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Abstract

The relevance of projection bias in decision making processes has been widely studied, but not specifically in experimental auctions. We study the role of projection bias in experimental auctions by examining the bidding behavior of hungry and non-hungry subjects on food products delivered either immediately after the auction or in one week's time. Results indicate that the difference in bids between a hot state (hunger) and a cold state (satiation) almost doubles when subjects have to predict their future tastes versus when they bid for a product intended for immediate consumption. More specifically, when subjects have to predict their future willingness to pay from their current tastes, they tend to over-predict their hunger and under-predict satiation.

Keywords: Experimental auction, willingness to pay, projection bias, hunger.

JEL codes: C90, D03, D44.

Introduction

Microeconomic theory posits that consumers accurately predict their future utility when solving their intertemporal optimization problems. However, accurately predicting future tastes requires that consumers understand both the direction and magnitude of how their tastes might change (Loewenstein, O'Donoghue, and Rabin 2003). Unfortunately, consumers do not always accurately predict these changes in their tastes and preferences. Loewenstein, O'Donoghue, and Rabin (2003) coined the term "projection bias" to describe the general bias that has been documented in relation to the prediction of future tastes.

One type of projection bias that occurs is when individuals fail to adequately predict future conditions that influence their current decisions. For example, customers ordering catalog clothes are overly influenced by the current weather (e.g., warm clothes orders jump significantly in cold weather and are then returned afterwards) (Conlin, O'Donoghue, and Vogelsang 2007); the sales of expensive and lasting goods, such as cars and houses, are also affected by the weather conditions at the time of the decision (Busse et al. 2012); "irrational" variables have been shown to have an effect on prices in eBay purchases (Mahatma 2006); people aroused by hunger, sex, or anger mispredict how they would act in a "calmer" state and, similarly, when they are in a cool state, mispredict the influence of arousal (Loewenstein, O'Donoghue, and Rabin 2003). In the field of medical science, patients who are in a state of fear or anxiety due to receipt of an adverse test result might need to make important treatment decisions with consequences that will apply after they have calmed down (Loewenstein 2005). In all of these examples, if the decisions apply to the present situation, then there should be no (projection) bias; whereas decisions applying to later times but made under current conditions can be subject to projection bias. In other words, people are likely to misjudge their future conditions and make decisions that differ from what they would if the future condition was equal to the current condition.

Projection bias is evident in the food domain as well. Hungry shoppers tend to buy different food items than non-hungry shoppers and their consumption pattern resembles that of people who expect to remain permanently famished (Mela, Aaron, and Gatenby 1997; Nisbett and Kanouse 1968). Hence, willingness to pay (WTP) for food products of hungry and non-hungry shoppers could vary as well depending on their hunger state. However, Gilbert, Gill, and Wilson (2002) found that if hungry shoppers were given a small piece of food (e.g., a muffin) right before entering a food market, they were able to limit their shopping to the initial items on a shopping list (Gilbert, Gill, and Wilson 2002). This documented bias is particularly important since the decision results may then carry on into subsequent periods. In this case, projection bias can be closely related to the lasting consequences of current decisions. For example, Read and Van Leeuwen (1998) presented office workers a choice of healthy and non-healthy snacks (fruit vs. candy bars) to be delivered in a week's time, either at a time when they were expected to be hungry or full. The workers chose the candy bar when they were expected to be hungry (since snacks are considered more satiating; see Jack, Piacentini, and Schröder 1997). In addition, if they were hungry at the moment of the buying decision, they were also more likely to choose the candy bar for any other subsequent occasion they were presented a choice.

Although the concept of projection bias as coined by Loewenstein, O'Donoghue, and Rabin (2003) has been studied in the literature, there are no known papers dealing with projection bias in experimental auction settings where the objective is to examine people's valuation for specific products (i.e., eliciting homegrown values). This is in part expected, given that most experiments auction products either for immediate consumption or immediate purchase. But what if consumers have to project their current preferences on a future date due to a variety of reasons such as current satiation? How would that reflect on their valuation for a product and thus their current decision to bid for the product? When studying willingness to pay for food, in experimental auctions, consumption is typically immediate, indicating there would be no projection bias. However, if the goal is to learn about food purchasing behavior, consumers are often faced with making a current decision for future consumption (i.e. purchasing groceries for a week's time period). Failure to account for projection bias could then render biased decisions i.e., basing their decision on a hot state with the potential to regret later. In our experiments, the difference in bids between a hot state and a cold state almost doubles when subjects have to project their tastes in one week's time.

In this article, we attempt to shed some light on the potential of the existence of projection bias in experimental auctions by auctioning food products that are intended for delivery and consumption either in the present or at a future date. We propose two central hypotheses that serve as the basis for the subsequent discussion: 1) depending on the hunger status (hungry or not), subjects will reveal different valuations for the same product; that is, will place greater valuation for the food product when hungry; and 2) irrespective of their hunger status, subjects who expect to receive the food product at a future date will have lower valuations for the product given the uncertainty they face in accurately predicting whether their future tastes will resemble their current tastes. We test these hypotheses by conducting experimental auctions at different points in time during the day (to vary hunger levels) with the food product to be received at varying times (immediately after the auction or with a time lag). Additionally, when the product is being given in the future, subjects will have to pay either in advance (at the end of the auction) or at the moment of receipt of the sandwich. Our results have significant implications for experimental auction designs.

Procedure

To explore the effect of projection bias on product valuation, we designed an experiment to test whether mistaken inferences about whether current states will also be felt at future points in time would appear as an effect on a subject's WTP for a perishable food product. First, we exogenously varied hunger levels by having subjects bid for a perishable food product (which was expected to be consumed right after the auction and not saved for the future) in two different times of the day when we expected subjects to be hungry or satiated. Half of the subjects participated in an auction before lunch time and half of the subjects participated in an auction after lunch time. Since we could not control whether a subject would be hungry or full at any given time (e.g., a subject may have decided to skip lunch or, conversely, to eat a satiating snack before lunch time), we also asked subjects about the time since their last meal. Comparing bids from the before-lunch and after-lunch sessions allows us to get an estimate of the effect of hunger on

WTP. To test if hunger levels would have an effect (if any) on projection bias, in half of the treatments we promised delivery of the sandwich with a time lag (i.e., exactly one week later) in addition to exogenously varying hunger levels. A comparison of the before- and after-lunch WTP values in treatments where delivery of the product is in the future and in treatments where delivery of the product is right after the auction gives us an indication on the mediation of hunger on projection bias (if any). Our experiment was conducted in Madrid, Spain.

Our between-subjects design involved 6 treatments in 12 sessions. To control for hunger levels we conducted sessions at two different times of the day: before lunch (6 sessions) and after lunch (6 sessions). In Spain, lunch is the main meal and unlikely to be skipped, and following local habits for lunch, the schedules set for the experiments were at 1 pm (before lunch) and at 3 pm (after lunch). For obvious reasons, we expected more hungry participants in the first case and less hungry participants in the second case. As mentioned previously, although the timing of the sessions were scheduled so as to have "hungry" and "satiated" participants, subjects were also asked questions pertaining to the time since their last meal. In an attempt to have similar meal situations for all participants, the experiments were carried out in the middle of the week (Tuesdays, Wednesdays, and Thursdays), to avoid potential effects of "weekend leftovers" that participants may bring on Mondays or special weekend plans on Fridays.

We also varied the time of delivery of the product to the highest bidders. In some sessions subjects received the food product immediately after the session (as is standard practice in auctions), while in other sessions delivery of the product occurred exactly one week later at the same time of the day. Highest bidders in the delayed delivery sessions received a coupon with which they could redeem their product from the experimenters. Subjects were assured that the products would be available when they redeemed their coupons the following week. To test the effect of imposing a commitment cost on subjects' valuation, half of the sessions that promised delivery of the good one week later required up-front payment for the good while the other half of the sessions required payment of the good upon delivery. The experimental design used in the study is depicted in table 1.

Two hundred and fifty-two subjects participated in the lab experiment. Each subject participated in only one session. The size of the groups varied from 18 to 22 subjects per session and each session lasted about an hour. Subjects were recruited through an announcement placed at the University of XX (removed for peer review; to be adjusted upon publication). Although the announcement was open to everybody, the great majority of participants were students from the university. Each participant was randomly assigned to a session for the study.

The product of the auction was carefully chosen so that it would be a typical and widely accepted lunch product and perfectly known to subjects. Consequently, a ham and cheese sandwich was used in the auction. We chose a perishable food product so that subjects knew they were bidding for a product intended for immediate consumption, and consequently to make subjects' current hunger status relevant to bidding behavior. To elicit subjects' WTP, a fourth-price Vickrey auction was employed. Considering the size of the session groups and the likelihood of disengaging some of the participants due to the small number of winners, the fourth-price auction was regarded as a compromise between a second-price auction and a random nth-price auction for engaging off-margin bidders. Shogren et al. (2001) found that the second-price auction worked better for on-margin bidders while the random nth-price auction worked better for off-margin bidders. Since the rules of the auction are somewhat complicated, we spent a significant amount of time educating and training the subjects about the auction mechanism. After arriving at the room reserved for the sessions, subjects were randomly seated. They were given an acceptance form and they received 10 euros (€) for taking part in the study, which they could use in the actual auction. A training phase with the auction mechanism was then conducted where the experimenter thoroughly explained how a fourth-price auction works. Subjects then took a short test regarding the procedure. The monitor explained the correct answers afterwards and made sure that all subjects completely understood the auction mechanism. Additionally, we conducted a "practice auction" to further show subjects how the auction works. In this practice auction, subjects had to bid in three real practice rounds for another product. The monitor emphasized that these rounds were real; that one binding round would be randomly chosen at the end of these rounds and that the highest bidders would actually have to pay for the products. The practice auction was identical for all sessions and was not part of the treatment design. The only purpose was to demonstrate to subjects how a fourth-price auction works. The experimental treatments were only applied to the ham and cheese sandwich. All transactions were completed at the end of the experiment. Subjects who participated in the "future delivery of the sandwich" treatments were informed about this specific procedure, just before the ham and sandwich auction started.

After getting fully familiarized with the auction mechanism and procedures, subjects were shown a ham and cheese sandwich packed in a brandless package.

Although this product was familiar to all participants, they were asked to pass it around and inspect it closely prior to the auction as if it were a product they would know less about (Alfnes 2007). Since it is possible that exposure to food during the experiment can increase hunger, all subjects were exposed to the products in the same amount of time. Participants in the “present” treatment were told that a sandwich would be delivered to each of the highest bidders right after the auction while participants in the “future” treatments were informed that a sandwich would be delivered to each of the highest bidders in one week. The monitor made clear to subjects in the “future” treatments that the winners of the auction each would be getting a fresh sandwich one week later. Depending on the treatment selected, subjects in the “future” treatments were also informed that they would be required to pay for their sandwiches immediately after the auction or at pick-up one week later. The participants then bid in five real auction rounds for a sandwich. After all rounds were finished, a binding round was then randomly chosen to determine the final highest bidders of the auction.

The participants were also asked to fill out a questionnaire that included socio-demographic- and health-related questions as well as specific questions about their hunger level. Questions about subjects’ preferences for ham and cheese sandwiches as well as their frequency of consumption were also included.

Econometric analysis and results

Figure 1 displays the mean and median bids across rounds. Subjects in the sessions before lunch (1 pm) were willing to pay a higher price than subjects in the *after* lunch treatments. In addition, subjects bidding to buy the sandwich immediately after the session (Present Treatment) bid higher than those bidding to buy the sandwich one week later (Future Treatment).

Mean and median bids for those who participated in the *future* treatments, broken down by when the payment for the sandwich was required and time of the session in the day, are shown in figure 2. Subjects who had to pay in the future show no difference in mean or median bids when comparing the before-lunch and the after-lunch sessions. This is an indication that when no commitment cost was imposed on bidding behavior, hunger status does not significantly affect bids. On the other hand, when subjects had to pay immediately after the session (*pay now*) for the sandwich that was going to be delivered one week later, they bid much lower when in the after-lunch session (when they are likely to be satiated) than when in the before-lunch session (when they are likely to be hungry).

Evidence of projection bias is depicted in figures 3 and 4 where the kernel density estimates of bidding behavior in the present and future treatments, respectively, are shown. The effect of hunger on bids in the present treatments (i.e., sandwich is delivered right after the auction) are depicted in figure 3. As shown, the distribution of bids in the before-lunch treatment is shifted more to the right. This implies that when subjects are (likely) hungry, they bid more for the sandwich. The left part of Figure 4 shows the effect of hunger in the future treatments (i.e., sandwich is delivered with a time delay of one week) when payment was required in advance (i.e., right after the auction). Given that the distribution of the before-lunch bids is shifted to the right, this figure also implies the effect of hunger. However, given that the distribution is shifted more to the right as compared with figure 3, it shows that subjects over-predict their future hunger status.

Similarly, it seems that subjects under-predict their level of satiation in the future, since the distribution of bids in the after-lunch treatment is shifted much more to the left as compared with figure 3. The difference in the gaps of the two distributions (before- and after-lunch) in the present and future treatments is evidence of projection bias. Trivially, the right panel of figure 4 shows that without commitment costs imposed in the auction, hunger status does not affect bids. Distributions of bids in the before- and after-lunch treatments are considerably overlapping.

To quantify the effect of projection bias and also explore whether the differences discussed so far hold under the scrutiny of conditional analysis, we estimated a random effects regression model, where the regression function is specified as:

(1) $$Bid_{it} = \begin{pmatrix} b_0 + b_1 Future_i + b_2 AfterLunch_i + b_3 FuturePay_i + b_4 LastMeal_i \\ +b_5 Future_i \times AfterLunch_i + b_6 FuturePay_i \times AfterLunch_i \\ +b_7 FuturePay_i \times LastMeal_i + b_8 Future_i \times LastMeal_i \\ +b_9 Round_{2i} + b_{10} Round_{3i} + b_{11} Round_{4i} + b_{12} Round_{5i} \end{pmatrix} + e_{it} + u_i$$

where *i* is a subscript for the individuals and *t* is a subscript indicating the time dimension. The random error term u_i is heterogeneity-specific to the individual and is constant over all time periods. The random error term e_{it} is specific to a particular observation and incorporates the time dimension into the model. With respect to the variables, *Future* is a dummy indicating whether subjects were bidding to get the sandwich one week later, *AfterLunch* is a dummy for Treatments that were conducted at 3 pm, *FuturePay* is a dummy indicating whether in the *Future* treatments subjects had to pay one week later or right after the auction, *LastMeal* is time since last meal and *Round* are round dummies. We estimate this specification with and without demographics/attitudinal variables, as shown in table 2, and find that results are fairly robust. The demographics/attitudinal variable included in one of the specifications include variables consistent with the variable name: dummy for males, age, dummy for students, income dummies, self-reported body mass index (*BMI*), dummy for whether the respondent likes cheese and ham sandwiches (*LikeHam*) and dummies for how frequently subjects eat ham and cheese sandwiches.

Equation (1) includes several interaction terms to help capture the differential effects evident in figures 1, 2, 3 and 4. To test whether the model with the interaction terms fits the data significantly better, we fitted the random effects model with maximum likelihood (ML) and performed a Likelihood Ratio (LR) test. [1] The model with the interaction terms fits the data significantly better (LR=35.96, p-value=0.00 and LR=34.63, p-value=0.00 for models (1) and (2) of table 2, respectively).

Coefficient estimates from equation (1) are shown in table 2. However, interpretation of the interacted variables is not straightforward. Marginal effects for each of the interacted variables needs to take into account the other interacted variables as well (Drichoutis and Nayga, 2011). For the *Future* variable this would be:

$$(2) \qquad \frac{\partial Bid}{\partial Future} = b_1 + b_5 AfterLunch + b_8 LastMeal \; .$$

Expression (2) can then be evaluated for *AfterLunch*=1 or 0:

$$(3) \qquad \left.\frac{\partial Bid}{\partial Future}\right|_{AfterLunch=1} = b_1 + b_5 + b_6 LastMeal \;\text{ and }\; \left.\frac{\partial Bid}{\partial Future}\right|_{AfterLunch=0} = b_1 + b_6 LastMeal \; .$$

Expression (3) is evaluated for the the median value of *LastMeal*. Similarly for the *AfterLunch* variable we have:

[1] The ML estimator has the same properties as the Feasible Generalized Least Squares (FGLS) and results using the ML estimator versus the FGLS are practically identical.

(4) $$\frac{\partial Bid}{\partial AfterLunch} = b_2 + b_5 Future + b_6 FuturePay$$

which gives rise to three marginal effects:

(5) $$\left.\frac{\partial Bid}{\partial AfterLunch}\right|_{\substack{Future=1,\\ FuturePay=1}} = b_2 + b_5 + b_6 \ , \ \left.\frac{\partial Bid}{\partial AfterLunch}\right|_{\substack{Future=1,\\ FuturePay=0}} = b_2 + b_5 \qquad \text{and}$$

$$\left.\frac{\partial Bid}{\partial AfterLunch}\right|_{\substack{Future=0,\\ FuturePay=0}} = b_2$$

Similar effects are in place for the *FuturePay* and *LastMeal* variables. Marginal effects for the interacted variables appear in Table 3. These results largely confirm what is seen by observation of figures 1 to 4. For example, subjects who bid to buy the sandwich for future consumption (one week later) bid less than subjects who bid to buy the sandwich right after the auction.[2] Subjects who bid to get the sandwich in the *Future before* lunch bid 0.39€ (0.38€ based on model (2)) lower than subjects who bid to get the sandwich immediately after the auction. Similarly, subjects who bid to get the sandwich in the *Future after* lunch bid 0.66€ lower than subjects who bid to get the sandwich immediately after the auction. Thus, the (negative) effect of getting the sandwich one week later is even larger when subjects are satiated at the time of the auction (-0.66€ vs. -0.39€).

One potential explanation for why subjects bid less when the sandwich is going to be delivered one week later is time discounting. Subjects are discounting the value of the sandwich one week later in present value. Another explanation that we cannot rule out (even though we took every precaution to reassure subjects this will not be the case) is

[2] Note that the effect is evaluated at the median of the *LastMeal* variable (which captures how hungry someone is at the time of the auction).

uncertainty about delivery of the sandwich. If some subjects were uncertain about whether the experimenter would actually deliver the sandwich one week later as promised, then these subjects would be motivated to shade their bids to account for the risk of not actually getting the sandwich. If we couple these two explanations with satiation at the time of the auction (after lunch sessions) which makes a sandwich look less appealing, shading a bid by (on average) as much as 66 cents sounds sensible. In all, the first two rows of table 3 show that subjects value the sandwich more when it is offered for immediate consumption and value it even more if this occurs before lunch, even when controlling for time since their last meal.

The next three rows of table 3 evaluate the effect of hunger (before- vs. after-lunch sessions) for the different treatments. Some studies suggest that people have strong preferences about the time of the day when they consume particular foods (Gilbert and Wilson 2007; Kramer, Rock, and Engell 1992; Birch, Billman, and Richards 1984). When in a satiated state, people consider the prospect of a meal not very appetizing if they have just finished eating (Gilbert 2006) or are less likely to purchase food than those who have yet to eat (Hoffman et al. 1993). Although previous studies focus specifically on the “time of the day” effect on bidding behavior by conducting auctions throughout the day (Morawetz, De Groote, and Chege 2011; Rutsaert et al. 2009; Hoffman et al. 1993; Menkhaus et al. 1992), we use the two-hour difference between auctions to allow for variation in hunger, not to measure “time of day” impact.

The effect of the before- and after-lunch treatments is a key effect because it allows us to quantify the effect of projection bias. The estimate of -0.34€ (-0.36€ for model (2)) is the quantified effect of hunger in the present treatments and roughly corresponds to the difference of distributions in figure 3. This implies that satiated subjects are, on average, willing to pay 0.34€ less than hungry subjects for the sandwich. When subjects have to predict their future WTP based on their current tastes (current level of hunger), the effect of hunger almost doubles to 0.61€ (0.65€ based on model (2)). This corresponds to the left part of figure 4 and is the result of over-predicting hunger and under-predicting satiation. Thus, the difference between these two effects (0.61€ vs. 0.34€) can be attributed to projection bias. Finally, hunger levels do not significantly affect bids when subjects are bidding in the future delivery treatments and do not have to feel the costs of their decision right away (i.e., future payment treatment). This last result corresponds to the right part of figure 4.

The effect of paying in the future for the sandwich that was going to be delivered one week later versus paying in advance is only significant in the after lunch sessions. Subjects increase their bids by almost 60 cents (63 cents for model(2)) when they have to pay upon delivery of the sandwich (and not right after the end of the auction) and when they are satiated. The difference for hungry participants is neither economically nor statistically significant.

The last three rows of table 3 show the effect of time since last meal on bids conditional on the treatment variables. The largest effect is observed for the present treatments; for every hour since their last meal, subjects increase their bids by 0.05 cents. Interestingly, time since last meal negatively affects bids in the treatments that promised delivery of the sandwich one week later, although the effects are much smaller. Perhaps there is a mechanism in place that acts proactively for those with low hunger levels (bid more to get the sandwich in the future in case I get hungry) and protectively for those with high hunger levels (bid more to get the sandwich now to satiate my appetite).

Regarding the remaining variables, the round dummy variables are neither economically nor statistically significant. This is also evident in figures 1 and 2, where lines are quite stable over rounds. There is a slight decrease of bids in round five which could be attributed to end game effects. Some demographic effects are also evident in table 2. For example, age has a positive statistically significant effect on bidding, and students (*Student*) bid more than non-students by €0.13. Other variables like income, Body Mass Index (BMI), liking ham sandwiches and eating ham sandwiches regularly are not significant.

Concluding Remarks

Over the past few years, there has been a growing trend towards integrating behavioral evidence from psychology to the usual lines of economic research. Much has been accomplished on this front since Rabin's 1998 article in the highly influential "Journal of Economic Literature", where he discussed the importance of linking Psychology and Economics. DellaVigna (2009) then added that "hopefully, ten years from now, we will be able to assess quantitatively which psychological factors matter in which decisions". In this study, we tried to explore how (projection) biases that are not predicted by classical microeconomic theory affect subjects' valuation within the context of experimental economic auctions and how this effect is mediated by hunger and preference for immediate gratification. Loewenstein (1996) states that when people are in what is called a “hot” state (e.g., angry, hungry, or in pain), it is difficult to imagine how they would feel or what they might do if they were in a “cold” state. These gaps lead to errors in predicting behavior. One implication of this projection bias is that people behave differently when in hunger or satiation. In fact, there is considerable research demonstrating that hunger not only influences taste evaluations (e.g., Scott 1990; Fantino 1984), but also influences attitudes towards food (Lozano, Crites, and Aikman1999) and attitudes towards shopping (Nisbett and Kanouse 1968; Mela, Aaron, and Gatenby 1997; Gilbert, Gill, and Wilson 2002). For example, people may change their behavioral intentions towards the purchase and consumption of food when they are hungry.

In this study, we examined the role of projection bias in experimental auctions by assessing the bidding behavior of hungry and non-hungry subjects on a perishable food product that was going to be given either right after the auction or in one week’s time. Hence, we investigated not only the role of hunger but also the role of immediate gratification in subjects’ valuations. Our results generally suggest that subjects who are offered the sandwich right after the auction are willing to pay more than those who had to wait one week to get their product. Time discounting and perhaps some uncertainty on whether the sandwich was actually going to be delivered could rationalize this result. Preferences tend to be clearly present-biased due to a need for immediate gratification and doubts about future necessities.

On the projection bias issue, we found that when subjects have to predict their future WTP from their current tastes, they tend to over-predict their hunger and under-predict satiation. Thus, the effect of hunger on bids almost doubles due to projection bias. Subjects are willing to pay 34 cents more when they are hungry as compared to when they are satiated but this effect almost doubles to 61 cents when subjects have to predict their future tastes.

Our findings suggest the important roles of hunger in examination of projection bias in experimental auctions. Our results have significant implications for future experimental auction designs. Experimental auctions are becoming a very popular tool used by economists to elicit consumers` WTP for food products. For perishable food products that are intended for immediate consumption, projection bias is less likely to be an issue although hunger would still play a significant role in shaping bidding behavior. However, for food products that can be stored for longer time and therefore intended for future consumption, projection bias can be an issue. As we show, current tastes significantly affects bidding behavior of a planned future consumption. If not taken into account, part of bids will include biased estimates of consumer preferences. Our results show that projection bias is significant even for one week's time. Our findings imply that both hunger levels and desire for immediate consumption (or conversely for delayed consumption) should be measured so that researchers using experimental auctions to examine food products can control for these factors in the WTP models.

Our results also have practical and important implications for marketing products. For example, results in this paper suggest that food delivery businesses (i.e., those that deliver food products from stores to specific locations such as homes) should strive to significantly reduce delivery times and not ask customers to pay well in advance of delivery. It might also be better to advertise or promote products before meals than right after meals. Results might also have implications on whether stores should allow taste tests in the store or not, since this could affect the level of hunger and quest for immediate gratification among shoppers. This results corresponds to findings by Gilbert, Gill, and Wilson (2002), who showed that shoppers who were given a muffin to eat before entering a supermarket were more likely to restrict their purchases in their shopping list.

While our findings are interesting and useful for designing future experimental auction studies involving food, we have to recognize that they are still based on specific contexts as in any experimental economics study. Specifically, our results are based on valuations for a familiar product. Future research should test the robustness of our findings with unfamiliar products. It is possible that the roles of hunger and immediate gratification could be less important when valuing products that are less familiar to subjects. For less familiar products, one could also test how experienced reward processes interact with hunger and immediate gratification by letting subjects taste a small sample of the food while deciding how much to bid, similar to one of the experiments conducted in Bushong et al. (2010).

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Table 1. Experimental Design and Number of Subjects Participating Per Session

		Time of Delivery of the Sandwich			**Total**
		After the auction	One week after the auction		
			*Subjects had to pay **immediately after** the auction*	*Subjects had to pay **one week after** the auction*	
Time of the day	Before Lunch	66 3 sessions	40 2 sessions	22 1 session	**128**
	After Lunch	64 3 sessions	20 1 session	40 2 sessions	**124**
Total		**130**	**60**	**62**	**252**

Table 2. Coefficient estimates from Random Effects Regression

	(1)		-2	
Constant	0.046	(0.302)	1.216**	(0.080)
Future	-0.239*	(0.124)	-0.225*	(0.126)
AfterLunch	-0.341**	(0.079)	-0.356**	(0.081)
Future × *AfterLunch*	-0.268*	(0.148)	-0.291*	(0.151)
FuturePay	-0.118	(0.145)	-0.118	(0.147)
FuturePay × *AfterLunch*	0.702**	(0.172)	0.727**	(0.173)
LastMeal	0.054**	(0.018)	0.056**	(0.018)
Future × *LastMeal*	-0.085**	(0.025)	-0.087**	(0.025)
FuturePay × *LastMeal*	0.005	(0.027)	0.011	(0.027)
$Round_2$	-0.002	(0.020)	0.003	(0.020)
$Round_3$	-0.004	(0.020)	0.001	(0.020)
$Round_4$	-0.035*	(0.020)	-0.030	(0.020)
$Round_5$	-0.047**	(0.020)	-0.042**	(0.020)
Males	-0.077	(0.059)	-	-
Age	0.026**	(0.006)	-	-
Student	0.129*	(0.073)	-	-
Inc_2	-0.028	(0.099)	-	-
Inc_3	0.115	(0.101)	-	-
Inc_4	-0.044	(0.109)	-	-
BMI	0.015	(0.010)	-	-
LikeHam	0.119	(0.133)	-	-
$FreqHam_2$	0.067	(0.074)	-	-
$FreqHam_3$	0.060	(0.077)	-	-
$FreqHam_4$	-0.015	(0.088)	-	-
N	1245		1255	

Note: **, * = Significance at 5%, and 10% level.

Table 3. Marginal effects for interacted variables

		(1)		(2)	
Future	*AfterLunch=1*	-0.655**	(0.107)	-0.667**	(0.108)
	AfterLunch=0	-0.387**	(0.095)	-0.377**	(0.098)
AfterLunch	*Future=1, FuturePay=1*	0.093	(0.115)	0.081	(0.116)
	Future=1, FuturePay=0	-0.609**	(0.125)	-0.646**	(0.127)
	Future=0, FuturePay=0	-0.341**	(0.079)	-0.356**	(0.081)
FuturePay	*AfterLunch=1*	0.592**	(0.117)	0.628**	(0.116)
	AfterLunch=0	-0.110	(0.120)	-0.099	(0.122)
LastMeal	*Future=1,FuturePay=1*	-0.026	(0.021)	-0.020	(0.021)
	Future=1,FuturePay=0	-0.031*	(0.017)	-0.031*	(0.018)
	Future=0,FuturePay=0	0.054**	(0.018)	0.056**	(0.018)
N		1245		1255	

Note: **, * = Significance at 5%, and 10% level. This table presents several conditional marginal effects. For example, "*Future*, *AfterLunch*=1" refers to the effect of *Future conditional* on *AfterLunch* taking the value of 1. Likewise, "*AfterLunch, Future=1, FuturePay=0*" captures the effect of timing of the session in the treatments that promised delivery of the good in the future and subjects had to pay in advance.

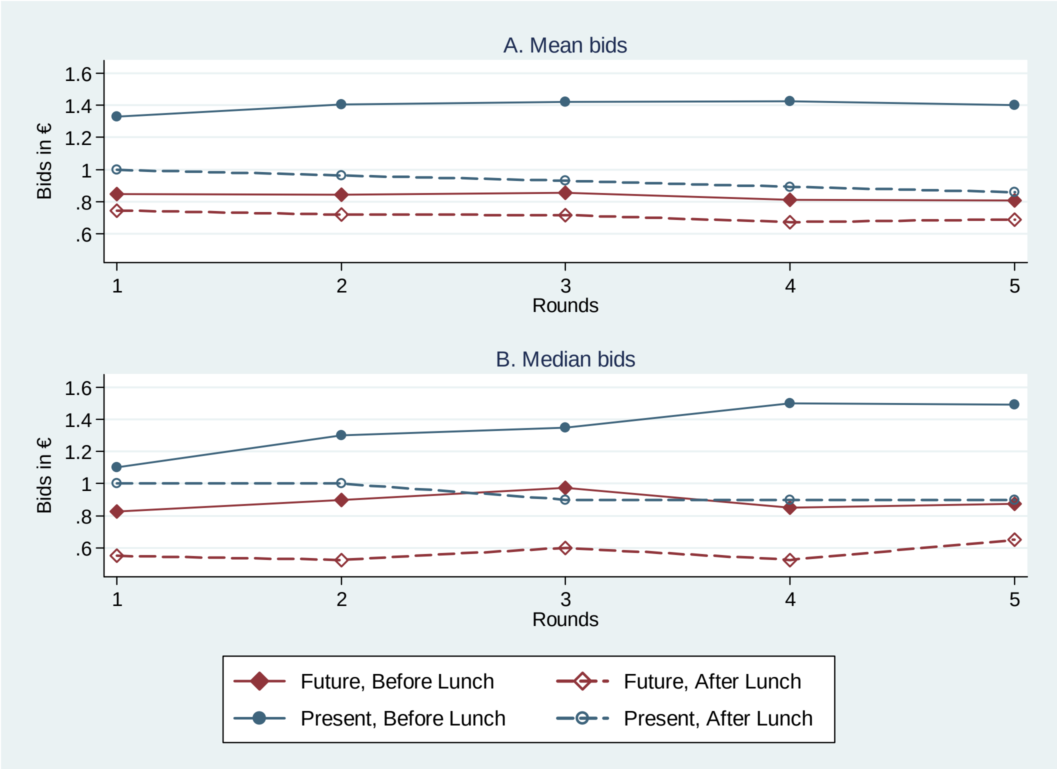

Figure 1. Mean and median bids across rounds

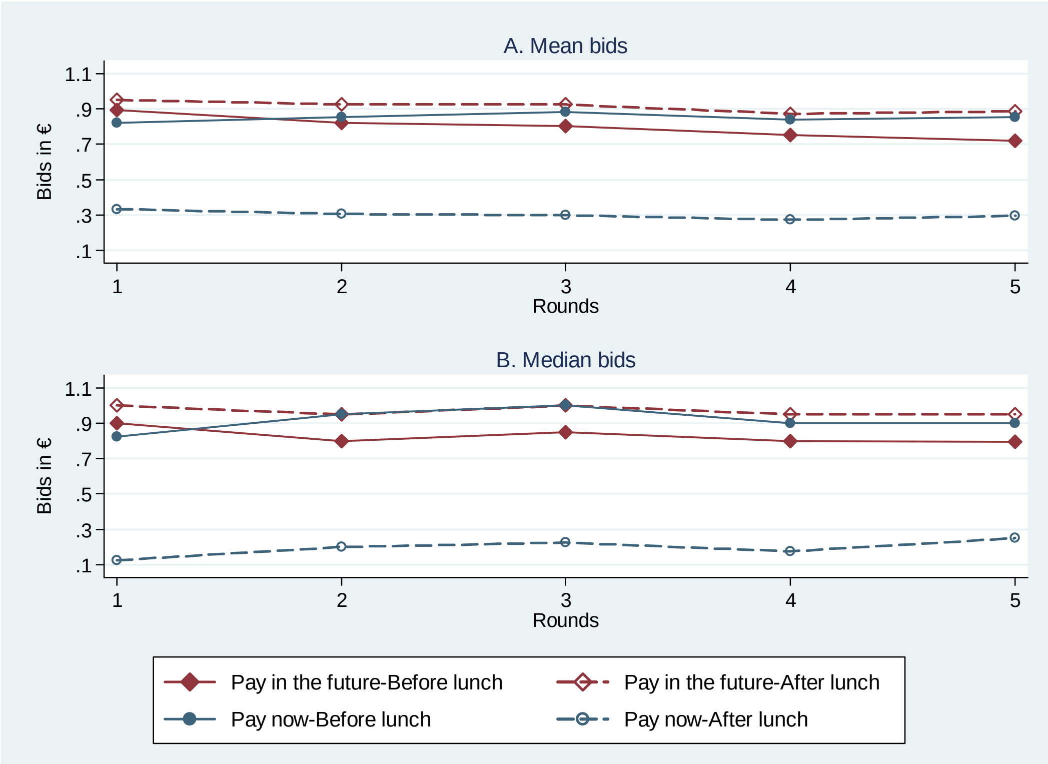

Figure 2. Mean and median bids across rounds for the future treatments

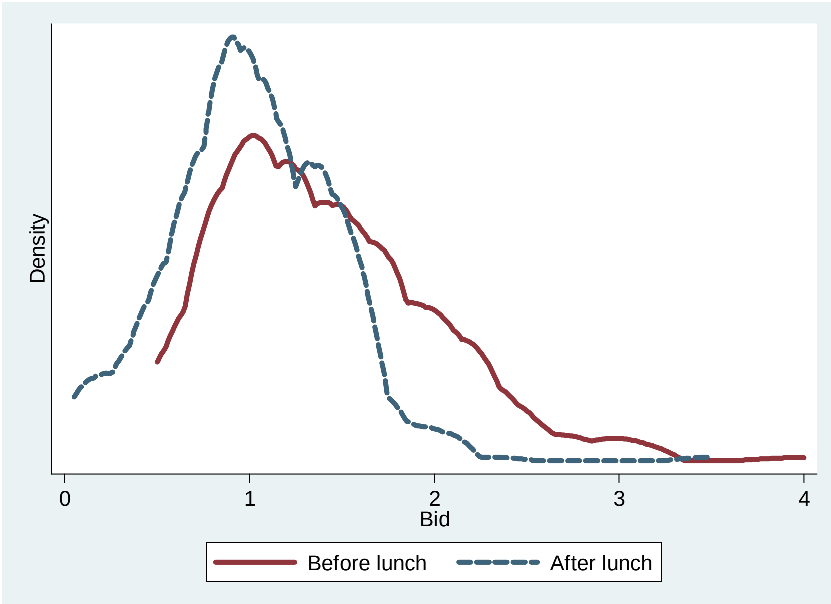

Figure 3. Kernel density estimates for bids in the present treatments

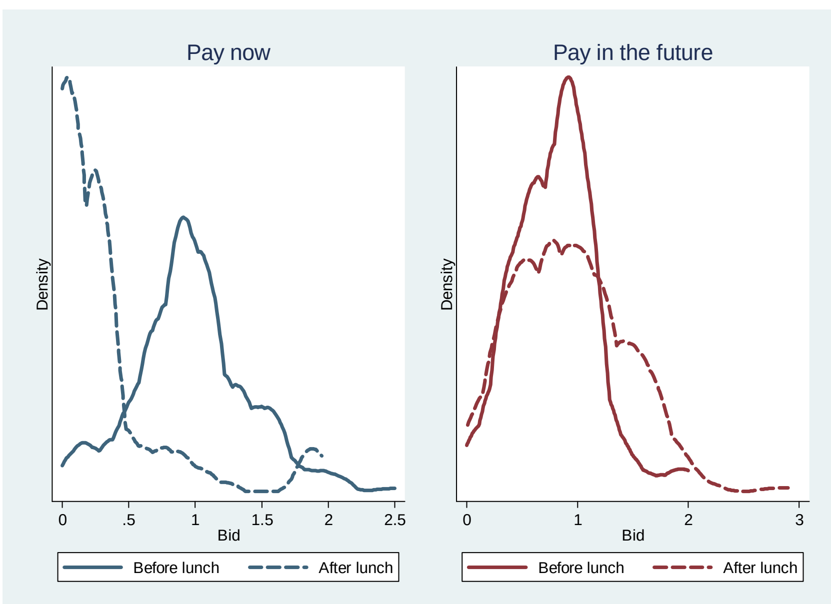

Figure 4. Kernel density estimates for bids in the future treatments