DOES PROJECTION BIAS EXIST IN NON-HYPOTHETICAL EXPERIMENTAL SETTING?

DE MAGISTRIS, T.
GRACIA, A.
NAYGA Jr., R.M.

Documento de Trabajo 13/02

CENTRO DE INVESTIGACIÓN Y TECNOLOGÍA AGROALIMENTARIA DE ARAGÓN (CITA)

UNIDAD DE ECONOMÍA AGROALIMENTARIA Y DE LOS RECURSOS NATURALES

Avda. Montañana, 930
50059 ZARAGOZA

Teléfono: 976716305
Fax: 976716335

1. Introduction

Some evidence is widely documented in experimental studies from social psychology that individuals often choose an alternative deemed inferior ex ante (e.g. unhealthy food) confirming that consumers present some preference-bias (Strotz, 1956; Rabin; 1997; Gul and Pesendorfer;1999). Gul and Pesendorfer (1999) provided a good example of this inconsistency in preferences, which occurs when a satiated individual prefers the healthy, vegetarian dish, whereas he craves for a hamburger when he is hungry. Also, Loewenstein et al. (2003) stated that some negative affective states that individuals experience at the exact moment when they make the decision between outcomes occurring at different points of the time have a huge importance. The author coined the term “projection bias” to describe a more general phenomenon of mistaken prediction that occurs when individuals have difficulty predicting when they will be in a different emotional “cold” state because their current “hot” state overrides them. Therefore, even though individuals understand the directions in which their tastes will change in the future, they systematically underestimate or overestimate the magnitude of these changes. The reason of this mistaken prediction is motivated by some affective states well-known as “visceral factors” (Loewenstein, 1996; 2003, 2005). The term visceral factors refer to wide range of negative emotions (ager, fear) and drive states (hunger, thirty, sexual desire) that can motive people to engage impulsive behaviour called “out of control”, characterized by unplanned and unconscious cognitive mediation (Bolles, 1975; Loewenstein, 1996; Loewenstein, 2003). For example, hunger state can be considered an aversive visceral factor that generates the desirability of food if an appetite-visceral mechanism is triggered by

immediate availability of food (Loewenstein, 1996). According to Loewenstein (1996), a sufficient level of intensity of hunger causes people to behave “out of control” because they behave contrary to their own long-term health self-interest, often with full awareness that they are doing so.

Evidence of projection bias with respect to food choice revealed that people who are in their hottest emotional state of hunger buy too much food (Read and van Leeuwen, 1998; Gilbert et al., 2002). To illustrate, Read and van Leeuwen (1998) developed an experiment with office workers, who were either hungry or satiated and were asked to choose a healthy and non-healthy snacks (e.g. fruit vs. candy bars) to be delivered in a week’s time, either at a time when they were expected to be hungry or satiated. The results from this experiment confirmed that workers chose non-healthy snacks when they were expected to be hungry. 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 faced. Therefore, individuals project their current hunger levels onto their future preferences.

The mentioned study by Read and Leeuwen, (1998) on projection bias focused on hypothetical choices where consumers were not incentivized to reveal their true preferences for these food products at the exact moment they were hungry or satiated. However, even though our study has a similar aim, to test the possible existence of projection bias in consumers’ decision for food, our novel contribution is that we designed an experiment were participants were incentivised to reveal their true preferences. Thus, our research question is: Does projection bias still

exist in consumers' decisions for food when a real experiment is used to incentive participants to reveal their true preferences for food products?

To answer to this question, we conducted a real experimental auction with two different treatments. Subjects who participated in both treatments were incentivized to reveal their true willingness to pay for different cheese products. However, the treatments differed by the timing when the auctioned cheese was delivered to participants in the future. In both treatments the experiment was set at lunch time when participants were expected to be hungry. In addition, while Read and Leeuwen (1998) manipulated the hunger state by varying the time of the day when participants made their choice, in our study we manipulated the level of appetite of participants by feeding them with enough food to get satiated during the experiment. This is the second contribution of our paper. To our knowledge there is not study which tested the existence of projection bias in consumers' food decisions by using a real experiment where the level of appetite of participants was controlled by feeding them with some food during the experiment.

The rest of the article is organized as follows. The next section discusses the experimental design, the rationale for the inclusion of the different treatments and the hypotheses and describe the implementation of the auction. The results are presented in section 3 and the final section discusses the importance and the implications of the findings.

2. Methodology

2.1 General experiment design

To test the existence of projection bias, we designed a real experimental auction with two treatments where each respondent participated only in one of the treatments. In the first treatment, called "future hunger" (H_1), participants were asked to reveal their WTPs for food products when they were currently hungry in the experiment (H_0, called currently hungry) and satiated (S_0, called currently satiated) being informed that they would get the product, if they win, the next day before lunch time when they were expected to be hungry (H_1). In the second treatment, called "future satiated" (S_1), participants were asked to reveal their WTPs for food products when they were hungry (H_0) and satiated (S_0) being informed that they would get the food product, if they win, the next day after lunch time when they were expected to be satiated (S_1).

Among the different experimental auction procedures we used the full bidding and among the different price mechanisms, we opted to use the n^{th} random price with repeated round (6 rounds) to benefit from the learning effect as stated by several authors (Alfnes and Rickersen, 2003; Lusk and Shogren, 2007; Shogreen *et al.,* 2001; Shogren, 2006) who argue that this procedure yields valuations more consistent with neoclassical economic theory. Moreover, we decided to use a price mechanism without price feedback to prevent the possible bid affiliation effects and other psychological effects (such as competition or anchoring effects) from the participants' level of hungry that was manipulated in our experiment avoiding having confounding effects between them. To control the hunger and satiated state of participants in the experiment, we manipulated their appetite or

hunger status by feeding them with the same amount of unrelated foods and beverage (e.g tortilla, vegetables, potatoes, squid, “tapas” and water) after the third round of the auction. In order to attempt similar meal situation, the sessions were settled up at the same time before lunch (1:00 pm) during the week day when people were expected to be hungry. Because the delivery of the product was delay to the next day and in order to avoid the transaction costs, subjects received a signed document where the experimenters stated to be obliged to hand-delivered the product to their job place or at home.

We selected for the experiment a semi-cured by pasteurized sheep milk cheese produced in the Castilla-La-Mancha region in Spain. In particular, we used four different versions of this cheese: the cheese without any claim, the cheese with a health-related claim (nutritional claim indicating a fat reduced content “light[1]”), the cheese with a regional claim (“Designation of origin- DOP”) and, the cheese with an organic claim (the European organic logo). The experiment was conducted in the region of Aragón (Spain), in the town of Zaragoza during May-June 2012. In total, 98 participants were randomly selected from different locations across the city using a stratified sampling procedure by age, gender and education level.

2.2. Hypotheses testing

In order to answer to our research question, whether projection bias still exists in consumers’ decisions for food when participants are incentivised to reveal their true Willingness to Pay (WTP) for food product, we test two hypotheses. The first hypothesis is whether the willingness to pay (WTP) for the different claimed cheese

[1] The cheese with this claim (“light”) contained 40% less fat than the other cheeses in the experiment.

products (light, DOP and, organic) revealed by participants when they are currently hungry in the experiment (H_0) but who anticipated being satiated in the future[2] (S_1) are equal to both the WTPs of cheese products (light, DOP and, organic) elicited when participants are currently satiated in the experiment (S_0) but they predicted being satiated in the future (S_1), and also equal to the WTPs of cheese products (light, DOP and, organic) offered by participants when they are currently hungry in the experiment (H_0) but they anticipated being also hungry in the future (H_1) defined by the following null hypotheses:

$$H0_{1.1} = WTP^{H_0S_1} = WTP^{H_0H_1}; H1_{1.1} = WTP^{H_0S_1} < WTP^{H_0H_1}$$

$$H0_{1.2} = WTP^{H_0S_1} = WTP^{S_0S_1}; H1_{1.2} = WTP^{H_0S_1} > WTP^{S_0S_1}$$

If one or both null hypotheses are rejected we can conclude that projection bias exists because of the influence of being currently hungry (H_0) in the "future satiated" treatment (S_1) on WTPs. Participants currently hungry (H_0) who will receive the cheese products when they expect to be satiated in the future (S_1) would be less willing to pay to get the product than those participants who are also currently hungry (H_0) but they know that they will receive the cheese when they expect to be hungry in the future (H_1), since the latter ones have a greater desire to get the product due to their future hungry state. However, those participants (currently hungry (H_0) who will receive the cheese when they expect to be satiated (S_1)) overestimate their WTPs, because they are willingness to pay for the cheese

[2] When they will finally received the product (in one day time)

products more than when they are currently satiated (S_0) and anticipated being also satiated in the future (S_1) because of the greater desire to get the product in their currently hunger state.

Therefore, the WTPs revealed by hungry participants (H_0) in the "future satiated" treatment (S_1) are bias in comparison with the WTPs elicited by both currently hungry participants (H_0) in the "future hungry" treatment (H_1) and currently satiated (S_0) in the same "future satiated" treatment (S_1).

In the same way the second hypothesis to test is whether the WTPs for different claimed cheese products (light, DOP and, organic) revealed by participants currently satiated (S_0) who anticipated being hungry in the future (H_1) are equal to both the WTPs of cheese products (light, DOP and, organic) elicited by participants currently hungry (H_0) who predict to be also hungry in the future (H_1), and also equal to the WTPs of cheese products (light, DOP and, organic) offered by those currently satiated participants (S_0) who anticipated being satiated in the future (S_1) defined by the following null hypotheses:

$$H0_{2.1} = WTP^{S_0H_1} = WTP^{H_0H_1}; H1_{2.2} = WTP^{S_0H_1} < WTP^{H_0H_1}$$

$$H0_{2.2} = WTP^{S_0H_1} = WTP^{S_0S_1}; H1_{2.1} = WTP^{S_0H_1} > WTP^{S_0S_1}$$

If one or both null hypotheses are rejected we can conclude that projection bias exists because of the influence of being currently satiated (S_0) in the "future hungry" treatment (H_1) on WTPs. Currently satiated participants (S_0) who will predict to receive the cheese product when they expect to be hungry in the future

(H_1) will increase their desire to get the products. However, because of their currently satiated state, these subjects would be less willing to pay to get products than when they are currently hungry (H_0) and expected to be hungry in the future (H_1), because they have a greater desire to get the product as they are currently hungry. However, those participants currently satiated (S_0) who expect to be hungry in the future (H_1) overestimate their WTPs. In other words, they are willingness to pay for the cheese products more than those participants currently satiated (S_0) who expect to be also satiated in the future (S_1) because the former participants would have a greater desire to get the product due to their future hunger state.

2.3 Implementation of auction

A total of 8 sessions with at least 12 participants were conducted. After arrival of the participants, they were informed that they would receive 10 € participation fee at the end of the session. We chose 10 € as participation fee because the market price of the cheese without any claim lied between € 1.25 and € 1.50 for 100 grams of product.

After subjects consented to participate in the auction, they were assigned an ID number and were asked to complete a questionnaire requesting information on socioeconomic and demographic characteristics as well as a question to measure participants' level of hunger. In particular, the question commonly used by Poppitt et al (1998) and Keim et al(1998) to assess self-reported hunger of individuals was included in the questionnaire. Participants were asked to give their degree of

subjective feelings of hunger, asking a question *"How hungry are you?* , in a likert scale where 1 indicates "not at all" and 5 indicates the highest intensity of hungry.

After the completion of this questionnaire, participants received the product information and the experimental auction instructions and they were asked to read them. Then, the experimenter read the auction instructions aloud emphasizing that their dominant strategy was to reveal their true values and that one round and one product will be randomly drawn as binding. They also informed participants that if they win the product they had to buy and pay for it right after the experiment but that they will receive the product the next day (before or after lunch depending on the treatment) at home or office by the experimenters. After the practice auction, the cheese auction was undertaken in the following steps:

Step 1. Subjects were asked to simultaneously submit a bid for each of the four cheese products. The bids were collected and ranked from highest to lowest but they were not posted to participants.

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

Step 3. After the end of the third round, the hunger status of participants was manipulated by providing them a amount of unrelated foods (e.g tortilla, vegetables, squid, "tapas" and water), asking them to eat until they fell satiated.

Step 4. After eating, participants came back to the lab and they were asked to assess again their self-reported hunger, asking the question *"How hungry are you?*

Step 5. Then, they were asked to simultaneously submit bid for each of the four cheese products for three additional rounds. The bids were collected and ranked from highest to lowest but they were not posted.

Step 6. When all the rounds were conducted, a random drawing determined which of the six rounds was binding. Then, a random drawing determined which of the four cheeses product was binding.

Step 7. The top n-1 bidders on the binding product in the binding round had to purchase the cheese product and paid a price equivalent to the n^{th} highest bid for the product. However, those bidders received the cheese at home or office depending of what they prefer the next day in accordance with conditions stipulated in the "agreement" and depending on the treatment they participated (before lunch or after lunch).

3. Results

Table 1 reports the sample characteristics and the definition of the socio-demographic variables for the two treatments. A total of 48 subjects participated in the "future hunger" treatment (H_1) and 50 individuals in the "future satiated" (S_1) treatment.

(INSERT TABLE 1)

We used the Kruskal-Wallis test to determine if there are significant differences in socio-demographic variables across the three treatments. The results of the tests suggest that there are no statistically significant differences across treatments by gender (*p-value* = 0.427), age (p-value= 0.861), education (*p-value* = 0.874) and income (*p-value* = 0.707). The results of these tests suggest that our randomization was successful in equalizing the characteristics of participants across the three treatments.

For the analysis, we excluded the first two rounds because they were used to allow participants to learn and gain experience with the mechanism. In addition, we excluded also the last two rounds (5th and 6th) to eliminate "end-period" effects. Hence, we only included rounds 3 and 4 in the analysis to compare bids immediately before and after the manipulation of the participants' hunger level. This procedure is similar to what Roosen et al. (1996) and Lusk et al. (2004) adopted in their analysis[3].

Table 2 shows the mean level of self-reported hunger of participants. We note that the mean of self-reported hunger level of participants before and after the manipulation of their hunger were statistically different from each other at the 5% significance level in both treatments (H_1 and S_1). These results indicate that participants stated a significantly lower self-reported level of hunger after having eaten the food offered to them after the 3rd round. This result suggests that the participants were indeed hungry when they came to the experiment and before eating the food given to them (H_0) and that they became satiated afterwards (S_0). Hence, we are able to test our projection bias hypotheses by comparing currently hungry or satiated participants between treatments.

(INSERT TABLE 2)

Table 3 reports the mean marginal WTPs for the three cheeses with claims ("light", "DOP" and "organic" cheese vis-à-vis the cheese product without claim)[4] in the two treatments when participants were currently hungry (H_0)) and when participants were currently satiated (S_0) together with the t-test of equality between WTP across treatments and rounds. Following Alfnes and Rickerten (2011), we used the marginal WTP instead of

[3] We also conducted an analysis using data from all the rounds and similar results were found.

[4] Difference between bid for the cheese with the "light", "DOP" and "organic" claim and the cheese product without claims, respectively

the total WTP (bids) since relative prices matter more. Alfnes and Rickerten (2011) also pointed out that testing should include a test of the relative valuations. These t-tests allow us to test our two research hypotheses.

First, we observed that the marginal WTPs when participants were currently hungry (H_0) were higher than the marginal WTPs when participants were currently satiated (S_0) for the three products in the two treatments. Moreover, we notice that for the three cheese products, the WTP values of participants who were currently hungry (H_0) who anticipated being hungry in the future (H_1) were the highest. On the other hand, the WTP values of the participants who were currently satiated (S_0) and who predicted being satiated in the future (S_1) were the lowest (except for the cheese with the “organic” claim).

Related to the first hypothesis, we see that the WTP values for the three cheese products for the currently hungry (H_0) participants who anticipated being satiated in the future (S_1) were lower (0.037, 0.213 and 0.156, respectively for the “light”, “DOP” and “organic” claim) than the WTP values revealed by participants currently hungry (H_0) who predicted beinghungry in the future (H_1) (0.21, 0.299 and 0.30, respectively for the “light”, “DOP” and “organic” claim). Moreover, the t-tests showed that the null hypothesis of equality between them were rejected at the 5% significance level for the cheese with the “light” and “organic” claims, indicating that the WTP values were statistically different(-1.99 and -2.02, respectively). On the other hand, the WTP values for participants currently hungry (H_0) who anticipated being satiated in the future (S_1) are higher than the WTP values for participants currently satiated (S_0) who anticipated being satiated in the future (S_1) for the cheeses with the “light” and “DOP” claims. However, the t-test indicated that the null hypothesis of equality was not rejected at the 5% significance level (0.7 and 0.89, respectively). These results suggest that the currently hungry participants (H_0) made some mistake in their prediction when revealing their WTP values for the cheese with the “light”

and “organic” claims when they expected to be satiated in the future (S_1). This result seems to indicate that projection bias exist.

Related to the second hypothesis, we see in table 3 that the WTP values for participants currently satiated (S_0) who anticipated being hungry in the future (H_1) were lower than the WTP values for participants currently hungry (H_0) who anticipated being hungry in the future (H_1) for the three cheese products. However, the t-tests indicate that the null hypotheses of equality between the WTPs were not rejected at the 5% significance level (1.07, 1.01 and 0.46, respectively). On the other hand, the WTP values for participants currently satiated (S_0) who anticipated being hungry in the future (H_1) were higher than the WTP values for participants currently satiated (S_0) who predicted to be satiated in the future (S_1) for the three cheese products. Moreover, the t-tests indicate that the null hypothesis of equality between the WTP values was rejected at the 5% significant level for the cheese with the “light” and “DOP” claims (2.3 and 1.81, respectively). Hence, the currently satiated participants (S_0) made some prediction mistakes when revealing their WTPs for the “light” and “DOP” cheese if they expected to be hungry in the future (H_1), suggesting that projection bias exists.

(INSERT TABLE 3)

Although we did not find statistically significant differences in the socio-demographic profiles of participants between the two treatments, we take these characteristics into account to corroborate whether our previous results hold when we control for participants’ socio-demographic profiles. Therefore, we modelled the marginal WTPs for the three cheese products as a function of socio-demographic variables and dummy variables corresponding to the different treatments and type of participants (currently hungry and satiated). To be able to test our hypotheses, we calculated four dummy variables: *i)*

dumH$_0$H$_1$ which takes value 1 for currently hungry participants (H$_0$) in the "future hungry" treatment (H$_1$) and zero otherwise; *ii) dumS$_0$H$_1$* which takes value 1 for currently satiated participants (S$_0$) in the "future hungry" treatment (H$_1$) and zero otherwise; *iii) dumS$_0$S$_1$* which takes value 1 for currently satiated participants (S$_0$) in the "future satiated" treatment (S$_1$) and zero otherwise; and *i) dumH$_0$S$_1$* which takes value 1 for currently hungry participants (H$_0$) in the "future satiated" treatment (S$_1$) and zero otherwise. Moreover, we included a set of socio-demographic variables *as* defined in table 2 (i.e., *Female, years, university and lowincome).*

Hence, to test the first research hypothesis, we specified the following model:

$$\begin{aligned} WTP_{it} = {} & b_0 + b_1(dumH_0H_1)_{it} + b_2(dumS_0S_1)_{it} + b_3(dumS_0H_1)_{it} + \\ & + b_4 female_i + b_5 years_i + b_6 university_i + b_7 lowincome_i + \varepsilon_{it} \end{aligned}$$

(1)

for each of the three cheese products. WTP$_{it}$ is the marginal WTP values for the *i*th consumer in the *t*th round (3rd and 4th roungs). So if b$_1$ and b$_2$ are not statistically different from zero (both individually and jointly considered), then, projection bias does not exist. On the other hand, if b$_1$ is statistically positive and/or b$_2$ is statistically negative, we can conclude that projection bias exists.

In the same way, to test the second research hypothesis we specified the following model:

$$\begin{aligned} WTP_{it} = {} & c_0 + c_1(dumH_0H_1)_{it} + c_2(dumS_0S_1)_{it} + c_3(dumH_0S_1)_{it} + \\ & + c_4 female_i + c_5 years_i + c_6 university_i + c_7 lowincome_i + \varepsilon_{it} \end{aligned}$$

(2)

for each of the three cheese products. WTP_{it} is the marginal WTP values for the i^{th} consumer in the t^{th} round (3^{rd} and 4^{th} roungs). So if c_1 and c_2 are not statistically different from zero (both individually and jointly considered), then projection bias does not exist. On the other hand, if c_1 is statistically positive and/or c_2 is statistically negative, we can conclude that projection bias exists.

We estimated the model defined by equation (1) and equation (2), using a random effects model to take into account individuals' heterogeneity (Baltagi, 2003). Estimated coefficients for the cheese with the "light", "DOP" and, "organic" claims for the two equations (model 1 and model 2) are presented in table 4, table 5 and table 6, respectively.

In table 4, we can see that the estimated coefficient for the dummy variable $dumH_0H_1$ (b_1) in model 1 is positive and statistically different from zero at the 5% significance level. This result means that the WTP values for the cheese with the "light" claim of currently hungry participants (H_0) in the "future satiated" treatment (S_1) are statistically lower than the WTP values for currently hungry participants (H_0) in the "future hungry" treatment (H_1). Moreover, the estimated coefficient for the dummy variable $dumS_0S_1$ (b_2) is not statistically different from zero at the 5% significance level which means that the WTP values for the cheese with the "light" claim of currently hungry participants (H_0) in the "future satiated" treatment (S_1) are statistically not different from the WTP values for currently satiated participants (S_0) in the "future satiated" treatment (S_1). These results corroborate the previous results exhibited in table 3, suggesting that projection bias exists because currently hungry participants were willing to pay more to get the cheese with the "light" claim when they anticipated being hungry in the future than when they anticipated being satiated.

Likewise, in model 2, the estimated coefficient for the dummy variable $dumH_0H_1$ (c_1) is positive and statistically significant at the 10 % significance level while the estimated

coefficient for the dummy variable $dumS_0S_1$ (c_2) is negative and statistically significant at the 10% significance level. These findings suggest that the WTPs for the cheese with the "light" claim of currently satiated participants (S_0) in the "future hungry" treatment (H_1) are statistically lower than the WTP values of subjects who were currently hungry (H_0) in the "future hungry" treatment (H_1). However, the later WTPs were statistically higher than the WTPs revealed by currently satiated individuals (S_0) in the "future satiated" treatment (S_1). These results are similar to the ones found in table 3 indicating that projection bias exists because of the influence of being currently satiated (S_0) in the "future hungry" treatment (H_1) on WTPs.

Participants currently satiated (S_0) who will receive the cheese product when they expect to be hungry in the future (H_1) would be less willing to pay for the products than when they are currently hungry (H_0) and expected to be hungry in the future (H_1). However, the participants currently satiated (S_0) who expect to be hungry in the future (H_1) would be willing to pay for the cheese products more than the participants currently satiated (S_0) who expect to be also satiated in the future (S_1).

(INSERT TABLE 4)

Table 5 reports the estimated coefficient for the cheese with the "DOP" claim. We can observe that the estimated coefficients for the dummy variables $dumH_0H_1$ and $dumS_0S_1$ are not statistically significant different from zero at the 5% level both in model 1 and model 2. This result implies that our two hypotheses were not rejected and hence, the participants did not exhibit projection bias when revealing their WTPs for cheese with the "DOP" claim. These results are slightly different from the ones in table 3 where the second hypothesis (in particular, $H0_{2.2}$) was rejected at the 5% significant level.

(INSERT TABLE 5)

Finally, table 6 shows that the coefficient for the dummy variable $dumH_0H_1$ in model 1 is positive and statistically different from zero at the 5% significance level. This result indicates that the WTP values for the cheese with the "organic" claim elicited by currently hungry participants (H_0) in the "future satiated" treatment (S_1) are significantly lower than the WTPs of currently hungry participants (H_0) in the "future hungry" treatment (H_1). In addition, the estimated coefficients for the dummy variable $dumS_0S_1$ in model 1 and the dummy variable $dumH_0H_1$ and $dumS_0S_1$ in model 2 are statistically not different from zero. These results are the same as the ones found in table 3 indicating that projection bias exists because hungry participants were willing to pay more to get the cheese with the "organic" claim when they anticipated being hungry in the future than when they anticipated being satiated. Hence, we can confirm that projection bias exists for the cheese product with the "organic" claim.

(INSERT TABLE 6)

4. Conclusions

It is widely documented in experimental settings from social psychology literature that individuals can often choose an alternative deemed inferior ex ante because a sufficient level of hunger can cause people to behave "out of control" and consequently will make decisions that are not in their best interest (e.g., in terms of their long-term health), often with full awareness that they are doing so (Loewenstein, 1996; Rabin (1997;). Loewenstein et al. (2003) coined the term "projection bias" to describe a more general phenomenon of

mistaken prediction that occurs when individuals have difficulty predicting when they will be in a different emotional "cold" state (e.g. satiated) because their current "hot" state (e.g. hunger) overrides them. Therefore, while individuals understand the directions in which their tastes will change, they can be prone to systematically underestimating or overestimating the magnitude of these changes.

As previously mentioned, past studies from the behavioural economics literature (e.g., Read and Leeuwen, 2002; Gilbert et al., 2002) focused on hypothetical choices or non-hypothetical field experiments to test projection bias. Our study differs from these past studies in various ways. First, we tested the existence of projection bias using a non-hypothetical lab experiment (i.e., experimental auction). Specifically, we examined whether projection bias exists when hungry and non-hungry subjects were incentivized to reveal their WTPs. Second, in order to avoid selection bias, we conducted all the sessions of our experiment at the same time (i.e., lunch time) instead of "before and after lunch" utilized in previous studies. To manipulate hunger level, we fed participants to make them satiated after a few rounds of auction. Third, instead of using different types of products, we used four different versions of the same product which corresponded to four different product claims (i.e., without claim, "light", "DOP" and "organic"), holding other product characteristics constant.

Our results confirm the existence of projection bias when consumers made their decisions about food products. In particular, we found the existence of projection bias in two out of the three analyzed cheese products with claims. Specifically, projection bias exists because our currently hungry participants were willing to pay more to get the cheese with the "light" and "organic" claim when they anticipated being hungry in the future than when they anticipated being satiated. Second, projection bias exists because for any current hunger or satiated state (H_0 and S_0), the participants were willing to pay more for

the cheese with the “light” claim when they anticipated being hungry in the future (H_1) than when they anticipated being satiated (S_1).

However, our results also suggest that individuals´ preferences are not dynamically inconsistent because participants were still willing to pay more for DOP and organic cheese than for “light” one when they were satiated or when they anticipated being satiated. In other words, participants did not give a disproportionate weight to short-term benefits and cost when bidding in the auction.

Our findings generally confirm that projection bias is prevalent in food decisions, since individuals` willingness to pay is influenced by their current and future hunger level, implying that it would be better for individuals to avoid buying food when they are in their “hungry” state. This finding has implications for food companies and retailers when launching a new product with specific claims in the food market. Since we found that hunger participants (current and future) would be more willing to pay to get the food product, the communication and promotion campaigns designed by food companies should be done in the specific time of the day when consumers are expected to be hungry. As trying the first time the product is the precursor of liking and then, re-buying, advertisement on TV, and tasting promotions on the store should be scheduled before lunch or dinner when consumers are expected to be hunger because of their greater desire to try the product.

Our results have also significant implications for the design and use of non-hypothetical experimental auctions to elicit WTP values from subjects for food products. For example, our results suggest that if participants has projection bias, their bidding decisions can be influenced by their current level of hunger or satiety. This finding is important since hunger levels of participants are not normally measured in experimental auctions. Given the increasing importance and use of experimental auctions to elicit consumers’ preferences and WTP valuesfor marketing and policy purposes, researchers and practitioners should

take into account the hunger level and control for this factor when designing the experimental auction. If they do not take this into account, their valuations could be confounded by participants' projection bias.

Acknowledgments

The study has been funded by European Union Marie Curie Project, FOODLABELS_PIOF-GA-2009-253323 entitled "Do consumers value food labels? An assessment of the impact of information and personality traits on the demand for food labels."

References

Alfnes, F., (2009). Valuing product attributes in Vickrey auctions when market substitutes are available. *European Review of Agricultural Economics* 36: 133-149.

Alfnes, F. and Rickertsen K. (2003). European Consumers` Willingness to pay for U.S. Beef in Experimental Auction Market. *American Journal of Agricultural Economics* 2: 396-405.

Alfnes, F. and Rickertsen, K. (2011). Non-Market Valuation: Experimental Methods. In: Roosen, J., Lusk, J., Shogren, J. (Eds), The economics of food consumption and policy, The Oxford Handbook of the Economics of Food Consumption and Policy. Oxford University Press: Oxford, 215-242.

Baltagi, B.H. (2003). Econometric analysis of panel data. Chichester: John Wiley & Sons.

Bolles, R.C. (1975). The theory of motivation, (2nd ed). New York: Harper & Row

Busse, M.R., Pope, D.G., Pope, J.C and Silva-Risso, J. (2012). Projection Bias in the Car and Housing Markets." Working Paper 18212. National Bureau of Economic Research, Cambridge, MA. http://www.nber.org/papers/w18212

Chang, J.B., Lusk, J. and Norwood, F.B. (2009). How Closely Do Hypothetical Surveys and Laboratory -Experiments Predict Field Behaviour?. *American Journal of Agricultural Economics* 91: 518-534.

Conlin, M., O'Donoghue, T. and Vogelsang, J., (2007). "Projection bias in Catalog Orders. *The American Economic Review*, Vol 97:1217-1249.

Corrigan, J.R., Drichoutis, A.C., Lusk, J.L., Nayga, M.R. Jr. and Matthew, M. (2012). Repeated Rounds with Price Feedback in Experimental Auction Valuation: An Adversarial Collaboration. *American journal of Agricultural Economics* 94: 97-115.

Cox, J.C. and Grether, D.M. (1996). The preference reversal phenomenon: response mode, markets and incentives. ***Economic Theory*** 7: C381-C405.

Gilbert, D.T., M.J., Gill, T.D. and Wilson, T.D. (2002). The future is now: temporal correction in affective Forecasting. *Organizational Behaviour and human Decision Processes* 88: 430-444.

Gul, F., and Pesendorfer, W. (2001). Tempation and self-control. *Econometrica* 69: 1403-1435

Harrison, G.W. (2006). Experimental Evidence on Alternative Environmental Valuation Methods. *Environmental and Resource Economics* 34:125-162.

Harrison, G.W. and List, A.J. (2004). Field Experiment. *Journal of Economic Literature* 42: 1009-1055.

Kahneman, D. and Tversky, A. (1979). Prospect theory: An analysis of decisions under risk. *Econometrica* 47: 263–291.

Keim, N.L., Stern, J.S. and Havel, P.J. (1998). Relation between circulating leptin concentrations and appetite during a prolonged, moderate energy deficit in women. *American Journal of Clinical Nutrition* 68: 794–801.

List, J.A., and G. A. Gallet (2001). What Experimental Protocol Influence Disparities Between Actual and Hypothetical State Value? *Environmental and Resource Economics* 20: 241-254.

List, J.A. (2003). Does Market Experience Eliminate Market Anomalies? *The Quarterly Journal of Economics* 118: 41-71.

List, J.A., Shogren, J.F. (1999). Price information and bidding behavior in repeated second-price auctions. *American Journal of Agricultural Economics* 81: 942-949.

Loewenstein, G. (1996). Out of control visceral influences on-behaviour. *Organizational Behaviour and Human Decision Processes* 65: 273-292.

Loewenstein, G. (2005). Hot-cold empathy gaps and medical decision making. *Health Psychology* 24: S49-S56

Loewenstein,G., O'Donoghue, T., and Rabin, M. (2003). Projection Bias in Predicting Future Utility. *The Quarterly Journal of Economics* 118 (4): 1209-1248.

Lusk, J.L. and Shrogren, J.F. (2007). Experimental Auctions: Methods and Applications in Economic and Marketing Research, Cambridge University Press, UK.

Murphy, J.J., Geoffrey, J.A., Stevens, T.H., and Weatherhead, D.(2005). Meta-Analysis of Hypothetical Bias in Stated Preference Valuation. *Journal of Environmental and Resource Economics* 30: 313–325.

Poppitt, S.D., Mccormack, D. and Buffenstein, R. (1998). Short-term Effects of Macronutrient Preloads on Appetite and Energy Intake in Lean Women. *Physiology & Behavior* 64: 279–285.

Rabin, M. (1997). Psychology and Economics. Working paper, Department of Economics. University of California, Berkeley, January.

Read, D. and van Leeuwen, B. (1998). Predicting hunger: the effect of appetite and delay on choice. *Organizational Behavior and Human Decision Processes* 76:189-205

Shogren, J.F. (2006). Valuation in the lab. *Environmental & Resource Economics* 34: 163-172.

Shogren, J.F., Margolis, M., Koo, C. and List, A. (2001). A Random Nth-Price Auction. *Journal of Economic Behavior and Organization* 46: 409-421.

Strotz R.H. (1956). Myopia and inconsistency in dynamic utility maximization. *The Review of Economic Studies* 23: 165-180.

Table 1. Sample characteristics and demographic variables definition (%, unless stated)

		Treatment		
Variable definition	Name (type)	Future hungry (H_1)	Future Satiated (S_1)	Test (p-value)[a]
Gender				
Male	FEMALE (dummy 1=female; 0 otherwise)	50.0	42.0	0.631
Female		50.0	58.0	(0.427)
Age (average)	YEARS (continuous)	47.0	46.0	0.259 (0.796)
Education of respondent	UNIVERSITY(dummy 1=university degree; 0 otherwise)			
Elementary School		16.67	16.00	
High School		54.17	50.00	0.2692
University		29.17	34.00	(0.874)
Average Household monthly Income				
Between € 600 and € 1,500	LOWINCOME(dummy 1=less than € 1,500; 0 otherwise	21.28	23.91	0.538
Between € 1,501 and €2,500		57.45	50.00	(0.764)
More than 2,500		21.28	26.09	
# participants		48	50	

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

Table 2. Level of self-reported participants hunger across treatments (H1 and S1)

	Future hungry (H_1)		Future satiated (S_1)	
	Round 3 (H_0)	Round 4 (S_0)	Round 3 (H_0)	Round 4 (S_0)
Hunger level	2.87	1.23	2.74	1.48
t-test (p-value)	8.90 (0.000)*		9.03 (0.000)*	

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

Table 3. Average marginal WTPs by treatment and round (€/ per 100 grams package for cheese)

	Future hungry (H_1)		Future satiated (S_1)	
	Hungry (H_0)	Satiated (S_0)	Hungry (H_0)	Satiated (S_0)
"Light"" cheese:	0.210	0.135	0.037	-0.02
t-test of equality (p-value):				
$H0_{1.1} = WTP^{H_0S_1} = WTP^{H_0H_1}; H1_{1.1} = WTP^{H_0S_1} < WTP^{H_0H_1}$		-1.99 (0.02)*		
$H0_{1.2} = WTP^{H_0S_1} = WTP^{S_0S_1}; H1_{1.2} = WTP^{H_0S_1} > WTP^{S_0S_1}$		0.70 (0.24)		
$H0_{2.1} = WTP^{S_0H_1} = WTP^{H_0H_1}; H1_{2.2} = WTP^{S_0H_1} < WTP^{H_0H_1}$		1.07 (0.14)		
$H0_{2.2} = WTP^{S_0H_1} = WTP^{S_0S_1}; H1_{2.1} = WTP^{S_0H_1} > WTP^{S_0S_1}$		2.30 (0.01)*		
"DOP" cheese	0.299	0.238	0.213	0.159
t-test of equality (p-value):				
$H0_{1.1} = WTP^{H_0S_1} = WTP^{H_0H_1}; H1_{1.1} = WTP^{H_0S_1} < WTP^{H_0H_1}$		-1.18 (0.11)		
$H0_{1.2} = WTP^{H_0S_1} = WTP^{S_0S_1}; H1_{1.2} = WTP^{H_0S_1} > WTP^{S_0S_1}$		0.89(0.18)		
$H0_{2.1} = WTP^{S_0H_1} = WTP^{H_0H_1}; H1_{2.2} = WTP^{S_0H_1} < WTP^{H_0H_1}$		1.01(0.15)		
$H0_{2.2} = WTP^{S_0H_1} = WTP^{S_0S_1}; H1_{2.1} = WTP^{S_0H_1} > WTP^{S_0S_1}$		1.81(0.03)*		
“Organic" cheese:	0.300	0.262	0.156	0.173
t-test of equality (p-value):				
$H0_{1.1} = WTP^{H_0S_1} = WTP^{H_0H_1}; H1_{1.1} = WTP^{H_0S_1} < WTP^{H_0H_1}$		-2.02 (0.02)*		
$H0_{1.2} = WTP^{H_0S_1} = WTP^{S_0S_1}; H1_{1.2} = WTP^{H_0S_1} > WTP^{S_0S_1}$		-0.25 (0.39)		
$H0_{2.1} = WTP^{S_0H_1} = WTP^{H_0H_1}; H1_{2.2} = WTP^{S_0H_1} < WTP^{H_0H_1}$		0.46 (0.32)		
$H0_{2.2} = WTP^{S_0H_1} = WTP^{S_0S_1}; H1_{2.1} = WTP^{S_0H_1} > WTP^{S_0S_1}$		1.18 (0.11)		

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

Table 4. Coefficient estimates from random effects regression for the "light" cheese product				
	Model 1		Model 2	
Variables	Coef	p-value	Coef	p-value
$dumH_0H_1$	0.154	0.045	0.075	0.068
$dumS_0S_1$	-0.06	-1.49	-0.139	0.071
$dumS_0H_1$	0.079	0.304	---	---
$dumH_0S_1$	---	---	-0.079	0.304
Female	0.168	0.020	0.168	0.020
University	-0.029	0.730	-0.029	0.730
Years	0.003	0.135	0.003	0.135
Lowincome	-0.073	0.506	-0.073	0.506
Constant	-0.165	0.127	-0.085	0.433
N observations	196		196	
R^2	0.12	0.12		

Table 5. Coefficient estimates from random effects regression for the “DOP” cheese product				
	Model 1		Model 2	
Variables	Coef	p-value	Coef	p-value
$dumH_0H_1$	0.080	0.176	0.060	0.152
$dumS_0S_1$	-0.054	0.191	-0.074	0.212
$dumS_0H_1$	0.020	0.732	---	---
$dumH_0S_1$	---	---	-0.020	0.732
Female	0.076	0.144	0.076	0.144
University	0.069	0.256	0.069	0.256
Years	0.001	0.386	0.001	0.386
Lowincome	-0.099	0.209	-0.099	0.209
Constant	0.114	0.150	0.135	0.101
N. observations	196		196	
R^2	0.08		0.08	

Table 6. Coefficient estimates from random effects regression for the “organic” cheese product				
	Model 1		Model 2	
Variables	Coef	p-value	Coef	p-value
$dumH_0H_1$	0.145	0.045	0.037	0.143
$dumS_0S_1$	0.017	0.500	-0.090	0.212
$dumS_0H_1$	0.107	0.138	---	---
$dumH_0S_1$	---	---	-0.107	0.138
Female	0.014	0.842	0.014	0.842
University	0.129	0.116	0.129	0.116
Years	0.004	0.061	0.004	0.061
Lowincome	-0.026	0.802	-0.026	0.802
Constant	-0.081	0.437	0.026	0.810
N. observations	196		196	
R^2	0.106		0.106	

Annex I. Population in Spain and Zaragoza

Table A1. Population by sex and age in Spain and Zaragoza (%)

		Sex		Age				
	Total	Female	Male	0-19	20-34	35-54	55-64	More than 64
Spain	46,148,605	50.99	49.01	19.88	20.80	31.10	11.05	17.14
Zaragoza	952,383	50.90	49.10	18.46	19.63	30.83	11.64	19.42

Source: Spanish Census of Population, 2011. www.ine.es