Effects of Cheap Talk on Consumer Willingness-to-Pay for Golden Rice

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Abstract

A large body of literature suggests individuals behave differently when responding to hypothetical valuation questions than when actual payment is required. Such findings have generated a great deal of skepticism over the use of the contingent valuation method and benefit measures derived from it. Recently, a new method, cheap talk, has been proposed to eliminate the potential bias in hypothetical valuation questions. Cheap talk refers to process of explaining hypothetical bias to individuals prior to asking a valuation question. This study explores the effect of cheap talk in a mass mail survey using a conventional value elicitation technique. Results suggest that cheap talk was effective at reducing willingness-to-pay for most survey participants. However, consistent with previous research, cheap talk did not reduce willingness-to-pay for consumers who were knowledgeable of the good evaluated.

Key words: cheap talk, contingent valuation, genetically modified foods, golden rice, hypothetical bias

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Introduction

In recent years, agribusinesses have become interested in producing and selling differentiated agricultural commodities. Estimates of consumer willingness-to-pay for new valued added traits are becoming important determinants of new product adoption. A number of methods have been employed to estimate demand for these quality improvements, including the contingent valuation (CV) method. Despite its popularity in valuing food quality attributes and environmental amenities, CV has been criticized for a variety of reasons (e.g., Diamond and Hausman).

Among the staunchest criticisms of CV is the fact that people tend to overstate the amount they are willing-to-pay for improvements in a public good or an increases in quality of a private good. Evidence of this "hypothetical bias" is widespread (Cummings, Harrison, and Rutström; List and Gallet; Loomis et al., 1997; Neill et al.).[1] To counter such problems, some research has begun to investigate means of calibrating hypothetical willingness-to-pay to non-hypothetical obtained in an experimental setting (Blackburn, Harrison, and Rutström; Fox et al.; List, Margolis, and Shogren; List and Shogren). Although such research has been useful for exploring the nature of hypothetical bias, applications are often limited to private goods, for which actual values can be estimated in a market-based experiment. Further, results from previous research imply that calibration factors vary on a case-by-case basis. Because calibration provides an *ex post* correction of hypothetical bias, a specific calibration factor must be determined for each study.

Cummings and Taylor introduced an alternative and more straightforward method of eliminating hypothetical bias in public good valuation. They employed a cheap talk script,

which simply explained the problem of hypothetical bias to study participants prior to administration of a valuation question. Cheap talk has been described in game theoretic literature as non-binding communication between two players in a game. In this regard, cheap talk can be thought of as non-binding communication between a researcher and survey respondent prior to elicitation of a hypothetical willingness-to-pay question. Using cheap talk to eliminate hypothetical bias is perhaps more general than calibration because it provides an *ex ante* bias correction that can be applied in any valuation task.

The results of previous literature are clear: cheap talk effectively removes hypothetical bias for consumers relatively unknowledgeable of the good evaluated. Cummings and Taylor found that cheap talk was effective at removing hypothetical bias in several public good valuations and List (2001a) found that cheap talk eliminated hypothetical bias with private goods in a field experiment. Utilizing cheap talk to reduce or eliminate hypothetical bias in non-market valuation provides the potential to overcome one of CV's greatest obstacles.

However, to date cheap talk studies have been limited to either a laboratory or closely controlled field setting.[2] Although laboratory or field experiments are extremely useful for testing behavioral hypotheses, they are often limited by small sample sizes and carry the potential for sample selection bias. Cheap talk will be more valuable to practitioners if its ability to mitigate hypothetical bias extends to large-scale applications such as mass mail or phone surveys. To that end, the goal of this paper is to explore the effect of cheap talk on willingness-to-pay elicited via mass mail survey (n = 4,900) for a novel food product: "golden" rice. We also expand on previous literature by analyzing cheap talk in the context of a traditional CV elicitation technique. Employing a double bounded dichotomous choice question, we find that estimated willingness-to-pay calculated from hypothetical responses with cheap talk are

significantly less than willingness-to-pay estimated from hypothetical responses without cheap talk. However, consistent with List (2001a), we find that cheap talk does not reduce willingness-to-pay for experienced, or in our case knowledgeable, consumers. For both classes of consumers, average willingness-to-pay for golden rice exceeds the price of traditional white rice.

Review of Cheap Talk Literature

Cummings and Taylor were the first to report on the potential of cheap talk to reduce or eliminate hypothetical bias with student participants in a laboratory setting. Their cheap talk script contained three primary sections with: a) an explanation of hypothetical bias, b) a discussion of why hypothetical bias might exist, and c) a request to avoid hypothetical bias in a subsequent valuation question. In their experiments, participants voted by referenda on contribution to a public good. Four different public goods were utilized in the experimental design and various subjects participated in real, hypothetical, and hypothetical with cheap talk referenda. The public goods varied by what was being delivered, where delivery was taking place, and the degree of the good delivered in relation the amount of the contribution. They also examined variations in cheap talk script.

The results of Cummings and Taylor's experiments can be summarized as follows: a) hypothetical valuations without cheap talk were typically greater than when real payment was required, b) hypothetical valuations with cheap talk were equal to real valuations in *every* treatment, and c) cheap talk did not introduce a downward bias in valuations that was coincidentally equal to hypothetical bias as evidenced by the fact that cheap talk did not decrease valuations when hypothetical, non-cheap talk valuations were already equivalent to real valuations. That is, cheap talk lowered willingness-to-pay when the propensity for hypothetical

bias existed and will left willingness-to-pay unaffected in cases where hypothetical bias didn't exist. Results were robust across all referenda and variations in the cheap talk script.

In a follow-up study, List (2001a) employed the use of a cheap talk design in a study of sports cards valuation in a field setting. Rather than utilizing a referendum voting format, List (2001a) used a 2nd price auction to elicit hypothetical, hypothetical with cheap talk, and real valuations. For inexperienced card traders, List (2001a) confirmed the results in Cummings and Taylor; cheap talk valuations were indistinguishable from real valuations, which were lower than hypothetical valuations. However, cheap talk failed to reduce hypothetical bias for experienced card dealers. List (2001a) concluded that experienced subjects might have been be less susceptible to the external prompting of a cheap talk script because they had developed hard-and-fast rules and valuation strategies which were not easily changed. Additionally, experienced card traders may have believed they were very familiar with market conditions and therefore discounted the cheap talk information. This finding presents a challenge to the future use of cheap talk. If cheap talk does not reduce hypothetical bias for experienced consumers, then estimating demand for this important market segment becomes more complex.

Despite the previous finding, however, List (2001b) found that real and hypothetical with cheap talk responses were equivalent for experience and inexperienced card traders, when using an alternative payment vehicle. Employing a choice experiment (where subjects make repeated choices between two or more alternatives described by varying attributes), cheap talk induced experienced participants to avoid hypothetical bias. When the elicitation question was framed in a manner more consistent with routine behavior (i.e., making a choice versus bidding in an auction), experienced subjects were apparently more open to accepting the cheap talk information. List (2001b) also examined the ability of cheap talk to eliminate hypothetical bias

in a choice experiment delivered by mail. Again, hypothetical responses were statistically different than when real payment was required, but hypothetical with cheap talk responses were statistically equivalent to real responses. For all experimental treatments with public and private goods, List (2001b) could not reject the null hypothesis of real and hypothetical with cheap talk equivalence. All previous studies have performed between-subject tests. That is, average responses across different samples of respondents were compared. To our knowledge, the effect of cheap talk on willingness-to-pay has yet to be analyzed n the context of a within-subject comparison.[3]

It should be noted that shorter requests to reduce hypothetical bias have been unsuccessful at reducing willingness-to-pay. In a mail survey, Poe et al. included a brief three-sentence discussion about hypothetical bias prior to asking a valuation question. They did not find any difference between responses in the two treatments. This finding was robust for dichotomous choice responses and for open-ended willingness-to-pay questions. Valuations have also been found to be unaffected by brief reminders of budget constraints and substitute goods (Loomis et al. 1994).

Because relatively few studies have analyzed cheap talk, continued investigation into the issue appears warranted. For example, it is unclear what effect elicitation environment may have on cheap talk effectiveness. List (2001b) found that cheap talk reduced hypothetical bias in a mail survey, but Poe et al. did not. Whether consumers will take time to read and assimilate lengthy cheap talk information in the comfort of their own home is perhaps questionable. Further, in experimental settings cheap talk appears to be effective for all cases except those involving experienced subjects. Yet there appears to be some interaction between experience and payment vehicle with regard to cheap talk effectiveness. In sum, there are a number of

unresolved issues regarding the effect of cheap talk on valuations. This study builds on previous research by analyzing the effectiveness of cheap talk using a popular elicitation mechanism: the double bounded dichotomous choice method. To shed light on some of the ongoing debates about cheap talk, we also studied the effect of cheap talk in a mass mail survey and investigate the interaction of cheap talk and subjective knowledge level of the respondent.

Golden Rice

To determine the effect of cheap talk on willingness-to-pay, we constructed a survey to estimate demand for a novel genetically enhanced food. Through advancements in biotechnology and genetic engineering, scientists have recently developed a brand of rice called "golden" rice. By introducing a daffodil gene into traditional rice seeds, scientists have engineered golden rice to contain beta-carotene, which the body converts to vitamin A. Golden rice gets its name from the pale yellow core at the center of each grain, which results from the introduction of the daffodil gene.

Golden rice was chosen as the product of analysis for a number of reasons. First, agribusiness firms have shifted public relation campaigns and research and development efforts toward promoting genetically engineered foods that have benefits for the consumer rather than the producer. Despite the widely held view that consumers will be accepting of genetically engineered foods that have been designed to have a benefit for them, little quantitative research has confirmed this hypothesis. This analysis represents an initial attempt to address this issue. Second, golden rice is an actual food created through genetic engineering – i.e., it is not contrived. Other foods with enhanced end-use benefits might be imagined, but few have actually been developed. Third, consumer demand for golden rice is unknown (both domestically and

abroad). Because golden rice has yet to be introduced into the marketplace it is currently a non-market good that provides a useful application in which to investigate the effect of cheap talk.

Because golden rice is a genetically engineered food, uncertainty exists regarding its future success in the marketplace. To date, most of the biotechnology industry's promotion of golden rice has focused on the potential benefits to consumers in third world countries whose diets mainly consist of rice. However, a market may also exist in well-developed countries such as the United States (U.S.). Vitamin A is an essential nutrient in the body and it plays a role in body functions such as vision, immune defense, maintenance of body linings and skin, bone and body growth, normal cell development, and reproduction. Vitamin A deficiency can cause blindness, sickness, and in severe cases death. Because of these benefits, consumers may place value in the enhanced nutrition of the novel food. Furthermore, consumers in the U.S. may value golden rice above traditional rice due to altruistic feelings toward those with poor diets. Golden rice may also be preferred to traditional rice because of the novelty of the good, which has been shown to influence purchasing behavior (Shogren, List, and Hayes). In contrast, concerns for genetic engineering may outweigh the positive end-use benefit. Whether golden rice will be successful in the U.S. marketplace is an empirical question, which can be addressed by a CV study. To our knowledge, no previous study has estimated demand for golden rice in the U.S.

A few studies have examined consumer preferences for genetically modified foods with enhanced end-use benefits. Lusk et al. (2002a) found that subjects were willing to pay premiums for chips containing corn genetically modified to increase the food's shelf life as opposed to chips containing corn genetically modified to increase crop yield on the farm. In addition the International Food Information Council (IFIC) found, in a 2001 survey of U.S. consumers, that 58 percent of consumers indicated they would be somewhat or very likely to purchase produce

that had been modified by biotechnology to taste better or fresher. They also found that 70 percent of consumers indicated they would be somewhat or very likely to purchase produce that had been modified by biotechnology to require fewer pesticide applications.

Without the benefit of enhanced end-use characteristics, fear or concern over biotechnology likely dominates purchasing behavior. Lusk et al. (2000), Lusk, Fox, and Roosen, and Noussair, Robin and Ruffieux have found that when no specific benefit is provided to by biotechnology, consumers are willing to pay premiums for non-genetically modified foods. That is, a genetically modified food with no specific benefit to consumers must be sold at a discounted price to non-genetically modified food to induce the "average" consumer into purchasing it. For further information on these and other studies, readers are referred to House et al., who provide an extensive summary of previous research on consumer acceptance of biotechnology and genetically modified foods.

Survey Design

We developed a mail survey to determine the effect of cheap talk on consumer willingness-to-pay for golden rice. Because consumers were likely unknowledgeable of golden rice, a base-line level of knowledge about the good was provided in the survey. In choosing the information source, we attempted to convey information that consumers would likely encounter when making the decision to purchase golden rice, which would come in two primary forms: information from the firm selling golden rice and information provided in the media. One half of the survey sample was provided a copy of a full-page advertisement placed by the Council for Biotechnology Information in *Newsweek* magazine, which originally appeared in the June 18, 2001 issue (pg. 31). The advertisement contained a picture of an Asian mother and daughter

eating rice with a text box describing golden rice. The remaining survey sample received an informational statement prepared by the author (see appendix A for copies of the two information sources). Responses to the willingness-to-pay questions were similar across information sources. As a result, we pooled data form both informational treatments for the following analysis.[4]

Following the information sheet, we asked respondents to answer several questions, which elicited demographic information as well as data about the respondents' stated knowledge of golden rice and genetically engineering. Following these questions, one-half of the survey sample was provided a cheap talk script. The script was very similar to the Cummings and Taylor script, but was modified to be consistent with our dichotomous choice question and a retail environment. To illustrate the potential influence of hypothetical bias in such questions, we included statistics reported by Shogren et al. in the cheap talk script. That is, subjects were told that studies have shown that over 80 percent of people said they would buy a particular new food in a hypothetical study, but only 43 percent of people actually bought the item when placed on the shelf. Appendix B contains a copy of the cheap talk script.

Finally, all subjects were asked a double-bounded dichotomous choice willingness-to-pay question (Hanneman, Loomis, and Kanninen). The question was posed as follows:

> Imagine you are purchasing rice in your local grocery store. You can chose between two types of rice. One is regular long-grain white rice that ***has not been*** genetically engineered. This ***non-genetically engineered*** rice does ***not*** contain vitamin A. The other rice option is *Golden Rice***.** *Golden Rice* **has been** genetically engineered **to contain** vitamin A. One serving of *Golden Rice* will satisfy 30% of your daily requirement for vitamin A, as outlined by the FDA. Now, imagine that you are in a grocery store and the price of a 1 lb. bag of regular long-grain white long grain is $\mathbf{\$P_{WR}}$. Would you purchase a 1 lb. bag of long grain *Golden Rice* if it cost $\mathbf{\$P_{GRI}}$?

If the respondent affirmatively answered the question, they were subsequently asked if they would purchase golden rice at $\$P_{GR2a}$; where $\$P_{GR2a} > \$P_{GR1}$. Conversely, if the participant

responded negatively to the question, they were subsequently asked if they would purchase golden rice at $\$P_{GR2b}$; where $\$P_{GR2b} < \$P_{GR1}$. If the respondent answered NO to both willingness-to-pay questions, a follow-up question was provided that inquired about the reason for both NO responses. All prices, $\$P_{WR}$, $\$P_{GR1}$, $\$P_{GR2a}$, and $\$P_{GR2b}$, were systematically varied across surveys. The price for white rice, $\$P_{WR}$, was varied at either \$0.75 or \$0.65 to be consistent with prices in grocery stores across the surveyed region. Although varying $\$P_{WR}$ complicates the design, we felt it was essential to be able to estimate a cross-price effect, which may be important for predicting the profitability of introducing a new product such as golden rice. Because consumers may perceive golden rice to be lower quality than white rice, due to genetic modification, consumers may place lower value on the food. Alternatively, consumers may value golden rice over white rice due to enhanced nutritional value. Thus, prices for golden rice were varied above and below the price for white rice, with a maximum possible price of \$1.05 and a lowest possible price of \$0.35. Price ranges were chosen by conducting an informal focus group with primary household shoppers and by observing prices for various rice products in grocery stores. The lowest possible golden rice price is about half as much as one might see for conventional white rice in the grocery store, and the highest possible price is almost twice as much as conventional white rice prices.[5]

Estimation Procedures

To analyze the CV responses, we estimated an interval-censored model (Cameron, 1988; Cameron and James). Assume that a consumer has a true willingness-to-pay for golden rice, WTP^*, where $WTP^* = x\beta + \varepsilon$. In this case, x is a vector of explanatory variables, β is a conformable vector of coefficients, and ε is an independently and identically distributed normal

error with mean zero and variance σ^2. WTP^* is not observed, but we can identify a range for WTP by utilizing survey responses. Respondents that answer NO to both CV questions, have WTP for golden rice between zero and $\$P_{GR2}$. Refer to this group of individuals as D_1. We set the lower range to zero rather than negative infinity because it is assumed consumers cannot have negative willingness-to-pay for golden rice. Respondents that answer YES to the initial CV question and NO to the follow-up, have WTP in the range of [$\$P_{GR1}$, $\$P_{GR2a}$]. Refer to this group of individuals as D_2. Conversely, respondents that answer NO to the initial CV question and yes to the follow-up have WTP in the range [$\$P_{GR2b}$, $\$P_{GR1}$]. Refer to this group of individuals as D_3. Lastly, respondents, group D_4, which answered YES to both CV questions have WTP in the range [$\$P_{GR2a}$, $\$P_{GRmax}$], where $\$P_{GRmax}$ is the maximum feasible premium available in the marketplace. For this analysis, we set $\$P_{GRmax}$ equal to \$1.50/lb, over twice the typical price of white rice. To estimate the mean willingness-to-pay in the sample, we slightly modified the likelihood functions shown in Cameron and Quiggin and Haab to account for the fact that willingness-to-pay is not expected to fall below zero or exceed \$1.50. Haab and McConnell discuss the importance of incorporating such information in the likelihood function prior to calculation of willingness-to-pay values. The estimated likelihood function is:

$$(1)\qquad LogL = \sum_{D_1} \log \Phi\left(\left(\frac{\$P_{GR2} - x\beta}{\sigma}\right) - \left(\frac{-x\beta}{\sigma}\right)\right) + \sum_{D_2} \log\left(\Phi\left(\frac{\$P_{GR2} - x\beta}{\sigma}\right) - \Phi\left(\frac{\$P_{GR1} - x\beta}{\sigma}\right)\right) +$$

$$\sum_{D_3} \log\left(\Phi\left(\frac{\$P_{GR1} - x\beta}{\sigma}\right) - \Phi\left(\frac{\$P_{GR2} - x\beta}{\sigma}\right)\right) + \sum_{D_4} \log\left(\Phi\left(\frac{\$P_{GR\max} - x\beta}{\sigma}\right) - \Phi\left(\frac{\$P_{GR2} - x\beta}{\sigma}\right)\right)$$

where Φ is the standard normal cumulative distribution function. The coefficient estimates in (1) can be loosely interpreted as the marginal effect of x_i on willingness-to-pay (Cameron 1988). In the interval-censored model, mean willingness-to-pay value is: $E(WTP) = \bar{x}\hat{\beta}$, where $\bar{x}$ is a

vector of the sample averages of the independent variables. If one is only interested in the location and scale of the willingness-to-pay within a sample, equation 1 can be estimated with only a constant as an explanatory variable, which yields the marginal mean and variance of the implicit willingness-to-pay (Cameron and Quiggin). However, such a procedure does not control for subject-specific characteristics that may affect valuations. Thus, a combined model will be estimated that includes demographic explanatory variables and a dummy variable identifying the cheap talk treatment. Because of the nature of the good in question, factors such as knowledge and consumption habits may also influence valuations and will therefore be incorporated into the estimation.[6]

Results

In July 2001, 4900 surveys were mailed to a random sample of consumers in the fourth largest rice producing state in the U.S. - Mississippi. Addresses were purchased from a reputable private company, which randomly drew names and addresses from the telephone directory. Four hundred seventy eight surveys were returned because of undeliverable addresses and 632 completed surveys were return resulting in a 14% response rate. To provide a consistent number of observations in the analysis that follows, we removed all partially completed surveys from the data set, which reduced the final number of observations to 574.[7]

Summary statistics and variable definitions are reported in table 1. About 64 percent of the respondents were female probably because we requested that the person that did the majority of the shopping in the household complete the survey. Respondents were 51 years of age on average and had family incomes just over $51,000 per year. Twenty-three percent of the sample had children under the age of 12 in the household and almost 40% had a bachelors degree. To

ascertain consumers' subjective level of knowledge, we asked whether they had heard of golden rice and asked how knowledgeable they were about genetically modified foods. Twenty seven percent of the subjects had heard of golden rice before receiving the survey. Only three percent of consumers claimed they were very knowledgeable about genetically modified foods, 58 percent indicated they were somewhat knowledgeable, and about 39 percent claimed they had no knowledge of genetically modified foods. Because of the low number of "very knowledgeable" consumers, we defined the knowledge variable as a dummy variable segregating those who knew nothing from those who knew at least something.[8] Summary statistics for the cheap talk sub-samples are also reported in table 1. For all variables reported in table 1, average responses are statistically indistinguishable across treatments.

Our respondents had slightly higher incomes and were more educated than the Mississippi population (U.S. Census Bureau). For example, the average household income in Mississippi in 2000 was $48,803 and 18.6 percent of the state population had received a bachelors degree; whereas, the average yearly household income in our sample was roughly $51,000 and almost 40% had received a bachelors degree. Furthermore, the sample is geographically restricted, including only Mississippi consumers. However, it is important to note that the goal of the study is not to generalize willingness-to-pay for golden rice on a national or global basis. The primary objective of the study is to determine the effect of cheap talk on willingness-to-pay. In this regard, our sample provides a test of the effect of cheap talk on two similar populations in which willingness-to-pay was elicited by mail survey. Furthermore, our survey sample has many advantages over respondent samples used in previous cheap talk studies. For example, our sample represents a much broader range of demographics than the

student sample in Cummings and Taylor, contains many more observations than List (2001a), and is derived from a survey with a higher response rate than the survey in List (2001b).

Summary statistics of the responses to the double bounded dichotomous choice questions are reported in figure 1. When given no cheap talk information, 77 percent of respondents indicated they would purchase golden rice. The average bid in the first dichotomous choice question for those subjects that responded YES was $0.72. However, when given cheap talk information, only 74 percent indicated they would purchase golden rice and the average price at which consumers answered affirmatively dropped to $0.69. For the first dichotomous choice question, differences between cheap talk treatments do not appear large. However, the effect of cheap talk is more pronounced in the follow-up question. The difference in the percentage of consumers responding YES to the second dichotomous choice question is over 10 percent (47 percent versus 59 percent) less with cheap talk than without. In addition, a greater percentage (4 percent) of respondents answered NO to the second dichotomous choice question when presented with cheap talk than when they were not given such information. The average prices corresponding to the second dichotomous choice question are conditional on the individual's response to the initial dichotomous questions. For example, the average bid of the second dichotomous choice question for those answering YES-YES in the cheap talk treatment was $0.86.

Figure 2 illustrates the percentage of respondents that indicated they would purchase golden rice at various price levels, segregated by cheap talk treatment. The plots in figure 2 are rough estimates of the inverse demand curves for golden rice implied by the initial dichotomous choice question. Clearly, cheap talk changes the slope of the demand curve. Respondents that were given cheap talk information were much more price sensitive than respondents who were

not given cheap talk information. Respondents that were not given cheap talk information exhibited rather inelastic demand for golden rice (as expressed in the initial dichotomous choice question), whereas respondents who where presented cheap talk information had relatively elastic demand.

Table 2 reports the results of equation 1 including the full set of explanatory variables listed in table 1. Results suggest that the cheap talk script had a statistically significant effect on willingness-to-pay elicited by the double bounded dichotomous choice question. Respondents that received the cheap talk script reported an implicit willingness-to-pay $0.06/lb on average lower than respondents without the cheap talk script. Although relatively small in absolute terms, respondents with cheap talk expressed a willingness-to-pay about 8 percent less than respondents without cheap talk. For agricultural commodities that traditionally have relatively low margins, an 8 percent change in a value estimate may invoke a very different product adoption decision. In this light, the change in willingness-to-pay invoked by cheap talk represents an economically significant effect. As expected, the price of white rice, a substitute good, was positive and statistically significant. The only other variable significantly related to willingness-to-pay was knowledge, implying that consumers that had no knowledge of genetically modified foods were willing to pay about $0.05/lb more than consumers with at least some knowledge about genetically modified foods. The fact that other demographic variables were insignificant in explaining willingness-to-pay for golden rice is consistent with Hamstra's analysis of European consumers.

Some concerns have been expressed with the double bounded dichotomous choice CV method because of the fact that willingness-to-pay implied from the first dichotomous choice question may be inconsistent with willingness-to-pay implied from the second dichotomous

choice question (e.g., Cameron and Quiggin). To determine whether this is a problem for our data, following Cameron and Quiggin, we estimated models using data from the first dichotomous choice question only and then estimated models using data from the second dichotomous choice question. Results suggest that willingness-to-pay was stable across the first and second dichotomous choice questions: mean willingness-to-pay from the first question was $0.87/lb. [$0.84, $0.90], mean willingness-to-pay from the second question was $0.86 [$0.83, $0.90], and mean willingness-to-pay from the pooled first and second questions model was $0.88 [$0.84, $0.91], where the numbers in brackets are the 95% confidence intervals. In this application, subjects appear to be responding to both willingness-to-pay questions consistently.[9]

Because List (2001a) found that cheap talk was ineffective at removing hypothetical bias for experienced and knowledgeable subjects (sports card dealers), we sought to determine if a similar effect was present here. Although none of our consumers could have had any direct experience with golden rice, we segmented our sample by knowledge of golden rice and genetic engineering. As shown in table 1, we created a variable referred to as "Experience" that took the value of one if the subject had heard of golden rice prior to the survey and had at least some knowledge of genetically modified foods and zero otherwise. That is, this group of subjects indicated they had more stated knowledge and information about golden rice specifically and genetically modified foods in general than did the "Inexperienced" group. In this respect, this group is similar to the card dealers in List (2001a). As shown in table 1, about 19% of the subjects were "Experienced."[10] Again, it is important to note that the Experience variable measures an individual's subjective level of knowledge, which, in this setting, is expected to be more highly related behavior and better explain the effect of cheap talk than objective knowledge levels.

For illustrative purposes, results of several estimates are reported in table 3. For each model reported in table 3, a different sub-sample of subjects was included in the estimation depending upon whether they were provided the cheap talk script and whether they were knowledgeable/experienced. To generate the mean willingness-to-pay estimates reported in table 3, equation 1 was estimated including only a constant term as a regressor. The resulting estimate for the constant is, by construction of the likelihood function, the mean willingness-to-pay for the particular sub-sample. Model 1 includes all subjects in the analysis, and results indicate that average willingness-to-pay for golden rice for the entire sample of respondents was $0.88/lb. Model 2 includes only respondents provided with cheap talk, and model 3 includes only respondents that were not provided cheap talk. Results are similar to that in table 2 - respondents that received a cheap talk script were willing to pay about $0.06/lb less ($0.913 versus $0.849) than respondents without cheap talk. Models 4 and 5 indicate that willingness-to-pay for golden rice was similar for experienced and inexperienced consumers. As shown in table 3, cheap talk appears to have divergent effects on experienced and inexperienced subjects. For inexperienced, unknowledgeable subjects (the majority of the sample), cheap talk drastically reduced average willingness-to-pay (by $0.10/lb). However, for experienced, knowledgeable subjects, cheap actually increased willingness-to-pay, however the result is not statistically significant. Although, the results in table 3 are useful for illustrative purposes, they are anecdotal because they do account for uncontrolled subject-specific effects.

Table 4 reports the results of several estimations. Model 1 in table 4 is identical to the model reported in table 2 except the Heard and NoKnowledge variables were replaced with the new combined Experience variable. Similar results were obtained in both cases. Model 2 is identical to Model 1 except it includes an interaction effect between the cheap talk treatment and

the Experience variable. Results suggest that cheap talk reduced average willingness-to-pay; however, this result failed to hold for knowledgeable, experienced subjects. The last two columns in table 4 illustrate this result an equivalent, but more straightforward manner. Cheap talk had no effect on consumers who were knowledgeable of golden rice and genetically engineered foods; however cheap talk significantly reduced willingness-to-pay for consumers unknowledgeable of golden rice and genetically engineered foods. These results are consistent with List (2001a) who found that cheap talk was ineffective at removing hypothetical bias for experienced, knowledgeable sports card dealers.

Because we did not elicit willingness-to-pay in a non-hypothetical treatment, it is important to note that we cannot conclude that our cheap talk script effectively removed hypothetical bias. Our results imply that cheap talk reduced stated willingness-to-pay for the majority of respondents in our sample. Ideally, one would conduct a treatment where actual payment was required. In this case, as with many environmental valuations, actual payment was not possible. Golden rice has yet to be commercially produced and sufficient physical samples of the product were unavailable.

Results also illustrate the impact that cheap talk might have on product adoption decisions. For example, if traditional white rice is priced at $0.70/lb, estimated average willingness-to-pay for golden rice is about $0.91/lb without cheap talk. In this case, one may surmise that so long as production, marketing, and stocking costs are not $0.21/lb more costly for golden rice than white rice, producers may be able to enhance profitability with this new food product. However, with cheap talk, estimated average willingness-to-pay is only $0.85/lb, which is $0.15/lb above the price of traditional white rice. One can imagine a wide range of conditions in which the profitability estimates, derived from a willingness-to-pay study that includes cheap

talk, might invoke an alternative investment decision than the profitability estimates from a willingness-to-pay study with no cheap talk.

Conclusions and Implications

Economists interested in non-market valuation have long been concerned about the fact that people behave differently in hypothetical and non-hypothetical settings. The advent of cheap talk may alleviate this concern for future research. However, the study of cheap talk is still in its infancy and the conditions in which cheap talk is effective at reducing hypothetical bias are not fully known. This study built on previous research in a number of ways. First, cheap talk was analyzed using responses obtained through a mass mail survey as opposed to an experimental setting. Second, cheap talk was analyzed in the context of a routinely used contingent valuation elicitation mechanism: the double bounded dichotomous choice technique.

Results suggest that cheap talk significantly reduced willingness-to-pay for consumers unknowledgeable about golden rice and genetic engineering. Because most consumers in the sample had little knowledge of genetic engineered and golden rice, the result also held in the aggregate. For those consumers who had heard of golden rice and were at least somewhat knowledgeable of genetic engineering, cheap talk did not reduce willingness-to-pay.

Because golden rice has yet to be commercially produced, the good was undeliverable, and a non-hypothetical treatment was not conducted. As such, we cannot definitely conclude that our cheap talk script effectively removed hypothetical bias. The ability to make such inferences depends on the extendibility and generalizability of the results in Cummings and Taylor and List (2001a). If results in Cummings and Taylor and List (2001a) are robust, in all cases where cheap talk reduces hypothetical willingness-to-pay, hypothetical bias is eliminated.

Extending these results to our study would imply that the cheap talk script removed hypothetical bias for consumers unknowledgeable of golden rice. If the results in Cummings and Taylor and List (2001a) are not robust, our results simply imply that the cheap talk script reduces willingness-to-pay for unknowledgeable consumers, while leaving knowledgeable consumer willingness-to-pay unaffected. Although not compatible with the findings of Cummings and Taylor, skeptics of the cheap talk method might contend that hypothetical bias did not exist to begin with and that the cheap talk script introduced a downward bias in the unknowledgeable sub-sample. It might also be argued that cheap talk reduced willingness-to-pay, but did not completely eliminate hypothetical bias. Whether cheap talk will effectively remove hypothetical bias for all goods and cases is something that can only be answered by future research where a non-hypothetical baseline exists. The current state of knowledge implies that cheap talk is an accurate tool for generating hypothetical willingness-to-pay estimates which are statistically equivalent to real willingness-to-pay, at least for subjects unknowledgeable of the good evaluated (Cummings and Taylor, List 2001a, List 2001b).

In this study, cheap talk did not reduce willingness-to-pay for consumers knowledgeable of golden rice. These results imply one of two conclusions about knowledgeable consumers: either a) hypothetical bias did not exist for this type of consumer or b) cheap talk did not remove hypothetical bias for this sub-sample of respondents. The former argument is supported by the findings of Paradiso and Antonella, who found that hypothetical bias was less severe for individuals more knowledgeable of the good evaluated. Thus, willingness-to-pay might not have declined because it did not need to – it was already similar to real willingness-to-pay. Such an argument would also be consistent with the result in Cummings and Taylor, who found that cheap talk did *not* lower willingness-to-pay for goods for which there was no hypothetical bias to

begin with. Perhaps, consumers more knowledgeable of the good have had an opportunity to put a sufficient amount of thought into their own valuation prior to the valuation question. On the other hand, hypothetical bias may reside in willingness-to-pay estimates reported by more knowledgeable consumers even after they are confronted with a cheap talk script. That is, more knowledgeable consumers might have stated a larger willingness-to-pay in a hypothetical setting than they would have in a real valuation, and this hypothetical valuation was not adjusted downward when provided with cheap talk. This argument would be supported by the results in List (2001a). List (2001a) found that cheap talk did not reduce willingness-to-pay for more knowledgeable, experienced consumers and as a result, hypothetical bias was still problematic for this consumer segment. Because a non-hypothetical reference point was not available in this application, we cannot confirm nor deny either hypothesis about the effect of cheap talk on more knowledgeable consumers.

Although a non-hypothetical treatment was not conducted in this study, some important conclusions can be drawn. Some have questioned whether cheap talk will be effective in a mass-mail survey. It has been hypothesized that, when in the comfort of their own homes, consumers might not take the time necessary to assimilate cheap talk information. What this study shows is that cheap talk *can* affect valuations even when an experimental monitor is not present to encourage subjects to put cognitive effort into their responses. In addition, this study not only shows that cheap talk affects valuation, but that valuations are affected in a manner consistent with previous experimental studies even though valuations were elicited by mail. So, to the extent that cheap talk has been shown to be effective in experimental settings, extendibility of this method to a broader audience through mass-mail or phone surveying appears promising.

Future research in this area might focus on investigating the relationship between knowledge level of subjects and the effectiveness of cheap talk. List (2001b) suggested that an alternative payment vehicle, used in conjunction with cheap talk, might induce more knowledgeable subjects to reduce hypothetical willingness-to-pay. Although our payment mechanism was more realistic than the auction in List (2001a), who found a similar interaction between cheap talk and knowledge, it is perhaps less realistic than the choice experiment used in List (2001b), who found no difference between experienced and inexperienced subjects. Certainly more research is needed to fully understand the interactions between knowledge and experience of the subjects, payment vehicle, and cheap talk effectiveness.

Footnotes

[1]Although the majority of evidence suggests hypothetical willingness-to-pay is overstated (e.g., List and Gallet), there is also evidence to suggest that hypothetical willingness-to-pay is similar to non-hypothetical willingness-to-pay in some settings (e.g., Carlsson and Martinsson; Haab, Haung, and Whitehead).

[2]Recent work by List (2001b) is one exception. In this study, a cheap talk design was administered in a mail survey (n = 1000 in each treatment).

[3]Cheap talk has also been found to be effective in other experiments where subject behavior typically deviates from that predicted by economic theory. Cherry and Shogren found that cheap talk arbitrage was equally as effective as real arbitrage at reducing preference reversals and Lusk and Hudson found that offers in an ultimatum bargaining game were closer to Nash equilibrium predictions with experimenter cheap talk than without.

[4]Estimating a full econometric model including demographics, we could not reject the null hypothesis of equivalent valuations across the two information treatments ($p = 0.42$). In addition, we tested for differences in the impact of cheap talk across informational treatments and did not find any statistically significant results. Any of these results are available from the author upon request.

Footnotes continued

[5]Specifically, when the P_{WR} was \$0.65/lb, P_{GR1} took the value of \$0.55/lb, \$0.65/lb. or \$0.75/lb, with (P_{GR2a}, P_{GR2b}) at (\$0.35/lb, \$0.75/lb), (\$0.50/lb, \$0.80/lb), or (\$0.55/lb, \$0.95/lb), respectively. Similarly, when the P_{WR} was \$0.75/lb, P_{GR1} took the value of \$0.65/lb, \$0.75/lb. or \$0.85/lb, with (P_{GR2a}, P_{GR2b}) at (\$0.45/lb, \$0.85/lb), (\$0.60/lb, \$0.90/lb), or (\$0.65/lb, \$1.05/lb), respectively. This yielded six survey versions. In all cases, P_{GR2i} were symmetric about P_{GR1}.

[6]We have also estimate equation 1 assuming $\ln(WTP^{*}) = x\beta + \varepsilon$. The same conclusions are reached in either case. Results of this alternative specification are available from the authors upon request.

[7]The response rate is relatively low compared to similar CV studies. Because of budgetary constraints, we were unable to provide monetary incentives to induce responses and the length of the survey likely hindered many potential respondents. Even with the low response rate, we were able to gather many more observations than would be possible with an experimental study with an equivalent budget constraint.

[8]Objective knowledge of biotechnology was also elicited by asking three true/false questions. In the following analysis, we use subjective rather than objective knowledge levels because what someone believes they know about biotechnology is much more likely to influence their valuation and how they react to cheap talk information than how much they actually know. None of the objective knowledge questions are significantly related to willingness-to-pay or the effect of cheap talk. These results are available from the authors upon request.

Footnotes continued

[9]Cheap talk has a statistically significant effect on willingness-to-pay whether estimations include: initial dichotomous choice data only, the second dichotomous choice data only, or the pooled model shown in equation 1 and discussed throughout the paper. Although statistically significant in all specifications, the effect of cheap talk appears to be somewhat stronger in the second dichotomous choice question, likely because the second bid was closer to true willingness-to-pay for most participants.

[10]In the following analysis, one could analyze the interaction between cheap talk and the Heard and NoKnowledge variables rather than constructing a single Experience variable. We have conducted the analysis both ways and very similar results are achieved with both approaches. We choose to report the results using only the Experience variable because it simplifies the discussion.

References

Blackburn, M., G. Harrison, and E. Rutström. "Statistical Bias Functions and Informative Hypothetical Surveys." *American Journal of Agricultural Economics.* 76(December 1994):1084-88.

Cameron, T.A., "A New paradigm for Valuing Non-market Goods Using Referendum Data: Maximum Likelihood Estimation by Censored Logistic Regression." *Journal of Environmental Economics and Management*. 15(September 1988): 355-79.

Cameron, T.A., "Interval Estimates of Non-Market Resource Values from Referendum Contingent Valuation Surveys." *Land Economics*. 67(November 1991):413-21.

Cameron, T.A. and M.D. James. "Efficiency Estimation Methods for Use with 'Closed-Ended' Contingent Valuation Survey Data." *Review of Economics and Statistics*. 69(May 1987):269-76.

Cameron, T.A. and J. Quiggin. "Estimation Using Contingent Valuation Data from a 'Dichotomous Choice with Follow-Up' Questionnaire." *Journal of Environmental Economics and Management*. 27(1994):218-234.

Carlsson, F. and P. Martinsson. "Do Hypothetical and Actual Marginal Willingness to Pay Differ in Choice Experiments?" *Journal of Environmental Economics and Management*. 41(2001):179-192.

Cherry, T.L. and J.F. Shogren. "Rationality Crossovers." Working paper, Department of Economics, Appalachian State University, 2001.

Cummings, R.G., G.W. Harrison, and E.E. Rutström. "Homegrown Values and Hypothetical Surveys: Is the Dichotomous Choice Approach Incentive-Compatible?" *American Economic Review*. 85(March 1995):260-266.

Cummings, R.G. and L.O. Taylor. "Unbiased Value Estimates for Environmental Goods: A Cheap Talk Design for the Contingent Valuation Method." *American Economic Review.* 89(June 1999):649-65.

Diamond, P.A. and J. Hausman. "Contingent Valuation: Is Some Number Better than No Number?" *Journal of Economic Perspectives*. 8(1994):45-64.

Haab, T.C. "Estimation Using Contingent Valuation Data from a 'Dichotomous Choice with Follow-Up' Questionnaire: A Comment." *Journal of Environmental Economics and Management*. 35(1998):190-194.

Haab, T.C., J.C. Haung, and J.C. Whitehead. "Are Hypothetical Referenda Incentive Compatible? A Comment." *Journal of Political Economy*. 107(February 1999):186-96.

Haab, T.C. and K.E. McConnell. "Referendum Models and Economic Values: Theoretical, Intuitive, and Practical Bounds on Willingness to Pay." *Land Economics*. 74(May 1998):216-29.

Hamstra, A. M.. *Consumer acceptance model for food biotechnology – final repor*t. The Hague:The SWOKA Institute, 1995.

Hanemann, W.M., J. Loomis, B. Kanninen. "Statistical Efficiency of Double-Bounded Dichotomous Choice Contingent Valuation." *American Journal of Agricultural Economics.* 73(November 1991):1255-63.

House, L., J.L. Lusk, M. Moore, and B. Morrow. "Consumer Acceptance of and Willingness to Pay for Genetically Modified Foods in the United States and the European Union: A Review of Recent Findings." Working Paper, Food and Resource Economics Department, University of Florida, 2002.

Fox, J.A., J.F. Shogren, D.J. Hayes, and J.B. Kliebenstein. "CVM-X: Calibrating Contingent Values with Experimental Auction Markets." *American Journal of Agricultural Economics.* 80(August 1998):455-465.

International Food Information Council Foundation (IFIC). "More U.S. Consumers See Potential Benefits to Food Biotechnology." March, 2001.

List, J.A. "Do Explicit Warnings Eliminate the Hypothetical Bias in Elicitation Procedures? Evidence from Field Auctions for Sports Cards." *American Economic Review*. 91(December 2001a):1498-1507.

List, J.A. "Using Choice Experiments to Value Non-Market Goods and Services." Working Paper, Department of Agricultural and Resource Economics, University of Maryland, 2001b.

List, J.A. and C.A. Gallet. "What Experimental Protocol Influence Disparities Between Actual and Hypothetical Stated Values?" *Environmental and Resource Economics*. 20(2001):241-54.

List, J.A., M. Margolis, and J.F. Shogren. "Hypothetical-Actual Bid Calibration of a Mulitgood Auction." *Economic Letters.* 60(September 1998):263-268.

List, J.A. and J.F. Shogren. "Calibration of the Differences Between Actual and Hypothetical Valuations in a Field Experiment." *Journal of Economic Behavior and Organization* 37(November 1998):193-205.

Lusk, J.L., M.S. Daniel, D.R. Mark, and C.L. Lusk. "Alternative Calibration and Auction Institutions for Predicting Consumer Willingness-to-Pay for Non-Genetically Modified Corn Chips." *Journal of Agriculture and Resource Economics.* 26(July 2001):40-57.

Lusk, J.L. and D. Hudson. "Effect of Monitor-Subject Cheap Talk on Ultimatum Game Offers." Working paper, Department of Agricultural Economics, Mississippi State University, 2001.

Lusk, J.L., M. Moore, L. House, and B. Morrow. "Influence of Brand Name, Store Loyalty, and Type of Modification on Consumer Acceptance of Genetically Engineered Corn Chips." *International Food and Agribusiness Management Review.* forthcoming, 2002.

Lusk, J.L., J. Roosen, and J.A. Fox. "Demand for Beef from Cattle Administered Growth Hormones or Fed Genetically Modified Corn: A Comparison of Consumers in France, Germany, the United Kingdom, and the United States" *American Journal of Agricultural Economics*. forthcoming, 2002.

Loomis, J., T. Brown, B. Lucero, and G. Peterson. "Evaluating the Validity of the Dichotomous Choice Question Format in Contingent Valuation." *Environmental and Resource Economics.* 10(September 1997):109-23.

Loomis, J. A. Conzales-Caban, and R. Gregory. "Substitutes and Budget Constraints in Contingent Valuation." *Land Economics*. 70(November 1994):499-506.

Neill, H.R., R.G. Cummings, P.T. Ganderton, G.W. Harrison, and T. McGuckin. "Hypothetical Surveys and Real Economic Commitments." *Land Economics.* 70(1994):145-54.

Noussair, C., S. Robin, and B. Ruffieux. "Do Consumers Not Care About Biotech Foods or Do They Just Not Read Labels?" *Economics Letters*. 75(2002):47-53.

Paradiso, M. and T. Antonella. "The Effect of Knowledge on the Disparity between Hypothetical and Real Willingness to Pay." *Applied Economics*. 33(September 2001):1359-64.

Poe, G.L., J.E. Clark, D. Rondeau, and W.D. Schulze. "Can Hypothetical Questions Predict Actual Participation in Public Programs? A Contingent Valuation Validity Test Using a Provision Point Mechanism." *Cornell Working Paper Series in Environmental and Resource Economics.* 97-05.

Shogren, J.F., J.A. List, and D.J. Hayes. 2000. "Preference Learning in Consecutive Experimental Auctions." *Amer. J. Agr. Econ.* 82(4) (November 2000):1016-1021.

Shogren, J.F., J.A. Fox, D.J. Hayes, and J. Roosen. "Observed Choices for Food Safety in Retail, Survey, and Auction Markets." *American Journal of Agricultural Economics.* 81(December 1999):1192-1199.

U.S. Census Bureau. Web address: http://www.census.gov.

Table 1 - Variable Definitions and Summary Statistics

Variable	Definition	Full Sample	With Cheap Talk	Without Cheap Talk
Gender	1 if female; 0 if male	0.639 (0.481)[a]	0.633 (0.483)	0.645 (0.480)
Age	age in years	51.223 (14.750)	50.451 (14.412)	51.933 (15.043)
Income	household income level 0 = less than $10,000; 1 = $10,000 to 19,999 . . . 18 = $180,000 to $189,999; 19 = more than $190,000	5.189 (3.681)	5.361 (3.660)	5.030 (3.700)
Child	1 if children under age of 12 in the household; 0 = otherwise	0.235 (0.424)	0.240 (0.428)	0.231 (0.422)
Education	1 if Bachelor's degree of higher; 0 otherwise	0.399 (0.490)	0.385 (0.487)	0.411 (0.493)
WhiteRice	1 if normally eat white rice; 0 if normally eat other types of rice	0.864 (0.343)	0.858 (0.349)	0.870 (0.337)
Rice	number of times per month rice is consumed	5.794 (5.954)	5.698 (4.346)	5.883 (5.460)
Heard	1 if heard of golden rice before survey; 0 otherwise	0.267 (0.443)	0.258 (0.438)	0.274 (0.447)
NoKnowledge	1 if no knowledge of genetically modified foods; 0 otherwise	0.385 (0.487)	0.393 (0.489)	0.378 (0.486)
Experience	1 if heard of golden rice before suvey and have at least some knowledge of genetically modified foods; 0 otherwise	0.195 (0.397)	0.193 (0.395)	0.197 (0.399)
Cheap Talk	1 if received cheap talk script; 0 otherwise	0.479 (0.500)	-	-
P_{WR}	price of white rice; either $0.65/lb or $0.75/lb	0.700 (0.050)	0.702 (0.050)	0.701 (0.050)
Number of Observations		574	275	299

[a]Numbers in parentheses are standard deviations

Figure 1 – Responses to Double Bounded Dichotomous Choice Questions With and Without Cheap Talk

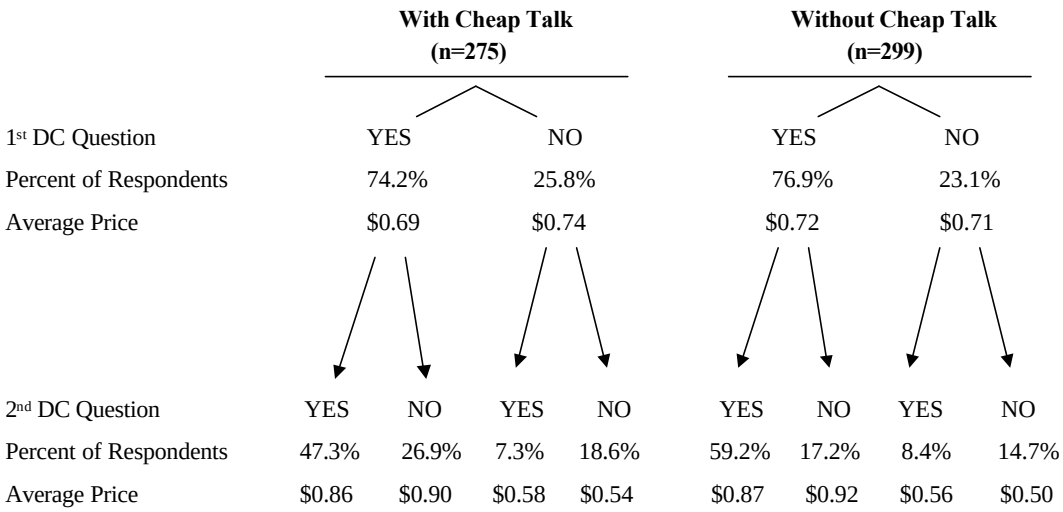

Figure 2 - Percentage of Respondents Willing to Purchase Golden Rice at Various Prices

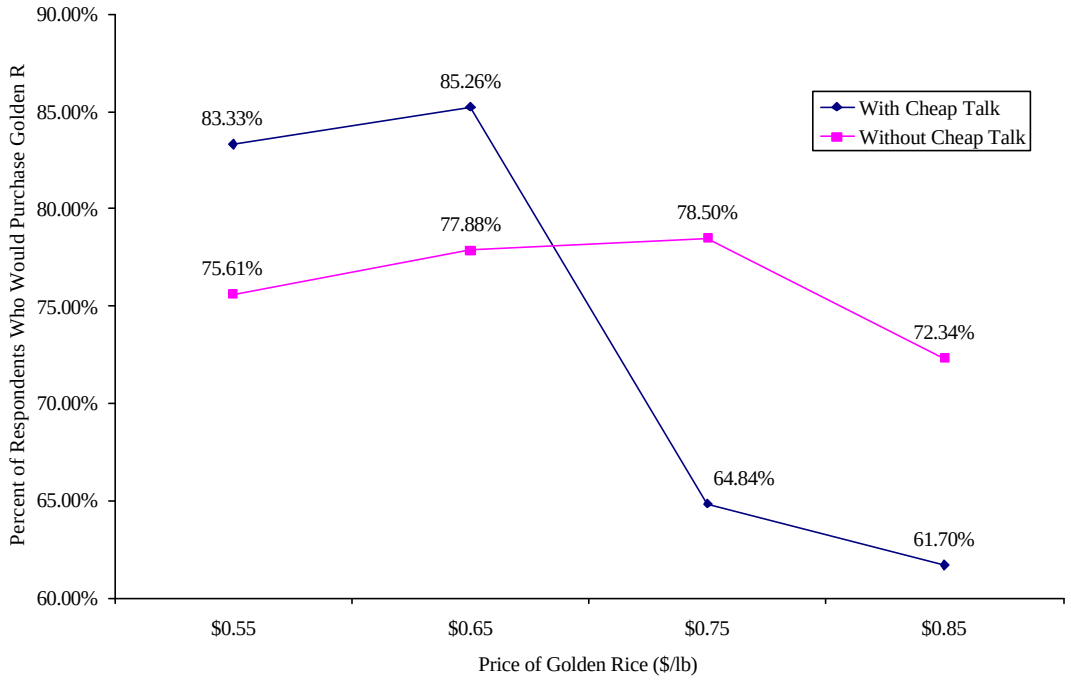

Table 2 – Effect of Cheap Talk on Willingness-to-Pay for Golden Rice

Variable	Coefficient	Standard Error
Intercept	0.565**	0.215
Gender	0.037	0.030
Age	-0.000	0.001
Income	-0.001	0.004
Child	-0.024	0.037
Education	-0.010	0.030
WhiteRice	-0.014	0.041
Rice	0.001	0.003
Heard	-0.013	0.032
NoKnowledge	0.046*	0.029
Cheap Talk	-0.061**	0.027
P_{WR}	0.491*	0.277
Scale	0.298	0.011

* and ** represent 10 percent and 5 percent levels of statistical significance, respectively
Number of observations = 547
Log likelihood = -690.55
Dependent variable is interval censored willingness-to-pay

Table 3 – Willingness-to-Pay Estimates Segregated by Cheap Talk Treatment and Knowledge/Experience Level

Model	Sub-Sample	Willingness-to-Pay ($/lb)[a]	Scale Parameter	Number of Observations in Sub-Sample	Log Likelihood Value
1	All Respondents	0.882 (0.014)[b]	0.303 (0.012)	574	-697.5
2	All Respondents with Cheap Talk	0.849 (0.020)	0.292 (0.017)	275	-340.3
3	All Respondents without Cheap Talk	0.913 (0.020)	0.310 (0.016)	299	-354.6
4	Experienced	0.864 (0.032)	0.306 (0.026)	112	-139.4
5	Inexperienced	0.887 (0.016)	0.302 (0.013)	462	-557.9
6	Inexperienced with Cheap Talk	0.838 (0.022)	0.294 (0.019)	222	-273.7
7	Inexperienced without Cheap Talk	0.932 (0.022)	0.303 (0.017)	240	-279.7
8	Experienced with Cheap Talk	0.896 (0.043)	0.278 (0.035)	53	-65.8
9	Experienced without Cheap Talk	0.832 (0.047)	0.327 (0.039)	59	-72.5

[a]Mean willingness-to-pay for golden rice obtained by estimating equation 1 and including only a constant as an explanatory variable, where the estimated parameter is, by construction of the likelihood function, the mean willingness-to-pay.
[b]Numbers in parentheses are standard errors.

Table 4 – Effectiveness of Cheap Talk with Knowledgeable and Unknowledgeable Consumers

	Full Sample		Sub Sample	
Independent Variable	**Model 1**	**Model 2**	**Experienced**	**Inexperienced**
Intercept	0.586**	0.601**	0.997*	0.501**
	(0.215)	(0.214)	(0.488)	(0.236)
Gender	0.039	0.041	0.101	0.024
	(0.030)	(0.029)	(0.068)	(0.033)
Age	-0.000	-0.000	-0.003	0.000
	(0.001)	(0.001)	(0.002)	(0.001)
Income	-0.002	-0.002	-0.002	-0.003
	(0.004)	(0.004)	(0.008)	(0.005)
Child	-0.025	-0.025	-0.016	-0.027
	(0.037)	(0.037)	(0.077)	(0.041)
Education	-0.012	-0.009	-0.045	0.006
	(0.030)	(0.030)	(0.065)	(0.034)
WhiteRice	-0.013	-0.016	-0.135	0.016
	(0.041)	(0.041)	(0.092)	(0.045)
Rice	0.001	0.001	0.005	-0.000
	(0.003)	(0.003)	(0.005)	(0.004)
Experience	-0.021	-0.103**		
	(0.035)	(0.048)		
Experience x Cheap Talk		0.169**		
		(0.069)		
Cheap Talk	-0.060**	-0.093**	0.085	-0.091**
	(0.028)	(0.031)	(0.062)	(0.031)
P_{WR}	0.498*	0.497*	0.022	0.581
	(0.278)	(0.276)	(0.627)	(0.308)
Scale	0.298**	0.297	0.289	0.295
	(0.012)	(0.011)	(0.025)	(0.013)
Number of Observations	574	574	112	462
Log Likelihood	-691.8	-688.8	-134.4	-550.8

* and ** represent 10 percent and 5 percent levels of statistical significance, respectively
Dependent variable is interval censored willingness-to-pay

Appendix A – Information Sheets

Information Sheet 1

Please read the following information before answering the survey questions:

Through advancements in biotechnology and genetic engineering, scientists have recently developed a brand of rice called "Golden Rice." By introducing a daffodil gene into traditional rice seeds, scientists have engineered Golden Rice to contain beta-carotene, which the body converts to vitamin A. Vitamin A is an essential nutrient in the body. It plays a role in body functions such as vision, immune defenses, maintenance of body linings and skin, bone and body growth, normal cell development, and reproduction. Vitamin A deficiency can cause blindness, sickness, and in severe cases death. Golden Rice gets its name from the pale yellow core at the center of each grain. The color is a result of the blending of the daffodil gene with the rice genes. Besides its color, Golden Rice tastes and feels, in all other respects, like traditional rice. Over the past 5 years, the U.S. Department of Agriculture (USDA), the Food and Drug Administration (FDA), and the Environmental Protection Agency (EPA) have approved numerous genetically engineered crops for use in food manufacture.

Information Sheet 2

-on next page

Biotechnology researchers call it "golden" rice.

For the color. For the opportunity.

"When mothers and their children eat an adequate amount of vitamin A in a daily meal, it could help alleviate more suffering and illness than any single medicine has done."

The excitement expressed by plant biologist Charles Arntzen reflects the golden opportunity that many see in a new strain of rice being developed with biotechnology. "Golden" rice contains increased amounts of beta-carotene, a source of vitamin A. Because rice is a crop eaten by almost half the world, golden rice could help relieve a global vitamin A deficiency that now causes blindness and infection in millions of the world's children.

Discoveries in biotechnology, from medicine to agriculture, are helping doctors treat our sick, farmers protect our crops – and could help mothers nourish our children, and keep them healthier. To learn more about biotechnology and agriculture, visit our Web site or call us.

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Appendix B – Cheap Talk Script

Please read the following information before answering the last survey questions.

In a moment, we are going to ask you a couple of questions about whether you would purchase *Golden Rice* at a particular price level in a grocery store. However, before you answer this question, we would like you to read the following information.

In a recent study, several different groups of people were asked whether they would purchase a new food product similar to the one you are about to be asked about. This purchase was hypothetical for these people, as it will be for you. No one actually had to pay money when they indicated a particular preference. The results of this study were that over 80 percent of people said they would buy the new food. However, when a grocery store actually put the *same* new food on their shelf, *but* where payment was real and people *really* did have to pay money if they decided to purchase the new food, the results were that only 43 percent of people *actually* bought the new food. That's quite a difference, isn't it?

We call this "hypothetical bias." Hypothetical bias is the difference that we continually see in the way people respond to hypothetical purchase questions as compared to real situations.

How can we get people to think about their purchase decision in a hypothetical question like they think in a grocery store, where if they decide to purchase a food they'll really have to pay money? How do we get them to think about what it means to really dig into their pocket and pay money, if in fact they really aren't going to have to do it?

Let me tell you why I think that we continually see this hypothetical bias, why people behave differently in a hypothetical setting than they do when they are actually in a grocery store. I think that when we say that we will purchase a new food at a particular price in a hypothetical survey we respond according to our best guess of what the food is really worth in the grocery store. But, when we are really in the grocery store, and we would actually have to spend our money if we decide to purchase the food, we think a different way: if I spend money on this, that's money I don't have to spend on other things. We shop in a way that takes into account the limited amount of money we have. This is just my opinion, of course, but it's what I think may be going on in hypothetical survey questions.

So if I were in your shoes, I would ask myself: if I were really shopping in the grocery store and I had to pay $X if I decide to buy *Golden Rice*: do I really want to spend my money this way? If I really did, I would indicate YES, I would purchase *Golden Rice* at price $X; if I didn't want to spend my money this way, I would indicate NO, I would not purchase *Golden Rice* at price $X.

In any case, I ask you to respond to *each* of the following purchase questions just *exactly* as you would if you were really in a grocery store and were going to face the consequences of your decision: which is to pay money if you decide to buy a food. Please keep this in mind when answering the last few questions.