PARTICIPANTS' COMPETITIVENESS AND BIDDING BEHAVIOR IN EXPERIMENTAL AUCTIONS: AN APPLICATION TO THE SPANISH MARKET

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Abstract

The aim of the paper was to examine if experimental auctions are demand revealing regardless the level of participants' competitiveness. Then, we design an experimental auction with two treatments to check if the level of participants' competitiveness does affect their bidding behavior. Both treatments had all the same designed characteristics except that in the second treatment, participants who reported the highest levels of competitiveness were not allow to participate in the auction. Then, we could directly compare bids from both treatments to test differences in bidding behavior between them. Our findings generally indicate that the level of participants' competitiveness does not affect bidding behavior and then, homegrown experimental auctions are demand revealing in practice regardless the level of participants' competitiveness.

Keywords: demand revelation, lamb meat, Spain, Ojinegra from Teruel

1. Introduction

In recent years, the use of non-hypothetical experimental methods such as experimental auctions, where participants make consequential bids with real products and real money, has become very popular in assessing consumers' preferences for product attributes or new products. Well over 100 studies were published in the academic literature using experimental auctions in a wide range of applications valuing such diverse goods as food, cars, coffee mugs, sports cards, and lotteries (Corrigan et al., 2011). One of the major reasons for the increasing popularity of experimental auctions is their theoretical economic incentive compatibility property assuring that participants have the dominant strategy to submit bids equal to their true value for the good. Then, to get true valuations from homegrown experimental auctions participants should be explicitly told about their weakly dominant strategy and provide with reasoning as to why they should follow it when bidding (Lusk and Shrogren, 2007). In other words, if participants before implementation of the auction are instructed that it is in their best interest to offer a bid equal to their true values, the experimental auction would be demand revealing in practice and therefore, participants will provide truthful biddings (as proved by Corrigan and Rousu (2008)). However, different factors can affect participants bidding behavior which might compromised the demand revealing properties of a theoretical economic incentive compatible auction even if participants are trained about the economic incentive compatibility issue. As Lusk and Shrogren (2007) pointed out some participants' personally traits may affect bidding behavior in experimental auctions and one personality trait of direct relevance for experimental auctions relates to the competitiveness of a person. It is reasonable to think that if participants have higher level of competitiveness, they would offer higher bids because their get additional utility from winning the auction. Then, the aim of our paper is

to analyze if the level of participants' competitiveness does affect their bidding behavior. In particular, we tested if there is a statistically significant difference between bids elicited by participants with two different levels of competitiveness (higher competitiveness and lower competitiveness).

To do that, we conducted an experimental auction with two treatments. In both treatments, participants, before the implementation of the auction, were asked about their level of competitiveness but in the second treatment those participants with the highest levels of competitiveness were not allow to participate in the auction. This manipulation aimed to diminish, *ceteris paribus*, the level of participants' competitiveness in the sessions including only those participants who stated lower level of competitiveness. Then, we will be able to test our hypothesis by comparing the elicited bids from the two treatments.

The rest of the article is organized as follows: the next section discusses the experimental design; the section following this presents the results and the final section provides some concluding remarks.

2. Experimental design

2.1. General design and hypothesis testing

To test our research hypothesis, we conducted an experimental auction for four lamb meat products with two treatments. We designed the two treatments as homogenous as possible with the only difference that in the second treatment, after asking participants about their level of competitiveness, those who reported the highest levels of competitiveness were not allow to participate in the auction. We then kept the rest of design characteristics similar between treatments including recruitment of subjects. Moreover, as lies can affect behavior

in experiments (Alfnes and Rickersten, 2011), we did not deceive participants because we provided true information about the auctioned products and we used real products, in other words, the products auctioned during the experiment posed the characteristics explained to participants. The experiments were conducted in the region of Aragón (Spain), in the town of Zaragoza and all participants were consumers, instead of students, and claimed to eat lamb meat at least occasionally to ensure that participants were familiar with the auctioned product as suggested by Alfnes and Rickersten (2011). Each participant attended only one of the two treatments, in other words, we designed a within experiment following Lusk and Schroeder (2004).

To test if participants' level of competitiveness does affect their bidding behavior, our hypothesis of interest is whether there is a statistically significant difference between bids elicited from treatment 1 (control treatment C) and treatment 2 (lower competitiveness treatment, LC), where the most competitive subjects were not allow to participate in the auction, depicted as:

$$H_0: \text{Bids}^{C} = \text{Bids}^{LC} \qquad H_1: \text{Bids}^{C} \neq \text{Bids}^{LC} \tag{1}$$

If we fail to reject this hypothesis, then we may conclude that Bids from both treatments are statistically equal and therefore, the level of participants' competitiveness does not affect participants bidding behaviour in the auction.

2.2. Experimental auction design

We used a simultaneous (i.e., full bidding) experimental auction[1] for four locally produced lamb meats[2] and asked subjects to simultaneously submit bids for each of the products. To avoid demand reduction effects, participants were told that they could only purchase one package of lamb meat. Therefore, a product was randomly drawn as the binding product at the end of the auction.

Among the different incentive compatible auction mechanisms, we used a 4th price auction because it provides more winners than a typical Vickrey second-price auction. The second-price auction method will only produce one winner per session and this situation could disengage some of the participants (e.g., off-margin bidders)[3]. Moreover, several papers in the past have also utilized the 4th price auction (e.g., Alfnes et al., 2008; Shaw et al., 2006; Muller and Ruffieux, 2011). We conducted five rounds in each session and the price and identification number of the four highest bidders for each product was written on a whiteboard after each round[4]. At the end of the session one of the rounds was randomly selected as the binding round.

[1] Alfnes (2009) indicated that the simultaneous auction approach seems to be the best choice when valuing products' quality attributes.

[2] We auctioned four packages of three lamb ribs: *i)* unlabelled non-suckling lamb meat; *ii)* unlabelled suckling lamb meat; *iii)* labeled non-suckling lamb meat; and *iv)* labelled suckling lamb meat. Lamb ribs were chosen because they are well-known and appreciated cuts in the Zaragoza market. The label was a sheep breed locally produced called "Ojinegra from Teruel".

[3] Lusk et al. (2007) found that if the number of participants who could purchase the product is approximately half the session size (N) (i.e., either a fourth of fifth price for commonly used session sizes), that this auction mechanism would generally be more effective in engaging all bidders (low, medium and high value bidders).

[4] The use of multiple rounds with price feedback (posted prices) was first applied in experimental auctions because as Plott (1996) suggested, people's preferences are learned through experience and market exposure. Hence, price feedback in multiple rounds was used as a mechanism for subjects to learn the auction market. However, some researchers have cautioned that repeated exposure of subjects to market price might cause their bids to become affiliated, which could cause the incentive compatibility property of the auction mechanism to break down (Milgrom and Weber, 1982; Harrison et al., 2004; Harrison, 2006; Corrigan and Rousu, 2006) and were in favor of one-shot institutions. On the other hand, there is another group of researchers who is supportive of the use of multiple rounds, arguing that this procedure yields valuations more consistent with neoclassical economic theory (Cox and Grether, 1996; Shogren et al., 2001; Alfnes and Rickersen, 2003; Lusk and Shogren, 2007; Shogren, 2006; Corrigan et al., 2011). Given that this issue is still unsettled in

2.3. Description of the auction implementation

After arrival of the participants, they were informed that they would receive 10 € participation fee at the end of the session. After subjects consented to participate in the auction, they were assigned an ID number and were asked to complete a survey requesting information on socioeconomic and demographic characteristics as well as a question to measure participants' level of competitiveness. We used a question commonly used in the psychology and marketing literature to assess competitiveness of individuals. In particular, we used a question with the following four items developed by Helmreich and Spence (1978) and applied by Brown and Peterson (1994), Brown, Cron and Slocum (1998) and, Mowen (2004): *i)* I enjoy competition more than others; *ii)* I feel that it is important to outperform others; *iii)* I enjoy testing my abilities against others; *iv)* I feel that winning is extremely important. Respondents were asked to give their degree of agreement with these four sentences in a 5-point Likert scale, where 1 indicates strong disagreement and 5 indicates strong agreement. After the completion of the questionnaire, the monitor, in the second treatment, checked the competitiveness question and around four participants with the highest levels of competitiveness were not allowed to participate in the session. They received the 10 € participation fees and thanks for their participation. Then, all the participants remaining in the sessions received the experimental instructions together with the product information. The monitor then read the instructions aloud emphasizing that their dominant strategy is to reveal their true values and that one round and one product will be randomly drawn as binding. They were also asked not to communicate with any other participant for any reason, because any attempt to communicate with each other would lead

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the literature, we opted to use multiple rounds with price feedback based on the premise that it could enhance the learning effect.

to the failure of the experiment. Moreover, the monitor encouraged the participants to ask questions about the auction procedure if they have some doubts. We then ran a practice auction using four different candy bars to fully familiarize participants with the auction mechanism and to instruct them that it is in their best interest to bid their true values. After the practice auction with the candy bars, we conducted the lamb meat auction. First, the monitor passed the packages of lamb ribs to be auctioned around so that each participant could inspect the products. Then, the lamb auction was conducted in several steps:

Step 1. Subjects were asked to simultaneously submit a bid for each of the four lamb meat packages. The bids were collected and ranked from highest to lowest and the ID number of the top three bidders and the 4^{th} highest price for each of the products were posted on the board.

Step 2. Step 1 was repeated for four additional rounds.

Step 3. After all the rounds were conducted, a random drawing determined which of the five rounds was binding.

Step 4. A random drawing determined which of the four lamb meat packages was binding.

Step 5. The top three bidders on the binding product in the binding round had to purchase the lamb meat package and paid a price equivalent to the 4^{th} highest bid for the product.

3. Results

Third and fourth columns in Table 1 report the descriptive statistics of the socio-demographic variables for treatment 1 and treatment 2. A total of 78 subjects participated in treatment 1, whereas a total of 54 subjects participated in treatment 2. We used the Kruskal-Wallis test to determine if there are significant differences in socio-demographic variables

across the two treatments. The results of the tests suggest that there are no statistically significant differences at the 5% level across treatments by gender (*p-value* = 0.99), household size (p-value=0.26), education (*p-value* = 0.92) and income (*p-value* = 0.93). Then, the socio-demographic characteristics for both samples are similar.

[Include table 1 here]

The mean bids for the four lamb meat products by rounds for treatments 1 and 2 are exhibited in Table 2 as well as the competitiveness index[5]. Our null hypothesis (H_0: $Bids^C = Bids^{LC}$; H_1: $Bids^C \neq Bids^{LC}$) is not rejected for all the rounds and the four products, then participants bids from both treatments are statistically equal. Moreover, as expected, the level of participant competitiveness is statistically higher in treatment 1 than in treatment 2. Results from these two tests indicated that the level of participants' competitiveness does not affect their bidding behavior because although the level of competitiveness is different (higher in the first treatment) across treatment, participants bids for the products are the same.

[Include table 2 here]

Nevertheless, to test our hypothesis after controlling for differences in socio-demographic characteristics and taking into account the panel nature of our data we modelled the elicited bids for the four lamb meat products as a function of socio-demographic variables, rounds

[5] The cronbach' alpha coefficient for the competitiveness question was 0.8 similar to the one found by Brown et al., (1998) and higher than the recommended level of 0.7. Using the scores given to the four sentences, we calculated a competitiveness index for each participant as the sum of each subject's responses to the 4 sentences. Hence, the competitiveness index is from 4 to 20.

and a *Treatment*2 dummy variable that takes value 1 if subjects participated in treatment 2 and 0 otherwise. The model specification is as follows:

$$(2)\quad Bids_{it} = \alpha + BX_i + \delta_1 round_2 + \delta_2 round_3 + \delta_3 round_4 + \delta_4 round_5 + \gamma Treatment_2 + \varepsilon_{it}$$

where $Bids_{it}$ is the bid for the i^{th} consumer in the t^{th} bidding round, X_i is a vector of demographic control variables (defined in table 1) and *round2, round3, round4 and round5* are dummy variables for the different rounds.

We estimated the model defined by equation (2) using a random-effects to take into account individuals' heterogeneity (Baltagi, 2003). Estimated coefficients using the STATA are presented in Table 3. The dummy variables for the rounds are positive and mostly statistically significant. However, the estimated coefficients suggest that round effects are not monotonically increasing across rounds, *ceteris paribus,* but fluctuating around the mean which implies that there are minimal bid affiliation effects.

To test our hypothesis (H_0: $Bids^C = Bids^{LC}$; H_1: $Bids^C \neq Bids^{LC}$), we used the t-ratio of the *treatment 2* variable. Because the estimated parameter for the *treatment 2* variable is not statistically significant for the four analyzed products we can conclude that bids for the two treatments are the same, corroborating our previous results using the Kruskal-Wallis test (Table 2).

[Include table 3 here]

Hence, our findings generally indicate that the level of participants' competitiveness does not affect bidding behavior for the four lamb meat products and then, experimental auctions are able to reveal the true preferences regardless of the level of participants'

competitiveness. In other words, if we use an incentive compatible mechanism in homegrown auctions and we instruct participants that it is in their best interest to offer a bid equal to their true value, the experimental auction will be demand revealing regardless the level of participants' competitiveness.

Concluding remarks

The increasing popularity of the experimental auctions to value new products or attributes is due to their theoretical economic incentive compatibility property. However, the effectiveness of the incentive compatibility property of the auction depends on several key assumptions. It is argued that results from homegrown experimental auctions are sometimes not demand revealing because of different reasons. In this paper we were interested in one of the factors that could change participants bidding behavior in the auctions, the level of competitiveness. Assuming that participants with higher level of competitiveness may offer higher bids because they gain additional utility from winning the auction, we were interested in checking if the level of participants' competitiveness does affect their bidding behavior which might compromise the empirical demand revealing property of the auction. To date no experiment has been specifically designed to examine this issue.

Our experiment consisted of two treatments with all the same designed characteristics except that in the second treatment, participants who reported higher levels of competitiveness were not allow to participate in the auction. Then, we can directly compare bids from both treatments to test differences in bidding behavior between them. Our results showed that bids from both treatments (higher competitiveness and lower competitiveness) are statistically similar. Then, our key finding is that the level of

participants' competitiveness does not affect bidding behavior and then, homegrown experimental auctions are able to reveal the true preferences regardless of the level of participants' competitiveness. Our contribution to the literature and to the practitioners working with experimental auctions is that, if we use a theoretical economic incentive compatible mechanism in homegrown auctions and make sure that participants are instruct that it is in their best interest to offer a bid equal to their true, then the experimental auction will be demand revealing in practice regardless the level of participants' competitiveness.

One possible criticism of our study is that we used a self-reported measure of participants competitiveness and further research is still needed using some objective indicator. However, the question used had been also applied in several empirical papers and the validity of the competitiveness scale in our case was high.

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Table 1. Definition and Means of Demographic Variables

Variable definition	Name (type)	Treatment 1	Treatment 2	Test[a]
Number of participants		78	54	
Gender				
Male	FEMALE (dummy	29.5	29.6	0.000
Female	1=female; 0 otherwise)	70.5	70.4	(0.988)
Age (years)	YEARS (continuous)	53.9	47.1	6.742 (0.009)**
Household size	HSIZE (continuous)	3.1	2.8	1.254 (0.262)
Education of respondent				
High School	HIGHSCHOOL (dummy 1=high school; 0 otherwise)	26.9	25.9	0.009 (0.92)
Income				
High income	HINCOME (dummy 1=more than 2,500 €; 0 otherwise)	26.9	27.8	0.007 (0.93)

[a]the Kruskal-Wallis non-parametric test was calculated.

* and ** denote statistically significant differences at 10% and 5%, respectively

Table 2. Mean bids for each lamb meat product in treatment 1 and treatment 2 by rounds and mean competitiveness index

	Bids						Competitiveness Index
	Round1	Round2	Round3	Round4	Round5	Mean	Mean
Lamb							
Treatment1	2.11	2.18	2.18	2.15	2.21	2.17	11.12
Treatment2	2.03	2.15	2.18	2.25	2.31	2.18	9.65
Test ($\chi^{2,}$ p-value)[a]	0.024 (0.88)	0.102 (0.75)	0.085 (0.77)	0.091 (0.76)	0.199 (0.65)	0.028 (0.87)	5.95 (0.01)**
Suckling lamb							
Treatment1	2.71	2.85	2.78	2.78	2.86	2.80	11.12
Treatment2	2.61	2.83	2.77	2.73	2.83	2.75	9.65
Test ($\chi^{2,}$ p-value)[a]	0.187 (0.66)	0.199 (0.65)	0.054 (0.82)	0.022 (0.88)	0.058 (0.81)	0.002 (0.96)	5.95 (0.01)**
Lamb labeled as "Ojinegra from Teruel"							
Treatment1	2.49	2.68	2.60	2.69	2.71	2.63	11.12
Treatment2	2.40	2.55	2.56	2.56	2.60	2.53	9.65
Test ($\chi^{2,}$ p-value)[a]	0.248 (0.62)	0.015 (0.90)	0.004 (0.95)	0.130 (0.72)	0.009 (0.93)	0.114 (0.73)	5.95 (0.01)**
Suckling lamb labeled as "Ojinegra from Teruel"							
Treatment1	2.94	3.13	3.07	3.10	3.14	3.08	11.12
Treatment2	2.97	3.18	3.05	3.05	3.11	3.07	9.65
Test ($\chi^{2,}$ p-value)[a]	0.000 (0.98)	0.482 (0.48)	0.155 (0.69)	0.043 (0.83)	0.164 (0.68)	0.232 (0.63)	5.95 (0.01)**

[a]the Kruskal-Wallis non-parametric test was calculated.

* and ** denote statistically significant differences at 10% and 5%, respectively

Table 3. Random-effect models for the four lamb meat products

Variables	Lamb	Suckling lamb	Labeled lamb	Labeled suckling
Constant	2.0244 (4.25)**	2.1020 (3.44)**	2.6548 (4.68)**	2.1856 (3.27)**
Female	0.4999 (3.08)**	0.8805 (4.13)**	0.6828 (3.84)**	0.9722 (4.15)**
Age	-0.0028 (-0.50)	0.0008 (0.11)	-0.0088 (-1.30)	0.0001 (0.02)
Hsize	-0.0700 (-1.06)	-0.0604 (-0.66)	-0.0532 (-0.64)	0.0018 (0.02)
Highschool	-0.0015 (-0.01)	-0.0101 (-0.05)	-0.1074 (-0.51)	-0.0262 (-0.10)
Hincome	0.2279 (1.13)	0.4121 (1.62)*	0.1005 (0.49)	0.3018 (1.12)
Round 2	0.0870 (1.75)*	0.1697 (2.39)**	0.1735 (2.87)**	0.1996 (2.58)**
Round 3	0.0995 (2.05)**	0.1048 (1.54)*	0.1312 (2.21)**	0.1122 (2.58)**
Round 4	0.1156 (2.26)**	0.0905 (1.25)	0.1839 (2.96)**	0.1293 (1.76)**
Round 5	0.1746 (3.30)**	0.1807 (2.45)**	0.2155 (3.25)**	0.1748 (2.26)**
Treatment 2	-0.0223 (-0.14)	-0.0562 (-0.25)	-0.1735 (-0.90)	-0.0110 (-0.04)
N	660	660	660	660
χ^2 p-value	28.9 (0.00)**	31.82 (0.00)**	38.53 (0.00)**	30.7 (0.00)**

* and ** denote statistically significant differences at 10% and 5%, respectively
z-ratios are in parenthesis, unless stated