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Collusion and the Choice of Auction: An Experimental Study

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Collusion and the choice of auction: An experimental study[1]

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ABSTRACT:

We bring to the lab the theoretical result of Robinson (1985, RAND Journal of Economics 16: 141 - 145) that collusion is incentive compatible in the English auction (EN) and not in the first-price sealed-bid auction (FP) in the case of one-shot interaction. Our data partly confirm Robinson's prediction: in FP all cartels break down, but a majority of cartels breaks down in EN as well. However, more cartels form in EN than in FP and stable cartels in EN obtain the item for a price well below its value. In the case of repeated interaction, the two auctions no longer differ in terms of cartel stability but stable cartels are still better able to reduce the winning bid in EN than in FP.

KEYWORDS: Collusion; English auction; First-price sealed-bid auction; Laboratory experiments

JEL CODES: C92; D44; L41

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1. INTRODUCTION

In a seminal analysis, Robinson (1985) shows that a crucial difference between the oral or English auction (EN) and the first-price sealed-bid auction (FP) is that cartels are stable only in the former.[1] The intuition is that in EN, submitting a higher bid than that of the designated winner does not secure winning the auction as the designated winner can react to this defection by further raising the bid. In contrast, in FP, where all bidders submit a bid once, the designated winner cannot retaliate in case of defection. In this paper, we test Robinson's theory in the lab.

There seems to be a consensus view that EN is more prone to collusion than FP (Phillips *et al*., 2003), a view that has trickled down into policy reports as well. For example, OECD (2006) gives auction designers the advice that "[w]here collusion is a significant threat, use sealed-bid rather than ascending bid (or "open") auctions." Perhaps surprisingly, Robinson's theory has not been tested in a controlled environment. Anecdotal evidence suggests that it is not universally true: both auction formats feature in prominent cartel cases, including FP in cartels for school milk tenders (Porter and Zona, 1999) and infrastructure procurement (Bajari and Ye, 2003), and EN in tobacco auctions (Phillips *et al*., 2003) and stamp auctions (Asker, 2010). Because of the illegal nature of cartels, it is difficult to find more systematic field evidence. Therefore, we rely on laboratory experiments to test Robinson's (1985) theory.[2]

Robinson (1985) assumes that a single, indivisible item is auctioned once, that bidders have formed an all-inclusive cartel, and that cartel members have credibly revealed their private information to each other. He derives his result for both the independent private values model and the common value model.[3] Robinson assumes that the designated winner is among the bidders with the highest valuation, and, according to the cartel agreement, is the only one who is active in the bidding. In our design we have subjects competing for a common value object in

[1] In EN, the price is raised successively until one bidder remains who wins the object at the final price. In FP, each bidder independently submits a concealed bid. The winner is selected among the highest bidders and pays her bid.

[2] We are not the first to study collusion in experimental auctions. One robust insight from the literature to date is that tacit collusion is rare: if subjects deviate systematically from the one-shot Nash prediction, they bid more aggressively instead of less (see Kagel (1995) for an overview). Explicit collusion, whereby subjects can communicate prior to the auction, does lead to lower bids (Isaac and Walker (1985), Phillips *et al*. (2003), Sherstyuk and Dulatre, 2008). Hu *et al*. (2011) is the only paper we are aware of that compares the collusive properties of EN and FP in a setting where subject can form cartels. In their design the cartel agreement is binding. However, it is precisely the non-binding nature of the cartel agreement that drives the result of Robinson (1985).

[3] In the independent private values model (Vickrey, 1961), each bidder is privately informed about her own value for the object, which does not depend on the values of the other bidders. In the common value model (e.g. Milgrom and Weber, 1982), the value is the same to all bidders. Before the start of the auction, they receive signals regarding this value which allows them to make independent estimates of the common value.

groups of three that are re-matched after every of 40 rounds. In any round, prior to the auction, a cartel forms if, and only if, all subjects agree to do so, after which a designated winner is randomly selected. All subjects are subsequently informed about this selection, and reminded about the cartel agreement, i.e., that only the designated winner submits a bid. The treatment variable is the type of auction.

Our result partly confirm Robinson's (1985) prediction: in FP literally all cartels break down, but the majority of cartels break down in EN as well. Still, our findings offer strong support for Robinson's qualitative prediction that more cartels are stable in EN than in FP. In addition, more cartels form in EN than in FP. Stable cartels in EN are also quite successful in that they obtain the item for a price well below its value. In both types of auctions, the winner in an unstable cartel pays a price close to the object's value.

We next test the robustness of our findings in a repeated-game setting. We observe that cartels become stable in both types of auctions, and that the winning cartel bid is reduced significantly. We also find that stable cartels are better able to reduce the winning bid in EN than in FP. However, the difference in cartel stability between the two types of auctions is no longer statistically significant.

The set-up of the remainder of this paper is as follows. Section 2 presents our experimental procedures and design for the re-matching case. Section 3 contains the experimental results. In Section 4, we report our results for the repeated-game setting. Section 5 concludes.

2. Experimental Procedures and Design

The computerized experiment was conducted at the Center for Research in Experimental Economics and political Decision making (CREED) of the University of Amsterdam. Students were recruited by public announcement. In total 117 students from the University's entire undergraduate population participated in one of six sessions. The points that subjects earned were converted according to an exchange rate of 1 point = € 0.25. A show-up fee of € 7 was converted to 28 points for those subjects that entered the experiment. To make sure that all subjects understood the experiment, they had to correctly answer several test questions before the experiment started. Average earnings were € 11.52 per subject while sessions took 60 to 90 minutes to complete.[4]

[4] Appendix A contains an English translation of the instructions.

At the start of each session, re-matching groups of nine subjects were formed randomly. Re-matching groups did not change during the sessions and communication between subjects (other than through their play) was not possible. All sessions consisted of 40 periods. At the start of each period subjects were matched randomly with two other subjects within the same matching group, against whom they could compete in the auction. We had 54 [63] subjects compete in FP [EN], yielding six [seven] statistically independent observations.

Recall that Robinson's (1985) result relies on the assumption that the bidders share their private information before the auction. In particular, in the common value model, he assumes that "all cartel members know each other's value estimates" while in the independent private values model, he assumes that it is common knowledge among the bidders which bidder has the highest value. In our design, we by-pass the question as to how the bidders manage to credibly reveal their information to each other before the auction by implementing a very simple common value setting: subjects compete for a single object with a common value of 10 points.[5] As a consequence, Robinson's (1985) assumption is satisfied by construction.[6]

At the beginning of each period, each subject was asked if she wanted to "make an agreement". If, and only if, all group members pushed the 'yes' button (rather than the 'no' button), a cartel formed.[7] As in Robinson (1985) we do not consider partial cartels.[8] Individual votes were not disclosed; subjects only learned whether or not 'an agreement had been reached'. When a cartel had formed the computer randomly assigned a designated winner. According to the cartel agreement only the designated winner should submit a bid. All members of the cartel were reminded of this agreement once the designated winner was selected; designated losers received the message that "[a]ccording to the agreement you are not supposed to submit a bid", while designated winners were informed that "[a]ccording to the agreement you are the only bidder who is supposed to submit a bid". The cartel agreement was not binding though. This

[5] Recall that we focus on comparing the collusive properties of EN and FP, and not on the natural role of auctions to elicit individual valuations.

[6] Hu *et al.* (2011) used a pre-knockout auction to determine the designated winner in an independent private values environment. They found the pre-knockout auction's efficiency in both EN and FP to lie around 95% (where efficiency is defined as $(w-v)/(V-v)$ with w and v [V] denoting the winner's value and the lowest [highest] value among the bidders. This outcome is in contrast to Robinson's (1985) assumption that the designated winner is always the bidder with the highest value.

[7] This procedure has been introduced by Apesteguia *et al*. (2007), and was subsequently adopted by e.g. Hinloopen and Soetevent (2008), Hu *et al*. (2011) and Bigoni *et al*. (2012).

[8] See, e.g., Marshall and Marx (2007) and Bos and Harrington (2010) for a theoretical analysis of partial cartels. Clemens and Rau (2012) provide an experimental test of partial cartel formation.

design feature corresponds to Robinson's (1985) set-up whereby "[t]he cartel is assumed to select from among its members a "designated winner" (who should be the member with the highest valuation if they differ) and to recommend that he follow a particular bidding strategy while requesting other cartel members to be inactive in the bidding" (Robinson, 1985, p. 143).

As Robinson (1985) notes, in EN, cartels are only weakly incentive compatible: because the costs of entering the auction is zero, the designated losers are indifferent between entering the auction or not. In fact, for all bidders, abstaining from bidding is weakly dominated by entering the auction. To encourage designated losers to stick to the cartel agreement we have designated winners pay automatically 2.5 points to both other cartel members (5 points in total) prior to the auction.[9]

We implemented the following auction rules. In FP, in any of the 40 periods, each subject could submit a bid from the set {0, 1, …, 10} or could decide to abstain from bidding. The highest bidder won the auction of that period.[10] Ties were resolved randomly (nobody won the object when all group members decided not to submit a bid). The winner earned the difference between her bid and 10, the common value of the object. In EN, in any period the first auction round was almost the same as in FP, the only difference being that the highest bidder became the provisional winner. In subsequent auction rounds, subjects had to bid strictly higher than the current highest bid (whereby the provisional winner was excluded from bidding in that auction round) or leave the auction. A bidder left the auction when she was not the provisional winner in the previous auction round and when she chose not to submit a bid in the current auction round. Once a bidder had left the auction, she could not submit a bid in later auction rounds of that period. The provisional winner became the auction winner when both other group members had chosen not to submit a bid (anymore) or if she bid 10. The auction winner paid her highest bid, which she had submitted in the penultimate auction round.[11]

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[9] Note that these side-payments do not affect the collusive properties of both EN and FP as they constitute a sunk cost (Robinson, 1985, p. 145). In laboratory experiments, a substantial fraction of the subjects tends to be inequity averse (e.g. Fehr and Schmidt (1999)). With side-payments, inequity averse bidders have less reason to deviate from the cartel agreement because the pay-off differences between the winner and the losers are less pronounced. In practice, side-payments are quite common. Asker (2010) gives a particularly striking example of a bidding ring of stamp dealers who organized no less than 1700 pre-auction knockouts in which the level of side-payments were decided.

[10] The reserve price is therefore 0. A higher (or more sophisticated) reserve price could be expected to influence the collusive behavior in FP (see Thomas, 2005).

[11] Our design precludes the seller to discriminate between buyers. In particular, we abstain from the possibility that the seller implements a mechanism whereby it becomes less profitable for buyers to collude (see Gruyer, 2009).

3. Experimental Results

Figure 1 shows subjects' propensities to collude and to defect over time (where we mark a bidder as defecting from the cartel agreement if, and only if, she submits a bid in the auction while being a designated loser). Table 1 summarizes these data, which we list in Appendix B. To avoid possible learning and end-game effects, we restrict the statistical analyses to periods 6 through 35.[12] In line with Robinson (1985), we consider a cartel to be stable if, and only if, all bidders stick to the cartel agreement.

Figure 1: Cartel activity over time across auctions

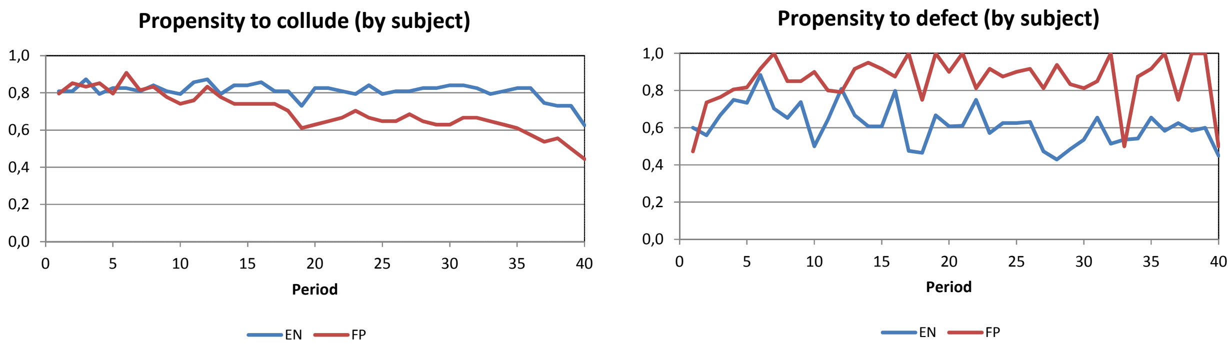


Table 1: Cartel activity across auctions[a]

	Propensity to collude (by subject)	Cartel formation	Propensity to defect (by subject)	Cartel breakdown
EN	0.82	0.57	0.62	0.73
	$\vee^{***}$	$\vee^{***}$	$\wedge^{***}$	$\wedge^{***}$
FP	0.70	0.34	0.89	1.00

[a] Significance levels are calculated with exact Wilcoxon rank-sum tests, counting each re-matching group as one, independent observation; ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

The data show that cartels are more likely to be formed in EN than in FP, and that in EN cartel defection is less likely than in FP. In fact, in FP literally none of the cartels is stable. The latter observation is perfectly in line with the theoretical result of Robinson (1985) that collusion is not incentive compatible in FP. At the same time there is only mild support for his prediction that in

[12] None of the reported results changes qualitatively if we include all periods.

EN complying to the cartel agreement is incentive compatible: in EN only a minority of cartels does not break down.

Figure 2: Relative frequencies of the winning cartel bids

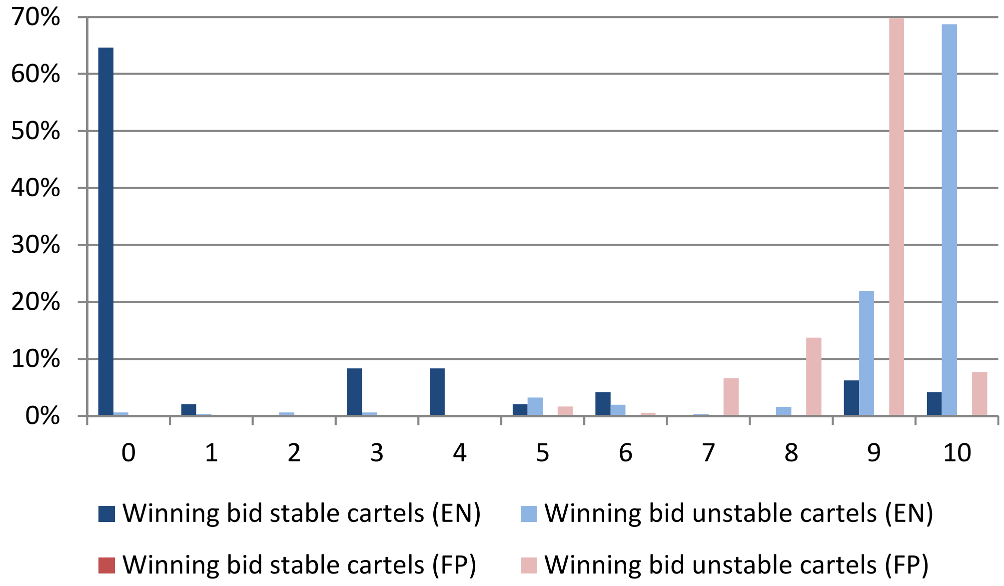


Figure 2 shows the winning cartel bids. Clearly, in EN it hardly pays to defect: the average winning cartel bid of defecting cartels is 9.3, which is also slightly (but statistically significantly) higher than the average winning defecting cartel bid in FP of 8.9 ($p = 0.007$). On the other hand, in EN it does pay to form a cartel and to comply with the cartel agreement: the average winning bid of 3.4 implies an average benefit of $(10 – 3.4)/3 = 2.2$ for each cartel member.[13]

To examine the underlying bidding strategies, we have summarized the bids of designated winners and designated losers in Table 2. Not surprisingly, the initial bid of the designated winner in EN does not differ (statistically) between stable and unstable cartels.[14] Indeed, over time initial bids of designated winners are quite stable, as is the probability that the designated winner secures the item (see Figure 3). In line with the strategy suggested by Robinson (1985), in

[13] We don't observe 'endogenous collusion' in the sense that group behavior evolves to charging the monopoly price without making an agreement (as in Brandts and Guillen, 2007).

[14] There is also no statistically significant relation between the level of the designated winner's initial bid and the probability of cartel defection.

case of cartel defection a bidding war commences: in unstable cartels both the designated winner and designated losers have to continue bidding up to a price of at least 9 to secure the item.[15]

Table 2: bids[a]

	Designated winner							
	FP			EN				
	Bid, winning		Bid, not winning	Initial bid		Final bid, wining		Final bid, not winning
Stable cartels				3.4	=	3.4		
				∨		∧**		
Unstable cartels	8.9	>***	6.2	1.7		9.4	>***	6.0
	Designated losers							
	FP			EN				
	Bid, winning		Bid, not winning	Initial bid		Final bid, winning		Final bid, not winning
Unstable cartels	8.8	>***	7.9	4.6		9.1	>***	6.9

[a] Significance levels are calculated with exact Wilcoxon rank-sum tests, counting each matching group as one, independent observation; ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

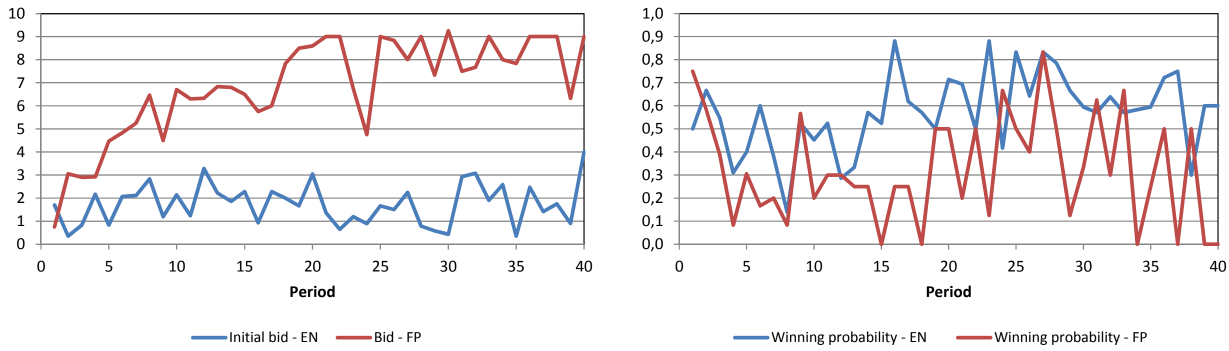
A comparable pattern is observed for FP. To secure the item a bid of about 9 has to be submitted. As a consequence, it does not pay to form a cartel: all cartels break down, and cartels do not win the item at a lower winning bid than non-cartels (p = 0.522). The pattern of increasing bids in FP in Figure 3 suggests that subjects learn in FP. In the early rounds designated winners submit low bids, much in line with the cartel agreement. However, by doing so, they have a low probability of securing the item. They respond by increasing their bids over time, which subsequently hover around 9 as of period 20.[16]

[15] Also the winning bid of the designated loser differs significantly from that of the designated winner in stable cartels (p = 0.055).

[16] In FP, the average winning cartel bid over periods 20 through 35 of designated winners and losers is 9.3 and 9.1 respectively. Still, the probability that the designated winner secures the item in FP is lower than in EN (p = 0.003).

Figure 3: Designated winner's (initial) bids (panel a) and probabilities of securing the item (panel b), over time across auctions

Panel a Panel b



4. Repeated Interaction

In the previous section, we observed that cartels are more likely to be stable in EN than in FP, but not as much as suggested by Robinson (1985); also in EN the majority of the cartels break down. Therefore, we next follow up on Robinson's remark that more cartels may become stable in either auction because "[p]otential cheaters may be deterred by the loss of long-run profits." (Robinson, 1985, p. 145). In four additional sessions, we examine the collusive properties of EN and FP in the case of repeated interaction.[17] At the beginning of each session groups of three subjects were formed that did not change over the course of the 40 periods.[18] All other aspects of the experimental procedures were unchanged. 24 [21] subjects participated in FP [EN] yielding eight [seven] independent observations.[19]

Tables 3 and 4 summarize the results on cartel activity. Compared to the case of re-matching, in FP cartels are more likely to be formed and cartels that form are less likely to break down,

[17] Indeed, in practice cartels typically center around a set of bidders that interact repeatedly (Phillips *et al.*, 2003). Note that repeating the auction does not affect the collusive properties of EN; collusion remains incentive compatible. Collusion in FP, whereby cartel members reveal their private signals prior to the auction, is incentive compatible if the auction is repeated an infinite number of periods and if bidders are 'patient enough' (Aoyagi, 2007; see also Fabra, 2003).
[18] Alternatively, a random stopping rule is implemented. However, collusive play in a finitely repeated-game setting is typically observed until the last couple of periods (Selten and Stoecker, 1983). In our experiment we also observe end-game effects, and, again, use periods 6 through 35 only in the numerical analyses.
[19] Subjects earned € 24.82 on average in sessions that lasted, again, between 60 and 90 minutes.

while only cartel stability is enhanced in EN. In addition, the two auctions no longer differ statistically in terms of cartel formation and cartel stability (see Table 4).

Table 3: Cartel activity across treatments[a]

	FP		EN	
	Propensity to collude	Propensity to defect	Propensity to collude	Propensity to defect
Re-matching	0.70	0.89	0.82	0.62
	∧***	∨***	∧	∨***
Fixed matching	0.91	0.43	0.87	0.26

[a] Significance levels are calculated with exact Wilcoxon rank-sum tests, counting each (matching) group as one, independent observation; ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 4: Cartel activity across auctions, fixed matching[a]

	Propensity to collude (by subject)	Cartel formation	Propensity to defect (by subject)	Cartel breakdown
EN	0.87	0.72	0.26	0.46
	∧	∧	∧	∧
FP	0.91	0.76	0.43	0.58

[a] Significance levels are calculated with exact Wilcoxon rank-sum tests, counting each group as one, independent observation; ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 5 lists the average bids of designated winners and designated losers in case of fixed matching. There are some marked differences compared to the re-matching case. In EN, the initial bids of both the designated winner and the designated losers are lower than in the case of re-matching ($p = 0.013$ and $p = 0.015$ respectively). In fact, stable cartels manage to obtain the item for the joint-profit maximizing price of zero. As a result, designated winners pay less in stable cartels than in the re-matching case. Similarly, the designated winner has to pay less to secure the item in unstable cartels ($p = 0.046$), and considerably less than 10. At the same time, designated losers have to pay the same, high price to be the auction winner ($p = 0.635$).

Designated winners thus continue bidding in a pricing war until the provisional winning bid is at least 9, unless they themselves are the provisional winner. Designated losers, on the other hand, quit the bidding war earlier, which is also supported by the (statistically weakly) lower non-winning final bid of designated losers (p = 0.063). One interpretation of this bidding pattern is that designated losers want to maintain the collective understanding of the cartel strategy because in any future period they could be the designated winner.

Table 5: bids, fixed matching[a]

	Designated winner							
	FP			EN				
	Bid, winning		Bid, not winning	Initial bid		Final bid, winning		Final bid, not winning
Stable cartels	2.4			0.0	=	0.0		
	∧**			∧		∧**		
Unstable cartels	5.4	>**	2.5	2.2		5.9	>	4.3
	Designated losers							
	FP			EN				
	Bid, winning		Bid, not winning	Initial bid		Final bid, winning		Final bid, not winning
Unstable cartels	4.6	>	4.2	1.9		8.5	>**	3.5

[a] Significance levels are calculated with exact Wilcoxon rank-sum tests, counting each group as one, independent observation; ***, ** and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

In FP with fixed matching, it is attractive to form a cartel in contrast to the re-matching case. Stable cartels now occur, and designated winners of these cartels pay less than the winning bids of designated winners and losers in unstable cartels.[20] This suggests that the threat of future

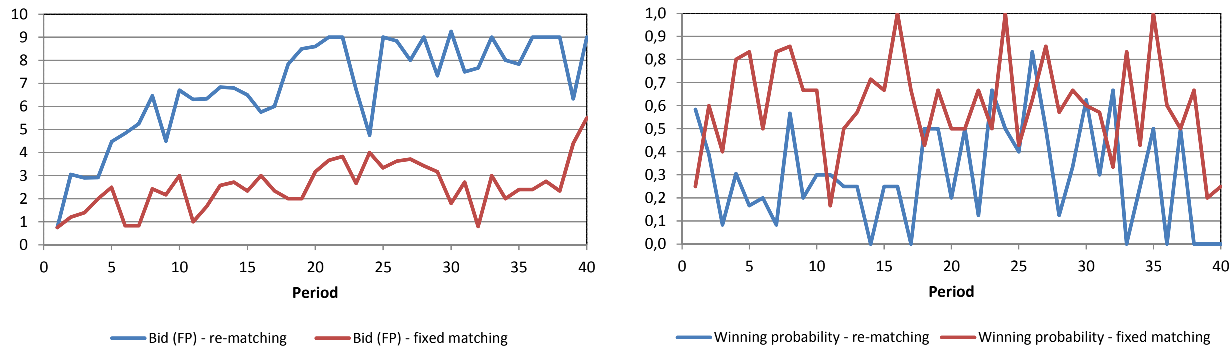
[20] Note that the winning bids of the designated winner and designated losers in unstable cartels do not differ (p = 1.000).

retaliation disciplines designated losers. As a result, designated winners are more confident that a low bid will secure them the item, which is indeed the case (see Figure 5).[21]

Figure 5: Designated winner's bids (panel a) and probabilities of securing the item (panel b) in FP, over time and across treatments

Panel a

Panel b



5. CONCLUSION

In this paper, we have tested Robinson's (1985) result that collusion is stable EN and not in FP in the case of one-shot interaction. Our data partly confirm Robinson's prediction: in FP all cartels break down, but a majority of cartels breaks down in EN as well. However, more cartels form in EN than in FP and stable cartels in EN obtain the item for a price well below its value. Our observations support the (policy) view that EN is more prone to collusion than FP. In the case of repeated interaction, we have observed that the two auctions no longer differ in terms of cartel stability but stable cartels are still better able to reduce the winning bid in EN than in FP. This might explain why also FP has featured in discovered cartels, because in practice it is quite common that the same set of bidders interact repeatedly. Our findings suggest that if bidders interact repeatedly, the choice between EN and FP should primarily be led by considerations other than their respective collusive properties, such as the lower vulnerability to the winner's curse of EN or the lower price variability in FP.

[21] The designated winners' bid with fixed matching is below that with re-matching ($p = 0.002$) while the probability of securing the item by the designated winner increases due to fixed matching ($p = 0.010$).

APPENDIX A: INSTRUCTIONS

The instructions are computerized. Subjects could read through the html-pages at their own pace. Below is a translation of the Dutch instructions for the English auction.

Welcome!

You are about to participate in an auction experiment. The experiment consists of **40 rounds** and each round consists of **2 steps**. Those steps are the same in each round and will be explained later in more detail.

In every round of the experiment, all participants will be randomly divided in **groups of 3** members. This will be done in such a way that participants will never be in the same group in two subsequent rounds; at the beginning of every round, you will be matched with two other participants than in the previous round.

Group members remain anonymous; you will not know with whom you are matched. Moreover, there will not be contact between separate groups during any round.

Earnings

In every round of the experiment, you can earn points. At the end of the experiment, points will be exchanged for Euros. The exchange rate will be

1 point = € 0.25

At the beginning of the experiment, you will receive a **starting capital** of **28 points**. At the end of every round, the points you will earn in this round will be added to your capital. If you earn a negative number of points in a round, these points will be subtracted from your capital.

In the remainder of these instructions, we will present an overview of the experiment followed by a further explanation of a single round. We will conclude with examples and test questions.

Overview of the experiment

You aim at buying a product in an **auction**, just like the other two members of your group. Only 1 item of the product is available in each round. In every round, you can bid in an auction.

In **step 1** of the experiment, you will get the opportunity to make an **agreement** with your group members about who will win the auction. An agreement will only be made if all group members desire to do so. An agreement is not binding, though.

In **step 2**, you and the other two group members will bid in the auction. You will earn points if you win the auction. If you win, the number of points that you earn in the auction will be equal to

10 – your winning bid

Now, an explanation of both steps follows.

Step 1: Agreement

In step 1 of every round, you will be asked the following question: “Would you like to make an agreement? If yes, press the YES button. If not, press the NO button.” You must answer YES or NO. The other two group members will have to make the same decision at the same time.

If all group members choose YES, an agreement will be made. The agreement will be that only one of the three group members will submit a bid. The others will not bid.

Chance determines who of the three group members will submit a bid according to the agreement. This agreement is not binding, though.

If one or more group members press the NO button, there will not be an agreement.

The group member the computer picks out to submit a bid, will pay the two other group members 2.5 points, so 5 points in total.

Step 2: The auction

The auction consists of several rounds. The winner of the auction obtains 10 points. You do not have to stick to an agreement (if any). This also holds true for the other two group members.

In every auction round, you can submit a bid by entering one of the following numbers:

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

You can also indicate not to enter any number. If you decide to do so, you will step out of the auction and you cannot submit a bid in later rounds of the auction.

In every round of the auction, bidders can only choose a higher number than the currently highest bid. The bidder with the current highest bid is the **provisional winner** of the object. In the case of identical highest bids, chance determines who of the highest bidders will become the provisional winner.

In each round of the auction, the provisional winner cannot submit a bid. Only the other group members can do so.

The provisional winner will **win the auction** if the other group members decide not to enter a number. In that case, the winner will pay his highest bid (entered in the previous round). The earnings in the auction for the winner is then equal to

10 – winning bid

A bid of 10 guarantees that someone wins the auction, provided that none of the other bidders has also submitted a bid of 10. If several group members bid 10, chance determines who will win the auction.

If all group members decide not to submit a bid in the first round, nobody will win the object.

APPENDIX B: (MATCHING) GROUP AVERAGES OVER TIME

Re-matching				Fixed matching			
Propensity to collude		Propensity to defect		Propensity to collude		Propensity to defect	
EN	FP	EN	FP	EN	FP	EN	FP
0.81	0.80	0.60	0.58	0.71	1.00	0.00	0.38
0.81	0.85	0.56	0.94	0.86	0.88	0.38	0.20
0.87	0.83	0.67	1.00	0.71	0.88	0.25	0.50
0.79	0.85	0.75	1.00	0.76	0.88	0.13	0.40
0.83	0.80	0.73	1.00	0.86	0.92	0.00	0.25
0.83	0.91	0.88	1.00	0.90	0.92	0.10	0.33
0.81	0.81	0.70	1.00	0.81	0.92	0.00	0.33
0.84	0.83	0.65	1.00	0.95	0.96	0.42	0.29
0.81	0.78	0.74	1.00	0.90	0.92	0.20	0.33
0.79	0.74	0.50	1.00	0.86	0.92	0.40	0.42
0.86	0.76	0.64	1.00	0.76	0.92	0.13	0.42
0.87	0.83	0.81	1.00	0.86	0.92	0.25	0.50
0.79	0.78	0.67	1.00	0.86	0.96	0.10	0.43
0.84	0.74	0.61	1.00	0.95	0.96	0.33	0.43
0.84	0.74	0.61	1.00	0.86	0.92	0.20	0.42
0.86	0.74	0.80	1.00	0.86	0.92	0.50	0.42
0.81	0.74	0.48	1.00	0.86	0.92	0.25	0.33
0.81	0.70	0.46	1.00	0.81	0.96	0.20	0.36
0.73	0.61	0.67	1.00	0.90	0.92	0.25	0.42
0.83	0.63	0.61	1.00	0.81	0.92	0.20	0.50
0.83	0.65	0.61	1.00	0.81	0.92	0.13	0.58
0.81	0.67	0.75	1.00	0.81	0.92	0.13	0.42
0.79	0.70	0.57	1.00	0.86	0.92	0.10	0.42
0.84	0.67	0.63	1.00	0.90	0.92	0.20	0.50
0.79	0.65	0.63	1.00	0.90	0.96	0.17	0.50
0.81	0.65	0.63	1.00	0.86	1.00	0.10	0.38
0.81	0.69	0.47	1.00	0.86	0.96	0.13	0.21
0.83	0.65	0.43	1.00	0.95	0.96	0.08	0.50
0.83	0.63	0.49	1.00	0.90	0.88	0.17	0.33
0.84	0.63	0.54	1.00	0.86	0.88	0.20	0.40
0.84	0.67	0.65	1.00	0.90	0.96	0.00	0.29
0.83	0.67	0.51	1.00	0.90	0.92	0.08	0.42
0.79	0.65	0.54	1.00	0.95	0.92	0.08	0.17
0.81	0.63	0.54	1.00	0.90	0.96	0.25	0.43
0.83	0.61	0.65	1.00	0.86	0.88	0.20	0.20
0.83	0.57	0.58	1.00	0.90	0.88	0.17	0.30
0.75	0.54	0.63	1.00	0.95	0.83	0.17	0.50
0.73	0.56	0.58	1.00	0.95	0.79	0.25	0.50
0.73	0.50	0.60	1.00	0.95	0.83	0.33	1.00
0.63	0.44	0.45	1.00	0.86	0.71	0.40	1.00

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