Online Appendix for:

Holdout: Existence, Information, and Contingent Contracting

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Results Relating to the Impact of Treatments and Chat

All communication between buyers and sellers over the course of the experiment was recorded. Each line of chat was independently coded into one of eight categories by two research assistants. Because coding introduces subjectivity, conflicts between codes were resolved by choosing the less specific of the two entered codes. The coding methodology is detailed in "Chat Coding Instructions" below.[1]

Result 1: The content of buyer and seller communication has little effect on buyer surplus.

The regressions in Table 1 report buyer surplus as a linear function of treatment variables and the volume of different types of messages. The intercept and the dummy variable for public information are the only variables that are significant at the 5% level in Regression 5. In Regression 6, all chat variables are omitted except Unilateral Negotiation (between Buyers and Sellers), which is significant in many alternative specifications not reported here. The negotiation variable and Period dummies are significant in this case. Note that the dummy variable for contingent contracts is not significant in either regression, reinforcing the results from the rank sum test earlier.

Result 2: The frequency with which different types of communication are observed differs systematically by treatment.

Having established that communication is not particularly relevant to the bargaining outcome, the next logical question is the extent to which the various categories of chat messages observed in the experiment are sensitive to the treatment variables. Table 2 reports the results of eight OLS regressions of treatment variables on the number of chat messages coded into different categories.

[1]It is noteworthy that communication among sellers in which it was discussed in what order sellers would commit, and specifically who would sell last, was classified as "Group Strategy Communication," and made up the majority of messages coded into that category.

Several results are noteworthy. Unilateral negotiation is the most observed type of communication in the Capital Constrained Private Information treatment. This is one of the most difficult treatments for the buyer and sellers to come to an agreement because the buyer faces a capital constraint that sellers have no credible way of verifying. Additionally, when information is public, sellers are more likely to negotiate on one another's behalf. Finally, seller collusion is observed more often in the Contingent Contracts institution. It might be speculated that the ability of sellers to split earnings more equally contributes to a greater willingness to act collectively.

Verbal Instructions

Please turn your attention to your computer monitor. You now see a screen displaying your randomly assigned role as the Buyer or Seller A, B, C, or D in the upper left hand corner. We will proceed to a scripted practice round to familiarize you with the computer interface you will be using during this experiment. You will not be paid for the practice round.

In the top box, you should see your role, the time remaining in the period, and button marked "Game." For the buyers only: in the top left, you can see a count of the units comprising the hypothetical object acquired by the buyer. Sellers, to the right of this is information about your value. Buyers (and also sellers) can see their values at the left bottom of the screen. In the middle of the screen is an area for trading units and a messaging interface for text communication.

The messaging system is provided for you to communicate with other subjects in the experiment, should you choose to do so, with the following two provisions: (1) Please refrain from using curse words or making derogatory or offensive statements. (2) Please do not reveal your identify or any characteristics which would allow another individual to identify you outside of the context of the experiment. We have the capability of monitoring chat communications and will ask subjects who violate these rules to leave with only their $10.00

show-up fee.

To use the chat interface, click on one of the check boxes on the left to select the buyer or a seller to send a message to. For the purpose of this practice period, please select "All Sellers." You will see that a message input box has appeared to the right. Please type a message in the box and click Enter. Once everyone has done this, we will continue.

You can select a different checkbox on the left to see messages from and send messages to only the buyer or a specific seller. You may also select "All Sellers" to see messages from or send a message to all sellers, as in the previous example. When you have a new unseen message, an exclamation point will appear to the left of the corresponding checkbox. When the message has been displayed, the exclamation point will disappear. Please send a few messages now to practice using the messaging interface.

Buyers have an additional option not available to sellers – making offers. Buyers, to make an offer you must select a checkbox and then click "Offer." Then, type a number to the immediate right. Then "confirm" below if you are satisfied with that offer. Only the seller to whom the offer was made can see the outstanding offer and the seller to whom the offer was made can accept by clicking "Accept" at the bottom of the screen. When an offer is accepted, the status of the unit changes from Unsold to Sold. Buyers, please make a practice offer of 100 cents to Seller A now. Seller A, when you see the buyers practice offer, please click "Accept." Now click "Confirm". Once this has been done, we will continue. Please recall that "sold" means that a contingent offer has been accepted. The units and money will not actually be transferred unless four such contracts have been made.

Buyers please note that the second and third lines from the top gives you "Your payment if 4 units are acquired" The right side at the bottom restates your initial starting fund. Information on your offer limit is shown in the middle of the screen. If you wish to withdraw some or all of your unaccepted offers, please select the offers to be withdrawn and click the "withdraw" button. You cannot withdraw or change the amount of any accepted contingent

contract. Recall that no contracts will be finalized unless the buyer obtains contracts for all four units.

Please note that during the actual experiment, sellers are free to accept or not accept any offer. Sellers may discuss the terms of potential offers with the buyer or other sellers through the chat interface, but binding contingent offers to acquire a unit must be made by buyers through the offer system previously described.

Offers can be made to individual sellers or all sellers simultaneously by selecting the corresponding checkbox. Offers made to all sellers will replace any outstanding offers for unsold units, but will not change the accepted offer at which a previously sold unit was acquired. We will now illustrate this. Buyers, please make a practice offer of 110 cents to Seller B now. Now select "All Sellers" and make an offer of 105 cents. The previous offer of 110 cents to Seller B has been replaced by the new offer of 105 cents to all sellers, but that the accepted offer of 100 cents to Seller A remains unchanged. Sellers B through D, when you see the buyers practice offer of 105 cents, please click "Accept" then click "Confirm". Once this has been done, we will continue.

If the buyer acquires all four units or if 12 minutes (720 seconds) elapse, the period will conclude. Following the conclusion of the period, you will be able to see the results in the top portion of your screen as seen presently.

At any time during the experiment you will be able to change to the "Game" screen by clicking the "Game" button in the upper right-hand corner. Please do so now. Once everyone has done this, we will continue.

On the "Game" screen you see a three by three matrix with check boxes in each cell. This is a tic-tac-toe game board which will allow you to play against the computer. You are always X and the computer is always O. The player that moves first is randomly determined for each new game. To place an X, simply click on any of the boxes. Once you do, the computer player will choose its location and you can choose again until the board is full or

one of you has won. The goal of the game is to get three Xs in a row. The row may be across, down or diagonal. The computer wins when it gets three Os in a row, across, down or diagonal. When an outcome is determined, you will note that there is a space below this board that will tell you the cumulative number of times you won, lost or had a draw with the computer. Please play through a game now. Once everyone has done this, we will continue.

You will not be paid for playing or winning games of tic-tac-toe. The Game screen is simply provided as an option to pass time. To return to the market decision screen, click the "Back" button in the upper right-hand corner. You may switch back and forth between the decision and Game screens at any time during the experiment without losing the progress of your game.

Chat Coding Instructions

This codebook is a guide to the interpretation and coding of chat from the experiments. The main purpose of coding is to allow statistical analysis of subject-level text communication. Variables of interest are the impact of the extent of negotiation, and collusion among sellers.

The text to be coded consists of 6867 lines of "contract" data (chat messages, offers, and trades) from sessions 5 through 10 of the data. Sessions 1 through 4 were pilot sessions, and will not be coded at this time. Each contract observation is in the order that it occurred after being sorted by session, period, and group. The following variables are listed in Table 3.

A coders task is to construct the code and bool columns from the text variable. It is crucial that coding be done within context. This means that a message shouldnt be considered in isolation of predecessors. For instance, a message of "no" or "okay" could be coded several different ways, and will depend upon the question that it is in response to. A more detailed explanation of the codes follows.

All Communication

1 Miscellaneous

Communication pertaining to the experiment, but not falling in other categories.

Example: "make me rich."

2 Discussion of Rules

Communication related to clarification of the rules of the experiment.

Example: "maybe it's a different group now"

3 Chatter

Communication explicitly unrelated to any aspect of the experiment.

Example: "so any Harry potter fans???"

Communication Between Buyer and Seller(s)

4 Individual Negotiation

Communication pertaining to own offers and acceptance.

Examples: "Ill sell you my thing for 410," "little high there"

5 Group Negotiation

Communication pertaining to negotiation on behalf of other seller(s) or a group.

Examples: "give a,c,and d all 300," "no one will go lower than 300"

6 Tattling or Advising

Communication requesting or relating facts about other seller(s) or offering advice.

Examples: "start with seller a and d," "they have the cheapest units"

Communication Between Seller and Seller(s)

7 Individual Strategy Communication requesting or exchanging facts about individual decisions or strategy.

Examples: "yeah he gave me what i told him 196," "did everyone sell their stuff yet?"

8 Group Strategy Communication requesting or discussing establishment/maintenance of a group strategy.

Examples: "dude lets up it to 300 each next time min," "well for the sake of the system, take it"

Table 1: Regressions of treatment and chat variables on buyer's surplus.

	Random Effects Linear Regressions on Buyer's Surplus					
	(7)			(8)		
(Constant)	0.6962	(0.0017)	**	0.6716	(0.0014)	**
Rotation	0.0628	(0.7024)		0.0352	(0.8103)	
Contingent	-0.1491	(0.4787)		-0.1453	(0.4261)	
Public	-0.3722	(0.0527)	†	-0.3552	(0.0240)	*
Contingent×Public	0.3014	(0.2590)		0.2682	(0.2405)	
Period 2	-0.3071	(0.0710)	†	-0.3280	(0.0303)	*
Period 3	-0.2899	(0.0844)	†	-0.3082	(0.0498)	*
Period 4	-0.0128	(0.9372)		-0.0211	(0.8881)	
General Chat						
Miscellaneous	-0.0013	(0.7707)		-	-	
Discussion of Rules	-0.0079	(0.6502)		-	-	
Unrelated Chatter	-0.0178	(0.4197)		-	-	
Between Buyer & Seller						
Unilateral Negotiation	-0.0067	(0.1449)		-0.0080	(0.0285)	*
Multilateral Negotiation	-0.0082	(0.6813)		-	-	
Advice or Tattling	0.0212	(0.6001)		-	-	
Between Sellers						
Discussion of Strategy	-0.0037	(0.6612)		-	-	
Seller Collusion	0.0011	(0.8974)		-	-	
AIC						

P-values in parentheses: † $p < .10$; * $p < .05$; ** $p < .01$.

Table 2: OLS regressions of treatment variables on occurrences of different categories of communication.

	Intercept	Algorithm	Contingent	Public	Period 2	Period 3	Period 4	Contingent ×Public
Miscellaneous	12.0583* (0.0213)	-1.6875 (0.7094)	-0.7083 (0.8874)	9.7083* (0.0254)	11.0500* (0.0204)	11.5000* (0.0159)	12.0500* (0.0117)	-13.6458* (0.0461)
Discussion of Rules	0.15000 (0.899)	0.65625 (0.528)	0.03125 (0.978)	0.12500 (0.898)	1.85000† (0.088)	-0.45000 (0.675)	-0.25000 (0.816)	2.00000 (0.199)
Unrelated Chatter	0.7042 (0.4812)	1.3750 (0.1209)	-1.9167† (0.0516)	-1.7083* (0.0422)	0.4500 (0.6204)	1.2500 (0.1714)	0.1500 (0.8688)	1.8333 (0.1647)
Unilateral Negotiation	32.633** (0.0000)	4.688 (0.32630)	-22.833** (0.0000)	-12.167** (0.00816)	-0.200 (0.96754)	12.100* (0.01587)	5.900 (0.23235)	14.917* (0.03835)
Multilateral Negotiation	2.054* (0.08228)	-2.188* (0.03655)	1.458 (0.20300)	3.542** (0.00048)	0.950 (0.37331)	0.950 (0.37331)	1.050 (0.32541)	-2.792† (0.07232)
Advice or Tattling	0.6625 (0.23214)	-0.5313 (0.27629)	-0.4062 (0.45044)	1.2500** (0.00779)	1.100* (0.03106)	0.6500 (0.19788)	0.8500† (0.09354)	-1.5000 (0.04129)
Discussion of Strategy	9.979** (0.00103)	2.875 (0.26694)	-2.917 (0.30802)	-4.458† (0.06986)	0.400 (0.88062)	1.900 (0.47637)	2.450 (0.35902)	3.083 (0.42353)
Seller Collusion	2.446 (0.32283)	-2.219 (0.30868)	7.698** (0.00194)	2.333 (0.25658)	2.550 (0.25769)	1.100 (0.622411)	0.650 (0.77203)	-2.083 (0.52047)

P-values in parentheses: † $p < .10$; * $p < .05$; ** $p < .01$.

Table 3: Chat code variable list and interpretation.

Variable	Description
session	Number of session, 5 through 10.
period	Number of period within session, 1 through 4.
group	Number of group within session, 1 through 2 or 4.
origin	Origin of contract, e.g. "from." 1 is buyer, 2 through 5 sellers.
target	Target of contract, e.g. "to." 1 is buyer, 2 through 5 sellers, and 0 all sellers.
type	Type of contract: 0: text, 1: offer, 2: trade (accepted offer).
offer	Amount of offer made or accepted, -1 if N/A or offer withdrawn.
code	Code number as described below; blank if offer.
bool	Positive value of text: 0 for false, 1 for true as described below.
text	Text of chat message; blank if offer.
time	Time elapsed in period when chat message sent, -1 for offers.