is the "scale-granularity" channel, which seems to be the most robust of the two channels (Leib et al., 2022). Therefore, we predict that in *Bargaining* granular requests trigger granular bids which are closer to the request compared to round bids that have similar sizes. As for *Auction*, evidence looking at these channels is absent and we cannot make directional hypotheses based on previous results. We speculate, however, that, because of its cognitive nature, the "scale-granularity" channel is relevant in *Auction* too (see Leib et al., 2022, for a similar argument).

4 Results

In this section we present the main results. We start by establishing some preliminary facts that will help understanding the main results. In section 4.1, we concentrate on testing the effect of the presence of cheap-talk opportunities on buyers' bids and efficiency (*hypothesis 1*. In section 4.2, we focus on the treatments where cheap talk is present and test whether the anchoring effect (*hypothesis 2*) and the granularity effect (*hypothesis 3*) arise and how they depend on the level of competition.

Before we present the main results, let us highlight that we found buyers and sellers making very few 'obvious' mistakes in the data. Buyers make an obvious mistake by bidding higher than their reservation value, which occurred in only 19 out of 3600 decisions (0.5 percent). Sellers chose a dominated option — i.e., a bid below their cost or the second-highest bid — in only 57 out of 2550 decisions (2.24 percent). See Appendix C.1 for additional information about buyers' and sellers' obvious mistakes.

4.1 The effect of the presence of cheap-talk requests

We now move to testing the hypotheses about the effect of the presence of cheap-talk opportunities on bids (*hypothesis 1a*) and on efficiency (*hypothesis 1b*).

The effect of cheap-talk requests on buyers' bids. A Wilcoxon rank sum test comparing bids in the *Request* and in the *No Request* treatments fails to reject the null hypothesis that cheap talk has no effect on bids both in *Bargaining* ($W = 69$, $p = 0.165$) and in *Auction* ($W = 36$, $p = 0.197$).[8] This aggregate null result, however, hides interesting effects. Columns (1) and (2) in Table 2 report the results of two linear models, one for each treatment, investigating the effect of the opportunity to make a cheap-talk request on the buyer's bids. In both models we expect to find a positive correlation between the reservation value and the bid made by the buyer with and without cheap talk. Moreover, we do not expect to find any correlation between the production costs and the bid when the seller has no opportunity to make a request. When, instead, the seller has the opportunity to make a request, there may be a correlation if the request is not pure cheap talk: (i) the request contains information about the private value of the seller and (ii) the buyer takes into account the request when choosing his bid.

Starting with the *Bargaining* treatment (Column (1)), we observe that, without cheap-talk opportunities, the bids are strongly correlated with the (normalized) reservation values (RV/1000-100), while the (normalized) production costs (PC/1000-50) and its interaction with the reservation value (RV/1000-100)×(PC/1000-50)) do not explain the bids. When introducing the cheap-talk opportunity, instead, we observe a significant contribution of the production cost in explaining the variance in the bids. Specifically, bids are positively correlated with the production costs (*Request*×(PC/1000-50)). This correlation increases with the buyers' reservation value (*Request*×(RV/1000-100)×(PC/1000-50)). These results suggest that the requests by the sellers contain information and that the buyers use this information in their bidding. Note that the sensitivity of the bids to the information contained in request increases with the possibility to make higher bids.

To make it easier to appreciate these results, the top panel of Figure 1 provides a graphical representation of the effects. The figure highlights how the effect of cheap talk has different signs and sizes depending on combinations of costs and reservation values. Note that, the dummy variable *Request* in the regression measures the average effect of the introduction of cheap talk for a reservation value of 100,000 ECU and a cost of 50,000 ECU. The figure shows how, for low reservation values, the introduction of cheap talk has either no impact or a small positive impact on the bids. For higher reservation values, instead, the presence of cheap talk favors the

[8] This test is performed taking averages at matching group level as the unit of observation. This results in 10 observations per treatment (11 observations in the *Auction-Request* treatment).

Table 2: Effects of the presence of cheap talk.

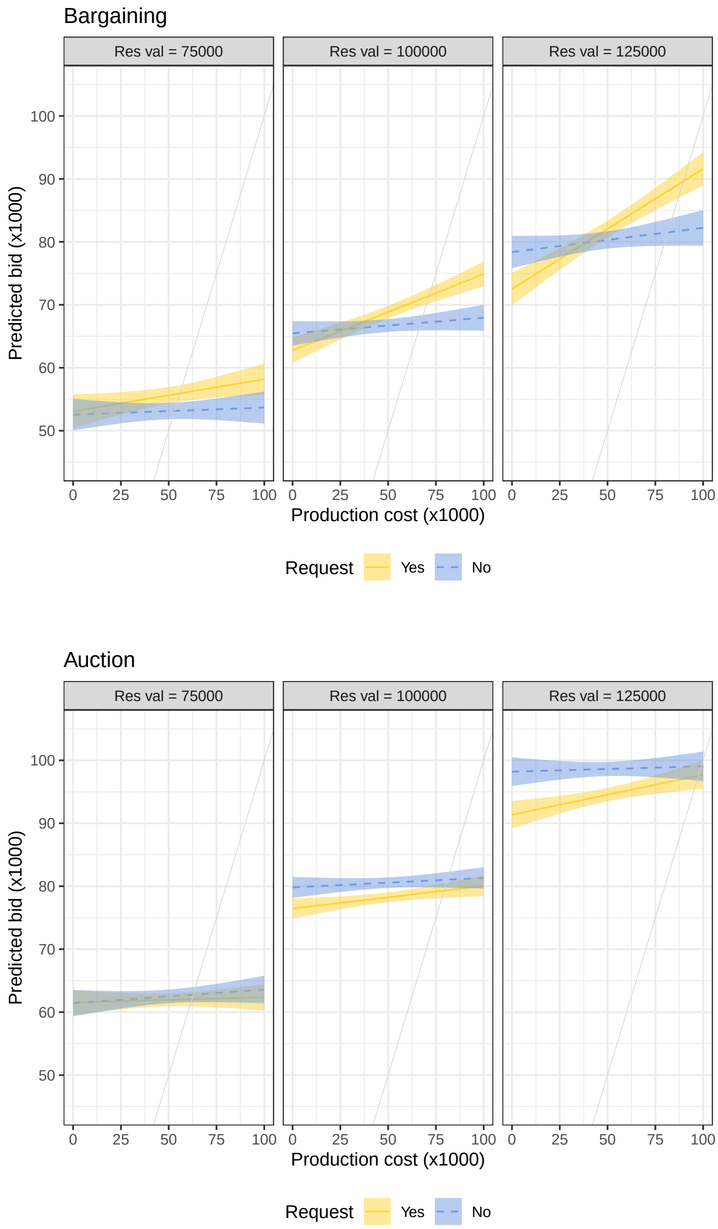
	Dependent variable:		
	Buyer bid/1000		
	OLS Robust	OLS Robust	OLS Robust
	(1)	(2)	(3)
	Bargaining	*Auction*	*Both*
RV/1000-100	0.544***	0.722***	0.544***
	(0.020)	(0.022)	(0.020)
PC/1000-50	0.025	0.015	0.025
	(0.017)	(0.016)	(0.017)
(RV/1000-100)×(PC/1000-50)	0.001	−0.0003	0.001
	(0.001)	(0.001)	(0.001)
Request	2.130	−2.320	2.130
	(1.447)	(1.490)	(1.447)
Request×(RV/1000-100)	−0.015	−0.071**	−0.015
	(0.030)	(0.027)	(0.030)
Request×(PC/1000-50)	0.096*	0.021	0.096*
	(0.045)	(0.029)	(0.045)
Request×(RV/1000-100)×(PC/1000-50)	0.002*	0.001	0.002*
	(0.001)	(0.001)	(0.001)
Auction			13.855***
			(1.471)
Auction×(RV/1000-100)			0.179***
			(0.030)
Auction×(PC/1000-50)			−0.010
			(0.023)
Auction×(RV/1000-100)×(PC/1000-50)			−0.001
			(0.001)
Auction×*Request*			−4.449*
			(2.077)
Auction×*Request*×(RV/1000-100)			−0.055
			(0.040)
Auction×*Request*×(PC/1000-50)			−0.075
			(0.053)
Auction×*Request*×(RV/1000-100)×(PC/1000-50)			−0.001
			(0.001)
Constant	66.708***	80.563***	66.708***
	(0.896)	(1.166)	(0.896)
Observations	1,500	2,100	3,600
N. Groups	20	21	41
R^2	0.560	0.691	0.665

Notes: All models reports robust standard errors clustered at group level in parentheses. The variables RV/1000-100 and PC/1000-50 capture reservation values and the costs in thousands of ECU and re-centered at their median value. *Request* is the cheap talk treatment dummy variable. *Auction* is the Auction treatment dummy variable. All regressions models are estimated in R (Robust clustered standard errors of type HC3). *** $\leq$ 0.001; ** $\leq$ 0.01; * $\leq$ 0.05; $^\circ$ $\leq$ 0.1.

buyer in the case of low production costs and favors the seller in the case of high production costs.

In the *Auction* treatment (Column (2)), we observe qualitatively the same results as in the *Bargaining* treatment when cheap-talk opportunities are not present: the bids are strongly correlated with the reservation values (RV/1000-100) while the production costs do not explain the bids (PC/1000-50 and (RV/1000-100)×(PC/1000-50)). However, we observe a different pattern when introducing cheap-talk opportunities. As a first result, production costs do not seem to help predicting the bids made (*Request*×(PC/1000-50) and *Request*×(RV/1000-100)×(PC/1000-50) are both not significant). As a second result, cheap-talk opportunities weakens the strength of the relationship between reservation values and bids ($\textit{Request}\times$(RV/1000-100)). This implies that bids for higher reservation values are lower when cheap talk is present compared to when it is not. The bottom panel of Figure 1 provides a graphical representation of the effects for the *Auction* treatment. From the figure it is clear that the correlation between costs and bids is weak and that, moving from lower to higher reservation values (from the panel to the left to the panel to the right), bids increase faster without cheap talk than with cheap talk.

Figure 1: Predicted bid with confidence bands.



Notes: The figure shows the predicted bids by treatment with 95% confidence bands. Predictions in the top and bottom panel are based on models (1) and (2) in Table 2, respectively.

Finally, Model (3) in Table 2 provides a test of the effect of competition, i.e., it compares the *Bargaining* and *Auction* treatments. Results show that competition substantially increases both the average bid (*Auction*) and the strength of the relationship between the reservation value of the buyer and his bid (*Request*×(RV/1000-100)). The interaction term *Auction*×*Request* shows that the presence of cheap-talk requests has a weaker impact with competition than without.

Given that sellers make optimal acceptance choices in 97.8% of the cases, the way cheap talk influences bids directly translates to its influence on the seller's payoffs. Additionally, analyzing the bids allows us to correct for censoring of the payoffs at 0: we can observe the counterfactual, i.e., the payoff that the seller would have obtained had he accepted the bid. Therefore, the analysis of the bid provides a better alternative to a Tobit model with the payoffs as the dependent variable. We report the Tobit regressions in Appendix C.2.

Do the requests contain information about the production costs? To interpret some of the results described above, we need to understand whether the seller's price request contains information about her production costs. While this must be the case for the *Bargaining* treatment, where we have observed that costs are correlated with the bids, it may not be the case in the *Auction* treatment. Indeed, Model (1) in Table 4 shows a strong correlation between requests and production costs in the *Bargaining* treatment, which becomes mildly significantly weaker in the *Auction* treatment. So, competition reduces the informativeness of the requests.

The above results can be summarized as follows.

Result 1a (Effect of the presence of cheap-talk opportunities on bids)

- *Requests contain information about the seller's cost.*
- *Competition reduces the informativeness of the requests.*
- *With and without competition, cheap-talk opportunities do not have an effect on the average bids.*
- *When cheap-talk opportunities are present, buyers condition their bids on the seller's costs with lower bids to sellers with low production costs and higher bids to sellers with high production costs.*
- *Competition weakens the possibility of the buyer to condition bids on the costs of the seller.*

Overall, the result leads to a rejection of *hypothesis 1a*, which states that bids are unaffected by cheap-talk opportunities. It shows that the presence of cheap talk has a subtle effect on the bids in *Bargaining*: requests contain information about the production costs that are used by the buyer, which provides lower bids to sellers with low production costs and higher bids to sellers with high production costs. This combined with the fact that sellers optimally accept bids translates to sellers being better off with cheap talk when costs are low and worse off with cheap talk when costs are high. The results highlight also that the presence of cheap talk show a different pattern when competition is present. The effect of cheap talk is milder in *Auction* than in *Bargaining*, with a weaker correlation between the costs and the bids.

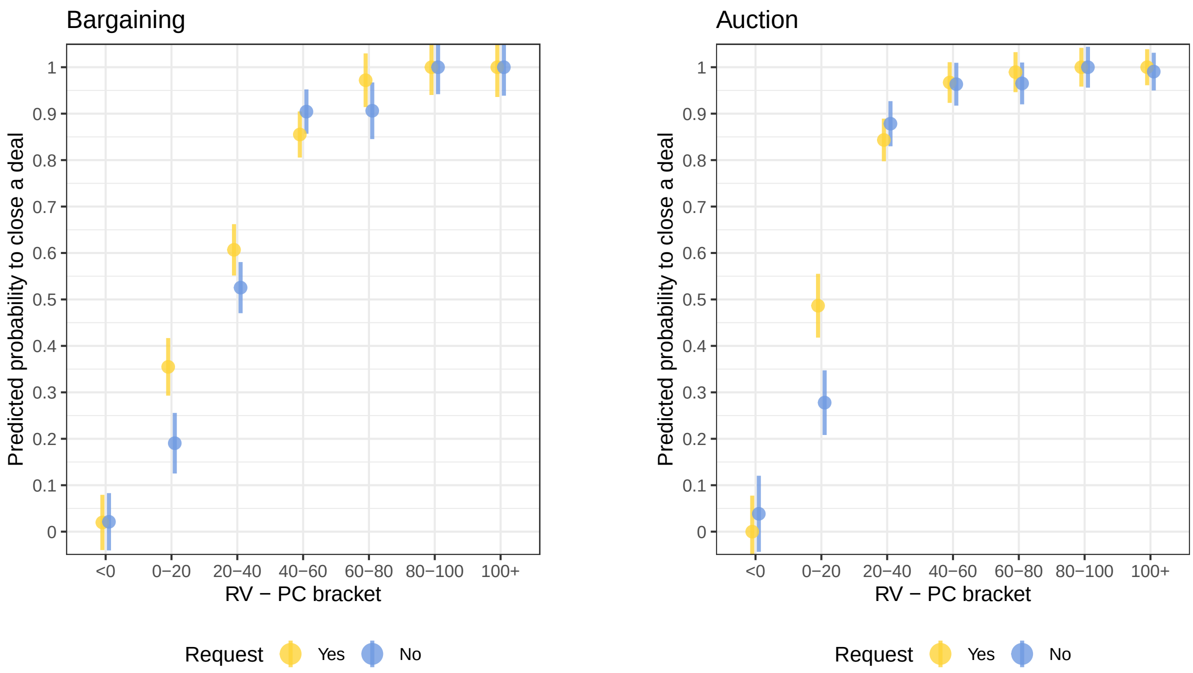
The effect of cheap-talk requests on efficiency. According to *hypothesis 1b*, cheap-talk opportunities have no impact on efficiency. In contrast, the observation that price requests contain information about the cost of the seller suggests that cheap talk could have a positive impact on efficiency, at least in *Bargaining*, because sellers with high costs have a higher likelihood to face high offers. To verify this we compare the fraction of closed deals — i.e., transactions that ends with a purchase — across treatments.[9]

Overall, the fractions of closed deals hardly depends on cheap-talk opportunities. In *Bargaining*, closed deals with and without cheap-talk opportunities are 69.5% and 68.0%, respectively. In *Auction*, these fractions are 88.2% and 86.6%, respectively. These outcomes suggest that the opportunity to post a request has a minimal impact on overall efficiency. This crude comparison, however, considers all possible types of deal, including those with a large potential surplus — where the cost and the reservation values are far apart — and those with a negative surplus — where the cost is higher than the reservation values — for which communication is less important to reach a profitable outcome. Indeed, as documented in the literature review, the presence of cheap talk is most effective for closing marginal deals, where the reservation values are relatively close to each other and there is not much room for bargaining (Valley et al., 2002).

To verify whether cheap-talk opportunity increases efficiency at the margin, we can look at Figure 2, which reports the fraction of closed deals by bracket of attainable surplus. The figure clearly shows that in the *Barganing* (*Auction*) treatment, the likelihood to close a deal with a surplus between 0 and 20,000 ECU is 16.6 (24.7) percentage points higher when cheap-talk

[9]Note that, since all bids are below the reservation value (99.5%) and all sellers accepted only the best profitable bids (97.8%), the fraction of closed deals is also a measure of efficiency. For additional information and analyses on efficiency, see Appendix C.3.

Figure 2: Fraction of closed deals by surplus bracket and treatment.



Notes: The figure shows the fraction of closed deals by surplus bracket (in thousands of ECU). Surplus is defined as $(v_1 - c)/1000$ and $(\max(v_1, v_2) - c)/1000$ in *Bargaining* and in *Auction*, respectively. Vertical lines represent 95% confidence intervals.

opportunities are present and that this difference vanishes for the more profitable deals. To formally test this, we run a series of linear probability models with robust standard errors clustered at the group level. The regressions, reported in Table 3, show the difference in the fraction of closed deals with and without cheap talk by attainable surplus' bracket. The estimated parameter of the indicator variable *Request*×(Surplus in [0,20)) in models (1) and (2) support the observation that cheap talk helps to close the marginal deals in both *Bargaining* and *Auction*, albeit with a marginally significant effect in the latter case. This leads to the following result.

Result 1b (Effect of the presence of cheap-talk opportunities on efficiency)

- *Cheap-talk opportunities have a positive effects on efficiency because they help closing marginal deals. The effect is statistically weaker when competition is present.*

This result leads to the rejection of *hypothesis 1b* in favor of the alternative hypothesis that cheap-talk opportunities improve efficiency because they help closing the marginal deals.

Table 3: Likelihood to close a deal by attainable surplus

	Dependent variable:		
	Closed deal		
	LPM Robust	LPM Robust	LPM Robust
	(1)	(2)	(3)
	Bargaining	*Auction*	*Both*
Surplus in [0,20)	0.169***	0.239*	0.169***
	(0.045)	(0.093)	(0.045)
Surplus in [20,40)	0.504***	0.840***	0.504***
	(0.056)	(0.047)	(0.056)
Surplus in [40,60)	0.883***	0.925***	0.883***
	(0.034)	(0.042)	(0.034)
Surplus in [60,80)	0.885***	0.927***	0.885***
	(0.042)	(0.042)	(0.042)
Surplus in [80,100)	0.979***	0.962***	0.979***
	(0.015)	(0.041)	(0.015)
Surplus in [100,150]	0.979***	0.952***	0.979***
	(0.015)	(0.041)	(0.015)
Request	−0.001	−0.038	−0.001
	(0.020)	(0.041)	(0.020)
Request×(Surplus in [0,20))	0.166**	0.247°	0.166**
	(0.064)	(0.138)	(0.064)
Request×(Surplus in [20,40))	0.083	0.003	0.083
	(0.092)	(0.055)	(0.092)
Request×(Surplus in [40,60))	−0.048	0.042	−0.048
	(0.051)	(0.049)	(0.051)
Request×(Surplus in [60,80))	0.067	0.063	0.067
	(0.052)	(0.043)	(0.052)
Request×(Surplus in [80,100))	0.001	0.038	0.001
	(0.020)	(0.041)	(0.020)
Request×(Surplus in [100,150])	0.001	0.048	0.001
	(0.020)	(0.041)	(0.020)
Auction			0.017
			(0.044)
Auction×(Surplus in [0,20))			0.070
			(0.103)
Auction×(Surplus in [20,40))			0.336***
			(0.073)
Auction×(Surplus in [40,60))			0.042
			(0.054)
Auction×(Surplus in [60,80))			0.042
			(0.059)
Auction×(Surplus in [80,100))			−0.017
			(0.044)
Auction×(Surplus in [100,150])			−0.027
			(0.044)
Auction×*Request*			−0.037
			(0.046)
Auction×*Request*×(Surplus in [0,20))			0.081
			(0.152)
Auction×*Request*×(Surplus in [20,40))			−0.079
			(0.107)
Auction×*Request*×(Surplus in [40,60))			0.090
			(0.071)
Auction×*Request*×(Surplus in [60,80))			−0.004
			(0.068)
Auction×*Request*×(Surplus in [80,100))			0.037
			(0.046)
Auction×*Request*×(Surplus in [100,150])			0.046
			(0.046)
Constant	0.021	0.038	0.021
	(0.015)	(0.041)	(0.015)
Observations	1,500	1,050	2,550
N. Groups	20	21	41
R^2	0.572	0.593	0.597

Notes: The dependent variable is a dummy that takes value 1 when a deal is closed (i.e., the seller accepts the bid of the buyer). All models reports robust standard errors clustered at group level in parentheses. The variables "Surplus in [a,b)" are dummies taking value 1 if the maximum attainable surplus is in the interval [a,b). The maximum attainable surplus is defined as "$v - c$" and "$\max(v_1, v_2) - c$" in Bargaining and in Auction, respectively. *Request* is the cheap talk treatment dummy variable. *Auction* is the Auction treatment dummy variable. All regressions models are estimated in R (Robust clustered standard errors of type HC3). *** $\leq$ 0.001; ** $\leq$ 0.01; * $\leq$ 0.05; ° $\leq$ 0.1.

4.2 Anchoring and granularity effects

In this section, we study anchoring and granularity effects. We restrict the attention to the treatments where the seller has the opportunity to post a price request and test the effects of the level and granularity of the request, i.e., *hypothesis 2* and *hypothesis 3*. Recall that granularity refers to the number of consecutive zeroes at the end of an integer number, with a *higher* number of zeroes meaning *lower* granularity. Formally, we define the granularity of a number as 4 minus the number of zeroes at the end of the number.[10]

The effect of the level of the requests (anchoring). *Hypothesis 2* states that the level of the request made by the seller has no influence on the bid made by the buyer. Figure 3 shows the relationship between requests and bids. The request of the seller defines an upper bound for virtually all the buyers' bids in the *Bargaining* treatment, suggesting a correlation between the two. In the *Auction* treatment, instead, the seller's request does not constrain the bids made by the buyers. Moreover, the correlation between the seller's request and the buyer's bid seems to be weaker. Column (3) in Table 4 confirms these observations in a linear regression, which can be summarized as follows:

Result 2 (Effects of the level of the price request)

- *Buyers' bids are positively correlated with the seller's request.*
- *Competition reduces the strength of this correlation.*

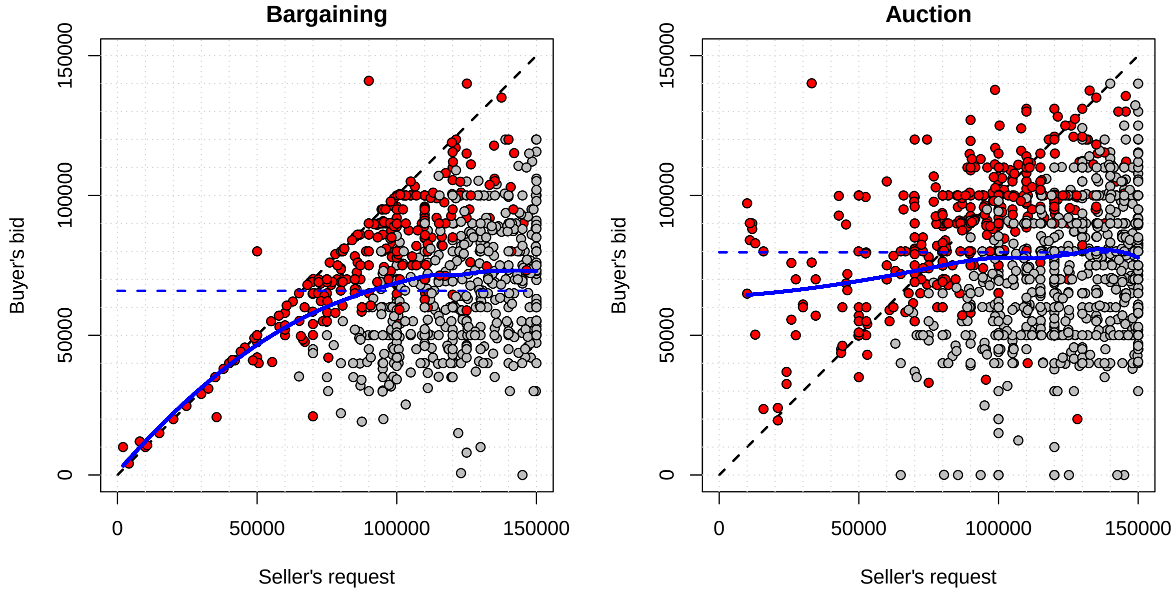
Result 2 shows that the request serves as an anchor for the bid of the buyer. Recall that in this case the anchor is informative, as Model (1) in Table 4 shows. Overall, this leads to the rejection of *hypothesis 2*, showing that anchoring to the first offer is a robust phenomenon that is only weakened by the introduction of competitive pressure.

The effect of the granularity of the requests (price precision). According to *hypothesis 3*, the granularity of the seller's request does not influence the level and the granularity of the buyer's bid.[11] The alternative prediction, derived from the literature, is that granular requests

[10] In our setting, the number of zeroes at the end of a seller's request and at the end of a buyer's bid can vary between 0 (e.g. 45,678) and 5 (100,000). Since 100,000 would be the only number with granularity -1, we assign this number to the numbers of granularity 0. This means that, in our experiment, granularity can vary from 4 to 0.

[11] Appendix C.4 shows that: (i) the level of the request and its granularity are not correlated; and (ii) the distribution of the granularity of the request is similar in the *Bargaining* and in the *Auction* treatments.

Figure 3: Buyers' bid by sellers' request and treatment.



Notes: The figure shows the bids of the buyer (y axis) by request (x axis). Gray dots represent bids of the buyer that cannot match the request of the seller, i.e., the cases where the reservation value v is lower than the request. Blue solid lines represent the bids' smooth conditional means estimated by LOESS. Blue dashed lines show the average bid in the no request treatments.

triggers bids that are closer to the request. Considering the level of the buyer's bid, Model (3) in Table 4 shows that the granularity of the request has no significant effects in both the *Bargaining* and the *Auction* treatments, when controlling for the level of the request and for the reservation value of the buyer. Model (4) provides further evidence by showing that the granularity of the request has no impact on the gap between the request and the bid in both treatments.

Zooming in, we look at the correlation between the granularity of the bid and the granularity of the request. Column (2) in Table 4 reports a linear regression model with the granularity of the buyer's bid as dependent variable. The regressions show that the granularity of the bid is correlated with the granularity of the seller's request in both the *Bargaining* and the *Auction* treatment.

Result 3 (Effects of the granularity of the price request)

- *Granular requests trigger granular bids both with and without competition.*
- *The granularity of the request has no effect on the level of the bids.*

This result does not reject *hypothesis 3*. While we support the idea that rounder offers

Table 4: Effect of the nature of cheap talk; Informativeness, Anchoring, and Granularity.

	Dependent variable:			
	Seller request/1000	Bid Granularity	Buyer bid/1000	|Req. - Bid|/1000
	OLS Robust	OLS Robust	OLS Robust	OLS Robust
	(1)	(2)	(3)	(4)
PC/1000-50	0.389***			
	(0.049)			
RV/1000-100		−0.002	0.541***	−0.568***
		(0.003)	(0.021)	(0.024)
RQ/1000-100		0.002	0.299***	
		(0.004)	(0.042)	
RQ Granularity		0.222*	0.231	0.535
		(0.103)	(0.478)	(1.282)
Auction	2.131	0.060	10.730***	0.097
	(5.810)	(0.348)	(2.256)	(5.309)
Auction×(PC/1000-50)	−0.181°			
	(0.105)			
Auction×(RV/1000-100)		0.001	0.115***	0.030
		(0.003)	(0.026)	(0.061)
Auction×(RQ/1000-100)		−0.004	−0.170**	
		(0.007)	(0.053)	
Auction×RQ Granularity		−0.062	0.214	−1.151
		(0.121)	(0.643)	(1.898)
Constant	110.749***	1.362***	65.009***	41.291***
	(2.880)	(0.228)	(1.736)	(3.322)
Observations	1,300	1,840	1,850	1,850
N. Groups	21	21	21	21
R^2	0.113	0.042	0.635	0.308

Notes: All models reports robust standard errors clustered at group level in parentheses. Dependent variables are reported in the second row of the table. The variables RV/1000-100, PC/1000-50, and RQ/1000-100 capture reservation value, the cost, and the request in thousands of ECU and re-centered at their median value. "Granularity" is defined as $\max(0, 4-k)$, where k is the number of zeroes ending the number. 10 observations are excluded from (2) because the buyer bid 0, a number for which the granularity is not defined. *Auction* is the Auction treatment dummy variable. All regressions models are estimated in R (Robust clustered standard errors of type HC3). *** ≤ 0.001; ** ≤ 0.01; * ≤ 0.05; ° ≤ 0.1.

trigger rounder counteroffers, in line with the scale-granularity hypothesis (Janiszewski and Uy, 2008; Loschelder et al., 2017), we fail to find an effect on the bid's level. This deviates from the accumulated evidence on price precision discussed in the literature section. Interestingly, the effect of granularity is not significantly affected by competition: we observe the same pattern of results in both treatments (see columns (2)-(4) in Table 4).

5 Conclusion

In real-estate markets and on internet platforms like eBay, sellers routinely set non-binding asking prices, and auction houses announce low- and high-price estimates for art being put up for auction. We have studied how competition moderates the way such cheap-talk communication affects trade between buyers and sellers. Our results show that most of the efficiency, anchoring, and granularity effects identified in the literature for bilateral bargaining survive with competition, although some of them become weaker. First, the ability of sellers to make a cheap-talk price request helps the trading partners close marginal deals both in bilateral bargaining and in competition. Second, sellers' price requests contain information about the costs, but the signal is weaker when competition is present. Competition also reduces the ability of buyers to exploit the information contained in the seller's price requests. Indeed, bids are more strongly anchored to the sellers' requests when competition is not present compared to when competition is present. Third, the granularity of the seller's request does not impact the selling price with or without competition, despite sellers communicating more granular requests attracting more granular bids from the buyers.

Our findings offer a potential explanation as to why cheap-talk communication between trading partners abounds in practice: it facilitates marginal deals being closed. In our experiment, the number of marginal deals closed increased by roughly 50% both with and without buyer competition (see Figure 2). Our observations also suggest that sellers have a good reason to think carefully about the way they set their asking prices, even if they are non-binding. While the granularity of the asking price hardly matters in the context of our experimental framework, the level of the asking price does, in particular in the case of bilateral bargaining.

Our results give rise to two research questions that may be addressed in future research. First, why do the sellers in our experiment not exploit buyers' sensitivity to their price requests? The solid blue lines in figure 3 indicate that a payoff-maximizing seller should make a request in the neighborhood of 140,000 ECU in both the *Bargaining* treatment and the *Auction* treatment. Instead, the sellers' requests are an increasing function of their costs. This observation is robust in the sense that sellers hardly increase their requests over time.[12] Possible explanations are that sellers are altruistic, seek efficiency, or value a fair distribution of the surplus. Such explanations would be in line with sellers having other-regarding preferences, for which the experimental economics literature has offered ample evidence (Cooper and Kagel (2016) is an excellent overview).

Second, how robust are the granularity effects found in the negatiotions literature?[13] In contrast to this literature, we have not observed the granularity of the seller's price request

[12] Table C.6 in Appendix C.5 suggests some learning for the *Bargaining* treatment. Model (1) shows that sellers disclose a significant amount of information in the first few periods of the experiment and this signal becomes weaker over time: sellers learn to make higher requests that are less correlated with their costs. However, the table also shows that learning is not complete. The correlation between requests and costs remains significant in the last periods of the experiment. In the *Auction* treatment, the correlation between requests and costs is already small in the first few periods and it does not significantly change over time (see Model(2) of Table C.6). Table C.7 in Appendix C.5 indicates that buyers respond to less informative seller requests by weakening the correlation between their bids and the request.

[13] See, e.g., Janiszewski and Uy (2008), Loschelder et al. (2014), Backus et al. (2019), and Leib et al. (2020)

affecting the average buyer's bid. We see two potential reasons for the divergence: (i) granularity effects only emerge in settings where the seller can signal other information than her costs, including "competence" and patience; (ii) granularity effects only emerge for specific cost/value draws. In our experiment, we have neutralized the attribution of the competence and patience channels. The good traded is fully described by the reservation values so that competence cannot play a role. Moreover, the timing of the trade does not affect payoffs so that patience cannot play a role either. As for the second explanation, our experimental framework allows for a large range of values on both sides of the markets, while the classic studies on the granularity effect focus on settings where the buyer is assumed to have a greater reservation value than the seller. So, the scope for granularity effects to occur in our experiment might be narrow because buyers may have values above or below the request.[14] Further exploring the way granularity affects trade outcomes in competitive settings seems like a promising path for future research to explore.

[14]Still, we find no evidence of an effect of requests' granularity on the magnitude of the bids even if we restrict attention to only the cases where the buyer's reservation values is greater than the request.

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A Appendix: Experimental instructions

Highlighted in yellow are the sentences present only in the *Request* treatments.

INSTRUCTIONS (BARGAINING)

Welcome! You are about to participate in a study funded by the University of Amsterdam. Please switch off your mobile phone and remain quiet. It is strictly forbidden to talk to the other participants during the study. It is very important that you follow these rules. Otherwise we must exclude you from the study and from all payments. The instructions are identical for all participants. Please read them carefully. Whenever you have a question or a concern, please raise your hand and the experimenter will come to your desk.

You will receive 7 euros for participating in this study. Beyond this you can earn more money, depending partly on the decisions that you take during the study, partly on the decisions of other participants, and partly on chance. The participation fee and any additional amounts of money you may earn will be paid to you in cash at the end of the study. Payments are carried out privately, i.e., with the others unaware of the extent of your earnings. During the study we will speak of ECU (Experimental Currency Units) rather than euros. The conversion rate between them is **one euro for every 10000 ECUs**.

ROLES, TASK, AND PAYOFFS

In this study there are **25 periods**. In each period, you are anonymously matched with another participant to form a couple. One of the two participants in the couple is assigned to the role of **Seller** and the other to the role of **Buyer**. The task of the Buyer and the Seller is to bargain over an item.

The Seller can sell the item to the Buyer. If sold, the item needs to be produced and the Seller pays the cost of production of ***c*** ECU. This means that, if the item it is not sold, the Seller's payoff is 0 ECU. If the item is sold, the Seller produces the item and his/her payoff is the price received for the item ***p*** minus the production cost ***c***.

The item is valuable to the Buyer. Buying the item gives to the Buyer a reservation value of ***v*** ECU. This means that, if the item is not bought, the Buyer's payoff is 0 ECU. If the item is bought, the Buyer's payoff is the reservation value ***v*** minus the price paid for the item ***p***.

The Seller's cost of production ***c*** and the Buyer's reservation value ***v*** are independently and randomly determined for each Buyer and each Seller in each period. This means that different Buyers and different Sellers have different values. The cost ***c*** can be any number between **0** and **100,000** (every value is equally likely). The reservation value ***v*** can be any number between **50,000** and **150,000** (every value is equally likely). The costs and the reservation values are private information, meaning that only the Seller learns his/her production cost and only the Buyer learns his/her reservation value. The other participants do not know these values.

WARNING: if the item is sold at a price that is lower than the production cost, the Seller obtains a negative payoff for the period. The same happens for the Buyer if the item is sold at a price that is higher than the reservation value. It is therefore very important for you to pay attention when you make your choices. If you sell below your production cost or if you buy above the reservation value your final payoff may be negative. These losses will be deducted from the show-up fee.

BARGAINING PROCEDURE

The bargaining procedure is the same in each period and it is as follows:

1. At the beginning of the period participants are randomly and anonymously matched in couples. One participant is randomly assigned to the role of the Seller and the other to the role of the Buyer.
2. The computer independently draws the production cost ***c*** and the reservation value ***v*** for each Seller and Buyer.
3. The Seller is informed about his/her production cost ***c*** and the Buyer is informed about his/her reservation value ***v***.
4. The Seller posts a **price request** for the item that is communicated to the Buyer.
5. The Buyer send an **offer** to the Seller.
6. When the Seller receives the offer, he/she has two choices:
    - **REJECT the offer** — in this case the item is not sold, both the Seller and the Buyer obtain a payoff of 0 ECU;
    - **ACCEPT the offer** — in this case the item is sold at the price offered by the Buyer, the Buyer pays the price and obtains his/her reservation value for the item, the Seller pays the production cost and cashes the price paid by the Buyer.

YOUR EARNINGS

Your earnings for this study are determined as follows: at the end of the study the computer will select **6 periods out of the 25 periods** at random. The total payoff you accumulated in these 6 periods will be converted in euros and added to the 7 euros participation fee. This final amount will be paid to you in cash at the end of the study.

You have reached the end of the instructions. We will now ask you to answer some questions on your computer screen to ensure that you understand the instructions completely. If you have any questions, please raise your hand and the experimenter will come to your desk.

INSTRUCTIONS (AUCTION)

Welcome! You are about to participate in a study funded by the University of Amsterdam. Please switch off your mobile phone and remain quiet. It is strictly forbidden to talk to the other participants during the study. It is very important that you follow these rules. Otherwise we must exclude you from the study and from all payments. The instructions are identical for all participants. Please read them carefully. Whenever you have a question or a concern, please raise your hand and the experimenter will come to your desk.

You will receive 7 euros for participating in this study. Beyond this you can earn more money, depending partly on the decisions that you take during the study, partly on the decisions of other participants, and partly on chance. The participation fee and any additional amounts of money you may earn will be paid to you in cash at the end of the study. Payments are carried out privately, i.e., with the others unaware of the extent of your earnings. During the study we will speak of ECU (Experimental Currency Units) rather than euros. The conversion rate between them is **one euro for every 10000 ECUs**.

ROLES, TASK, AND PAYOFFS

In this study there are **25 periods**. In each period, you are anonymously matched with two other participants to form a group. One of the three participants in the group is assigned to the role of **Seller** and two to the role of **Buyers**. The task of the Buyers and the Seller is to bargain over an item.

The Seller can sell the item to one of the Buyers. If sold, the item needs to be produced and the Seller pays the cost of production of ***c*** ECU. This means that, if the item it is not sold, the Seller's payoff is 0 ECU. If the item is sold, the Seller produces the item and his/her payoff is the price received for the item ***p*** minus the production cost ***c***.

The item is valuable to the Buyers. Buying the item gives to the Buyer a reservation value of ***v*** ECU. This means that, if the item is not bought, the Buyer's payoff is 0 ECU. If the item is bought, the Buyer's payoff is the reservation value ***v*** minus the price paid for the item ***p***.

The Seller's cost of production ***c*** and the Buyers' reservation value ***v*** are independently and randomly determined for each Buyer and each Seller in each period. This means that different Buyers and different Sellers have different values. The cost ***c*** can be any number between **0** and **100,000** (every value is equally likely). The reservation value ***v*** can be any number between **50,000** and **150,000** (every value is equally likely). The costs and the reservation values are private information, meaning that only the Seller learns his/her production cost and only the Buyer learns his/her reservation value. The other participants do not know these values.

WARNING: if the item is sold at a price that is lower than the production cost, the Seller obtains a negative payoff for the period. The same happens for the Buyer if the item is sold at a price that is higher than the reservation value. It is therefore very important for you to pay attention when you make your choices. If you sell below your production cost or if you buy above the reservation value your final payoff may be negative. These losses will be deducted from the show-up fee.

BARGAINING PROCEDURE

The bargaining procedure is the same in each period and it is as follows:

1. At the beginning of the period participants are randomly and anonymously matched in groups of three. One participant is randomly assigned to the role of the Seller and the others to the role of the Buyers.
2. The computer independently draws the production cost ***c*** and the reservation values ***v*** for each Seller and Buyer.
3. The Seller is informed about his/her production cost ***c*** and the Buyers are informed about their reservation values ***v***.
4. The Seller posts a **price request** for the item that is communicated to the Buyers.
5. Each one of the two buyers send an **offer** to the Seller.
6. When the Seller receives the offers, he/she has two choices:
    - **REJECT both offers** — in this case the item is not sold, the Seller and the two Buyers obtain a payoff of 0 ECU;
    - **ACCEPT the offer of one of the two buyers** — in this case the item is sold at the price offered by the selected Buyer, the selected Buyer pays the price and obtains his/her reservation value for the item, the Seller pays the production cost and cashes the price paid by the selected Buyer. The other Buyer obtains a payoff of 0 ECU.

YOUR EARNINGS

Your earnings for this study are determined as follows: at the end of the study the computer will select **6 periods out of the 25 periods** at random. The total payoff you accumulated in these 6 periods will be converted in euros and added to the 7 euros participation fee. This final amount will be paid to you in cash at the end of the study.

You have reached the end of the instructions. We will now ask you to answer some questions on your computer screen to ensure that you understand the instructions completely. If you have any questions, please raise your hand and the experimenter will come to your desk.

B Appendix: Equilibrium Analysis

In this appendix, we derive the equilibrium properties of the bargaining games studied in our experiment. To enhance readability, all monetary variables are expressed in units of 100,000 ECU. A seller and n risk-neutral buyers, labelled $i = 1, \ldots, n$, interact in the following setting. The seller owns a good to which she attaches value c. Buyer i's valuation of the good is v_i. The players' values are private information and i.i.d. drawn. c is drawn from a uniform distribution on the interval $[0, 1]$ and the v_i's are drawn from a uniform distribution on the interval $[1/2, 3/2]$. The seller and the buyers interact in the following three-stage game:

1. The seller announces a price p in the range $[0, 3/2]$.
2. Each buyer i independently submits a bid $b_i \geq 0$.
3. The seller rejects all bids or accepts one of them.

If the seller accepts buyer i's bid, the seller's payoff equals $b_i - c$, buyer i's payoff is equal to $v_i - b_i$ and buyers other than i earn zero. If the seller rejects all bids, the payoffs of all players are zero.

In the experiment, we study two cases: $n = 1$ (bilateral negotiation or *bargaining*) — where competition is absent — and $n = 2$ (*auction*) — where competition on the side of the buyers is present. Now, we elaborate on the perfect Bayesian equilibrium of both cases. First, notice that in the third stage, the seller trivially accepts the highest bid if and only if this bid exceeds c. She rejects any other bids, i.e., bids below c and bids below the highest bid. In the first stage, the price announced by the seller cannot reveal information about the seller's value. The reason is that if it did, the buyers would alter their bidding strategy in stage 2. But then, the seller would be better off by always choosing the price yielding the highest expected payoff from the buyers' strategies, regardless of her value c, which is a contradiction to the assumption that the price contains any information. Many seller strategies have the property of not revealing information, e.g., always choosing $p = 3/2$ (or any other price in $[0, 3/2]$) or randomizing over the entire interval $[0, 3/2]$. So, in the second stage, the buyers ignore the price the seller announces in stage 1. In the case of *bargaining*, the buyer solves

$$\max_b P(b \geq c)(v_i - b) = \min(b, 1)(v_i - b)$$

Clearly, the bidding curve $\beta(v_i) = \frac{v_i}{2}$ is the unique solution.

Turning to the *auction* case, suppose a symmetric equilibrium exists in which both buyers bid according to the same strictly increasing equilibrium bidding curve β. Assuming that buyer $j = 1, 2$ bids $\beta(v_j)$ when his value is v_j, the best response of buyer $i = 3 - j$ follows from

$$\max_b P(b \geq c)P(b \geq \beta(v_j))(v_i - b) = \min(b, 1)\left(\beta^{-1}(b) - \frac{1}{2}\right)(v_i - b)$$

For $b \leq 1$, the equilibrium first-order condition is given by

$$\left(\beta^{-1}(b) - \frac{1}{2}\right)(v_i - 2b) + \frac{b(v_i - b)}{\beta'(\beta^{-1}(b))} = 0$$

at $b = \beta(v_i)$, which implies

$$\beta'(v_i) = \beta(v_i)\frac{v_i - \beta(v_i)}{(v_i - \frac{1}{2})(2\beta(v_i) - v_i)}$$

For $b > 1$, the equilibrium first-order condition is

$$-\left(\beta^{-1}(b) - \frac{1}{2}\right) + \frac{v_i - b}{\beta'(\beta^{-1}(b))} = 0$$

at $b = \beta(v_i)$, so that

$$\beta'(v_i) = \frac{v_i - \beta(v_i)}{v_i - \frac{1}{2}}$$

Because this system of differential equations is not readily solvable, we rely on numerical simulation to approximate it. Figure B.1 presents both the buyer's optimal bidding strategy for the *bargaining* case and the equilibrium bidding curve for the *auction* case.

Figure B.1: Equilibrium bidding curve.

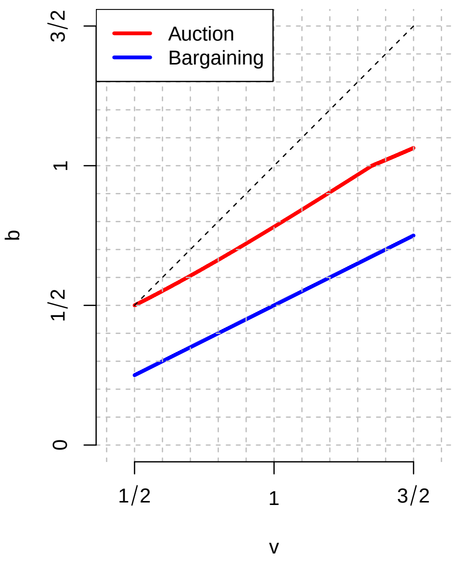


Table B.1: Expected equilibrium payoffs for the seller and the buyer(s) and equilibrium probability to trade

(a) Expected equilibrium payoffs

	Bargaining ($n = 1$)	Auction ($n = 2$)
Seller	13/96≈0.135	0.399
Buyer(s)	13/48≈0.271	0.261

(b) Probability to trade

	Bargaining ($n = 1$)	Auction ($n = 2$)
Equilibrium	50.0%	87.3%
Complete info	87.5%	95.8%

Table B.1 presents the expected equilibrium payoffs for the seller and the buyer(s). The *bargaining* yields twice as much expected payoffs for the buyer than the seller. These figures highlight the theoretical effect of competition when cheap talk does not have an impact on the bargaining outcomes. Note that competition increases the opportunity to close a deal, which is not surprising given that the likelihood to observe high reservation values increases with the number of buyers.

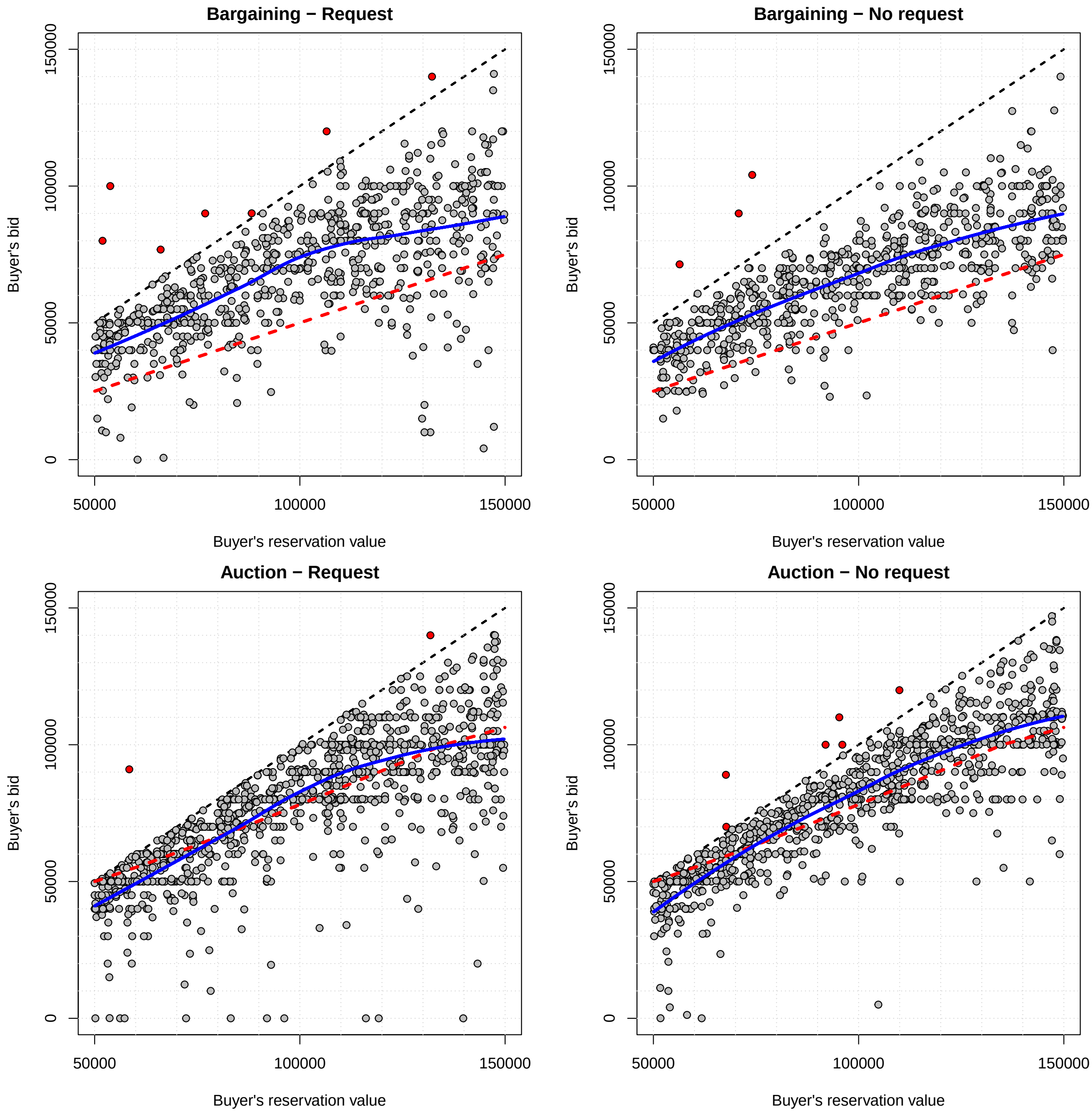
C Appendix: Additional analysis

C.1 Mistakes and dominated choices

Here we assess whether participants understood the incentives and the bargaining procedure by looking at the costly mistakes they make. Sellers and buyers can make different costly mistakes. Buyers can make mistakes by bidding higher than their reservation value and Sellers can make mistakes by accepting bids lower than their reservation value. Figures C.1, C.2, and C.3 show buyers and sellers' costly mistakes when making and accepting bids.

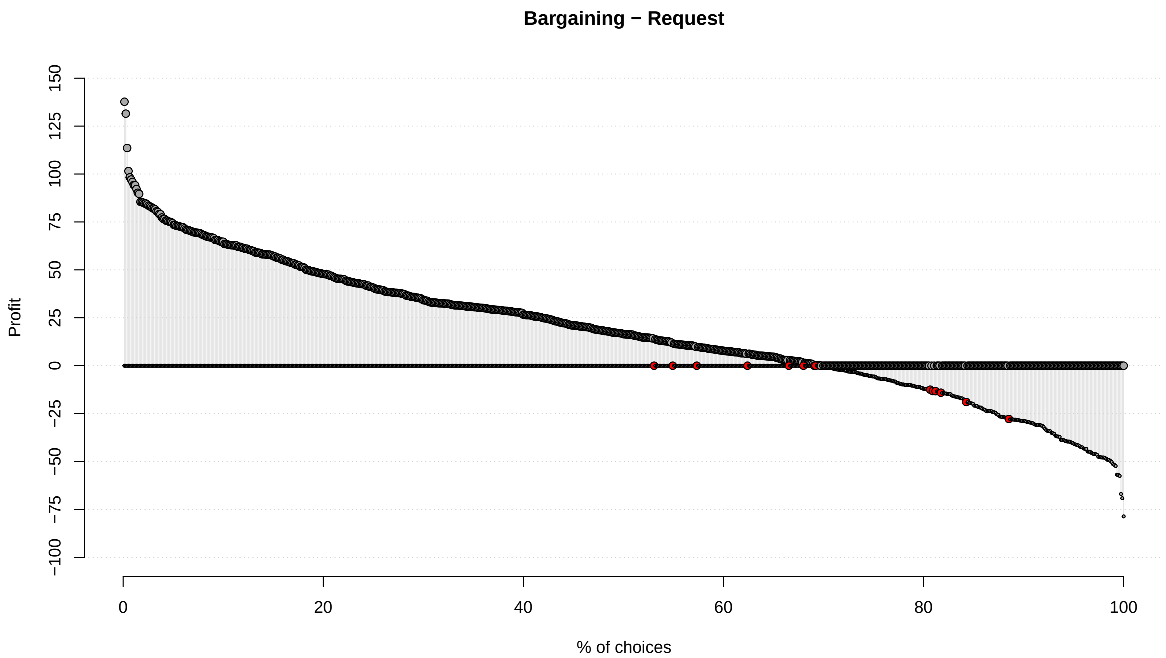
Figure C.1 reports the buyers' bids by reservation value and shows that mistakes are very rare. In almost all the cases buyers make bids that do not exceed their reservation value. Figure C.2 and C.3 show the behavior of the sellers in the *Bargaining* and in the *Auction* treatments, respectively. Sellers seem to make very few mistakes as well: in most of the cases they choose the most profitable option.

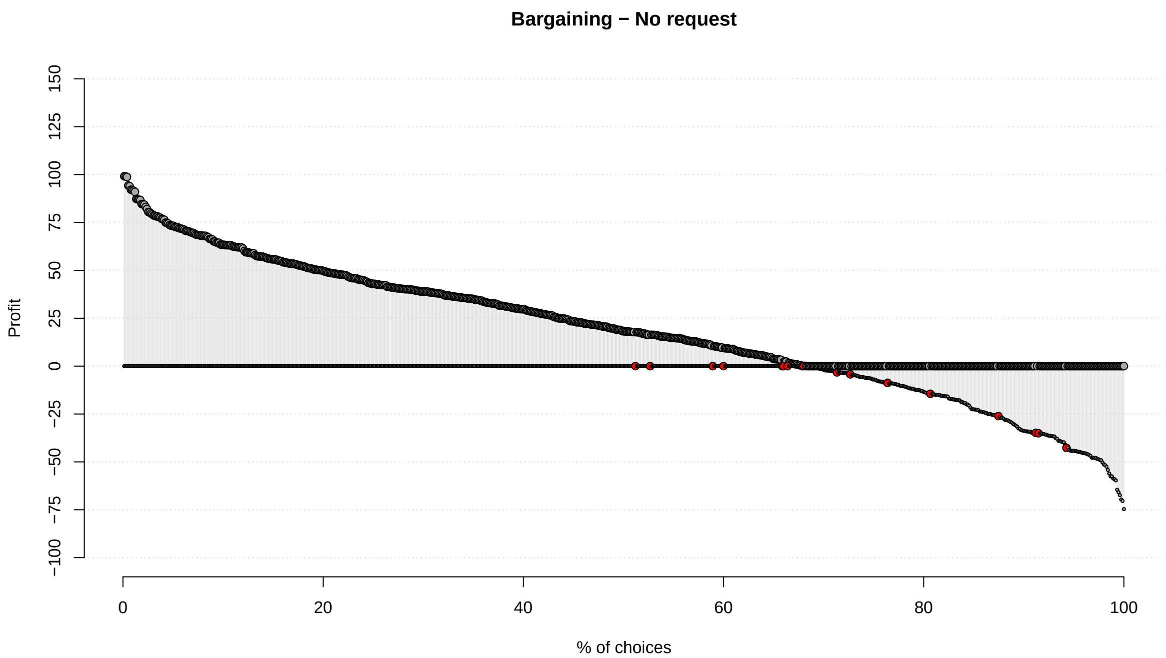
Figure C.1: Buyers' bid by reservation value and treatment.



Notes: The figure shows the bids of the buyer (y axis) by reservation value (x axis). Red dots represent bids that exceeded the reservation value. Red dashed lines are the risk-neutral Nash equilibrium bidding curves. Blue solid lines represent the bids' smooth conditional means estimated by LOESS.

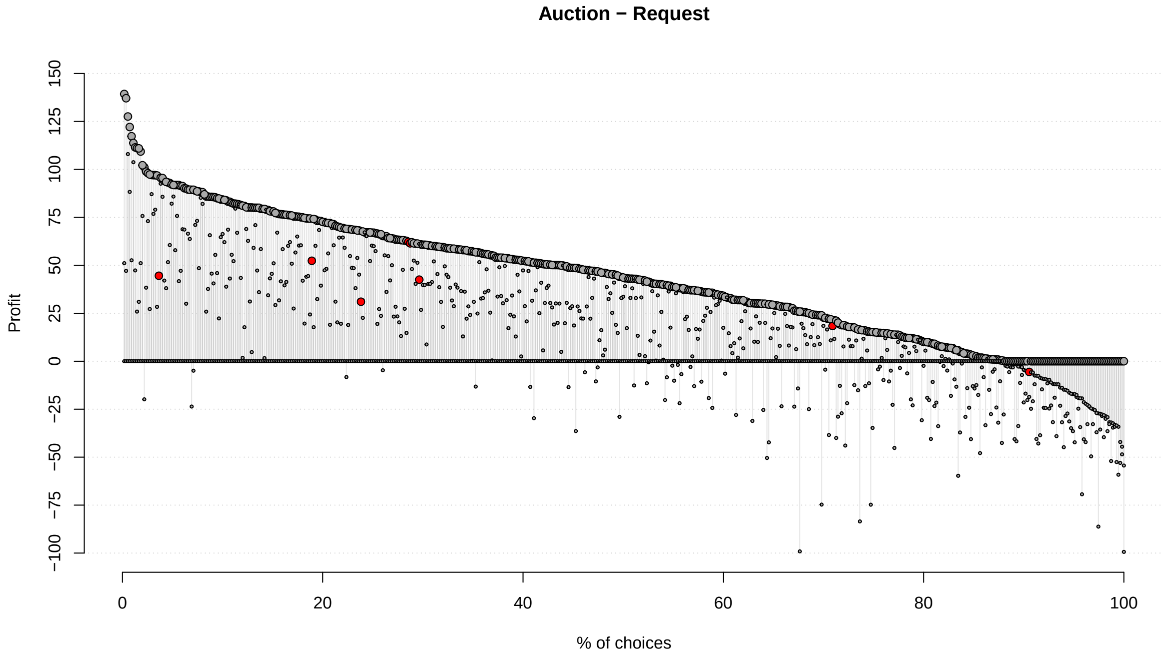
Figure C.2: Sellers' acceptance decision by *Request* condition (in the *Bargaining* treatment).

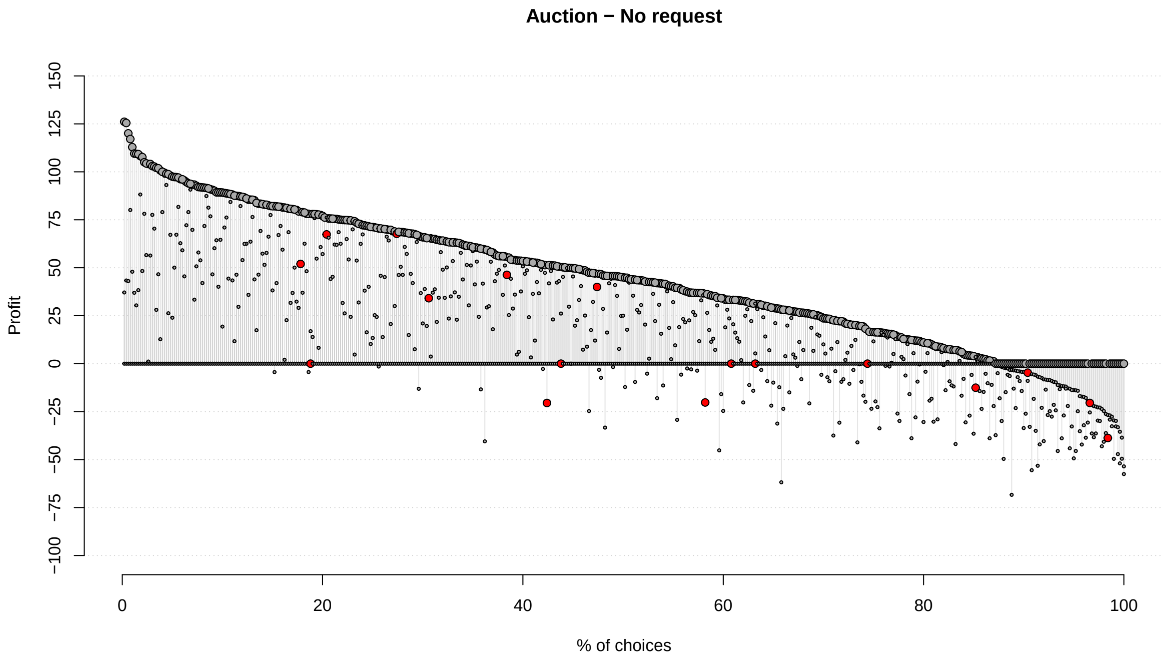




Notes: The figure shows the acceptance decision of the sellers ordered by profit (bid - production cost). There are 2 dots for each decision, representing the two options (reject vs accept). The size of the dot indicates the choice, with a big dot indicating the chosen option and a small dot indicating the other option. The color of the dot represent the optimality of the choice, with a red dot indicating that the chosen option was not the most profitable.

Figure C.3: Sellers' acceptance decision by *Request* condition (in the *Auction* treatment).





Notes: The figure shows the acceptance decision of the sellers ordered by profit (highest of the two bids - production cost). There are 3 dots for each decision, representing the three options (reject vs accept offer of buyer 1 vs accept offer of buyer 2). The size of the dot indicates the choice, with a big dot indicating the chosen option and a small dot indicating the other options. The color of the dot represent the optimality of the choice, with a red dot indicating that the chosen option was not the most profitable.

C.2 Effect of cheap talk on Seller's payoff

Table C.1: Effects of the presence of cheap talk on Seller's payoff (Tobit).

	Dependent variable:		
	Seller's payoff/1000		
	Tobit Robust	Tobit Robust	Tobit Robust
	(1)	(2)	(3)
	Bargaining	*Auction*	*Both*
PC/1000-50	-1.005^{***}	-1.019^{***}	-0.995^{***}
	(0.031)	(0.028)	(0.032)
Request	2.877	-1.418	2.824
	(1.860)	(1.841)	(1.819)
Request × (PC/1000-50)	0.099°	0.071	0.098°
	(0.058)	(0.050)	(0.057)
Auction			26.143^{***}
			(2.053)
Auction × (PC/1000-50)			-0.030
			(0.043)
Auction × *Request*			-4.222
			(2.580)
Auction × *Request* × (PC/1000-50)			-0.025
			(0.076)
Constant	15.257^{***}	41.814^{***}	15.559^{***}
	(1.355)	(1.522)	(1.347)
Observations	1,500	1,050	2,550
Left censored	484	139	623
N. Groups	20	21	41
Pseudo R^2	0.125	0.120	0.133

Notes: All models reports robust standard errors clustered at group level in parentheses. The variable PC/1000-50 captures the costs in thousands of ECU re-centered at their median value. *Request* is the cheap talk treatment dummy variable. *Auction* is the Auction treatment dummy variable. All regressions models are estimated in Stata. *** ≤ 0.001; ** ≤ 0.01; * ≤ 0.05; $^{\circ}$ ≤ 0.1.

Table C.2: Effects of the presence of cheap talk on Seller's payoff (OLS of Best bid received - cost).

	Dependent variable:		
	(Best bid received - cost)/1000		
	OLS Robust	OLS Robust	OLS Robust
	(1)	(2)	(3)
	Bargaining	*Auction*	*Both*
PC/1000-50	-1.003^{***}	-1.021^{***}	-1.003^{***}
	(0.020)	(0.026)	(0.020)
Request	2.303	-2.340	2.303
	(1.618)	(1.901)	(1.618)
Request×(PC/1000-50)	0.096^{*}	0.055	0.096^{*}
	(0.045)	(0.052)	(0.045)
Auction			26.479^{***}
			(1.940)
Auction×(PC/1000-50)			-0.018
			(0.033)
Auction×*Request*			-4.643°
			(2.496)
Auction×*Request*×(PC/1000-50)			-0.042
			(0.068)
Constant	15.878^{***}	42.357^{***}	15.878^{***}
	(1.063)	(1.623)	(1.063)
Observations	1,500	1,050	2,550
N. Groups	20	21	41
R^2	0.638	0.676	0.690

Notes: As the dependent variable, we use the counterfactual uncensored payoff, i.e., the payoff that sellers would have obtained by accepting the best offer. This corrects for the censoring at 0 better than the Tobit. All models reports robust standard errors clustered at group level in parentheses. The variable PC/1000-50 captures the costs in thousands of ECU re-centered at their median value. *Request* is the cheap talk treatment dummy variable. *Auction* is the Auction treatment dummy variable. All regressions models are estimated in R (Robust clustered standard errors of type HC3). *** ≤ 0.001; ** ≤ 0.01; * ≤ 0.05; $^{\circ} \leq 0.1$.

C.3 Efficiency and likelihood to close a profitable deal.

C.3.1 Efficiency: comparison with equilibrium predictions.

The outcome of the bargaining is efficient when the players yield the highest possible joint payoff, i.e., they obtain the maximal surplus. In the case of $n = 1$, joint payoffs are maximized if the good is sold when the seller has a lower value than the buyer ($c \leq v$) and not sold otherwise. If $n = 2$, joint payoffs are maximized if (i) the good is sold to the buyer with the higher value among the two and the seller's value is lower than the value of this buyer ($c \leq \max(v_1, v_2)$); or if (ii) the good is not sold and the seller's value is higher than both buyers' values. Therefore, to measure efficiency we look at the fraction of deals that generated the maximum attainable surplus, i.e. the number of deals *not closed* when attainable surplus is negative plus the number of deals *closed* when attainable surplus is positive and it is the highest possible surplus, divided by the total number of interactions.

In the *Bargaining* case the fraction of efficient choices is therefore calculated as follows

$$E_B = \frac{1}{n} \sum_{i=1}^{n} \mathbb{1}(c_i \leq v_i) \cdot \mathbb{1}(d_i = 1) + \mathbb{1}(c_i > v_i) \cdot \mathbb{1}(d_i = 0)$$

where d_i is 0 when the offer of the buyer is rejected and 1 when the offer is accepted. In the *Auction* case the fraction of efficient choices is calculated as follows

$$E_C = \frac{1}{n} \sum_{i=1}^{n} \mathbb{1}(c_i \leq \max(v_{1,i}, v_{2,i})) \cdot \mathbb{1}(d_i = j | v_{j,i} = \max(v_{1,i}, v_{2,i})) + \mathbb{1}(c_i > \max(v_{1,i}, v_{2,i})) \cdot \mathbb{1}(d_i = 0)$$

where d_i is 0 when no offer is accepted and it is the number of the buyer when the offer of that buyer is accepted, i.e., either 1 or 2.

Column (4), labeled "Efficient choices", in Table C.3 reports these fractions. As it is apparent, the fraction of efficient choices in *Request* and *No request* are similar. A Wilcoxon rank sum test fails to reject the null hypothesis that cheap talk has no effect on the fraction of efficient deals both in *Bargaining* ($W = 68$, $p = 0.183$) and in *Auction* ($W = 52$, $p = 0.858$).[15]

[15] This test is performed taking averages at matching group level as the unit of observation. This results in 10 observations per treatment (11 observations in the *Auction-Request* treatment). A different approach to test efficiency is to focus on the surplus in ECU generated in *Request* and in *No request*. Also with this measure, a Wilcoxon rank sum test fails to reject the null hypothesis that cheap talk has no effect on efficient deals both in the *Bargaining* ($W = 53$, $p = 0.853$) and in the *Auction* ($W = 53$, $p = 0.918$) treatments. Also this test is performed taking averages at matching group level as the unit of observation.

Table C.3: Closed deals and efficient choices.

Treatment	Deals with surplus > 0			Efficient choices	N
	Eq. pred (1)	Upper bound (2)	Observed (3)	(4)	
Bargaining-Request	49.2%	86.5%	69.5%	82.4%	750
Bargaining-No request	52.8%	87.5%	68.0%	80.0%	750
Auction-Request	85.5%	94.7%	88.2%	79.5%	550
Auction-No request	85.2%	94.8%	86.6%	79.0%	500

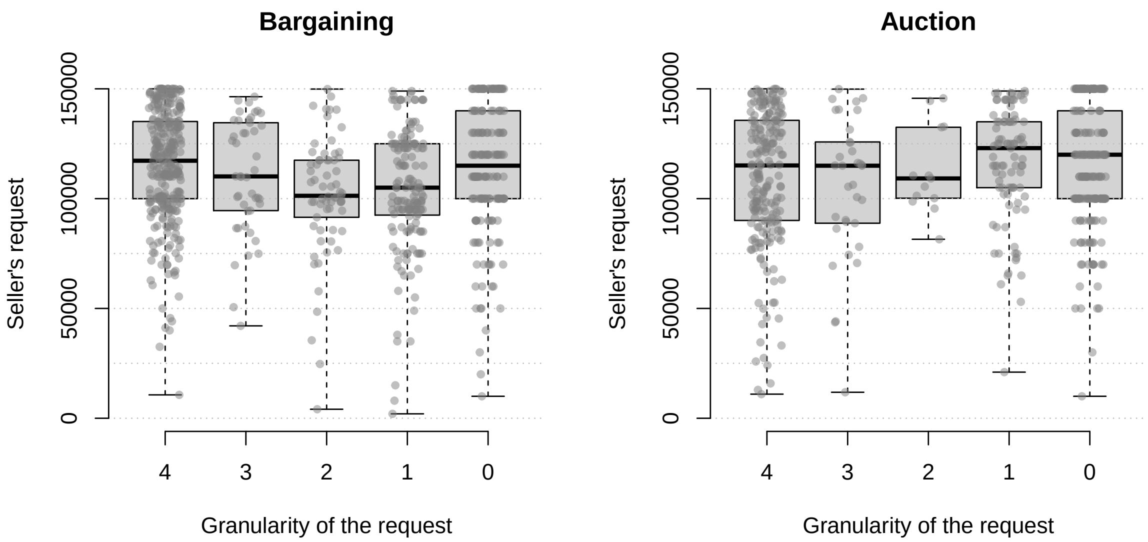
Notes: The table presents information about the fraction of closed deals, the fraction of efficient choices; and the number of choices by treatment. Specifically, Column (1) reports the predicted fraction of closed deals that should be observed under equilibrium; column (2) the fraction of deals that can be closed with a positive surplus; column (3) the observed fraction of deals closed; and column (4) the fraction of choices that are efficient (i.e., choices that give the highest surplus).

Columns (1), (2) and (3) of Table C.3 report statistics regarding the fractions of closed deals. They permit to compare the observed fraction of closed deals to the equilibrium predictions and to the upper bound of profitable deals that can be closed. The observed fractions are higher than the equilibrium ones in both *Bargaining* and *Auction*, but in *Bargaining* these differences are more pronounced. This is in line with the fact that buyers' bids are substantially higher compared to the equilibrium predictions. Risk aversion can be an explanation for this result.

C.4 Granularity of the request across treatments and its correlation with the bids

Check whether the granularity of the request is similar across treatments. Figure C.4 and Table C.4 shows the distribution the seller's request by level of granularity. The distribution seems not to differ across treatments. About 40% of the bids have the maximum level of granularity and not many bids are rounded to the 10 (granularity 3) and to the 100 (granularity 2). If anything, there is a higher fraction of bids with low granularity in the *Auction* treatment compared to the *Bargaining* treatment. As for the level of the bid, it does not seem to be strongly correlated with its granularity.

Figure C.4: Granularity of the sellers' request.



Notes: Granularity captures the roundness of the request: Granularity 4 means that the bid is not rounded (no zeros ending the bid); Granularity 3 means that the bid is rounded at 10 (1 zero ending the bid); Granularity 2 means that there the bid is rounded at 100 (2 zeroes ending the bid); Granularity 1 means that the bid is rounded at 1000 (3 zeroes ending the bid); Granularity 0 means that the bid is rounded either at 10000 or at 100000 (either 4 or 5 zeroes ending the bid).

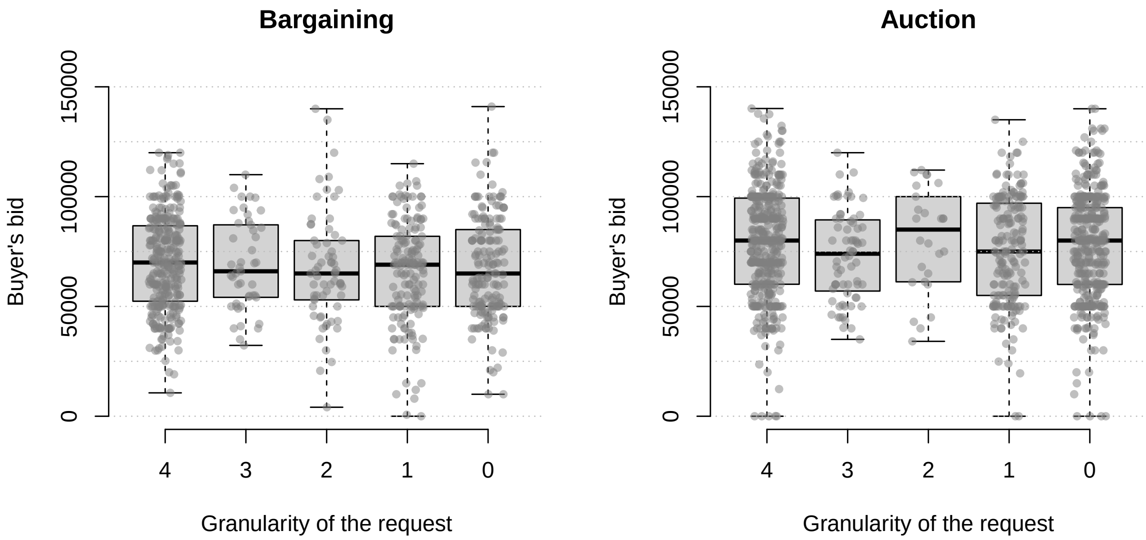
Table C.4: Fraction of request for each level of Granularity.

	Granularity (N. zeroes)					N
	4 (0)	3 (1)	2 (2)	1 (3)	0 (4-5)	
Bargaining	41.5%	6.0%	8.7%	21.2%	22.7%	750
Auction	38.0%	6.2%	2.4%	16.9%	36.5%	550

Notes: Granularity captures the roundness of the request: Granularity 4 means that the bid is not rounded (no zeros ending the bid); Granularity 3 means that the bid is rounded at 10 (1 zero ending the bid); Granularity 2 means that there the bid is rounded at 100 (2 zeroes ending the bid); Granularity 1 means that the bid is rounded at 1000 (3 zeroes ending the bid); Granularity 0 means that the bid is rounded either at 10000 or at 100000 (either 4 or 5 zeroes ending the bid).

Correlation between granularity of the request and bids. Figure C.5 shows the distribution of the bids by granularity of the request in both the *Bargaining* and the *Auction* treatment. The figure suggests that granularity is not highly correlated with the level of the bid.

Figure C.5: Buyer's bid by granularity of the sellers' request.



Notes: Granularity captures the roundness of the request: Granularity 4 means that the bid is not rounded (no zeros ending the bid); Granularity 3 means that the bid is rounded at 10 (1 zero ending the bid); Granularity 2 means that there the bid is rounded at 100 (2 zeroes ending the bid); Granularity 1 means that the bid is rounded at 1000 (3 zeroes ending the bid); Granularity 0 means that the bid is rounded either at 10000 or at 100000 (either 4 or 5 zeroes ending the bid).

C.4.1 Additional analysis on the likelihood to close a deal

Columns (1), (2), and (3) in Table C.5 report a series of linear probability models showing how the cost and reservation value(s) of the seller and buyer(s) impact on the likelihood to close a deal. Figure C.6 shows this relationship graphically.

Regression results in Table C.5 suggest that: (i) the probability to close a deal is decreasing in the seller's cost and it is increasing in the reservation value of the "best" buyer (i.e., the one with the highest reservation value), in both the *Bargaining* and *Auction* treatments; (ii) there is an interaction effect between costs and reservation values meaning that the probability to close a deal decreases with production costs at at a slower rate for higher levels of the reservation value; For the median reservation values and costs, cheap talk increases the likelihood to close a deal by 4.1 percentage points in the *Bargaining* treatment but has no significant effect in the *Auction* treatment.

Figure C.6 shows a series of scatter-plots representing the combinations of costs and reservation values observed in the experiment. The dots are-color coded according to the outcome of the transaction, with red dots representing closed deals and gray dots representing rejected bids. Diagonal lines show the different levels of the attainable surplus, which increases moving from bottom-right to top-left.[16]

Comparing the panels to the right with the one to the left it is becomes apparent how cheap talk has little effect when the potential surplus is very high — i.e., top left corner where virtually all the dots are red — and when there is no room for bargaining — bottom-right corner where virtually all dots are gray. The effect is on the marginal deals, i.e., the deals where there is the opportunity for a positive surplus but this surplus is small. Here the fraction of red dots that are in between the "0K" and the "20K" lines looks different with and without cheap talk.

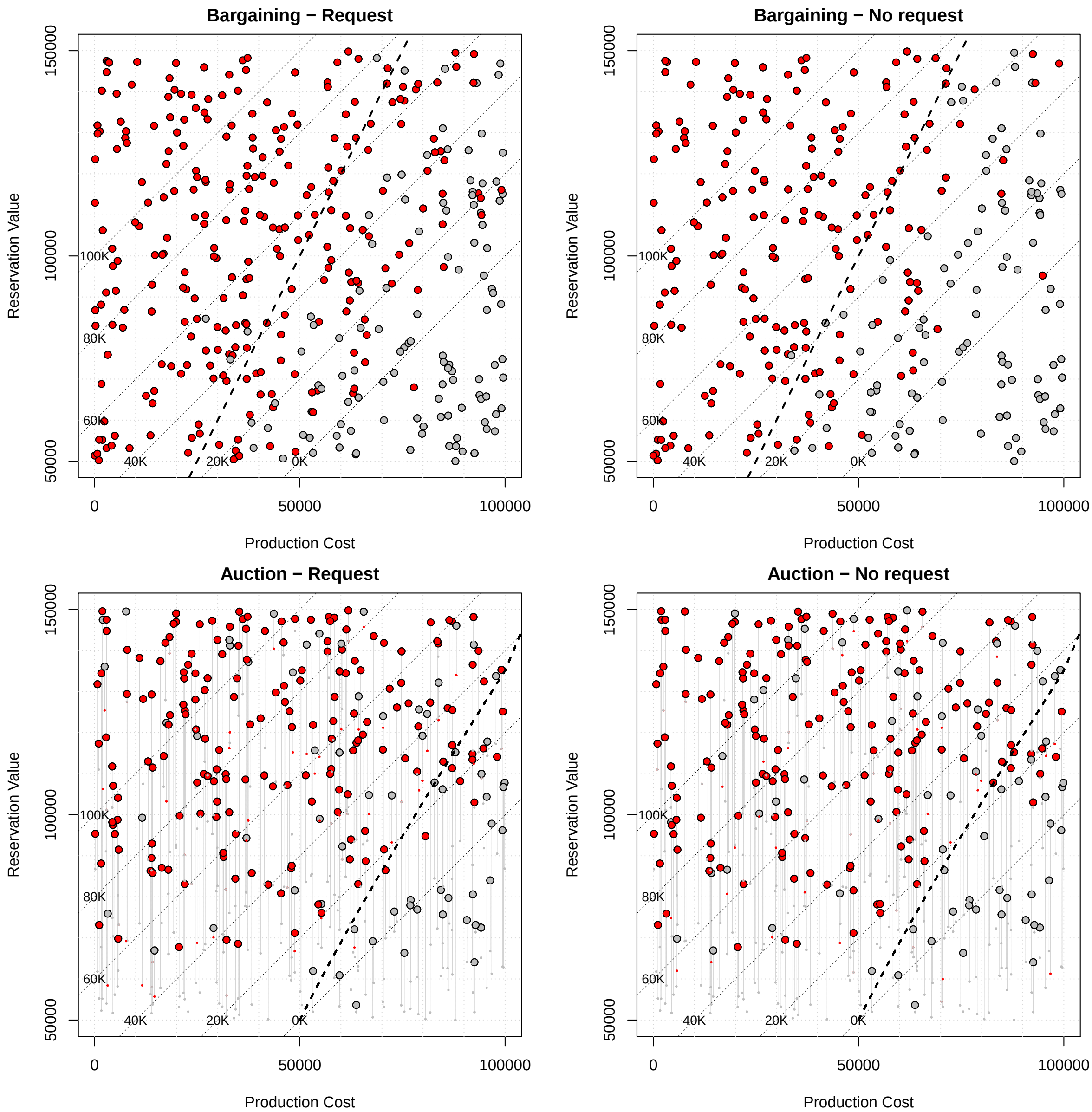
[16] For instance, the bottom-right corner (below the "0K" line) identifies combinations where the surplus is negative, and the top-left corner (above the "100K" line) identifies combinations where the surplus is greater than 100,000 ECU. Intermediate stripes capture surplus levels going from 0 ECU to 100,000 ECU in steps of 20,000 ECU.

Table C.5: Likelihood to close a deal

	Dependent variable:		
	Closed deal		
	LPM Robust	LPM Robust	LPM Robust
	(1)	(2)	(3)
	Bargaining	*Auction*	*Both*
RV/1000-100	0.005^{***}	0.005^{***}	0.005^{***}
	(0.0004)	(0.0005)	(0.0004)
PC/1000-50	-0.010^{***}	-0.007^{***}	-0.010^{***}
	(0.0003)	(0.0005)	(0.0003)
(RV/1000-100)×(PC/1000-50)	0.0001^{***}	0.0002^{***}	0.0001^{***}
	(0.00001)	(0.00002)	(0.00001)
Request	0.041^{*}	0.010	0.041^{*}
	(0.018)	(0.017)	(0.018)
Request×(RV/1000-100)	0.0003	0.0003	0.0003
	(0.001)	(0.001)	(0.001)
Request×(PC/1000-50)	0.001	0.0003	0.001
	(0.001)	(0.001)	(0.001)
Request×(RV/1000-100)×(PC/1000-50)	0.00002	0.00001	0.00002
	(0.00002)	(0.00002)	(0.00002)
Auction			0.121^{***}
			(0.017)
Auction×(RV/1000-100)			0.0003
			(0.001)
Auction×(PC/1000-50)			0.003^{***}
			(0.001)
Auction×(RV/1000-100)×(PC/1000-50)			0.0001^{***}
			(0.00002)
Auction×*Request*			−0.031
			(0.024)
Auction×*Request*×(RV/1000-100)			−0.00003
			(0.001)
Auction×*Request*×(PC/1000-50)			−0.0004
			(0.001)
Auction×*Request*×(RV/1000-100)×(PC/1000-50)			−0.00001
			(0.00003)
Constant	0.671^{***}	0.792^{***}	0.671^{***}
	(0.012)	(0.012)	(0.012)
Observations	1,500	1,050	2,550
N. Groups	20	21	41
R^2	0.565	0.473	0.562

Notes: The dependent variable is a dummy that takes value 1 when a deal is closed (i.e., the seller accepts the bid of the buyer). All models reports robust standard errors clustered at group level in parentheses. The variables RV/1000-100 and PC/1000-50 capture reservation values and the costs in thousands of ECU and re-centered at their median value. *Request* is the cheap talk treatment dummy variable. *Auction* is the Auction treatment dummy variable. All regressions models are estimated in R (Robust clustered standard errors of type HC3). *** $\leq$ 0.001; ** $\leq$ 0.01; * $\leq$ 0.05; $^{\circ}$ $\leq$ 0.1.

Figure C.6: Closed deals by treatment as a function of the seller's cost and of the buyer's reservation value.



Notes: The figure shows closed deals by treatment as a function of the seller's cost and of the sellers' reservation values. The color of the dot indicates whether the deal has been closed or not. A red dot means that the seller accepted the bid of the buyer, a gray dot means that he/she did not accept. Diagonal dotted lines represent different surplus levels, indicated by their labels. The thick dashed line represents the equilibrium threshold of accepted deals. If participants behave according to the equilibrium predictions, deals below these lines should not be closed. The panels for the *Auction* treatments show the reservation value of both buyers connected by a gray line. The highest is represented with a big dot and the lowest with a small dot.

C.5 Additional analysis on learning

Table C.6: Learning. Seller request over time.

	Dependent variable:	
	Seller request/1000	
	OLS Robust	OLS Robust
	(1)	(2)
	Bargaining	*Auction*
Period 16 to 20	-1.284	-5.868°
	(2.421)	(3.051)
Period 11 to 15	-3.844	-11.778^{***}
	(2.354)	(3.373)
Period 6 to 10	-4.492	-12.553^{**}
	(3.329)	(3.076)
Period 1 to 5	-15.536^{***}	-28.211^{***}
	(3.818)	(5.661)
PC/1000-50	0.314^{***}	0.151
	(0.091)	(0.132)
Period 16 to 20×PC/1000-50	0.012	0.128
	(0.097)	(0.087)
Period 11 to 15×PC/1000-50	0.062	0.040
	(0.049)	(0.090)
Period 6 to 10×PC/1000-50	0.091	0.025
	(0.131)	(0.069)
Period 1 to 5×PC/1000-50	0.272^{**}	0.180
	(0.096)	(0.119)
Constant	115.649^{***}	124.521^{***}
	(4.100)	(4.813)
Observations	750	550
N. Groups	10	11
R^2	0.218	0.154

Notes: All models reports robust standard errors clustered at group level in parentheses. Dependent variables are reported in the second row of the table. The variable PC/1000-50 captures the cost in thousands of ECU and re-centered at the median value. *Period X to Y* is a dummy taking value 1 if the seller request is made in periods between X and Y. The reference category is the last block of 5 periods, i.e., periods 21 to 25. All regressions models are estimated in R (Robust clustered standard errors of type HC3). *** ≤ 0.001; ** ≤ 0.01; * ≤ 0.05; $^{\circ} \leq 0.1$.

Table C.7: Learning. Buyer bids over time.

	Dependent variable:	
	Buyer bid/1000	
	OLS Robust	OLS Robust
	(1)	(2)
	Bargaining	*Auction*
Period 16 to 20	−0.051	2.512
	(3.366)	(4.421)
Period 11 to 15	−1.721	0.471
	(3.322)	(2.751)
Period 6 to 10	−0.408	-4.014°
	(2.585)	(2.166)
Period 1 to 5	4.255	-6.349°
	(3.867)	(3.818)
RV/1000-100	0.502^{***}	0.687^{***}
	(0.058)	(0.043)
Period 16 to 20×RV/1000-100	0.036	−0.039
	(0.052)	(0.055)
Period 11 to 15×RV/1000-100	0.009	−0.002
	(0.065)	(0.057)
Period 6 to 10×RV/1000-100	0.096	0.004
	(0.062)	(0.048)
Period 1 to 5×RV/1000-100	0.029	-0.098°
	(0.079)	(0.051)
RQ/1000-100	0.273^{***}	0.085
	(0.061)	(0.073)
Period 16 to 20×RQ/1000-100	0.014	0.004
	(0.111)	(0.113)
Period 11 to 15×RQ/1000-100	-0.092^{*}	−0.010
	(0.040)	(0.066)
Period 6 to 10×RQ/1000-100	−0.051	−0.002
	(0.060)	(0.058)
Period 1 to 5×RQ/1000-100	0.199^{***}	0.059
	(0.058)	(0.054)
RQ Granularity	0.029	0.246
	(1.055)	(0.791)
Period 16 to 20×RQ Granularity	0.267	−0.439
	(1.002)	(0.800)
Period 11 to 15×RQ Granularity	0.878	−0.305
	(1.110)	(0.801)
Period 6 to 10×RQ Granularity	1.017	1.302
	(0.952)	(1.010)
Period 1 to 5×RQ Granularity	−0.113	−0.411
	(1.739)	(1.322)
Constant	64.520^{***}	78.256^{***}
	(2.919)	(3.099)
Observations	750	1,100
N. Groups	10	11
R^2	0.624	0.656

Notes: All models reports robust standard errors clustered at group level in parentheses. Dependent variables are reported in the second row of the table. The variables RV/1000-100 and RQ/1000-100 capture reservation value and the request in thousands of ECU and re-centered at their median value. "Granularity" is defined as $\max(0, 4-k)$, where k is the number of zeroes ending the number. *Period X to Y* is a dummy taking value 1 if the seller request is made in periods between X and Y. The reference category is the last block of 5 periods, i.e., periods 21 to 25. All regressions models are estimated in R (Robust clustered standard errors of type HC3). *** ≤ 0.001; ** ≤ 0.01; * ≤ 0.05; $^{\circ} \leq 0.1$.