Health Benefits and Uncertainty: An Experimental Analysis of the Effects of Risk Presentation on Auction Bids for a Healthful Product*

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Abstract: Experimental subjects receive a different presentation of a food product's potential health risk reductions if eaten regularly. They are then asked to bid for the product. Results suggest that the bids vary across the groups that receive differing risk information.

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Introduction

We examine what people might be willing to pay in an experimental auction for a cookie made with a healthful syrup, given various kinds of information conveying reduced risks of diabetes and colon cancer. These risks reductions may be difficult to quantify, may largely depend on individual characteristics and behavior, and are more difficult to communicate to people than other measures of risk (Kolata 2005). Such factors likely introduce uncertainty about the risks themselves, deemed "ambiguity" (Ellsberg 1961). Using four treatments in separate classroom experiments, we elicit subjects' risk perceptions and auction bids for the cookie. We use a variety of approaches to discern each subject's subjective probabilities, including a treatment involving a combination of life-duration tradeoffs and probability weighting functions (PWFs). PWFs, especially nonlinear ones, relax some of the traditional axioms of the conventional expected utility (EU) framework (see Tversky and Khaneman; Quiggin). PWFs for financial gambles have been examined before (see for example, Wakker and Deneffe), and in one study, mortality risks have been the sole focus (Bleichrodt and Pinto) but little effort has been made to tie ambiguous risks or PWFs to values for products with health-related benefits.[1] This paper is a first step in this line of research.

Many economists have acknowledged shortcomings of the EU framework, and several alternatives relax key restrictive assumptions that the EU framework imposes (see

[1] Eisenberger and Weber explore the relationship between ambiguity and values. Fox et al. (2002) also examines the affect of information on food choices and Kivi and Shogren (2005) look at ambiguity's connection to food choice in a fashion similar to our 4th treatment.

Starmer, 2000). Explanations of ambiguity include conflicting information (Fox and Tversky): if experts themselves are not clear about the risk magnitudes, then it is difficult to imagine that the public will be. Most theorists assume that individuals will be averse to ambiguity, but the degree of aversion remains an open empirical question.

The cookie's syrup is grown in Peru using the Yacon Tuber. It is low in sugars and can aid in digestion, thereby reducing the risk of colon cancer, diabetes, and heart disease. Exact health risk reductions have not been scientifically determined at this time, so this presents an important opportunity to examine choices with ambiguity present, and to explore whether subjects can provide information that reveals their PWFs. We hypothesize that high subjective risks will increase auction bids for the Yacon cookie, as compared to bids from subjects who do not know that the product has health-risk reducing benefits. We also hypothesize ambiguity aversion will reduce the bids, relative to non-ambiguous risk presentations (Sarin and Weber).

Experimental Design

Pencil and paper experiments were developed after several focus groups and pretests were held. Subjects for the experiments were undergraduate students at Texas A&M University. Four treatments were developed with varying presentations of the health risk information given to subjects which could affect their auction bid for the homemade Yacon cookie. We used a 4th price Vickrey auction (see Starmer and Sugden), first endowing each individual with a conventional homemade sugar/syrup cookie. The auction involved six rounds of bids with two practice sessions. Subjects were told that the winners would be the three highest bidders in one randomly selected round. Each has to

pay the fourth highest bid. Subjects were told the 4th highest bid after each round of bidding and the winners were revealed at the end of the experiment.

Students voluntarily participated in one of the four treatments during a regularly scheduled class meeting. One class received one treatment and each student was compensated with $20 at the end. All subjects were asked identical questions about demographics, their health, diet, and questions to reveal their private rate of discount, and asked to taste the two cookies.

Group 1 receives no information about the Yacon cookie, other than it is being marketed. All subjects in groups 2-4 view a risk ladder, a common visual device for risk communication. Group 2 received “clear” risk information about the reductions in colon cancer and diabetes risks that a person could expect by adopting a diet that substituted Yacon for regular corn and sugar syrup products. Group 3 subjects receive the same information, and are asked to provide six values of life year that reveal their indifference between lotteries over life duration. These can be used to map out their utility function for life duration. Utilities can then be used to estimate PWFs. However, theory requires conditions on successive values of the life years, relative to a reference value. If violated, lotteries are not co-monotonic and the probability weights are not valid (see Bleichrodt and Pinto). Group 4 receives conflicting risk information in the form of a conflicting second “expert” opinion.

Results

Subjects in the study could perform tasks they were given, with some notable exceptions. When asked to choose among time/money bundles, many of the subjects in each group did not reveal that they had one constant discount rate. Of those whose

responses reveal a single constant discount rate, Treatment 3 group had the lowest average discount rate, which would possibly explain a high mean bid from them, as the Yacon cookie's health benefits come later in life.

Group 3 members could not all perform the tasks to provide utility-theoretic and consistent utility functions and PWFs. Forty-one of 54 subjects provide responses that violate co-monotonicity. We do not report the probability weights for the small number of non-violating members of Group 3. However, because the attempt to elicit the utility function over life-duration and probability weights for this group may influence their bids, we use a dummy variable for group 3 in a regression below.

Mean bids, averaged over all rounds are reported (WTPALL) in Table 1, as are round six bids (WTP6), as there may have been learning from earlier rounds. Median bids are zero. The high mean WTPALL is for group 3. The smallest bids are for the first group, which receives no risk information. The high mean WTP6 is from group 4, which received risk information that may have caused ambiguity. However, we note that the highest bidder in round six for group 4 has a relative diagnosed with diabetes and was seated next to the second highest bidder. We speculate that these two students shared information, as both of their previous five round action bids were very low, but we did not catch them talking to one another. Dropping this sole high bid, WTP6 is also highest for group 3.

The mean taste response for the homemade Yacon cookie is low for all groups, emphasizing the need for a product to taste good when marketing a healthful product. However, this response is higher for group 4 than for groups 2 and 3. To explore possible covariate effects, a simple censored regression on the bids of groups 2, 3 and 4 was run to

allow for zero and possible unobserved negative bids. A variable for perceived risk (the respondent's own assessment of the risk reduction in colon cancer, which was considerably higher than the presented "expert" risk reductions), and a positive taste for the syrup cookie had significant positive influences on the amount bid. Income, and a dummy variable for Treatment group 3 (the group with the lowest indicated private discount rate) were not significant explanatory variables.

Summary/Conclusions

These results indicate that subjects' maximum willingness to pay for a product varies depending on the amount of information about the product's health risk reductions that they are given, which influences their risk perceptions. Subjective risks are quite important in the analysis: these play a role in explaining auction bids for the healthy product. Ambiguity in these risks may also be an important consideration. These results may indicate to producers that less than clear information about a product's health risk reduction benefits, may lead to lower WTP. Eliciting probability weights for mortality risks with undergraduate students was not successful, possibly indicating that the Bleichrodt and Pinto (2000) study may be so because of the fact that graduate students are used rather than undergraduate students. With more training about probabilities they can better comprehend this task. It is also becoming a consensus among health economists that younger people just do not think much, or carefully about their future health risks, but it is doubtful that age difference between graduate and undergraduate students accounts for difficulty in our subjects' providing the weights. This may suggest the need for longer training and learning periods during an experiment on those unfamiliar with probabilities.

Table 1: Mean Taste Responses and Mean WTP by Treatment Group*

	Treatment 1 (n = 35)	Treatment 2 (n= 49)	Treatment 3 (n = 54)	Treatment 4 (n = 30)
Taste, sugar cookie (mean, 1 to 5 scale)	2.2	3.34	3.2	3.38
Taste, Yacon cookie (mean, 1 to 5 scale)	1.47	1.65	1.71 (28 responded with 1)	1.9 (14 responded with 1)
Mean WTP, 6th round	$0.024	$0.06	$0.14**	$0.18**
Mean WTP from all rounds	$0.01	$0.05	$0.11	$0.064
Number of zero bids	31	30	35	25
Importance of cookieB taste in bidding (1 = not at all, 5 = a lot)	NA	4.2 (33 responded with 5)	4.23 (37 responded with 5)	3.83 (14 responded with 5)
Importance of diabetes health benefits/colon cancer benefits (1 = not at all, 5 = a lot)	NA	2.19/2.08	2.71/2.60	2.6/2.53
Risk treatment	None	Given baseline risks and then risk reductions of 0.01 and 0.05% respectively	Extensive risk, elicitation of probability weights	Extensive, but with ambiguity introduced

* Treatment 1 was given no specific risk information; 2 is presented with "expert/objective" risks; 3 receives risks and PWF questions; and Treatment 4 is presented with ambiguity (2 expert assessments that differ). Taste scale: 1 is "don't like it at all" up to a 5, which is "I really like it." ** The mean bid for treatment 3 has a high of $5. The high bid for Treatment 4 (WTP6) was $3.00. Removing only this high bid, group 4's mean WTP6 = $0.08.

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