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The role of participants' competitiveness in consumers' valuation for food products using experimental auctions

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Abstract: The aim of the paper is to assess the effect of the participants' competitiveness on their valuation for food products. Specifically, to investigate the effect of the participants' competitiveness on their bids in a non-hypothetical experimental auction. Then, we designed an experimental auction to measure the consumers' preferences for food products with two treatments. Both treatments had all the same designed characteristics except that in the second treatment, the participants who reported the highest levels of competitiveness were not allowed to participate in the auction. Then, we could directly compare bids from the participants with two different levels of competitiveness (higher competitiveness and lower competitiveness). Because the bids from the two treatments were found statistically the same, we can conclude that the consumer's valuation for food products using the non-hypothetical experimental auctions are independent on the level of the participants' competitiveness.

Key words: bids, lamb meat, Spain

In recent years, the use of the non-hypothetical experimental auctions, where the participants make consequential bids with real products and real money, has become very popular in assessing the consumers' preferences for product attributes or new products. Lusk and Shogren (2007) indicated that up until 2006, more than 100 academic studies have utilized experimental auctions to elicit the consumers' preferences for various products. Numerous other studies have also used the experimental auctions since 2006[1]. One of the major reasons[2] for the increasing popularity of experimental auctions is their theoretical economic incentive compatibility property meaning that each bidder in the auction has the dominant strategy to submit bids equal to their true value for the good. Then, to get true valuations from experimental auctions, the 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 the participants before the implementation of the auction are instructed that it is in their best interest to offer a bid equal to their true values, the participants will provide truthful biddings (as proved by Corrigan and Rousu 2008). However, it is possible that the participants might derive utility from winning the auction because of their degree of competitiveness (Corrigan and Rousu 2006, Lusk and Shrogren 2007). Then, it would be possible that the participants in the auction bid higher than their true willingness to pay (WTP) for the product because they want to win the product. This higher bidding could happen even

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[1]Alfnes et al. 2008; Bernard and Bernard 2009, 2010; Froehlich et al. 2009; Colson and Huffman 2011; Colson et al. 2011; De Groote et al. 2011; Lee et al. 2011; Rousu et al. 2008; Akaichi et al. 2012; De Steur et al. 2012; Costanigro et al. 2014; among others.

[2]Other advantage of the experimental auctions is that detailed information about consumers' preferences can be obtained without requiring strong a priori assumptions about the consumers' utility function (Lusk and Shorgren 2007).

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after the participants are instructed that their best strategy is to bid their true WTP.

The objective in this paper is to assess the effect of the participants' degree of competitiveness on their bids for food products in a non-hypothetical experimental auction.

In other words, we test if there is a statistically significant difference between the bids elicited by the 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, the 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 allowed to participate in the auction. This manipulation aimed to diminish, *ceteris paribus*, the level of the participants' competitiveness including only those participants who stated a lower level of competitiveness. Then, we will be able to test our hypothesis by directly 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.

EXPERIMENTAL DESIGN

General design and hypothesis testing

To reach our aim, 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 the participants about their level of competitiveness, those who reported the highest levels were not allowed to participate in the auction. We kept the rest of design characteristics similar between the treatments including the recruitment of subjects. Moreover, to set the level of competition among the participants to buy the auctioned product similar between treatments, the number of participants per session in both treatments was kept the same (11 participants).

As lies can affect behaviour in experiments (Alfnes and Rickersten, 2011), we did not deceive the participants because we provided true information about the auctioned products and we used real products, in other words, the products auctioned during the experiment possessed the characteristics explained to the 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 the 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 between-subject experiment following several papers on experimental auctions (Lecocq et al. 2005; Rousu et al. 2007).

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

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

If this hypothesis is not rejected, then we may conclude that the Bids from both treatments are statistically equal and therefore, the level of the participants' competitiveness does not affect the participants bidding behaviour in the auction. Therefore, the participants' valuation for food products in experimental auctions is independent on the level of the participants' competitiveness.

Experimental auction design

We used a simultaneous (i.e., full bidding) experimental auction[3] for four locally produced lamb meats[4]

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

[4]We auctioned four packages of three lamb ribs: (i) unlabeled non-suckling lamb meat; (ii) unlabeled 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".

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and asked the subjects to simultaneously submit bids for each of the products. To avoid the demand reduction effects, the 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).[5] 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[6]. At the end of the session, one of the rounds was randomly selected as the binding round.

Description of the auction implementation

After the arrival of the participants, they were informed that they would receive 10 € participation fee at the end of the session. After the subjects consented to participate in the auction, they were assigned an ID number and were asked to complete a survey requesting information on the socio-economic and demographic characteristics as well as a question to measure the participants' level of competitiveness. We used a question commonly used in the psychology and marketing literature to assess the 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 et al. (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. The 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 experiment[7]. 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 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 to the failure of the experiment. Moreover, the monitor encouraged the participants to ask questions about the auction procedure if they have any doubts. We ran a practice auction using four different candy bars to fully familiarize the 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:

[5]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).

[6]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, 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; Shogren 2006; Lusk and Shogren 2007). Given that this issue is still unsettled in the literature, we opted to use multiple rounds with price feedback based on the premise that it could enhance the learning effect.

[7]The number of people recruited for the second treatment was higher to set the final number of participants per session the same for both treatments.

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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 the highest to the lowest and the ID number of the top three bidders and the 4th 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 4th highest bid for the product.

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 any significant differences in the 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 the treatments by gender (p-value = 0.99), the 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.

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[8]. 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 the participants bids from both treatments are statistically equal. Moreover, as expected, the level of the participant competitiveness is statistically higher in treatment 1 than in treatment 2. Results from these two tests indicated that the level of the participants' competitiveness does not affect their bidding behaviour because although the level of competitiveness is different (higher in the first treatment) across treatment, the participants bids for the products are the same.

Nevertheless, to test our hypothesis after controlling for differences in the socio-demographic characteristics and taking into account the panel nature

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

[8]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.

[9]We had five round bids for each participant.

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of our data[9], we modelled the elicited bids for the four lamb meat products as a function of the socio-demographic variables, rounds 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:

$$Bids_{it} = \alpha + BX_i + \delta_1 round_2 + \delta_2 round_3 + \delta_3 round_4 + \\ + \delta_4 round_5 + \gamma Treatment2_i + \varepsilon_{it} \quad (2)$$

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. Finally, ε_{it} is the overall error term.

We estimated the model defined by equation (2) using a panel random-effects to take into account individuals' heterogeneity (Baltagi 2003). Estimated coefficients using the STATA are presented in Table 3. Because our panel data is a micro panel (with very few years and many individuals), we expected to have heteroskedasticity problems. However, although we did not expect the serial correlation, we test the autocorrelation of first-order using the Wooldrigde test for the autocorrelation in the panel data (Wooldrigde 2002; Drukker 2003). The associated *p*-values for the Wooldrigde test indicated that the null hypothesis of no first-order autocorrelation was rejected for the four estimated equations. Then, because of the presence of the heteroskedasticity and serial correlation, we calculated the robust standard errors for disturbances being heteroscedastic and auto-correlated (Hoechle 2007). The dummy variables for the rounds are positive and mostly statistically significant. However, the estimated coefficients suggest that the 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 analysed products, we can conclude that the bids for the two treatments are the same, corroborating our previous results using the Kruskal-Wallis test (Table 2).

Table 2. Mean bids for each lamb meat product in treatment 1 and treatment 2 by rounds and the 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 (χ^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 (χ^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 labelled 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 (χ^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 labelled 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 (χ^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

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

Variables	Lamb	Suckling lamb	Labelled lamb	Labelled suckling
Constant	2.0244 (3.93)**	2.1020 (3.54)**	2.6548 (4.55)**	2.1856 (3.32)**
Female	0.4999 (2.74)**	0.8805 (4.05)**	0.6828 (3.36)**	0.9722 (3.94)**
Age	–0.0028 (–0.47)	0.0008 (0.11)	–0.0088 (–1.34)	0.0001 (0.02)
Hsize	–0.0700 (–1.00)	–0.0604 (–0.65)	–0.0532 (–0.62)	0.0018 (0.02)
Highschool	–0.0015 (–0.01)	–0.0101 (–0.04)	–0.1074 (–0.50)	–0.0262 (–0.10)
Hincome	0.2279 (1.22)	0.4121 (1.87)*	0.1005 (0.49)	0.3018 (1.20)
Round2	0.0870 (1.72)*	0.1697 (2.88)**	0.1735 (2.85)**	0.1996 (2.66)**
Round3	0.0995 (1.75)*	0.1048 (1.45)*	0.1312 (1.91)**	0.1122 (1.48)
Round4	0.1156 (1.96)**	0.0905 (1.02)	0.1839 (2.53)**	0.1293 (1.49)
Round5	0.1746 (2.80)**	0.1807 (2.01)**	0.2155 (2.90)**	0.1748 (1.93)**
Treatment2	–0.0223 (–0.14)	–0.0562 (–0.26)	–0.1735 (–0.93)	–0.0110 (–0.05)
N	660	660	660	660
χ^2 *p*-value	20.15 (0.03)**	39.29 (0.00)**	26.86 (0.00)**	35.54 (0.00)**
Wooldrige test *p*-value	78.20 0.000	29.06 0.000	7.28 0.008	23.27 0.000

* and ** denote statistically significant differences at 10% and 5%, respectively; *z*-ratios are in parenthesis (calculated using the robust standard errors to disturbances being heteroscedastic and auto-correlated (Hoechle2007)).

Hence, our findings indicated that the level of the participants' competitiveness does not affect their bidding behaviour for the four lamb meat products and, therefore, the participants' valuation for the products is independent of the level of the participants' competitiveness. In other words, if we instruct participants that it is in their best interest to offer a bid equal to their true value, the level of the participants' competitiveness does not affect the bids they offer for the auctioned product using the non-hypothetical experimental auctions. Then, valuation for food products are the same for the competitive and less competitive participants.

CONCLUDING REMARKS

The increasing popularity of the experimental auctions to value new products or attributes is due to their theoretical economic incentive compatibility property. In other words, the participants had the incentive to truly bid for the auctioned product. However, the participants with a higher level of competitiveness may offer higher bids because they gain an additional utility from winning the auction that could drive the level of the participants' competitiveness does affect their bids for the products being valued.

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 allowed to participate in the auction. Then, we could directly compare the bids from both treatments to test the differences in bids between them. Our results showed that the bids from both treatments (higher competitiveness and lower competitiveness) are statistically similar. Then, our key finding is that the level of the participants' competitiveness does not affect the bidding behaviour and then, the valuations obtained from the experimental auctions are the same regardless of the level of the participants' competitiveness.

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Our contribution to the literature and to the practitioners working with experimental auctions to value food products is that, if we use the non-hypothetical auctions and make sure that the participants are instructed that it is in their best interest to offer a bid equal to their true, then the valuations obtained for products are independent on the level of the participants' competitiveness.

One possible criticism of our study is that we used a self-reported measure of the participants competitiveness and a 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. A further research should be undertaken using other type of experimental auctions, other products and in other geographical settings to corroborate our finding.

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