RISK PERCEPTION, BIAS, AND RESISTANCE TO NEW FOOD TECH: THE CASE OF GMOS

A Thesis
Submitted to the Graduate Faculty
of the
North Dakota State University
of Agriculture and Applied Science

By

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In Partial Fulfillment of the Requirements
for the Degree of
MASTER OF SCIENCE

Major Department:
Agribusiness and Applied Economics

November 2019

Fargo, North Dakota

North Dakota State University
Graduate School

Title

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MASTER OF SCIENCE

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ABSTRACT

GMOs are very controversial among consumers. Many fear that they may have risks scientists are not accounting for. Some GMOs, such as GMO soybean oil, have concerns over their processing methods as well. Traditional risk assessments that only account for hazard do not take these fears into account. Including risk perception, bias, and resistance is a way to account for consumers' fears. Risk perception, bias, and resistance together create an aggregate that in turn affects willingness-to-purchase. A discrete choice experiment assessed risk perception of, bias towards, and resistance towards GMOs. Respondents revealed their preferences between buying GMO or non-GMO soybean oil, each with a selection of attributes. Stated preferences on a series of scales showed their risk perception of, bias towards, and resistance towards GMOs. On the whole the results showed that risk perception, bias, and resistance together were significant factors on respondents' choice of GMO soybean oil.

ACKNOWLEDGEMENTS

I would like to thank William Nganje and Rajani Ganesh Pillai for doing so much to help me complete this thesis including being on my thesis defense committee. I'd also like to thank Jeremy Jackson for being willing to be on my thesis defense committee and giving me advice on how to improve my thesis.

DEDICATION

I dedicate this thesis to my parents who raised me and made me who I am today. I also dedicate this thesis to my siblings who I could not live without.

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1. INTRODUCTION

1.1. GMO Background Information

Ever since GMOs were first introduced to the market they have been surrounded by controversy with many consumers fearing the dramatic impact they could have upon being introduced. Fears over negative impacts on human health, the environment, and the economy are common. The concerns were significant enough that on July 27, 2001 the Royal Commission on Genetic Modification recommended to the New Zealand governor-general that far more scrutiny of GM foods would be warranted (Reece, 2004). After examining multiple GMO health concerns, including fears over GMO DNA invading the human genome, they found that the risks of GMOs to health were unknown and that they should be independently tested to ensure their safety. They examined the effect of GMOs on the environment including concerns over genetic pollution. They listened to testimonies about the loss of biodiversity. They recommended safeguards to defend against these and other events.

With regards to the economy the commission listened to many concerns over how GMOs would affect it. This included fears over GM companies trying to convince farmers to not do chemical farming and arguments from trade unionists against the commercial use of GMOs because of the unknown effects it could have on trade. Arguments over the labeling of GMOs were heard as well. In response the commission found that GMOs should be properly regulated, further research of the risks and benefits of GMOs was needed, and GMOs should be labeled among other findings (Reece, 2004).

As can be seen there are many concerns over GMOs. With that said not everyone is negative about GMOs. Others look at the potential for GMOs to resist biotic and abiotic stresses, to have higher productivity, and greater nutritional quality (Ghosh, 2001). While recognizing the fears of consumers they do not want decisions made purely on those fears. Instead they desire a "symbiotic relationship between the public and private sectors" (Ghosh, 2001, p. 655) in order to both address fears over GMOs while still allowing the creation of GMOs under proper regulation (Ghosh, 2001). Others point out the danger of blaming GMOs for things that they are not related to. Kloor (2014) writes how some opponents of GMO cotton in India claimed that the technology had led to the suicides of hundreds of thousands of farmers. These claims were based on dubious evidence and appeared to be wrong. This left the real reasons for the suicides to be unaddressed and uninvestigated Kloor (2014). This diverse range of beliefs in regards to GMOs shows how controversial they are.

All of this has contributed to the argument over whether to regulate, ban or label GMOs that has occurred in countries all across the world. Government responses have differed in many ways such as the stringent labeling requirements of GMOs by the European Union and the far less stringent labeling requirements of the United States. Furthermore experts have argued over what to do about GMOs as well (Lynas & Tudge, 2014). This differing in labeling requirements has made addressing the concerns of consumers in regards to GMOs difficult. Effective risk communication strategies are being created however, tailored to different countries (Racovita et al., 2013). With that said, society will struggle to address the fears of consumers over GMOs if it is unable to communicate to the public how risky GMOs are. In order for comprehensive risk communication to be feasible however there needs an understanding of what exactly the risk perception, bias, and resistance of the general population actually is. Without that risk communication is infeasible as it will be unclear what the public finds risky in regards to GMOs.

1.2. Fears over New Food Technology

Consumers may have hesitation to new food technology in general, fearing it has risks that have not been considered. As such while this thesis will still predominantly concentrate on GMOs, we extended our analysis to include fears over processing. When GMO soybeans are made into soybean oil they often go through a process that involves the use of hexane residue. There are some concerns that elevated levels of hexane residue in food could pose health concerns (Lehman, 2019). When non-GMO soybeans are processed they are often manually extracted and therefore do not have these concerns. However hexane extraction is cheaper than manual extraction as can be seen in part by the much higher costs of non-GMO soybean oil. There are also concerns on being able to detect GMOs with DNA-based methods in processed food (Gryson, 2010).

Our approach is holistic analyzing fears related to production and processing of GMO foods. Between these two processes the survey was able to look at how people respond to GMO food and potentially unsafe ways of processing food. This paper will therefore explore the risk bias, perception, and resistance that can be derived from GMO's production and processing methods, and analyze how they contribute to resistance or fears over new food technology.

1.3. Analyzing Risk

In order to analyze consumer views on new food technology effectively this thesis will analyze risk perception of new food technology, bias towards new food technology, and resistance towards new food technology. The literature defines risk as a function of the actual risk (hazard) and the fear of the unknown (outrage) (Sandman, 1993). Bias includes cognitive bias that is defined as "cases in which human cognition reliably produces representations that are systematically distorted compared to some aspect of objective reality" (Haselton, Nettle, &

Murray, 2016, p. 968). Resistance (food neophobia) refers to “a reluctance to eat unfamiliar foods” (Alley & Potter, 2011, p. 707). It is important that all three are analyzed together. This is the first study to the best of our knowledge to attempt as such. Risk perception, bias, and resistance should be analyzed jointly as each could have an impact on the others. Also, the three combine to form an aggregate called extended food neophobia scale. This aggregate in turn affects willingness to purchase. (Figure 1) presents a framework for our hypothesis:

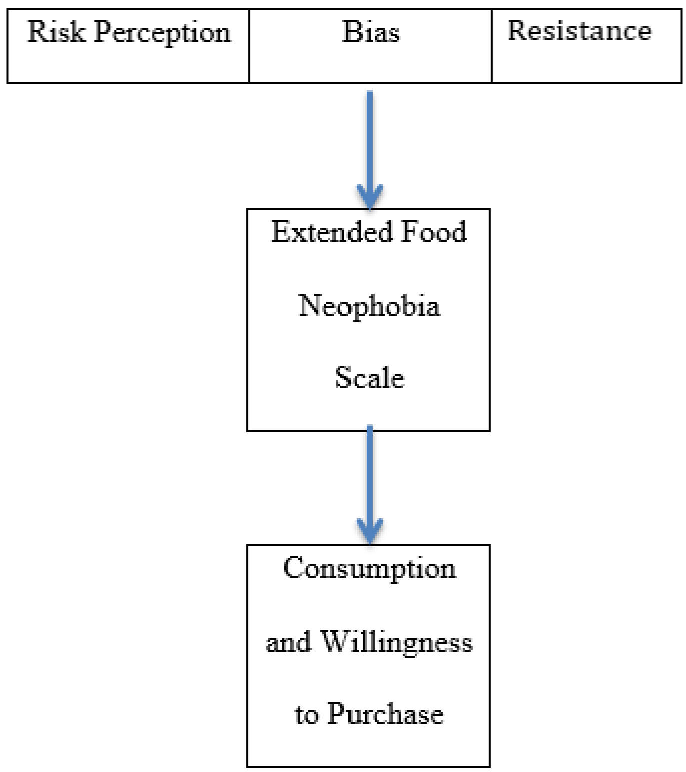

Figure 1. Framework for Risk Perception, Bias, Resistance, and Consumption.

Given their importance all three elements will be analyzed in this thesis. Our first hypothesis is that more positive risk perception of GMOs will lead to higher willingness-to-pay for GMOs. Our second hypothesis is that more positive bias of GMOs will lead to higher willingness-to-pay for GMOs. Our third hypothesis is that less resistance to GMOs will lead to higher willingness-to-pay.

The contributions of this thesis are as follows. First, we selected soybean and soybean oil to understand complexity from production to processing of GMO products. Second, we develop an aggregate scale, called extended food neophobia scale, which captures perception, resistance, and bias. This provides a holistic framework to understand resistance to food technology. This process allowed us to test seven (three perception, two bias, and two resistance) different scales that have been validated by the literature for other food technologies. Finally, we estimated willingness to pay for non-GMO vs. GMO soybean oil.

With all that said this thesis had five objectives. First we design a survey to elicit stated preferences between GMOs and non-GMOs, new food technology and old food technology. Second we analyze consumers' perception of risk towards GMOs with choice experiments. Third we analyze how consumers' cognitive bias affects their preference for new food technologies like GMOs with validated bias scales. Fourth we analyze how consumers' resistance towards GMOs and new food technologies affect their acceptance of those technologies. Fifth is to develop an aggregate index of factors that affect willingness-to-purchase of new food technologies like GMOs. The rest of the thesis is organized as follows. In chapter two we summarize research on risk perception, bias, and resistance. In chapter three we summarize the methodology of the choice experiment, survey, and analysis. In chapter four we analyze the demographics and data. In chapter five we conclude the thesis with recognitions of its limitations and recommendations for future studies. It is important to note that in this thesis non-GMO soybean oil and manual soybean oil are interchangeable terms referring to the same thing. Likewise GMO soybean oil and regular soybean oil are also interchangeable terms referring to the same thing.

2. LITERATURE REVIEW

2.1. Risk and Risk Perception

Understanding and measuring risk is important as risk affects the economy. Risk analysis is often used to measure risk. In Caswell (2000) she analyzes the risk analysis of agricultural biotechnology using GMO labeling as a case study. According to Caswell the food safety of agricultural biotechnology is evaluated by looking at the welfare effect of the food when compared to alternatives. These effects are then monetized through benefit-cost analysis. Understanding risk is just as important as measuring it. Effective operations and supply chain management (OSCM) has shown to be particularly reliant on understanding human behavior (Bendoly, Donohue, & Schultz, 2006; Bendoly & Speier, 2008; Gino & Pisano, 2008). How humans deal with and view risk is part of human behavior and therefore important to OSCM.

Risk assessment guidelines for GMOs have already been made throughout the world including in Canada, the European Union, the USA, and Australia. Policy was made based on their assessments (Paoletti, et al., 2008). A stronger understanding of risk perception of consumers will help these countries further assess the risk of GMOs for their respective consumers and respond accordingly. Our survey only deals with the United States but could be used for other countries as well. Risk perception is particularly important for the United States considering the decision by the Food and Drug Administration (FDA) to treat GMOs as "substantially equivalent" to non-GMO food unless give reason to believe otherwise. The difference in processing methods between GMOs and non-GMOs will only make this outrage more pronounced.

Risk perception is important to risk analysis because it takes into account that consumers have their own measures of risk and those measures may be different from what the riskiness of a product is from a scientific standpoint. A basic risk assessment of products that does not include risk perception is therefore incomplete as it misses key aspects of risk. The importance of risk perception can be seen from its significant implications in regards to smoking behavior (Popova, Owusu, Weaver, & Kemp, 2018).

Risk perception matters for research trying to understand how the public views the danger of something. Gaskell et al. (2004) explored how risk perception related to GM foods and how it was misperceived. The risk perception of GMOs in the early days largely relied on 'hazards' for research. Eventually in order to measure the cognitive and evaluative measures of risk researchers came up with "dread risk" and "unknown risk." Dread risk measured how fatal an event would be and for how many people. Unknown risk measured how involuntary, unknown, and new a hazard was. In 1985 it was found that DNA technology was found to be risky for both dread risk and unknown risk although only moderately so for unknown risk, showing that biotechnology was seen as risky even in early days (Slovic, Fischhoff, & Lichtenstein, 1985).

This was analyzed further in Slovic, Finucane, Peters, & Macgregor (2004) that showed affective factors as being important for risk perception. How someone feels about the riskiness of something influences the risk perception of that thing. This is reflected in the experiential system, one of the two ways people understand risk. It uses "images and associations, linked by experience to emotion and affect (a feeling that something is good or bad)" (Slovic et al., 2004, p. 311)." The other system is called the analytic system that "uses algorithms and normative rules, such as probability calculus, formal logic, and risk assessment (Slovic et al., 2004, p. 311)." Together the analytical and experiential systems allow humans to usually be rational in important situations.

As Gaskell et al. (2004) discusses public opposition to GMOs was therefore assumed to be because they misunderstood what the actual risk of GMOs was (Lichtenstein et al., 1978). Providing accurate information to the public was therefore assumed to be a way to convince them of the safety of GMOs. With the proper information people would realize that GMOs were actually quite safe like the experts said. This assumed that the experts measured risk correctly while the public did not and that their valuation of the benefits was the same.

Their findings would complicate these assumptions. They used data from the 1999 Eurobarometer survey on biotechnology. Two sets were used in this analysis. One of them was the trade off and relaxed groups that compared biotechnology as having benefits with risk and benefits with no risk respectively. The other was the skeptical group and trade off group that compared no benefits with risk and benefits with risk respectively. There were five areas people were measured on those being technology optimism, scientific knowledge, education, gender, and trust. The more trust people had in the food chain correlated with a higher chance of being in the relaxed group. Men were also more likely to be in the relaxed group. On the other hand the more technological optimism someone had the less likely they were to be skeptical compared to the trade off group. Those with greater trust in the food chain, who were male, and who had more scientific knowledge of biology were less likely to be in the skeptical group. All this suggests differences in background of relaxed and skeptical people.

The paper goes further into the perception of benefits and how that alters the outlook of people on biotechnology. They find that an increase in the perception of benefits leads to an increase in risk perception. Benefit-cost analysis only comes into play as people increasingly feel that there is some sort of benefit. This is particularly important as 60% of the people surveyed were in the skeptical group. When there is no benefit, people tend not to care about risk with there being nothing to take the risk for. For relaxed people the paper suggests that the opposite could be the case with increases in benefits leading to people ignoring or minimizing the risk. What this all suggests is that the issue many people have with GM foods is the lack of clear benefits. For some groups of Europeans this was not true with both perceived risk and benefits mattering. But for a much larger group this was true.

Further research analyzing public risk perception has already been done. Harrison, Boccaletti, & House (2004) looked at the risk perception of consumers in the United States and Italy. Demographics measured were gender, age, education, size of household, children in home, and willingness to buy GMOs. Further questions were asked, previously developed with focus groups and pretesting, to find out what those surveyed saw as the benefits and risks of GMOs. Background information on GMOs was given along with questions measuring how knowledgeable a person was of GMOs.

Results suggested a similarity between Italy and the United States in their willingness-to-buy. In both places as the risk to human health and the environment went up willingness-to-buy went down. Interestingly, this study found risk to human health and the environment to be the dominant factors in determining support for GMOs. Trust in the government increased willingness-to-buy. Based on a previous paper Harrison, Boccaletti, and House suggest that greater trust could lead to less perceived risks and a more positive attitude for GMOs (Moon & Balasubramanian, 2004). Knowledge and awareness about GMOs were not found to be significant. Despite these similarities Italians were less likely to buy GMOs than Americans. Increases in perceived risks of GMOs decreased the chance of Italians buying them more than it did for Americans. The paper suggests that this could be because Italians see more media describing the negative aspects of GMOs. Increases in age lead to decreases in willingness to buy. On the whole, those with less and more education than a high school education were shown to be more likely to buy GMOs. More specifically for Italians those who had less than a high school education were more likely to buy GMOs while for Americans those with a college education were more likely to buy GMOs. US men are more likely to buy GMOs and increases in household size for US families had a positive correlation with buying GMOs.

Past consumption of and experiences with perceived risky substances affects current consumption. The risk perception of those substances is affected as well. Adda (2007) analyzed how this occurred in France with regards to the mad cow disease. Further beef consumption had a lower perceived marginal risk for those at higher and lower exposure levels. Households with higher and lower consumption also reduced their consumption of beef less than households with moderate consumption.

2.2. Risk and Cognitive Bias

Cognitive bias is important to risk communication. Consumers are not purely rational and unbiased. A basic risk assessment of products that does not include cognitive bias is therefore incomplete as it misses key aspects of risk. This importance can be seen in how risk bias has been shown to have important implications in regards to insurance (Viscusi, 1995). Cognitive bias is something that always needs to be looked at. A lot of research has shown people having consistent shortcomings when making individual decisions (Machina, 1982; Kahneman & Tversky, 1979). This includes incorporating bias when making risky decisions.

SLichtenstein, Slovic, Fischhoff, Layman, & Combs (1978) found that the lethality of high probability events are underestimated while the lethality of low probability events are overestimated. Slovic, Fischhoff, & Lichtenstein (2005/1980) found that media bias, limited cognitive ability, anxieties from the gambles of life, and spurious experience causes people to misjudge risks, have unwarranted confidence in judgments, and deny uncertainty. Evidence will not necessarily end disagreements in risk both as definitive evidence is hard to obtain and weaker evidence will likely reinforce pre-existing beliefs. As such people are both biased in their evaluations of risk and it is difficult to get them to change those evaluations.

2.3. Resistance to GMOs

In Siegrist (2008) there are two important factors affecting the acceptance of innovative food technologies. Those are perceived trust and naturalness. Siegrist (2000) found that trust has a positive impact on acceptance of gene technology. The more trust the less resistance. This impact came from increasing the perceived benefits and decreasing the perceived risks of gene technology. As those are key in determining acceptance of gene technology trust indirectly influences acceptance of biotechnology. This gives further support to the idea that perceived benefits matter when it comes to acceptance of biotechnology. Brown and Ping (2003) showed that GMOs with obvious consumer benefits were found to be more acceptable than those without. Perception of risk towards GMOs went down as well when there were perceived consumer benefits. As such it is expected that the clearer the benefits to the consumer are the less resistance there will be towards positive change of their perception and behavior towards GMOs.

2.4. Willingness to Pay

Homburg, Koschate, & Hoyer (2005) found that more satisfied customers are willing to pay more with the potential to influence pricing strategies. Higher WTP means greater satisfaction of the product and purchasing experience. This is not surprising as it is to be expected that people would be willing to pay more for experiences and products they want. But it does suggest that a higher willingness-to-pay means a higher perceived benefit of the product.

As discussed previously under Gaskell et al. (2004) greater benefits means a more positive risk perception of the product. This in turn means less overall resistance to the product. As such WTP is important when assessing the risks of products.

Breidert, Hahsler & Reutterer (2006) described discrete choice analysis as an indirect survey that elicits stated preferences. This in turn can be used to find WTP. Surveys are cheaper and take less time than other methods. Discrete choice analysis is more flexible when dealing with new product and price combinations. The cheapness, less time, and more flexibility was why a survey was used to find WTP (Breidert et a., 2006). Less time means results can be gained faster, cheapness was beneficial because we had limited funding, and creating generic reasons for the health and environmental benefits of GMO and non-GMO soybean oil was easier than having to find specific benefits for GMO soybean oil and non-GMO soybean oil as might have been the case in an experiment. The survey's ease of use made it easier to get stated preferences and in turn willingness-to-pay.

3. METHODOLOGY

The basis for this methodology is the utility maximization theory (Neumann and Morgenstern, 1947) which states that when choosing among risky outcomes individual decision makers will maximize his or her utility by maximizing expected value. Markowitz (1952) further developed mathematic proofs that utility could be maximized through the mean-variance analysis. The methodology of Michael Paul Orth (2004) greatly influenced the writing of this methodology and is therefore quite similar to it being word for word in some cases.

3.1. Theory and Economic Model

The maximum likelihood (ML) method, the simulated maximum likelihood (SML) method, or the full information maximum likelihood (FIML) method is used to estimate the multinomial discrete choice model. Conditional logit, mixed logit, nested logit, heteroskedastic extreme value, and the multinomial probit models are supported by the procedure of the multinomial discrete choice model. In many cases the model is trying to acquire discrete not continuous data. Traditional types of regressions are not applicable to these cases or qualitative response models. Discrete choice models that are an example of this can be seen in making a single choice from an unordered set of alternatives. For our survey deciding which soybean oil to buy if any depends on price, environmental benefits, and health benefits.

This is modeled by describing the probability that given a set of regressors X_{ij} a person, i, chooses choice j as seen in equation 1:

$$P\left(y_i = j \middle| x_{ij}\right) = F(x_{ij}\beta) \tag{1}$$

Usually, F is the cumulative density function as that causes probabilities to be within (0, 1). The vector of parameters is β. Another way to interpret discrete choice models is through random utility models. Assume that when individual i makes choice j the utility function is:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad (2)$$

with $V_{ij} = x_{ij}\beta$ being a non-stochastic linear function and ε_{ij} the error disturbances.

According to McFadden (1973) the conditional logit model occurs if ε_{ij} has a Type I independent extreme value distribution and a cumulative distribution function $\exp(-\exp(\varepsilon_{ij}))$. Choosing j from J alternatives has a probability of

$$P_i(j) = \frac{\exp(V_{ij})}{\sum_{k=1}^{J} \exp(V_{ij})} \quad (3)$$

This model, Luce's choice axiom, was created using "the choice axiom that implies independence from irrelevant alternatives (IIA) (Orth, 2004, 39)." Conditional logit models assume IIA, which is not always reasonable as irrelevant alternatives are not always independent from each other. However for this thesis IIA was assumed to be true.

This study assumes that consumers try to maximize their utility given a budget constraint. Choice experiments were developed from the Lancastrian microeconomic approach, where utility is derived from attributes instead of from products directly. Accordingly, if the price changes a consumer can change from one set of goods to another that has a more preferred set of attributes. Models of consumer demand need to be linked to the Lancastrian theory of value to explain choice experiments' underlying theory (Alpizar, Carlsson, & Martinsson, 2003).

There are two parts to an individual's decision, those being how much of a good to consume, the continuous choice, and which good to consume, the discrete choice (Alpizar et al., 2003). This is called discrete/continuous choice. This can be seen in how consumers need to decide whether to buy a gallon of non-GMO soybean oil, buy a gallon of GMO soybean oil, or opt-out and purchase nothing. In our survey if soybean oil is purchased the amount is a given and therefore the survey only looks at which good to consume or the discrete choice.

The framework for discrete choices with regards to non-market goods often assumes a continuous dimension. The framing of the decision context isolates the discrete choice and makes respondents choose a purely discrete choice (Alpizar et al., 2003)). As "the objective is to obtain the value of a certain predefined program that includes a given continuous decision, a contingent valuation method (CVM) survey assumes the same specific continuous dimension (Orth, 2004, 40)." GMOs are a market good, but for this survey flexibility was needed with regards to the environmental and health benefits of GMOs that would have at been difficult to find in the market and may not have been available at all. As such the contingent valuation method was used through a choice experiment and survey goods were treated as non-market.

For discrete choices, equation 4 is each individual's maximization problem:

$$Max_{c,x} U(c_1(A_1), \dots, c_n(A_n); z)$$

$$s.t.\ i. \sum_{i=1}^{N} p_i c_i\,(A_i) + \ z = y$$

$$ii. c_i c_j = 0, \forall i \neq j$$

$$iii. z \geq 0, c_i(A_i) \geq 0\ for\ at\ least\ one\ i \qquad (4)$$

with income being *y*, the price of each combination being p_i, a composite bundle of ordinary goods being z with a price normalized to one, a quasi-concave utility function being $U(\ldots)$, and $c_i(A_i)$ being "alternative combination *i* (profile *i*) as a function of its generic and alternative specific attributes, the vector A_i" (Orth, 2004, p. 41).

Following from the maximization problem are a number of properties: First, profiles that are defined by all relevant alternatives are $c_i's$. Profile choices are fixed for a given amount such as a day or unit. Based on this, there are N applicable combinations or profiles. N depends on the design type for the combinations, attribute numbers, and the choice experiment attribute levels. As combinations are predetermined, this means that the utility functions are already defined for respondents. For our thesis respondents chose from three choices with each choice having three attributes. Two of the attributes had two levels while one had three levels. In total the full factorial design would have N=128.

Second, the price variable must be related to the alternative profile, taking into account its continuousness. An example of this are the various prices for GMO soybean oil in the survey.

Third, restriction ii defines the number of alternatives. Choice experiments are usually used to obtain a single choice. The necessity of a single choice can be specified by the choice experiment. As perfect substitutes have a corner solution they have a single choice solution regardless of restriction ii.

Fourth, as $c_j(A_j)$ is a fixed quantity and the choice is discrete a given income means that ordinary goods z is fixed. Combined with the restriction that only a single profile, c_j, can be chosen results as in equation 3:

$$z = y - p_j c_j \tag{5}$$

Fifth, it is stated by restriction iii that the respondent must purchase non-negative amounts of the goods being analyzed and ordinary goods. Assuming the analyzed good is a necessity for the respondent then for at least one i c_i>0 with the respondent being forced to make a choice.

The process to solve this maximization problem this was taken directly from Michael Orth's (2004) thesis with only the equations, equation numbers, variables, and citations not being a direct quote:

> There is a two-step process will be followed to solve the maximization problem. First, a discrete choice is assumed, profile j is chosen, i.e. $c_j = c_j^{fixed}, c_j = 0, \forall i \neq j$,

where c_j^{fixed} is the fixed continuous measure of the given profile. Weak complementarity is assumed, i.e. the attributes of the other non-selected profiles do not affect the utility function of profile j (Alpizar et al., 2003). Formally, this is written as:

$$\text{if } c_i = 0, \text{ then } \frac{\partial U}{\partial A_i} = 0, \forall i \neq j \tag{6}$$

Using equations (6) and (7) it is possible to write the conditional utility function given $c_j = c_j^{fixed}$ as:

$$U_j = V_j\big(c_j(A_j), p_j, y, z\big) = V_j\big(A_j, y - p_j c_j\big) \tag{7}$$

For the next step refer to the unconditional indirect utility function:

$$V(A, p, y) = \max\ (V_1(A_1, y - p_1 c_1), \ldots, V_N(A_N, y - p_N c_N)) \tag{8}$$

where the function V[…] captures the discrete choice, given an exogenous and fixed quantitative assumption regarding the continuous choice. Thus, It follows that the individual chooses the profile j if and only if:

$$V_j\big(A_j, y - p_j c_j\big) > V_j(A_i, y - p_i c_i), \forall i \neq j \tag{9}$$

Equations (9) and (10) complete the economic model for purely discrete choices. These two equations are the basis for the econometric model and the estimation of welfare effects that are discussed in the following sections. It is important to note that the econometric model that is used with contingent valuation method studies can be viewed as a special case of the model above, where there are only two profiles. One profile is a before-the-project description of the good and the other is the after-the-project description of the same good. A certain respondent will say yes to the good if: $V_i^1(c_i(A_i^1), y - bid) > V_i^0(c_i(A_i^0), y)$, where A_i^t entirely describes the good, including its continuous dimension.

> In this step, the deterministic model of consumer behavior has been presented and discussed. The next step is to make this deterministic model operational for this study. There are two main issues involved with making the model operational; First, the assumption about the functional form of the utility function; second, to introduce a component into the utility function that will capture unobservable behavior in the marketplace. These issues are linked by principle, since the form of the utility functions determines the relationship between the probability distribution of the disturbances and the probability distribution of the indirect utility function (pp. 43-44).

3.2. Survey and Data

This section was taken from Michael Orth's (2004) thesis and describes different ways to elicit preferences, the only difference is that farmers is replaced with consumers:

> There are many different procedures for eliciting preferences. Ranking is the most common survey practice, where consumers are asked to simply rank a number of alternatives. This ranking method is not consistent with economic analysis and will not be considered for this project. The next procedure for analyzing consumers' preferences could be the continuous choice method, where the consumers are allowed to choose any level or combination they would prefer at that time. This method will not be feasible for the current investigation because many of the product attributes must be carefully selected and it will not be possible for all combinations to be logical and consistent (p. 54).

For the experimental design the discrete choice method will be used instead of these alternatives, as through that method it is possible to only have logical and consistent attributes to present consumers with.

This section from Orth (2004) expands further on the experimental design:

> Experimental design, in this case, is the creation of choice sets in an efficient manner. The standard approach in marketing, transportation, and health economics has been to use orthogonal designs, where the variations of the attributes of the alternatives are uncorrelated in all choice sets. A design is developed in two steps: First, obtaining the optimal combinations of attributes and attribute levels to be included in the experiment; second, combining those profiles in choice sets. A starting point is the full factorial design, which is a design that contains all possible combinations of the attribute levels that characterize the different alternatives (pp. 54-55).

For our thesis the full factorial design was then split into four different survey versions. Respondents were then randomly given one of these versions. Each survey had questions on demographics, on personal preferences, a choice experiment, and a experimental vignette. The choice sets were the only thing different between them and each version had thirty-two different choice sets. Respondents were then randomly given one of these versions. Each version had roughly the same number of respondents. Version 1 had 183 respondents, version 2 had 180 respondents, version 3 had 180 respondents, and version 4 had 181 respondents.

3.2.1. Demographics

Respondents were asked nine questions in regard to demographics. These questions were about their education level, their gender, their marital status, their income level, the number of members in their household, whether there were children younger than 18 in their household, whether the lived in a rural or urban area, whether they were the primary purchaser in their household, and who the primary purchaser in their household was. They were meant to measure a wide range of statistics so that significant demographic variables were not missed. Most of these questions have been included in previous literature (Al Khayri & Hassan, 2012; Harrison et al., 2004; Loureiro & Hine, 2002).

The two primary purchaser questions are similar but they were included for different reasons. Whether a respondent was the primary purchaser or not would reveal their perspective of decisions about food and could have an impact on their willingness to purchase GMOs. If their not the primary purchaser, and therefore may not have to bear responsibility for any food risks, they could be more willing to take risks than if they were the primary purchaser. Respondents were asked whom the primary purchaser in their family was specifically to reveal whether the wife was the primary purchaser or not. Studies have shown that women tend to be more skeptical of GMOs than men (Gaskell et al., 2004; Moerbeek & Casimir, 2005) and as such it could be that if the wife is the primary purchaser in a household the household in general is less accepting of GMOs. Respondents were asked whether they lived in a rural or urban area, as those in rural areas could be more familiar with GMOs being closer to the farming of GMO food.

3.2.2. Personal Preference Scales

Respondents were asked to fill out a series of seven scales each of which included multiple statements. They ranked the statements on a scale of 1 to 7. For the Risk and Benefit Perception Scale respondents were asked to answer, "I think it is risky to consume GMO soybean oil" and "I think it is beneficial to consume GMO soybean oil." This scale was included because of the risk that comes with some food (Nganje, Siaplay, Kaitibie, & Acquah, 2006) and because of the positivity consumers have shown toward differently grown and labeled food (Nganje, Hughner, & Lee, 2011). For the Subjective Knowledge and Attitude Toward GMO Scale respondents were asked to answer, "compared with an average person I know a lot about GMO," "I know a lot about how to evaluate the quality of GM foods," and "People who know me consider me as an expert in the field of GMO foods." This scale was taken from Pieniak, Verbeke, and Scholderer (2010) and was included to measure self-reported knowledge of GMOs.

For the Passive Resistance Scale respondents were asked to answer "I generally consider changes to be a negative thing," "I like to do the same old things rather than try new and different ones," "I would rather be bored than surprised," "If I were to be informed that there's to be a significant change regarding the way things are done at work, I would probably feel stressed," "when I am informed of a change of plans, I tense up a bit," "when things don't go according to plans, it stresses me out," "often, I feel a bit uncomfortable even about changes that may potentially improve my life," "when someone pressures me to change something, I tend to resist even if I think the change may ultimately benefit me," "I sometimes find myself avoiding changes that I know will be good for me," "I often change my mind," "I don't change my mind easily," "my views are very consistent over time," "overall, my personal need for innovations in the field of technological products as being too low," "overall, I consider the number of innovations in the field of technological products as being too low," "overall, I consider the pace of innovations in the field of technological products as being too low," "in the past, I was very satisfied with available technological products," "in my opinions, past technological products were completely satisfactory, so far," and "past technological products fully met my requirements." This scale was taken from Heidenreich and Handrich (2015) and was included to measure resistance against innovation.

For the Personal Risk Preferences scale respondents were asked "I like to try new things, knowing well that some of them will disappoint me," "although a new thing has a high promise of reward I do not want to be the first one who tries it. I would rather wait until it has been tested and proven before I try it," "when I have to make a decision for which the consequence is not clear, I like to go with the safer option although it may yield limited rewards," "I like to try new things, knowing well that some of them will disappoint me," "to earn greater rewards, I am willing to take higher risks," "I prefer a tested-and-tried approach over a new approach, although the new approach has some possibility of being a better one in the end," "I like to implement a plan only if it is very certain that the plan will work," and "I seek new experiences even if their outcomes may be risky." This scale was taken from Hung, Tangpong, Li, and Li (2012) and was included to measure risk perception.

For the Decision Style Scale respondents were asked "I prefer to gather all the necessary information before committing to a decision," "I thoroughly evaluate decision alternatives before making a final choice," "in decision-making, I take time to contemplate the pros/cons or risks/benefits of a situation," "investigating the facts in an important part of my decision making process," "I weigh a number of different factors when making decisions," "when making decisions, I rely mainly on my gut feelings," "my initial hunch about decisions is generally what I follow," "I make decisions based on intuition," "I rely on my first impressions when making decisions," and "I weigh feelings more than analysis in making decisions." This scale was taken from Hamilton, Shih, & Mohammed (2016) and was included as how respondents make decisions could affect their bias towards GMO soybean oil.

For the Health Consciousness Scale respondents were asked "I reflect about my health a lot," "I am very self-conscious about my health," "I am generally attentive to my inner feelings about my health," and "I am constantly examining my health." This scale was taken from Mai and Hoffman (2012) and was included as how health conscious someone is could affect their risk preferences towards GMO soybean oil.

For the Food Technology Neophobia Scale respondents were asked "There are plenty of tasty foods around so we don't need new to use new food technologies to produce more," "The benefits of new food technologies are often grossly overstated," "new food technologies decrease the natural quality of food," "there is no sense trying out high-tech food products because the ones I eat are already good enough," "new foods are not healthier than traditional foods," "new food technologies are something I am uncertain about," "society should not depend heavily on technologies to solve its food problems," "new food technologies may have long tern negative environmental effects," "new products produced using new food technologies can help people have a balanced diet," "new food technologies give people more control over their food choices," and "the media usually provides a balances and unbiased view of new food technologies." This scale was taken from Cox and Evans (2008) and was included as resistance to new food technologies could affect resistance towards GMO soybean oil.

In the section of personal preference scales respondents were also asked a question about how often they consume soybean oil. This was included as Adda (2007) found that previous consumption of a product affects current consumption. How much soybean oil, non-GMO or GMO, a respondent has consumed could affect how much they consume in the present time.

3.2.3. Choice Experiment

In the middle of the survey is the choice experiment. Before the choice experiment there are a few statements in regards to GMOs and soybeans. Respondents were first told that 94% of soybean acreage in the United States is GMO as taken from the United States Department of Agriculture (2018). Then it is explained that when extracting soybean oil from soybeans, hexane extraction is more common for GMO soybeans while manual extraction is more common for non-GMO soybeans. It is explained that elevated levels of hexane residue might pose health concerns but hexane extraction is cheaper than manual extraction. Health benefits of soybean oil were said to include preservation of healthy heart and brain function and the normal growth and development of the body. Environmental benefits of soybean oil were said to include more efficient use of water and pesticides leading to improved environmental quality. All of this is to provide basic information about GMO soybean oil to the respondents. This is to ensure that all respondents have at least basic information about the situation before making their decisions.

All of this is followed by the choice experiment itself. The choices are between regular extraction, manual extraction, and no purchase. Regular extraction and manual extraction are representative of GMO and non-GMO soybean oil respectively based on the information given to those surveyed. The attributes of these choices are the price, environmental benefits, and health benefits of the given soybeans. Consumers could buy either a gallon of soybean oil or nothing. All of this is meant to measure the extent of the benefits required for people to choose GMO soybean oil. It also measures how different kinds of benefits affect people's decision making. Only a few choices and attributes were included in order to keep the survey simple.

The choice experiment used three prices for each type of soybean oil. $3.50, $4.50, and $5.50 for GMO soybean oil and $15.00, $25.50, and $36.00 for non-GMO soybean oil. $15.00 and $36.00 were around the same price as actual non-GMO soybean oil products (Jedwards International, 2018; Mountain Rose Herbs, 2018). $3.50 and $5.50 were around the same price as actual GMO soybean oil products after conversion (Healthy Brand, 2018; Supreme Oil, 2018). The GMO soybean oil products were larger than one gallon and their prices had to be converted into what they would have been for one gallon. A mistake was made with the $3.50 price however. The product it was based on was 35 lb. of soybean oil. The price had to be converted into what it would be for one gallon. Because of a mistake it was found to be around $3.50 when it was actually around $6.00. However, prices of GMO soybean oil can range from around $4.00 to $6.00 (Healthy Brand, 2019; Healthy Brand, 2018) for a gallon. So $3.50 to $5.50 for a gallon covers the range of soybean prices. Considering the dominance of GMO soybeans in the market, GMO soybean oil was considered to be any soybean oil that did not specifically say it was non-GMO.

Many surveys have used environmental and health benefits as attributes (Hu, Hunnemeyer, Veeman, Adamowicz, &Srivastava, 2004; Fortin & Renton, 2003; Kayabasi & Mucan, 2011). Health benefits have been shown to cause respondents to have higher levels of approval for GM foods (Wachenheim & Lesch, 2004). Environmental benefits have been shown to be a significant factor in WTP for rice, and sometimes a positive significant factor for WTP of GMO rice (Delwaide et al., 2015). Harrison, Boccaletti, & House (2004) found health and environmental risks to be dominant factors in determining GMO support. As such health and environmental benefits were included as attributes.

Price was used as an attribute as consumers have been shown to be willing to pay significantly more for non-GMO products (Loureiro & Hine, 2002). Many surveys have used environmental and health benefits as attributes (Fortin & Renton, 2003; Hu, et al. 2004; Kayabasi & Mucan 2011). Health benefits have been shown to cause respondents to have higher levels of approval for GM foods (Wachenheim & Lesch, 2004). Environmental benefits have been shown to be a significant factor in WTP for rice, and sometimes a positive significant factor for WTP of GMO rice (Delwaide et al., 2015). Harrison et al. (2004) found health and environmental risks to be dominant factors in determining GMO support.

3.2.4. Experimental Vignette

Those surveyed also filled out an experimental vignette. The experiment puts you in the position of a consumer at a grocery store where they have to choose between soybean oil made through manual or hexane (regular) extraction. The consumer has $204.30 (Department of Agriculture, 2018) to spend on food for their household. It is once again stated that non-GMOs are manually extracted while GMOs are hexane extracted and that there are possible concerns over hexane extraction. They have to buy oil and other foods for the next two weeks. Buying regular soybean oil will allow them to buy the food they want, buy environmentally friendly food, and be able to make healthy meals. Buying manually extracted soybean oil will make it so they are not able to buy environmentally friendly food and only sometimes make healthy meals. The choices only describe the food situation for the first week, leaving the second week uncertain. Regular soybean oil allowing for healthy meals and environmentally friendly food offset the concerns over the health and environmental risks of GMOs. The experimental vignette is highly restrictive having no opt-out and only one scenario. It is largely there to so how ineffective an experimental vignette is compared to a choice experiment that has an opt-out and many choice sets.

3.3. Empirical Models

To expand further upon deterministic models along with stated and revealed preferences this section, apart from the equations, was taken from Orth's (2004) with the only exception to this being the equations, equation numbers, variables, and citations, which are slightly different:

> Stated and reveal preference structures might appear inconsistent with a deterministic model. It is generally assumed that these inconsistencies are the result of observational deficiencies arising from unobservable components, such as characteristics of the

individual or non-included attributes of the alternatives in the experiment, measurement error, and/or heterogeneity of preferences (Alpizar et al., 2003). The Random Utility approach (Alpizar et al., 2003) is used to link the deterministic model with a statistical model of human behavior in order to allow for these effects. A random disturbance with a specified probability distribution, ε, is introduced into the model, and an individual will choose profile *j* if and only if:

$$V_j\left(A_j, y - p_j c_j \varepsilon_j\right) > V_i(A_i, y - p_i c_i \varepsilon_i); \forall i \neq j \tag{10}$$

In terms of probability, the function is written:

$$P(choose\ j) = P(V_j\left(A_j, y - p_j c_j \varepsilon_j\right) > V_i(A_i, y - p_i c_i \varepsilon_i); \forall i \neq j) \tag{11}$$

The exact specification of the econometric model depends on how the random elements, ε, enter the conditional indirect utility function and the distributional assumption. Simplify the problem by dividing into the specification of the utility function and the specification of the probability distribution in the error term (pp. 44-45).

Researchers often assume that the error term is additive in utility functions. It is restrictive but it simplifies welfare measure estimations and result computations (Alpizar et al., 2003).

This next section builds upon the previous quote and is taken from Orth's (2004) thesis with the exception of the equations, equation numbers, variables, and citations which are slightly different:

The probability of choosing alternative *j* under an additive formulation can be written as:

$$P(choose\ j) = P(V_j\left(A_j, y - p_j c_j\right) + \varepsilon_j > V_i(A_i, y - p_i c_i) + \varepsilon_i; \forall i \neq j) \tag{12}$$

The model needs to specify the functional form for V(…) and select the relevant attributes (A_i) that determine the utility derived from each alternative in order to specify a utility function. These attributes should then be included in the choice experiment.

There is a trade-off between the benefits of assuming a less restrictive formulation and the complications that arise from doing so when choosing a functional form. A simple functional form (e.g. linear income) makes estimation of the parameters and calculation of welfare effects easier, but the estimates are based on more restrictive assumptions (Alpizar et al., 2003) (pp. 45-46).

Several models are often used to analyze stated preference data. Traditional regression techniques are not relevant when choosing from an unordered set of alternatives for qualitative response models. Discrete choice data can be looked at by discrete logit, heteroskedastic extreme value, and conditional logit. However, the independence of irrelevant alternative assumption puts limitations on them. However, as IIA is being assumed for this thesis these limitations are not relevant. There are models that do not assume IIA such as the multinomial probit model. The multinomial probit model assumes a multivariate normal distribution for the vector of errors and permits correlated utilities. But the model is difficult and largely uses simulations for estimations. Along with this it is limited by assuming a multivariate normal distribution for the vector of errors. As such, given the assumption of independence of irrelevant alternatives, the multinomial logit model will be used for this thesis. The multinomial logit model does not account for heterogeneity, as the mixed logit model or nested multinomial logit model do, but those models are beyond the scope of this thesis.

This section comes from Orth's (2004) thesis with the exception of the equations, equation numbers, variables, and citations that are slightly different. It expands further upon the multinomial logit model:

> The Multinomial Logit model (MNL) is the most common model used in applied work. The popularity of this model rests in its simplicity of estimation, but the model relies on restrictive assumptions. This section begins by introducing the MNL model and discussing its limitations. The section continues by introducing less restrictive models. Suppose that the choice experiment in this case consists of M choice sets, where each choice set, S_m, consists of K_m alternatives, such that $S_m = (A_{1m}, \dots, A_{Km})$, where A_i is a vector of attributes. It is now possible to write the choice probability for alternative j from choice set S_m as:
>
> $$P(j|S_m) = P\big(V_j(A_{jm}, y - p_j c_j) + \varepsilon_j > V_i(A_{im}, y - p_i c_i) + \varepsilon_i; \forall i \in S_m\big) = P(V_j(\dots) + \varepsilon_j - V_i(\dots) > \varepsilon_j; \forall i \in S_m \qquad (13)$$
>
> This choice probability can then be expressed in terms of the joint cumulative density function of the error term as:
>
> $$P(j|S_m) = CDF_{\varepsilon|S_m}\big(V_j + \varepsilon_j - V_1, V_j + \varepsilon_j - V_2, \dots, V_j + \varepsilon_j - V_n\big). \qquad (14)$$
>
> The MNL model assumes that the random components are independently and identically distributed with an extreme value type I distribution (Gumbel). This distribution is characterized by a scale parameter δ.[1] The scale parameter is related to the variance of the distribution such that $var_\varepsilon = \pi^2/6\mu^2$. When it is assumed that the random components are extreme value distributed, the choice probability in (14) can be written as:

[1] In practice, the standard Gumbel distribution is chosen with $\mu = 1$ and $\delta = 0$.

$$P(j|S_m, \beta) = \frac{\exp(\mu V_j)}{\sum_{i \in S_m} \exp(\mu V_i)} \quad (15)$$

The size of the scale parameter is irrelevant when it comes to the choice probability of a certain alternative (Alpizar et al., 2003), but by looking at equation (15) it is clear that the true parameters are confounded with the scale parameter. It is not possible to identify this parameter from the data. For example, if the scale is doubled, the estimated parameters in the linear specification will adjust to double their previous values.[2] The presence of a scale parameter raises several issues for the analysis. First, consider the variance of the error term: $var_\varepsilon = \pi^2/6\mu^2$. An increase in the scale reduces the variance; therefore high fit models have larger scales. The extreme case is $\mu \rightarrow \infty$ where the model becomes completely deterministic (Alpizar et al., 2003). Second, the impact of the scale parameter on the estimated coefficients imposes restrictions on their interpretation. All parameters within an estimated model have the same scale and therefore it is valid to compare their signs and relative sizes. Conversely, it is not possible to compare estimated parameters from different models as the scale parameter and the true parameters are confounded. (pp. 46-48, Footnotes 1 & 2).

The multinomial logit model has two problems. It assumes alternatives are independent and it does not take into account heterogeneity. If alternatives are not independent the MNL model should not be used. There are other models that could be used instead of the MNL model. In the nested MNL model the assumption of homoscedasticity is relaxed. For the nested MNL model alternatives are put in subgroups with different subgroups being allowed to have different

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[2] $\beta^{estimated} = \mu\beta^{true}$, and $\beta^{estimated}$ in a linear specification will adjust to changes in μ. The issue of the scale parameter is not specific to multinomial models and Gumbel distributions. The scale parameter of the normal distribution for the case of probit models is $1/\sigma$. All discussion regarding the scale parameter of the Gumbel distribution also applies to nested MNL and probit models as well.

variances. Assuming that error terms are independently, but non-identically, distributed, type I extreme value, with scale parameter μ_i is an alternative specification (Alpizar et al., 2003). Relaxing the IIA restriction would allow for different cross elasticities among all pairs of alternatives. The heterogeneity of nested alternatives' covariance could be modeled (Alpizar et al., 2003). Other models, such as the mixed logit model, could deal with problems of heterogeneity as well. However, models beyond the multinomial logit model are beyond the scope of this thesis.

4. RESULTS

After the survey was completed it was sent to Qualtrics where they distributed it to a random sample of the United States in 2019. They got this sample from people who were registered with them to take surveys. There were four different surveys and respondents took one of the surveys, to provide a full experimental design. The experimental vignette, demographic questions, and personal preferences questions were the same; the only difference was that the choice experiment questions had different choice sets depending on which survey was taken. Respondents had to be a resident of the United States, at least 18 years old, and an English speaker. As required by the Institutional Review Board informed consent was mandatory for respondents to participate in the survey. There were 724 respondents who answered 23,168 choice sets. As such n=23,168.

4.1. Results of Demographics

The following table provides information on the data

Table 1

Percentages of Demographics

1. Size of household	
1	15.33%
2-4	69.89%
4+	14.78%
Average	3.10
2. Primary purchaser of food in household	
Husband	20.30%
Wife	49.59%
Other	30.11%
3. Education level	
Less than a high school degree	5.80%
High school/Two year degree	61.88%
Bachelor's degree and higher	32.32%
Median	Two year degree
4. Gender	
Male	33.15%
Female	66.02%
Other/Prefer not to answer	0.83%
5. Marital Status	
Single	47.93%
Married	44.20%
Other/Prefer not to answer	7.87%
6. Household income	
Less than $50,000	57.32%
$50,000-$100,000	29.28%
More than $100,000	13.40%
Median	$25,000-$50,000
7. Children younger than 18 in household	
Yes	43.23%
No	56.77%
9. Primary shopper for food	
Yes	87.43%
No	12.57%
10. Community of residence	
Rural	41.57%
Urban	58.43%
11. Consumption of regular soybean oil	
Less than once a week	63.40%
1-7 times a week	29.42%
7+ times a week	7.18%

According to the US Census (2018) the median household income between 2013-2017 in 2017 dollars was $57,652. During that same period of time 87.3% of people 25 years and older had at least a high school degree and 30.9% had a bachelor's degree or higher. As such 56.4% of people 25 years and older had at least a high school degree but not a bachelor's degree. The latest update has 50.8% of Americans female.

Respondents were asked about the size of their household. This is important as buying for larger households means buying more food. On average respondents had a household size around 3. Many of the respondents had between 2 and 4 members in their households with 69.89% of households being within those bounds. It should be noted that some respondents did not respond to this question as a few put down 0 household members, opting out. Those who selected 0 were assumed to have meant 1.

Respondents were asked who the primary purchaser in the household was. This is important as different household members could make different decisions with regards to GMOs and non-GMOs. The primary purchaser was often the wife at 49.59%. Other made up a notable number, up to 30.11%. Presumably most of those who chose other were either single or had members other than the wife, husband, or child be the primary purchaser. Examples of this could be roommates, uncles, or grandparents.

Respondents were asked what their gender was. This question was included as gender could influence purchasing decisions. The majority of respondents, 66.02%, were female. This is a much higher rate of response than would be suggested by United States demographics but still represents the majority of the population.

Respondents were asked whether they were the primary purchaser in the household. This question was included as being the primary purchaser or not would affect their perspective of food purchasing decisions for the household. Of respondents 87.43% were the primary shopper for the family.

Respondents were asked what their education level was. Education level was included to provide different perspectives and different education levels could affect how much they know about GMOs, soybean oil, and hexane residue. Almost all respondents had at least a high school degree with this being the case for 94.20% of respondents. This is higher than what US demographics would suggest, but concurs with the fact that the majority of the US population graduated from high school. To narrow it down further the majority of respondents had a high school or two-year degree at 61.88%. This is again higher than expected with respect to US demographics but concurs with the majority of the US population having a high school or two-year degree.

Respondents were asked what their income level was. Income level was included to provide different perspectives and because people with higher income levels could be more willing to buy the more expensive manually extracted soybeans than those with lower income levels. With a median of $25,000-$50,000 respondents made less than would be expected given US demographics. However 29.28%, a significant proportion, of respondents made between $50,000-$100,000 and 13.40% made more than $100,000 suggesting that a wide range of income levels were still represented.

Respondents were asked whether they had children younger that 18 in their household. People in households that had younger kids in them would be less willing to take risks and may react differently to GMOs. Of respondents, 43.23% had children younger than 18 in the household.

Respondents were asked whether they were married. Marriage is significant life milestones that can change perspective on things and those who are married have at least one more household member to worry about. Of respondents 44.20% were married.

Respondents were asked whether they lived in an urban or rural community. This is important, as those in more rural areas are likely to know more about the agricultural products used for soybean oil than those in more urban areas. Of respondents, 41.57% live in urban areas.

Respondents were asked how often they consumed regular soybean oil. Their rate of consumption could well have an impact on how risky they are willing to be with regard to future consumption and trust of control mechanisms (locus of control). Those who had consistently consumed regular soybean oil would be more used to it and may be more willing to purchase it. Respondents consumed soybean oil less than once a week 63.40% of the time. It is important to note that though respondents said they did not consume regular soybean oil they may have consumed it unknowingly. An example of this would be regularly consuming vegetable oil without realizing that it is often largely made up of soybean oil that is likely to have been regularly extracted, with hexane.

4.2. Results of Survey Vignette

Respondents were asked to respond to an experimental vignette to reveal whether they would buy regular or manual extracted soybean oil given the conditions described previously. Of respondents 62.02% were willing to buy regularly extracted soybean oil under the conditions of the experimental vignette. This suggests several reasons; substantial benefits do exist with GMOs, risks are minimal to nonexistent, and high trust in control measures. With that said 37.98% of respondents were not willing to consume GMO oil suggesting that there is a substantial market for non-GMO soybean oil. With that said adding a third option to opt out would likely have changed these results as will be shown by the results of the choice experiment.

4.3. Results of Choice Experiment

Respondents were asked to choose between regular soybean oil, manually extracted soybean oil, and no purchase given various conditions as described above. Recall that the attributes and attribute-levels differed from question to question to capture full information from our experimental design. This is important to present a real market scenario to respondents. Respondents chose regularly extracted soybean oil 50.17% of the time. These results differ somewhat from the experimental vignette, as less people were willing in each version to buy regular soybean oil. Much of this can be explained from the addition of a third choice, no purchase, as that was selected 28.13% of the time. It appears many were forced to buy soybean oil in the experimental vignette as the addition of a third option led to substantial decreases in purchases of both manually extracted soybean oil and regular soybean oil. Some respondents may not consume soybean oil at all.

This was particularly true of those who selected manually extracted soybean oil in the experimental vignette. The percentage of respondents choosing manual soybean oil declined from 37.98% in the vignette to 21.70% in the choice experiment. In each version the decline was more substantial than the corresponding decline for those who chose regular soybean oil. This suggests that the market for manual soybean oil may be much smaller than suggested by the vignette. The results from the survey and choice experiment provide strong inference for objective one.

4.3.1. Significance of Results of Multinomial Logistic Regression

Tables 2 through 8 represent preliminary models. These models are there to ensure that only relevant variables are in the final analysis and to provide early analysis of the different scales for significance before the analysis of the aggregate model. The variables are divided into three different groups. These groups are demographics, choice experiment attributes, and personal preference questions. The personal preference scales are tested validated scales of related variables that were measured together to ensure that coefficients were consistent with prior research findings. The models were estimated through *NLOGIT Version 5*. William Greene and David Hensher wrote most of the software package at Econometric Software, Inc.

For this model choice based sampling was corrected for. The estimated asymptotic covariance matrix is often adjusted to deal with model misspecification. This causes the MLE to be consistent. However, the estimated asymptotic covariance matrix is computed incorrectly. The "sandwich estimator" is often used as an adjustment for this. It is NLOGIT's choice-based sampling estimator that has weights equal to one. The procedures matrix is:

$$\text{Est.Asy. Var}\left[\hat{\beta}\right] = \left[\sum_{i=1}^{n}\left(\frac{\partial^2 \log F_i}{\partial \hat{\beta}\,\partial \hat{\beta}'}\right)\right]^{-1}\left[\sum_{i=1}^{n}\left(\frac{\partial \log F_i}{\partial \hat{\beta}}\right)\left(\frac{\partial \log F_i}{\partial \hat{\beta}'}\right)'\right]\left[\sum_{i=1}^{n}\left(\frac{\partial \log F_i}{\partial \hat{\beta}\,\partial \hat{\beta}'}\right)\right]^{-1} \qquad (16)$$

Table 2 represents these multinomial logit results for choice experiment attributes:

$$Y = a_{ENVIR}Environment + b_{HEALT}Health + c_{PRICE}Price + \varepsilon$$

HEALT represent health benefits (1) or no health benefits (0), ENVIR represent environmental benefits (1) or no environmental benefits (0), PRICE is the price per gallon of soybean oil. These are the choice experiment attributes that respondents were surveyed about. CHOIC 1 implies GMO soybean oil, CHOIC 2 implies non-GMO soybean oil, and CHOIC 0 implies opting out. The R-squared being high enough at .4061724 and the significance level being low at .00000 suggest that the multinomial analysis was a valid analysis for this model.

Table 2

Analysis of Choice Experiment Attributes

Chi squared= 19467.46876		Significance Level= .00000	Degrees of Freedom= 4		McFadden Pseudo R-squared= .4061724
Variable	GMO Coefficient	GMO Marginal Effects	Non-GMO Coefficient	Non-GMO Marginal Effects	Opt-Out Marginal Effects
ENVIR	3.01817***	.53000***	.89576***	-.52688***	-.00312***
HEALT	4.84415***	.54309***	2.67505***	-.53718***	-.00591***
PRICE	.35387***	-.05575***	.57931***	.05646***	-.00071***

Note: ***, **, * ➔ Significance at 1%, 5%, 10% level.

All three of the variables are significant at the 1% level for GMO soybean oil and non-GMO soybean oil. The three variables have a positive coefficient for both soybean oil types. As such all three variables will be included in the aggregate analysis.

Health benefits have been shown to cause respondents to have higher levels of approval for GM foods (Wachenheim & Lesch, 2004). Environmental benefits have been shown to be a significant factor in WTP for rice, and sometimes a positive significant factor for WTP of GMO rice (Delwaide et al., 2015). Harrison et al. (2004) found health and environmental risks to be dominant factors in determining GMO support. As such the effects of health and environmental benefits are corroborated by the literature. As seen in the marginal effects increases in health benefits and environmental benefits cause consumers to be more likely to buy GMO soybean oil instead of non-GMO soybean oil. Given that environmental and health benefits are significant factors it makes sense that many consumers who would normally buy non-soybean oil would be much more willing to buy GMO soybean oil if it had health benefits. This applies to consumers and environmental benefits as well.

Non-GMO soybean oil is much more expensive than regular soybean oil. In our choice experiment the average price for soybean oil was $4.50 per gallon while the average price for non-GMO soybean oil was $25.50 per gallon. That consumers were willing to buy manual soybean oil at those high prices is not surprising, as consumers have been shown to be willing to pay significantly more for non-GMO products (Loureiro & Hine, 2002). That increases in price made consumers more willing to purchase non-GMOs, as seen in the marginal benefits, is therefore as expected. A 1% increase in price will increase the choice of non-GMO by 5.646% and decrease the choice of GMO by 5.575%

Table 3 represents these multinomial logit results for demographics:

$$Y = a_{HOME} NumberofHouseholdMembers + b_{PPFH} WhoPrimaryPurchaser + c_{EDUC} Education + d_{GEND} Gender + e_{MAST} MaritalStatus + f_{HOIN} HouseholdIncome + g_{CHYOU} HouseholdChildrenYounger18 + h_{PRPU} AreyouPrimaryPurchaser + i_{RESID} TypeofCommunity + \varepsilon$$

These are the demographic questions that respondents were surveyed about. HOME is the number of household members. Some respondents reported extremely high numbers going as high as 80. As such the data was adjusted so that household sizes greater than 10 were changed to 3, around the average household size PPFH is the primary purchaser for the household specifically whether it was the wife (1) or someone else (0). EDUC is the education level. GEND is gender specifically whether female (1) or other (0). MAST is marital status (1 being married, 0 being other). HOIN is household income. CHYOU is children younger than 18 living in the household (1 being yes, 0 being no). PRPU is primary purchaser for the household (1 being yes, 0 being no). RESID is residence, rural (1) or urban (0). The R-squared is low at .0139330 but the significance level is .00000 suggesting that the multinomial analysis was a valid analysis for this model.

Table 3

Analysis of Demographic Variables

Chi squared= 667.79600		Significance Level= .00000	Degrees of Freedom= 16		McFadden Pseudo R-squared= .0139330
Variable	GMO Coefficient	GMO Marginal Effects	Non-GMO Coefficient	Non-GMO Marginal Effects	Opt-Out Marginal Effects
HOME	.11337***	.03752***	-.08438***	-.02670***	-.01082***
PPFH	-.11635***	-.01866**	-.09586**	-.00367	.02233***
EDUC	.17088***	.03050***	.11232***	.00055	-.03105***
GEND	-.28663***	-.02630***	-.41703***	-.03986***	.06616***
MAST	-.14764***	-.03132***	-.05142	.00730	.02402***
HOIN	-.02172*	-.01135***	.05440***	.01163***	-.00028
CHYOU	-.10804***	.03303***	-.55195***	-.08227***	.4924***
PRPU	-.63473***	-.12515***	-.30827***	.01653*	.10862***
RESID	.16862***	.01634**	.23733***	.2209***	-.03843***

Note: ***, **, * ➔ Significance at 1%, 5%, 10% level.

Size of household, education level, gender, household income, children younger than 18, are you the primary purchaser, and residence were significant for both regular and manual soybean oil at the 1% level. Marital status was significant at the 1% level only for regular soybean oil. Household income was significant at the 1% level for manual soybean oil but at the 10% level for regular soybean oil. Primary purchaser for household was significant at the 1% level for regular soybean oil but at the 5% level for manual soybean oil. Size of household, education level, and residence were positive for regular soybean oil. Primary purchaser for household, gender, marital status, household income, children younger than 18, and are you the primary purchaser were negative for regular soybean oil. Size of household, primary purchaser for household, gender, marital status, children younger than 18, and are you the primary purchaser were negative for manual soybean oil. Education level, household income, and residence were positive for manual soybean oil. As all the factors are significant for at least one choice they will all be included in the final model.

Household size has been found to be both significant and positive for GMO products in the United States (Harrison et al., 2004). Harrison was looking at urban population but it nonetheless supports our findings. The marginal effects show that a 1% increase in household size will increase the choice of GMO soybean oil by 3.752% and decrease the choice of non-GMO soybean oil by 2.670%. This comes at the expense of manual soybean oil. This could be because larger households spend more of their income on food and are therefore more likely to select the cheaper products.

Education level has not always been found to be significant (Gaskell et al., 2004). It is also unclear how education affects preferences for GMOs (Harrison et al., 2004). Harrison did find that in the United States higher levels of education were both significant and positive for GMO preference and therefore our findings that education was significant and positive for regular soybean oil does have some corroboration. A 1% increase in education level will increase the choice of GMO soybean oil by 3.050%. Meanwhile the marginal effect is insignificant for manual soybean oil. This could be because more education leads to greater knowledge of GMOs and the fact that they have not been proven to be a risky food technology.

Women have been shown to be less accepting of GMOs, corroborating our findings, but the effect has not always been shown to be significant (Harrison et al., 2004; Al-Khayri & Hassan, 2012; and Gaskell et al., 2004). Nonetheless there is literature that has found gender to be significant so gender being significant in our survey is unsurprising. What the marginal effects show that is interesting is that women were less likely to buy both regular and manual soybean oil. This could be because women wanted to avoid any risk at all as soybean oil is unhealthy.

People who are married have been found to be less accepting of GMOs and for the effect to be significant (Al-Khayri & Hassan, 2012; Linnhoff, Volovich, Martin, & Smith, 2017). Linnhoff was specifically studying millennials and Al-Khayri was studying Saudi Arabia but nonetheless they suggest that our findings have support in the literature. The marginal effects show that being married makes respondents more likely choose the opt out option. These findings could be similar to women with married people wanting to avoid any risk at all if soybean oil is unhealthy.

Household income has been shown to be both significant and have a negative impact on willingness to pay for GMOs (Loureiro & Hine, 2002). This corroborates what was found in this paper. A 1% increase in household income will decrease the choice of GMO soybean oil by 1.135% and increase the choice of non-GMO soybean oil by 1.163%. This is likely because having more income gives consumers more options in what they can buy.

Having children younger than 18 in the household has been shown to be a negative factor in willingness to pay for GMOs but has been found to be often, though not always, insignificant (Loureiro & Hine, 2002; Harrison et al., 2004). Harrison did find it be significant at the 10% level for the United States so our findings are not without some corroboration. The marginal effects are interesting as they show that having children younger than 18 make it more not less likely to choose regular soybeans. Opting out was also more likely to be chosen. This comes at the expense of manual soybeans. Some respondents could be avoiding soybean oil because they want to feed their kids healthy foods. Other respondents might want soybean oil but need it cheap as they are buying for a sizeable household, as would be the case if they had kids. Regular soybean oil in that case would be preferable to manual soybean oil.

Rzymski & Krolczyk (2016) found that rural residents were more opposed to GM foods than urban residents. This is interesting because our findings found that rural consumers were significantly more in favor of GMOs than urban consumers. This could be explained from the fact that they were doing a survey in Poland. Our findings are supported by Napier, Tucker, Henry, and Whaley (2004), which found that respondents that had family members who were farming were more supportive of GMOs than non-farmers with the difference being significant. The marginal effects show that those in rural areas were more likely to purchase GMOs and non-GMOs. This could be because rural respondents were more familiar with soybeans and soybean oil in general and were therefore more willing to consume regular and manual soybean oil.

Butler & Vossler (2018) found that primary grocery shoppers were more likely to believe that natural food products meant non-GMO with limited processing. Given the importance of naturalness to consumers this suggests that they could prefer non-GMO products. As such our survey showing that primary purchasers were significantly less likely to buy GMOs is reasonable. The marginal effects show that being the primary purchaser meant respondents were less likely to buy GMOs and more likely to opt out. This could be because primary purchasers when faced with the pressure of choosing the food for the household were less likely to pick food they perceived as risky while simultaneously avoiding food that was unhealthy. The fact that women make up a sizable majority of our respondents, tend to be the primary purchaser for the family (Flagg, Sen, Kilgore, & Locher, 2014), and are shown in this survey to be more likely to opt out could be a factor as well.

Respondents were asked whom the primary purchaser in the household was specifically to find out whether the wife was the primary purchaser. This matters because women tend be less accepting of GMOs than men and because women tend to be the primary purchaser for the family (Flagg et al., 2014) so their opinions are disproportionately important on consumer culture. Many of the respondents were women so they are likely talking about themselves if they chose wife. Lastly, even if the respondent is not a wife the food culture could still be influenced if the wife is the primary purchaser, altering how the respondent feels about GMOs. As both coefficients are significant and negative this suggests that the wife being the primary purchaser does have a notable impact. The marginal effects show that wives are less likely to purchase regular soybean oil and more likely to opt out. This coincides with women in general being more likely to opt-out.

Table 4 represents these multinomial logit results for personal preferences:

$$Y = a_x RiskBenefitQuestion1to2 + b_x SubjectiveKnowledgeQuestion1to4 + c_x PassiveResistanceQuestions1to18 + d_x PersonalRiskQuestions1to8 + e_x DecisionStyleQuestions1to10 + f_x HealthConsciousnessQuestion1to4 + g_x FoodTechNeophobiaQuestions1to13 + h_{CRSO} SoybeanOilConsumption + \varepsilon$$

These are the personal preference questions that respondents were surveyed about. a_x and the other coefficients have an x as part of them to symbolize that they are stand-ins for multiple coefficients. Each personal preference question is a separate variable that has a corresponding coefficient. RGMS is “I think it is risky to consume GMO soybean oil.” BGMS is “I think it is beneficial to consume GMO soybean oil.” These questions make up the Risk and Benefit Perception Scale.

K is “compared with an average person I know a lot about GMO.” KN is “I know a lot about how to evaluate the quality of GM foods.” KNO is “people who know me consider me as an expert in the field of GM foods.” These questions make up the Subjective Knowledge and Attitude Towards GMO Scale.

PIRA is “I generally consider changes to be a negative thing.” PIRB is “I like to do the same old things rather than try new and different ones.” PIRC is “I would rather be bored than surprised.” PIRD is “if I were to be informed that there’s to be a significant change regarding the way things are done at work, I would probably feel stressed." PIRE is "when I am informed of a change of plans, I tense up a bit." PIRF is "when things don't go according to plans, its stresses me out." PIRG is "often, I feel a bit uncomfortable even about changes that may potentially improve my life." PIRH is "when someone pressures me to change something, I tend to resist even if I think the change may ultimately benefit me." PIRI is "I sometimes find myself avoiding changes that I know will be good for me." PIRJ is "I often change my mind." PIRK is "I don't change my mind easily." PIRL is "my views are very consistent over time." PIRMR is "overall, my personal need for innovations in the field of technological products as being too low." PIRNR is "overall, I consider the number of innovations in the field of technological products as being too low." PIROR is "overall, I consider the pace of innovations in the field of technological products as being too low." PIRMR, PIRNR, and PIROR are reversed. PIRP is "in the past, I was very satisfied with available technological products." PIRQ is "in my opinions, past technological products were completely satisfactory, so far." PIRS is "past technological products fully met my requirements." These questions make up the Passive Resistance Scale.

RPA is "I like to try new things, knowing well that some of them will disappoint me." RPBR is "although a new thing has a high promise of reward, I do not want to be the first one who tries it. I would rather wait until it has been tested and proven before I try it." This question was reversed. RPCR is "when I have to make a decision for which the consequence is not clear, I like to go with the safer option although it may yield limited rewards." This question was reversed. RPD is "I like to try new things, knowing well that some of them will disappoint me." RPE is "to earn greater rewards I am willing to take higher risks." RPFR is "I prefer a tested-and-tried approach over a new approach, although the new approach has some possibility of being a better one in the end." This question was reversed. RPGR is "I like to implement a plan only if it is very certain that the plan will work." This question was reversed. RPH is "I seek new experiences even if their outcomes may be risky." These questions make up the Personal Risk Preferences scale.

DSSRA is "I prefer to gather all the necessary information before committing to a decision." DSSRB is "I thoroughly evaluate decision alternatives before making a final choice." DSSRC is "in decision-making, I take time to contemplate the pros/cons or risk/benefits of a situation." DSSRD is "investigating the facts in an important part of my decision making process." DSSRE is "I weigh a number of different factors when making decisions." DSSIA is "when making decisions, I rely mainly on my gut feelings." DSSIB is "my initial hunch about decisions is generally what I follow." DSSIC is "I make decisions based on intuition." DSSID is "I rely on my first impressions when making decisions." DSSIE is "I weigh feelings more than analysis in making decisions." These questions make up the Decision Style Scale.

HECOA is "I reflect about my health a lot." HECOB is "I am very self-conscious about my health." HECOC is "I am generally attentive to my inner feelings about my health." HECOD is "I am constantly examining my health." These questions make up the Health Consciousness Scale.

FTNSA is "there are plenty of tasty foods around so we don't need to use new food technologies to produce more." FTNSB is "the benefits of new food technologies are often grossly overstated." FTNSC is "new food technologies decrease the natural quality of food." FTNSD is "there is no sense trying out high-tech food products because the ones I eat are already good enough." FTNSE is "new foods are not healthier than traditional foods." FNTSF is "new food technologies are something I am uncertain about." FTNSG is "society should not depend heavily on technologies to solve its food problems." FTNSH is "new food technologies may have long term negative environmental effects." FTNSI is "it can be risky to switch to new food technologies too quickly." FTNJR is "new food technologies are unlikely to have long term negative health effects." FTNKR is "new food products produced using new food technologies can help people have a balanced diet." FTNLR is "new food technologies give people more control over their food choices." FTNMR is "the media usually provides a balances and unbiased view of new food technologies." These questions make up the Food Tech Neophobia Scale. FTNJR, FTNKR, FTNLR, and FTNMR are reversed.

They were rated on a scale of 1 to 7. The only exception to this is CRSO or "how often do you consume regular soybean oil?" That question was measured on a scale of 1, less than once a week, 2, less than seven times a week, and 3, more than seven times a week. It is important to note that the three perception scales were Risk and Benefit Perception Scale, Personal Risk Preferences, and Health Conscious Scale. The two bias scales were Subjective Knowledge and Attitude Toward GMO Scale and Decision Style Scale. The two resistance scales were Passive Resistance Scale and Food Technology Neophobia Scale. The R-squared is low at .0756964 but the significance level is low at .00000 suggesting that the multinomial analysis was a valid analysis for this model.

Table 4

Analysis of Personal Preference Variables

Chi squared= 3628.05861		Significance Level= .00000	Degrees of Freedom= 116	McFadden Pseudo R-squared= .0756964	
Variable	GMO Coefficient	GMO Marginal Effects	Non-GMO Coefficient	Non-GMO Marginal Effects	Opt-Out Marginal Effects
CRSO	.26201***	.02342***	.38637***	.03499***	-.05842***
RGMS	-.17687***	-.03883***	-.04867***	.01120***	.02763***
BGMS	.07627***	.01714***	.01735	-.00543***	-.01171***
K	.05175***	.00695**	.05491***	.00340	-.01035***
KN	-.07845***	-.02565***	.05601***	.01771***	.00794**
KNO	-.02210	-.01285***	.06768***	.01351***	-.00065
PIRA	-.02181	-.00188	-.03277*	-.00301	.00490*
PIRB	.01509	.00166	.01939	.00155	-.00321
PIRC	-.09039***	-.02355***	.00923	.01132***	.01222***
PIRD	.04159***	.01203***	-.01528	-.00702***	-.00501*
PIRE	.04866***	.01002***	.01954	-.00207	-.00794**
PIRF	-.00038	.00432	-.04070**	-.00664***	.00232
PIRG	.00067	.00338	-.02962	-.00493*	.00155
PIRH	-.01278	-.00327	.00077	.00151	.00176
PIRI	.06678***	.01444***	.02045	-.00389	-.01055***
PIRJ	-.02060	-.00993***	.04420***	.00949***	.00044
PIRK	.07632***	.00970***	.08604***	.00584***	-.01554***
PIRL	.07632***	.01927***	-.00218	-.00864***	-.01063***
PIRMR	.03719***	.00357	.05261***	.00460*	-.00817***
PIRNR	.05939***	.00935**	.05038**	.00183	-.01117***
PIROR	-.05877***	-.00121	-.12397***	-.01397***	.01518***
PIRP	-.11769***	-.02269***	-.06138***	.00269	.02000***
PIRQ	.03267*	.00295	.04788**	.00431	-.00727**
PIRS	.07023***	.01724***	.00258	-.00720**	-.01004***
RPA	.10076***	.02715***	-.01858	-.01398***	-.01316***
RPBR	.07340***	.01237***	.05470***	.00101	-.01339***
RPCR	-.03444**	-.00846**	-.00125	.00353	.00492*
RPD	.02785*	.01582***	-.08174***	-.01644***	.00062
RPE	.03381**	-.00049	.08224***	.00983***	-.00934***
RPFR	-.05970***	-.01905***	.03832**	.01277***	.00628**
RPGR	.03576**	.02328***	-.13238***	-.02561***	.00233
RPH	.05160***	.01421***	-.01235	-.00763***	-.00658**
DSSRA	-.03604**	.00695*	-.14688***	-.02020***	.01325***
DSSRB	-.02998	-.01051**	.02798	.00785**	.00267
DSSRC	.00044	.00614	-.05561**	-.00918***	.00303
DSSRD	-.00052	-.00485	.04345*	.00719**	-.00234
DSSRE	.10180***	.01567***	.08961***	.00366	-.01933***
DSSIA	-.01050	-.01236***	.08972***	.01587***	-.00351
DSSIB	.04250**	.01215***	-.01431	-.00696**	-.00519
DSSIC	-.00640	.00382	-.04992**	-.00750***	.00368
DSSID	.01570	.00665*	-.02519	-.00584**	-.00081
DSSIE	.02865*	.00952***	-.02187	-.00670**	-.00282
HECOA	.03473**	.01154***	-.02647	-.00811***	-.00342

Table 4. *Analysis of Personal Preference Variables* (continued)

Chi squared= 3628.05861		Significance Level= .00000	Degrees of Freedom= 116		McFadden Pseudo R-squared= .0756964
Variable	GMO Coefficient	GMO Marginal Effects	Non-GMO Coefficient	Non-GMO Marginal Effects	Opt-Out Marginal Effects
HECOB	-.04408***	-.01034***	-.00605	.00379	.00655**
HECOC	.00747	-.00654*	.07740***	.01189***	-.00536*
HECOD	-.03818**	-.00135	-.07534***	-.00822***	.00957***
FTNSA	.02984**	-.00101	.07786***	.00954***	-.00854***
FTNSB	-.12584***	-.02738***	-.03690**	.00760***	.01978***
FTNSC	.05159***	.00392	.08244***	.00794***	-.01186***
FTNSD	.02316	.01559***	-.09041***	-.01735***	.00177
FTNSE	-.06893***	-.01622***	-.00896	.00601**	.01021***
FTNSF	-.03035**	-.00424	-.03070*	-.00175	.00598**
FTNSG	.04088***	.00979***	.00374	-.00382	-.00597**
FTNSH	.08888***	.01557***	.06079***	.00033	-.01591***
FTNSI	-.07908***	-.02139***	.01534	.01110***	.01029***
FTNJR	-.05897***	-.00845***	-.05772***	-.00308	.01152***
FTNKR	-.03427**	-.00511	-.03172	-.00149	.00659**
FTNLR	-.09390***	-.01684***	-.06061***	.00024	.01660***
FTNMR	-.07050***	-.00363	-12860***	-.01346***	.01709***

Note: ***, **, * ➔ Significance at 1%, 5%, 10% level.

CRSO, RGMS, K, KN, PIRK, PIROR, PIRP, RPBR, DSSRE, FTNSC, FTNSH, FTNJR, FTNLR, and FTNMR are significant for GMO and non-GMO soybeans at the 1% level. BGMS, PIRC, PIRD, PIRE, PIRI, PIRJ, PIRL, PIRS, RPA, RPH, HECOB, FTNSE, FTNSG, and FTNSI are significant for non-GMO soybean oil at the 1% level. KNO, PIRA, DSSIA, HECOC, and FTNSD are significant for GMO soybean oil at the 1% level. PIRA and DSSRD are significant for non-GMO soybean oil at the 10% level. DSSIE is significant for GMO soybean oil at the 5% level. PIRF, DSSRC, and DSSIC are significant for non-GMO soybean oil at the 5% level. RPCR, DSSIB, HECOA, and FTNKR are significant for GMO soybean oil at the 5% level. PIRNR, RPFR, and FTNSB are significant at the 1% level for GMO soybean oil and at the 5% level for non-GMO soybean oil. PIRMR, RPE, RPGR, DSSRA, HECOD, and FTNSA are significant at the 1% level for non-GMO soybean oil and at the 5% level for GMO soybean oil. PIRQ is significant at the 10% level for GMO soybean oil and at the 5% level for non-GMO soybean oil. FTNSF is significant at the 5% level for GMO soybean oil and at the 10% level for non-GMO soybean oil. RPD is significant at the 10% level for GMO soybean oil and at the 1% level for non-GMO soybean oil. PIRB, PIRG, PIRH, DSSRB, and DSSID are not significant for both GMO and non-GMO soybean oil. All but these five variables will be averaged in future models, creating composite scales. This averaging will be done as described in each scales' corresponding literature.

The question "I think it is risky to consume GMO soybean oil" (RGMS) was negative and significant for both GMO and non-GMO soybean oil. The question "I think it is beneficial to consume GMO soybean oil" (BGMS) was positive and significant for regular soybean oil and insignificant for manual soybean oil. These questions were included because of the perceived risk that comes with some food (Nganje et al., 2006) and because of the predilection consumers have shown toward differently grown and labeled food (Nganje et al., 2011). BGMS being positive for GMOs shows that respondents who thought GMOs were beneficial were more likely to buy them. RGMS being negative for GMOs shows that respondent who though GMOs were risky were less likely to buy them. The marginal effects support this further by showing that as the BGMS increases by 1% the choice of GMOs goes up by 1.714% while the choice of non-GMOs goes down by .543%. As RGMS increases by 1% the choice of non-GMOs goes up by 1.120% while the choice of GMOs goes down by 3.3883%

The question "Compared with an average person I know a lot about GMO" (K) was positive and significant for GMO and non-GMO soybean oil. The question "I know a lot about how to evaluate the quality of GM" (KN) was negative for GMO soybean oil, positive for non-GMO soybean oil, and significant for both. The question "People who know me consider me as an expert in the field of GMO foods" (KNO) was positive and significant for non-GMO soybean oil. These questions make up the Subjective Knowledge and Attitude Towards GMO Scale

(Pieniak et al., 2010) that was included to measure self-reported knowledge of GMOs. As the results are mixed, it is unclear how the Subjective Knowledge and Attitude towards GMO Scale affects support for regular soybean oil. As such analysis for this group will wait until the aggregate model.

Many of the Passive Resistance Scale (PIRA to PIRS) questions were significant for GMO soybean oil. The majority of those significant questions were positive for GMO soybean oil. These results are represented by three questions that were significant at the 1% level for GMO soybean oil. The questions "I don't change my mind easily" (PIRK) and "my views are very consistent over time" (PIRL) were both positive and significant for GMO soybean oil. The question "In the past, I was very satisfied with available technological products" (PIRP) was negative and significant for GMO soybean oil. The marginal effects show that a 1% increase in PIRK, PIRL, and/or PIRP led to a change in choice of GMO soybean oil by .970%, 1.927%, and/or -2.269% respectively. This scale was taken from Heidenreich & Handrich (2014) and was included to measure resistance to innovation. The results are surprising, as resistance to change would be expected to cause respondents to be against GMO soybean oil and the perceived risk that comes with it. The marginal effects are similar to these findings as well.

The Personal Risk Preferences questions were largely positive for the choice of GMOs although still somewhat mixed in their results. All were significant for GMO soybean oil. These results are represented by three questions that were significant for GMOs at the 1% level. The questions "I like to try new things, knowing well that some of them will disappoint me" (RPA) and "I seek new experiences even if their outcomes may be risky" (RPH) were positive and significant for GMOs. The reversed question "I prefer a tested-and-tried approach over a new approach, although the new approach has some possibility of better one in the end" (RPFR) was negative and significant for GMOs. The marginal effects show that a 1% increase in RPA, RPH, and/or RPFR led to a change in choice of GMO soybean oil of 2.715%, 1.421%, and/or -1.905% respectively. On the whole the marginal effects show that greater risk propensity led to a greater willingness to purchase GMO soybean oil. This scale was taken from Hung et al. (2012) and was included to measure risk propensity. These findings are not surprising as GMOs are typically viewed as being risky and as such it makes sense that those who are willing to take greater risks have a greater willingness to purchase regular soybean oil.

For the Decision Style Scale there are two sets of questions that need to be analyzed. The first five questions ranked how cautious respondents were in their decision-making. These questions are "I prefer to gather all the necessary information before committing to a decision" (DSSRA, "I thoroughly evaluate decision alternatives before making a final choice" (DSSRB), "in decision-making, I take time to contemplate the pros/cons or risks/benefits of a situation" (DSSRC), "investigating the facts is an important part of my decision making process" (DSSRD), and "I weigh a number of different factors when making decisions" (DSSRE). Only two of those questions were significant for GMO soybean oil. Those were "I prefer to gather all the necessary information before committing to a decision" and "I weigh a number of different factors when making a decisions." The first question is negative and the second question is positive towards GMO soybean oil. The second five questions ranked how impulsive respondents were in their decision-making. These questions are "when making decisions, I rely mainly on my gut feelings" (DSSIA), "my initial hunch about decisions is generally what I follow" (DSSIB), "I make decisions based on intuition" (DSSIC), "I rely on my first impressions when making decisions" (DSSID), and "I weigh feelings more than analysis in making decisions" (DSSIE). Only two of those questions were significant for GMOs. The first question was “my initial hunch about decisions is generally what I follow” while the second question was “I weigh feelings more than analysis in making decisions.” Both of these variables were positive for GMO soybean oil. This scale was taken from Hamilton et al. (2016) and was included as how respondents make decisions could affect their risk perception of GMOs. For the first five questions the mixed results means we will need to wait until these variables are averaged to do an effective analysis on their overall effect on resistance and WTP for GMO soybeans. The second five questions imply that those with more intuitive decision making tend to be more positive toward GMOs. This is reasonable as it makes sense that those who are more intuitive could be less cautious and less likely to think deeper about the potential risks of their purchasing decisions. The marginal results support this showing that a 1% increase in DSSIB and/or DSSIE led to an increase in choice of GMO soybean oil by 1.215% and/or .952% respectively.

The Health Consciousness Scale was a mixed bag for its effects on GMOs. Three of the questions were significant. Those three were “I reflect about my health a lot” (HECOA), “I am very self-conscious about my health” (HECOB), and “I am constantly examining my health” (HECOD). HECOA had a positive effect on choosing GMO soybean oil. HECOB and HECOD had a negative effect. Like many of these other variables it had mixed effects that made it unclear how that group of questions affected GMO soybean oil support. As such analysis of the aggregate model will shed more light on this.

The Food Technology Neophobia Scale had a mixed bag for its effects on GMOs. However a majority of questions had a negative impact on willingness to pay for GMOs. This can be derived from the results of three of the questions, those being “the benefits of new food technologies are often grossly overstated” (FTNSB), “new food technologies may have long term negative environmental effects” (FTNSH), and “new foods are not healthier than traditional foods" (FTNSE). FTNSB and FTNSE are both significant and negative. FTNSH is significant and positive. The marginal effects show that a 1% increase in FTNSH, FTNSE, and/or FTNSB led to a change in the choice of GMO soybean oil of 1.557%, -1.622%, and -2.738% respectively. This suggests that more negative views of new food technology led to more negative views of GMOs. This is particularly notable for FTNSH as negative environmental effects are one of the major fears over GMOs as described previously. This is not surprising as GMOs are considered a new food technology.

CRSO was significant and positive for both GMO and non-GMO soybean oil. Marginal effects show that a 1% increase in consumption of GMOs led to an increase in the choice of GMO soybean oil and non-GMO soybean oil by 2.342% and 3.499% respectively. Rate of consumption of soybean oil was included, as Adda (2007) has shown that past consumption affects current consumption. Past habit of consumption affects how risky individuals are willing to be. CRSO was included as a variable to take into account this effect.

Table 5 represents these multinomial logit results for the first round of averages for all indexes:

$$
\begin{aligned}
Y = {} & a_{RGMS} RiskBenefitQuestion1 + a_{BGMS} RiskBenefitQuestion2 \\
& + a_{KNOWF} SubjectiveKnowledgeAverage \\
& + a_{RSALT} PassiveResistanceAverageQuestions1and3 \\
& + a_{ER} PassiveResistanceAverageQuestions4to6 \\
& + a_{STFALT} PassiveResistanceAverageQuestion9 \\
& + a_{CR} PassiveResistanceAverageQuestions10to12 \\
& + a_{SQSI} PassiveResistanceAverageQuestions13to15 \\
& + a_{SQSP} PassiveResistanceAverageQuestions16to18 \\
& + a_{RP} PersonalRiskAverage \\
& + a_{DSSRALT} DecisionStyleAverageQuestions1,3to5 \\
& + a_{DSSIALT} DecisionStyleAverageQuestions6to8,10 \\
& + a_{HECO} HealthConsciousnessAverage \\
& + a_{FTNSU} FoodTechNeophobiaAverageQuestions1to6 \\
& + a_{FTNSR} FoodTechNeophobiaAverageQuestions7to10 \\
& + a_{FTNCH} FoodTechNeophobiaAverageQuestions11and12 \\
& + a_{FTNSM} FoodTechNeophobiaAverageQuestion13 \\
& + a_{CRSO} SoybeanOilConsumption + \varepsilon
\end{aligned}
$$

These are the averages of the personal preference questions that respondents were surveyed about. The only variables that are not averaged are the RiskBenefit variables and the SoybeanOilConsumption variable. These averages were done according to their corresponding literature, for validating the results. Variables that have ALT at the end of them have been slightly altered from what the literature suggests. All we have done is only included questions in the average that were significant, leaving out those that were not significant. The R-squared is low at .0549533 but the significance level is low at .00000 suggesting that the multinomial analysis was a valid analysis for this model.

KNOWF is the average of the Subjective Knowledge and Attitude Towards GMO Scale. RP is the average of the Personal Risk Preferences scale. HECO is the average of the Health Consciousness Scale. DSSR is the average of DSSRA, DSSRB, DSSRC, DSSRD, and DSSRE. DSSI is the average of DSSIA, DSSIB, DSSIC, DSSID, and DSSIE.

RSALT is the average of PIRA and PIRC excluding PIRB, which was included in the literature. STFALT is equivalent to PIRI because the average excluded PIRG and PIRH, which were included in the literature. ER is the average of PIRD, PIRE, and PIRF. CR is the average of PIRJ, PIRK, and PIRL. SQSI is the average of PIRMR, PIRNR, and PIROR. SQSP is the average of PIRP, PIRQ, and PIRS.

FTNSU is the average of FTNSA, FTNSB, FTNSC, FTNSD, FTNSE, and FTNSF. FTNSR is the average of FTNSG, FTNSH, FTNSI, and FTNJR. FTNCH is the average of FTNKR and FTNLR. FTNSM is equivalent to FTNMR.

Table 5

Analysis of First Round of Personal Preference Averages

Chi squared= 2633.86210		Significance Level= .00000	Degrees of Freedom= 34		McFadden Pseudo R-squared= .0549533
Variable	GMO Coefficient	GMO Marginal Effects	Non-GMO Coefficient	Non-GMO Marginal Effects	Opt-Out Marginal Effects
RGMS	-.15945***	-.03423***	-.05073***	.00906***	.02516***
BGMS	.06573***	.01362***	.02536**	-.00299*	-.01063***
KNOWF	-.02566**	-.02728***	.18961***	.03454***	-.00726***
RSALT	-.08607***	-.02150***	.00014	.00950***	.01201***
STFALT	.01511	.00385	-.00068	-.00178	-.00207
ER	.05560***	.02233***	-.07680***	-.01896***	-.00337
CR	.15769***	.02699***	.11253***	.00147	-.02845***
SQSI	-.01777	.00316	-.06905***	-.00959***	.00643**
SQSP	.00856	-.00047	.02373	.00303	-.00255
DSSIALT	.10014***	.02179***	.02919	-.00614***	-.01565***
DSSRALT	.08645***	.02622***	-.04214**	-.01656***	-.00966***
RP	.18713***	.05252***	-.05273**	-.02941***	-.02311***
HECO	-.06979***	-.01067***	-.06137***	-.00258	.01325***
FTNSU	-.05392***	-.01438***	.00831	.00732**	.00705**
FTNSR	.02336	.00104	.04359	.00472	-.00575
FTNCH	-.15452***	-.02818***	-.09444***	.00121	.02697***
FTNSM	-.09826***	-.00928***	-.13857***	-.01236***	.02164***
CRSO	.25080***	.02149***	.37373***	.03491***	-.05639***

Note: ***, **, * ➔ Significance at 1%, 5%, 10% level.

RGMS, ER, CR, HECO, FTNCH, FTNSM, and CRSO were found to be significant for both GMO and non-GMO soybean oil at the 1% level. BGMS, DSSRALT, and RP were significant for GMO soybean oil at the 1% level and non-GMO soybean oil at the 5% level. KNOWF was significant for non-GMO soybean oil at the 1% level and significant for GMO soybean oil at the 5% level. RSALT, SQSI, DSSIALT, and FTNSU were significant at the 1% level for one of the choices and insignificant for the other choice. SQSI was significant for non-GMO soybean oil at the 1% level and insignificant for GMO soybean oil. STFALT, SQSP, and FTNSR were insignificant for both choices. As such those three variables will not be included in the second round of personal preference averages.

The sixth table represents these multinomial logit results for the second round of averages for all indexes:

$$Y = a_{RGMS}RiskBenefitQuestion1 + a_{BGMS}RiskBenefitQuestion2$$
$$+ a_{KNOWF}SubjectiveKnowledgeAverage$$
$$+ a_{IRCALT}PassiveResistanceAverageQuestions1,3to6,10to12$$
$$+ a_{SQSALT}PassiveResistanceAverageQuestions13to15$$
$$+ a_{RP}PersonalRiskAverage$$
$$+ a_{DSSRALT}DecisionStyleAverageQuestions1,3to5$$
$$+ a_{DSSIALT}DecisionStyleAverageQuestions6to8,10$$
$$+ a_{HECO}HealthConsciousnessAverage$$
$$+ a_{FTNSALT}FoodTechNeophobiaAverageQuestions1to6,11to13$$
$$+ a_{CRSO}SoybeanOilConsumption + \varepsilon$$

This is the second round of personal preference averages. The only question groups that were averaged again are the Passive Resistance Scale and the Food Technology Neophobia Scale. As before variables that have ALT at the end have left out variables that were not significant. The R-squared is low at .0469577 but the significance level is low at .00000 suggesting that the multinomial analysis was a valid analysis for this model.

IRCALT is the average of PIRA, PIRC, PIRD, PIRE, PIRF, PIRJ, PIRK, and PIRL excluding PIRB, PIRG, PIRH, and PIRI. SQSALT is the average of PIRMR, PIRNR, and PIROR excluding PIRP, PIRQ, and PIRS. FTNSALT is the average of the entire Food Technology Neophobia Scale excluding of FTNSG, FTNSH, FTNSI, and FTNJR.

Table 6

Analysis of Second Round of Personal Preference Averages

Chi squared= 2250.63758		Significance Level= .00000		Degrees of Freedom= 20	McFadden Pseudo R-squared= .0469577
Variable	GMO Coefficient	GMO Marginal Effects	Non-GMO Coefficient	Non-GMO Marginal Effects	Opt-Out Marginal Effects
RGMS	-.15752***	-.03388***	-.04969***	.00897***	.02491***
BGMS	.05951***	.01151***	.03050**	-.00143	-.01009***
KNOWF	-.02585**	-.03053***	.21938***	.03955***	-.00902***
IRCALT	.10094***	.02649***	-.01171	-.01304***	-.01346***
SQSALT	-.09576***	-.00557**	-.16715***	-01747***	.02303***
RP	.13966***	.04829***	-.12223***	-.03578***	-.01251***
DSSRALT	.13212***	.03345***	-.00412	-.01519***	-.01826***
DSSIALT	.16899***	.03155***	.09710***	-.00230	-.02925***
HECO	-.00864	-.00123	-.00843	-.00046	.00170
FTNSALT	-.24619***	-.04861***	-.11727***	.00739**	.04122***
CRSO	.21869***	.01734***	.33968***	.03285***	-.05018***

Note: ***, **, * ➔ Significance at 1%, 5%, 10% level.

RGMS, SQSALT, RP, DSSIALT, FTNSALT, and CRSO are significant for GMO and non-GMO soybean oil at the 1% level. BGMS is significant at the 1% level for GMO soybean oil and at the 5% level for non-GMO soybean oil. KNOWF is significant at the 1% level for non-GMO soybean oil and significant at the 5% level for GMO soybean oil. IRCALT and DSSRALT are significant at the 1% level for GMO soybean oil and insignificant for the other. HECO is not significant for GMO and non-GMO soybean oil. As such it will not be included in future models.

The seventh table represents these multinomial logit results for the third round of averages for all indexes:

$$Y = a_{RGMS} RiskBenefitQuestion1 + a_{BGMS} RiskBenefitQuestion2$$
$$+ a_{KNOWF} SubjectiveKnowledgeAverage$$
$$+ a_{PIRALT} PassiveResistanceAverageQuestions1,3to6,10to15$$
$$+ a_{RP} PersonalRiskAverage$$
$$+ a_{DSSRALT} DecisionStyleAverageQuestions1,3to5$$
$$+ a_{DSSIALT} DecisionStyleAverageQuestions6to8,10$$
$$+ a_{FTNSALT} FoodTechNeophobiaAverageQuestions1to6,11to13$$
$$+ a_{CRSO} SoybeanOilConsumption + \varepsilon$$

This is the third round of personal preference averages. The only question group that has new averages is the Passive Resistance Scale. As before variables that have ALT at the end have left out variables that were not significant. The R-squared is low at .0437086 but the significance level is low at .00000 suggesting that the multinomial analysis was a valid analysis for this model. PIRALT is the average of the entire Passive Resistance to Innovation Scale excluding PIRB, PIRG, PIRI, PIRH, PIRP, PIRQ, and PIRS.

Table 7

Analysis of Third Round of Personal Preference Averages

Chi squared= 2094.91235		Significance Level= .00000		Degrees of Freedom= 16	McFadden Pseudo R-squared= .0437086
Variable	GMO Coefficient	GMO Marginal Effects	Non-GMO Coefficient	Non-GMO Marginal Effects	Opt-Out Marginal Effects
CRSO	.22587***	.01777***	.35182***	.03413***	-.05190***
RGMS	-.15664***	-.03380***	-.04842***	.00909***	.02471***
BGMS	.06707***	.01201***	.04317***	-.00013	-.01188***
KNOWF	.00977	-.02636***	.26225***	.04286***	-.01650***
PIRALT	.04512*	.02512***	-.12610***	-.02608***	.00096
RP	.04620***	.03824***	-.24314***	-.04580***	.00756***
DSSRALT	.11900***	.03204***	-.02114	-.01661***	-.01543***
DSSIALT	.19919***	.03414***	.14210***	.00193	-.03607***
FTNSALT	-.26871***	-.05057***	-.15064***	.00428	.04629***

Note: ***, **, * → Significance at 1%, 5%, 10% level.

CRSO, RGMS, BGMS, RP, DSSIALT, and FTNSALT are significant for GMO soybean oil and non-GMO soybean oil at the 1% level. PIRALT is significant for GMO soybean oil at the 10% level and for non-GMO soybean oil at the 1% level. KNOWF is significant for non-GMO soybean oil at the 1% level and insignificant for GMO soybean oil. DSSRALT is significant for GMO soybean oil at the 1% level and insignificant for non-GMO soybean oil.

4.3.2. Choice Experiment Aggregate Analysis

The eighth table represents these multinomial logit results for the aggregate analysis:

$$
\begin{aligned}
Y = {} & a_{ENVIR}Environment + a_{HEALT}Health + a_{PRICE}Price \\
& + a_{HOME}NumberofHouseholdMembers + a_{PPFH}WhoPrimaryPurchaser \\
& + a_{EDUC}Education + a_{GEND}Gender + a_{MAST}MaritalStatus \\
& + a_{HOIN}HouseholdIncome + a_{CHYOU}HouseholdChildrenYounger18 \\
& + a_{PRPU}AreyouPrimaryPurchaser + a_{RESID}TypeofCommunity \\
& + a_{RGMS}RiskBenefitQuestion1 + a_{BGMS}RiskBenefitQuestion2 \\
& + a_{KNOWF}SubjectiveKnowledgeAverage \\
& + a_{PIRALT}PassiveResistanceAverageQuestions1{,}3to6{,}10to15 \\
& + a_{RP}PersonalRiskAverage \\
& + a_{DSSRALT}DecisionStyleAverageQuestions1{,}3to5 \\
& + a_{DSSIALT}DecisionStyleAverageQuestions6to8{,}10 \\
& + a_{FTNSALT}FoodTechNeophobiaAverageQuestions1to6{,}11to13 \\
& + a_{CRSO}SoybeanOilConsumption + \varepsilon
\end{aligned}
$$

This is the aggregate model analysis. All third round personal preference variables, demographic variables, and choice experiment variables are included in this analysis. The R-squared is high at .9071679 and the significance level is low at .00000 suggesting that the multinomial analysis was a valid analysis for this model.

Table 8

Analysis of the Aggregate Model

Chi squared= 43479.71825		Significance Level= .00000	Degrees of Freedom= 40	McFadden Pseudo R-squared= .9071679	
Variable	GMO Coefficient	GMO Marginal Effects	Non-GMO Coefficient	Non-GMO Marginal Effects	Opt-Out Marginal Effects
ENVIR	3.08254***	-.02412***	3.74271***	.02421***	-.82445D-04***
HEALT	4.42202***	-.03283***	5.32071***	.03295***	-.00012***
PRICE	1.53908***	-.02857***	2.31937***	.02861***	-.4162D-04***
HOME	-.10131**	.00922***	-.35284***	-.00922***	.29420D-05*
PPFH	-.09412	.00083	-.11694	-.00084	.25199D-05
EDUC	-.01215	.00497**	-.14779*	-.00497**	.45956D-06
GEND	-.28431*	.01105*	-.58584***	-.01105*	.78473D-05*
MAST	-.06530	-.01125*	.24142	.01124*	.14222D-05
HOIN	-.02353	-.00048	-.01043	.00048	.61100D-06
CHYOU	-.63699***	.02478***	-1.31328***	-.02479***	.17583D-04***
PRPU	-.72328***	-.00226	-.66210**	.00224	.19126D-04**
RESID	-.00868	.00171	-.05529	-.00171	.27732D-06
CRSO	.18936*	-.00268	.26261*	.00269	-.50977D-05*
RGMS	-.11760***	-.00185	-.06715	.00185	.30689D-05**
BGMS	-.00354	.00410***	-.11541**	-.00410***	.20696D-06
KNOWF	-.00601	-.00827***	.21964***	.00827***	0.0
PIRALT	-.17103*	.02664***	-.89774***	-.02664***	.52720D-05*
RP	-.32124***	.03598***	-1.30280***	-.03598***	.95147D-05***
DSSRALT	-.02415	.00932***	-.27839***	-.00932***	.89781D-06
DSSIALT	.14335***	-.00311	.22816***	.00311	-.38887D-05**
FTNSALT	-.23561***	.00707**	-.42853***	-.00707**	.64456D-05**

Note: ***, **, * ➔ Significance at 1%, 5%, 10% level.

PRICE, ENVIR, and HEALT were significant for both non-GMO and GMO soybean oil at the 1% level. CHYOU was significant at the 1% level for GMO and non-GMO soybean oil. RP, DSSIALT, and FNTSALT were significant at the 1% level for GMO and non-GMO soybean oil. HOME was significant at the 1% level for non-GMO soybean oil and at the 5% level for GMO soybean oil. PRPU was significant at the 1% level for GMO soybean oil and at the 5% level for non-GMO soybean oil. GEND and PIRALT were significant at the 1% level for non-GMO soybean oil and at the 10% level for GMO soybean oil. CRSO was significant at the 10% level for GMO soybean oil and non-GMO soybean oil. RGMS was significant at the 1% level for GMO soybean oil and not significant for non-GMO soybean oil. DSSRALT and KNOWF were significant at the 1% level for non-GMO soybean oil and not significant for GMO soybean oil. BGMS was significant at the 5% level for non-GMO soybean oil. EDUC was significant at the 10% level for non-GMO soybean oil. PPFH, MAST, HOIN, and RESID were not significant for both choices.

ENVIR and HEALT were significant and positive for GMO soybean oil and non-GMO soybean oil. The marginal benefits show that a 1% increase in ENVIR and HEALT decreased the choice of GMO soybean oil by 2.412% and 3.283% respectively and increased the choice of non-GMO soybean oil by 2.412% and 3.295% respectively. These marginal benefits suggest that the findings in the literature that environmental benefits and health benefits alleviated concerns over GMOs were true but that the effect was even greater for non-GMOs.

PRICE was significant and positive for GMO soybean oil. The marginal benefits show that a 1% increase in PRICE decreased the choice of GMO soybean oil by 2.857% and increased the choice of non-GMO soybean oil by 2.861%. Price being positive for both is not surprising as in the data price was only positive when consumers purchased soybean oil. The marginal benefits suggest though that this effect disproportionately increased the probability of buying manual soybean oil, which makes sense given that manual soybean oil is more expensive than regular soybean oil.

HOME was significant and negative for GMO soybean oil. This is different from previous research. The marginal benefits show that a 1% increase in household size increased the choice of GMO soybean oil by .922% and decreased the choice of non-GMO soybean oil by .922%. This is closer to previous research. As such our findings are different from Harrison et al. (2004) but still suggest GMO products gain comparatively to non-GMO products from larger household sizes.

PPFH was not significant for GMO or non-GMO soybean oil suggesting that ultimately the wife being the primary purchaser did not have an impact. MAST was found to be not significant for GMO or non-GMO soybean oil suggesting that marital status did not have an impact going against al Khayri & Hassan (2012) and Linnhoff et al. (2017). HOIN was found to be not significant for GMO or non-GMO soybean oil suggesting that household income did not have an impact going against Louriero (2002). RESID was found to be not significant for GMO or non-GMO soybean oil suggesting rural vs. urban did not have an impact.

EDUC was negative and only barely significant for non-GMO soybean oil at the 10% level. The marginal effects show that a 1% increase in EDUC decreased the choice of non-GMO soybean oil by -.497%. This goes against goes against what Harrison et al. (2004) found but is similar to Gaskell et al. (2004) who found education to be insignificant. As EDUC was only barely significant these results have some corroboration.

GEND was significant and negative for non-GMO and GMO soybean oil at the 10% level. The marginal effects show that women were more likely to buy regular soybean oil at the expense of manual soybean oil. This is largely in line with what was inferred before in Table 3's analysis. The only significant difference was the positive marginal effect on regular soybean oil and that effect was only significant at the 10% level that makes those results less than clear.

CHYOU was found to be negative and significant for GMO and non-GMO soybean oil. The marginal benefits show that households with children younger than 18 were more likely to buy regular soybean oil. These results reinforce inferences found in Table 3's analysis.

PRPU was significant and negative for GMO and non-GMO soybean oil. Marginal effects were not significant for GMO or non-GMO soybean oil. The marginal effects lack of significance could be explained by how PRPU was a binary variable and therefore 1% increases were not possible. Being the primary purchaser therefore made consumers less likely to buy soybean oil. This correlates Butler and Vossler's (2017) findings that primary grocery shoppers were more likely to believe that natural food products meant non-GMO with limited processing with the suggestion that they could prefer non-GMO products. However given PRPU's negativity for manual soybean oil they appear to have opted out altogether perhaps wanting to buy a healthier oil.

RGMS was negative and significant for regular soybean oil. The marginal effects for regular soybean oil were not significant. As such the results were mixed. Still, going back to objective two this suggests that respondents who had higher RGMS had a higher risk perception of GMO soybean oil which is unsurprising given it directly asks about risk.

BGMS was positive and significant for non-GMO soybean oil. Marginal effects however show that a 1% increase in BGMS decreased choice of non-GMO soybean oil by -.410% while increasing choice of GMO soybean oil by .410%. For objective two this suggests that the impact of BGMS on regular soybean oil is unclear given its insignificance for regular soybean oil. However the marginal effects do suggest that, as expected, BGMS has at least some positive effect on risk perception of regular soybean oil. Going back to objective two while the results are overall unclear the marginal effects at least suggest that respondents who had higher BGMS had a lower risk perception of GMOs.

KNOWF is positive and significant for non-GMO soybean oil. Marginal effects show that increasing KNOWF by 1% increased the choice of non-GMO soybean oil by .827% while decreasing the choice of GMO soybean oil by .827%. These findings are somewhat what would be expected given the literature (Wunderlich & Gatto, 2015) that shows that those with higher self-reported knowledge were more negative about GMOs. It would make sense that those consumers might instead purchase non-GMO soybean oil. With respect to objective three while the results are unclear given the marginal benefits it at least suggests that this scale does not have a positive effect on bias towards GMO soybean oil.

PIRALT is significant and negative for both GMO and non-GMO soybean oil. Marginal effects show that increasing PIRALT by 1% increases the choice of GMO soybean oil by 2.664% and decreases the choice of non-GMO soybean oil by 2.664%. These results suggest that while greater PIRALT causes resistance to GMOs it causes even greater resistance to non-GMOs. With regards to objectives four as this scale measures resistance it suggests that higher passive resistance to innovation increases resistance towards GMOs.

RP is significant and negative for non-GMO and GMO soybean oil. Marginal effects show that increasing RP by 1% increases the choice of GMO soybean oil by 3.598% and decrease the choice of non-GMO soybean oil by 3.598%. The results are therefore mixed. The marginal effects suggest that higher risk propensity means respondents are more willing to choose GMO soybean oil compared to non-GMO soybean oil. However the coefficients being negative suggest that on the whole the effect is still negative. As such in regards to objective two the results are mixed.

DSSRALT is significant and negative only for non-GMO soybean oil. Marginal effects show that a 1% increase in DSSRALT decreases the choice of non-GMO soybean oil by -.932% and increases the choice of GMO soybean oil by .932%. As such it is unclear what effect

DSSRALT has on GMO soybean oil. For objective three the marginal results at least suggest that more cautious respondents were not more biased against GMOs.

DSSIALT was positive and significant for GMO and non-GMO soybean oil. The marginal effects were not significant for manual and regular soybean oil. For objective three these results suggest that more intuitive people were more positively biased towards GMOs although the marginal effects' lack of significance casts doubt on that.

FTNSALT was negative and significant for both GMO and non-GMO soybean oil. The marginal effects show that a 1% increase in FTNSALT increased the choice of GMO soybean oil by .707% and decreased the choice of non-GMO soybean oil by .707%. These results suggest that higher FTNSALT caused respondents to be more resistant to GMO soybean oil, but that the effect was even greater for non-GMO soybean oil. For objective four since this scale measures resistance this suggests that higher food technology neophobia has a negative effect on resistance towards GMOs.

4.4. Willingness-to-Pay

Lusk & Hudson (2004) define WTP as minimizing expenditure when constrained by a specified amount of utility. The change in a good's quality can be measured by:

$$WTP = M(p, U, q_0) - M(p, U, q_1) \tag{17}$$

In this equation U is the specified amount of utility with p and q being price and quality of the product respectively. WTP is how much consumers would be wiling-to-pay for an increase in the quality of a product given a level of utility (Lusk & Hudson, 2004). To measure this in practice we use the marginal willingness to pay for an attribute increase:

$$MWTP_k = -\frac{\theta_k}{\theta_{price}} \tag{18}$$

Based on this willingness-to-pay for GMO soybean oil was found for each of the variables in the aggregate analysis:

Table 9

Willingness-to-Pay for GMO Soybean Oil

Willingness-to-Pay					
ENVIR	$2.00***	CHYOU	-$0.41***	RP	-$0.21***
HEALT	$2.87***	PRPU	-$0.47***	DSSRALT	-$0.02
HOME	-$0.07**	RESID	-$0.01	DSSIALT	$0.09***
PPFH	-$0.06	CRSO	$0.12*	FTNSALT	-$0.15***
EDUC	-$0.01	RGMS	-$0.08***		
GEND	-$0.18*	BGMS	$0.00		
MAST	-$0.04	KNOWF	$0.00		
HOIN	-$0.02	PIRALT	-$0.11*		

Note: ***, **, * ➔ Their GMO coefficient was significant at the 1%, 5%, 10% level.

Environmental and health benefits were dominant factors in willingness-to-pay having by far the greatest effect. This implies that environment and health are top priorities of consumers and GMOs with benefits in those areas are much more acceptable than those without. Children younger than 18 and being the primary purchaser had the largest negative effect on WTP. This implies that responsibility is a major factor in WTP although the fact that larger households had a minimal affect on WTP challenges this finding. The impact of other factors was minimal with none having an effect greater than $0.21. Environmental and health benefits are therefore implied to be the most important factors for WTP by far.

The fact that environmental and health benefits had a positive willingness-to-pay while "I think it is risky to consume soybean oil" and Personal Risk Preferences had a negative willingness to pay implies that our first hypothesis is fulfilled and more positive risk perception of GMOs will lead to higher willingness-to-pay. "I think it is beneficial to consume GMO soybean oil" did not have a significant GMO coefficient. The cautious Decision Style Scale variable (DSSRALT) and Subjective Knowledge and Attitude Toward GMO Scale did not have a significant GMO coefficient but the intuitive Decision Style Scale variable (DSSIALT) had a positive willingness-to-pay showing at least some evidence that our second hypothesis is fulfilled and positive bias leads to higher willingness-to-pay. The Health Consciousness Scale did not have a significant GMO coefficient but the Food Technology Neophobia Scale and the Passive Resistance Scale had a negative willingness-to-pay. While the results are somewhat mixed, these results largely imply that our third hypothesis is fulfilled and less resistance to GMOs will lead to a higher willingness-to-pay.

5. CONCLUSION

5.1. Risk Perception, Bias, and Resistance

The results show that many variables have an impact on WTP for regular soybean oil and manual soybean oil. Stated preferences between GMOs and non-GMOs, new food technology and old food technology are clearly made with many variables being significant for both and affecting each in different ways. This shows that our survey successfully fulfilled our first objective. This can be clearly seen in sections 4.2 and 4.3. This also shows that choice experiments present more accurate choices compared to experimental vignettes as the ability to opt-out changed the results significantly. Along with this choice experiments are more flexible with many scenarios being tested instead of just the one in the experimental vignette.

Price, Environmental Benefits, Health Benefits, "I think it is risky to consume GMO soybean oil" and Personal Risk Preferences were all significant for the choice of GMO soybean oil at the 1% level. "I think it is beneficial to consume GMO soybean oil" was not significant and Health Consciousness scale was not in the aggregate model. They therefore had an impact to varying degrees on the risk perception of GMOs and new food technology. This combined with the analysis of those variables fulfills objective two and suggests that risk perception should be included when analyzing GMOs and new food technology.

The cautious Decision Style Scale and Subjective Knowledge (DSSRALT) and Attitude Toward GMO Scales were not significant for the choice of GMO soybean oil. The intuitive Decision Style Scale (DSSIALT) was significant at the 1% level for GMO soybean oil. As such the results for objective three were mixed but largely negative with only one of the scales having a clear impact on bias towards GMOs and new food technology and the other two not being significant.

The Food Technology Neophobia Scale was significant at the 1% level and the Passive Resistance Scale was significant at the 10% level. The Health Consciousness Scale was not included in the final analysis. As such the results for objective four were mixed but largely positive with only one of the three scales not being significant.

The fact that the Health Consciousness Scale was not included in the final analysis is notable particularly as health benefits had such a significant effect and concerns over health are often a major factor in fears over GMOs. It could be that the respondents who rated higher on the Health Consciousness Scale had health concerns that did not have to do with GMOs. Alternatively, perhaps they did have health concerns over GMOs but as they had health concerns over non-GMO food as well those concerns were not significant.

Through the other three objectives the fourth objective is fulfilled. The Passive Resistance Scale, Food Tech Neophobia Scale, "I think it is risky to consume GMO soybean oil," Intuitive Decision Making Preferences and Personal Risk Preferences should all be included in an aggregate list of factors that affect willingness-to-purchase of food technologies like GMOs. The other scales we used should be explored further but based on these results it would appear that they should not be included. This aggregate will make up the Extended Food Tech Neophobia Scale that will explain willingness-to-purchase and consumption of GMOs and new food technology.

5.2. Limitations of our Thesis and Recommendations for Future Research

There are a few limitations to this thesis and recommendations for future studies. Limitations were that independence of irrelevant alternatives was assumed for our models. Our data was not analyzed through other models such as the mixed logit model, conditional logit model, and nested multinomial logit model. Heterogeneity was not tested for.

Recommendations to future studies would be to explore whether these results can be found in other countries as well. Sub-groups were not explored in this study and could explain the kind of people who perceive new food technology positively and those who do not. Lastly, future studies should look at whether these results are similar for the preparation and production of other GMO foods and products.

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APPENDIX A. SURVEY

Experimental Vignette

Imagine that you are a consumer at a grocery store. This store offers two kinds of soybean oil, one that is produced through manual extraction and one that is produced through hexane extraction. When creating soybean oil, you know that manual extraction is more common for non-Genetically Modified (non-GMO) soybeans while hexane extraction is more common for Genetically Modified (GMO) soybeans. You have read that some studies show elevated levels of hexane residue might pose health concerns. A gallon bottle of soybean oil averages $4.50 if it is hexane extracted but $25.50 if it is manually extracted. You have a total of $204.30 to spend on oil and other foods you would like to buy for the next two weeks. Which soybean oil do you buy?

Regular Soybean Oil	Manually Extracted Soybean Oil
Buying the regular soybean oil allows you to afford the food you want for the week. You are always able to make healthy meals. You are able to afford environmentally friendly food. Regular Soybean oil is from GMO soybeans. The oil contains higher levels of hexane residue, which might pose health concerns.	Buying the manually extracted soybean oil makes it difficult to afford the food you want for the week. You are only sometimes able to make healthy meals. You are unable to afford environmentally friendly. Manually extracted Soybean oil is from non-GMO soybeans. The oil contains lower levels of hexane residue, which might avert health concerns.

Decision

You, the consumer, have a very limited amount of funds you can spend on food. Paying for manually extracted soybean oil would allow you to avoid any health problems regular soybean oil could pose. But it would force you to buy less nutritious food. You would not be able to buy more environmentally friendly food either.

Select the box of the choice you would make.

Regular Soybean Oil □ Manually Extracted Soybean Oil □

Risk and Benefit Scale

Risk and Benefit Perception Scale

7 – point scale (1 = Strongly Disagree; 7 = Strongly Agree)

Questions	1	2	3	4	5	6	7
I think it is risky to consume GMO soybean oil.							
I think it is beneficial to consume GMO soybean oil.							

Subjective Knowledge and Attitude towards GMO Scale

7 – point scale (1 = Strongly Disagree; 7 = Strongly Agree)

Questions	1	2	3	4	5	6	7
Compared with an average person I know a lot about GMO.							
I know a lot about how to evaluate the quality of GM foods							
People who know me, consider me as an expert in the field of GM foods.							

How often do you consume regular soybean oil?

a. Less than once a week ☐

b. Less than seven times a week ☐

c. More than seven times a week ☐

Passive Resistance Scale

7 – point scale (1 = Strongly Disagree; 7 = Strongly Agree)

Questions	1	2	3	4	5	6	7
I generally consider changes to be a negative thing							
I like to do the same old things rather than try new and different ones							

Questions	1	2	3	4	5	6	7
I would rather be bored than surprised							
If I were to be informed that there’s to be a significant change regarding the way things are done at work, I would probably feel stressed							
When I am informed of a change of plans, I tense up a bit.							
When things don’t go according to plans, its stresses me out.							
Often, I feel a bit uncomfortable even about changes that may potentially improve my life.							
When someone pressures me to change something, I tend to resist it even if I think the change may ultimately benefit me.							
I sometimes find myself avoiding changes that I know will be good for me.							
I often change my mind.							
I don’t change my mind easily.							
My views are very consistent over time.							
Overall, my personal need for innovations in the field of technological products as being too low.							
Overall, I consider the number of innovations in the field of technological products as being too low.							
Overall, I consider the pace of innovations in the field of technological products as being too low.							
In the past, I was very satisfied with available technological products.							
In my opinions, past technological products were completely satisfactory, so far.							
Past technological products fully met my requirements.							

Personal Risk Preferences

7 – point scale (1 = Strongly Disagree; 7 = Strongly Agree)

Questions	1	2	3	4	5	6	7
I like to try new things, knowing well that some of them will disappoint me.							
Although a new thing has a high promise of reward, I do not want to be the first one who tries it. I would rather wait until it has been tested and proven before I try it.							
When I have to make a decision for which the consequence is not clear, I like to go with the safer option although it may yield limited rewards.							
I like to try new things, knowing well that some of them will disappoint me.							
To earn greater rewards, I am willing to take higher risks.							
I prefer a tested-and-tried approach over a new approach, although the new approach has some possibility of being a better one in the end.							
I like to implement a plan only if it is very certain that the plan will work.							
I seek new experiences even if their outcomes may be risky.							

<u>Decision Style Scale</u>

7 – point scale (1 = Strongly Disagree; 7 = Strongly Agree)

Questions	1	2	3	4	5	6	7
I prefer to gather all the necessary information before committing to a decision							
I thoroughly evaluate decision alternatives before making a final choice.							
In decision-making, I take time to contemplate the pros/cons or risks/benefits of a situation.							
Investigating the facts in an important part of my decision making process.							
I weigh a number of different factors when making decisions.							

Questions	1	2	3	4	5	6	7
When making decisions, I rely mainly on my gut feelings.							
My initial hunch about decisions is generally what I follow.							
I make decisions based on intuition.							
I rely on my first impressions when making decisions.							
I weigh feelings more than analysis in making decisions.							

Health Consciousness Scale

7 – point scale (1 = Strongly Disagree; 7 = Strongly Agree)

Questions	1	2	3	4	5	6	7
I reflect about my health a lot.							
I am very self-conscious about my health.							
I am generally attentive to my inner feelings about my health.							
I am constantly examining my health.							

Food Technology Neophobia Scale

7 – point scale (1 = Strongly Disagree; 7 = Strongly Agree)

Questions	1	2	3	4	5	6	7
There are plenty of tasty foods around so we don't need new to use new food technologies to produce more.							
The benefits of new food technologies are often grossly overstated.							
New food technologies decrease the natural quality of food							
There is no sense trying out high-tech food products because the ones I eat are already good enough.							
New foods are not healthier than traditional foods.							
New food technologies are something I am uncertain about.							

Questions	1	2	3	4	5	6	7
Society should not depend heavily on technologies to solve its food problems.							
New food technologies may have long tern negative environmental effects							
It can be risky to switch to new food technologies too quickly.							
New food technologies are unlikely to have long tern negative health effects.							
New products produced using new food technologies can help people have a balanced diet.							
New food technologies give people more control over their food choices.							
The media usually provides a balances and unbiased view of new food technologies.							

Choice Experiment Questions

According to the United States Department of Agriculture, in 2018 94% of soybean acreage is GMO. When extracting soybean oil hexane extraction is more common for GMO soybeans and manual extraction is more common for non-GMO soybeans. Some studies show elevated levels of hexane residue might pose health concerns. Regular extracted soybean oil could be cheaper than manually extracted soybean oil. Health benefits of soybean oil include preservation of healthy heart and brain function and the normal growth and development of the body. Environmental benefits include more efficient use of water and pesticides leading to improved environmental quality.

Choices/Features	Option A Regular Extraction☐	Option B Manual Extraction☐	Option C No Purchase☐
Price per Gallon	$5.50/$4.50/$3.50	$15.00/$25.50/$36.00	
Health Benefits	Yes/No	Yes/No	
Environmental Benefits	Yes/No	Yes/No	

Note: There were four different surveys with one being randomly given to respondents. In each survey were 32 questions featuring different combinations of the above features. Each survey had roughly the same number of respondents.

Demographic Survey

1. How many members are in your household? _____ (number)

2. Who is the primary purchaser of food in your household?

a. Wife ☐
b. Husband ☐
c. Children ☐
c. Other ☐

3. What is your education level?

a. Did not go to school ☐
b. Did not finish high school ☐
c. High school degree ☐
d. Two year degree ☐
e. Undergraduate degree ☐
f. Graduate/Professional degree ☐

4. What is your Gender?

a. Male ☐
b. Female ☐
c. Other ☐
d. Prefer not to answer ☐

5. What is your marital status?

a. Married ☐
b. Single ☐
c. Other ☐
d. Prefer not to answer ☐

6. What is your household income?

a. Less than $25,000 ☐
b. $25,000 – $50,000 ☐
c. $50,000 – $75,000 ☐
d. $75,000 – $100,000 ☐
e. $100000 – $150000 ☐
f. More than $150,000 ☐

7. Do you have children younger than 18 years old living in your household?

Yes ☐
No ☐

8. Are you the primary shopper in your household for food products?

Yes ☐
No ☐

10. How would you describe your community of residence?

Rural ☐
Urban ☐

APPENDIX B. EXPANDED ANALYSIS OF CHOICE EXPERIMENT ATTRIBUTES

Chi squared= 19467.46876		Significance Level= .00000	Degrees of Freedom= 4		McFadden Pseudo R-squared= .4061724	
Variable	Coefficient	Standard Error	z	Prob. |z|>z*	95% Confidence Interval	
Characteristices in numerator of Prob(CHOIC=1) GMO Soybean Oil						
ENVIR	3.01817	.24300	12.42	.0000	2.54189	3.49445
HEALT	4.84415	.50823	9.53	.0000	3.84804	5.84026
PRICE	.35387	.02160	16.38	.0000	.31153	.39621
Characteristics in numerator of Prob(CHOIC=2) Non-GMO Soybean Oil						
ENVIR	.89576	.24418	3.67	.0002	.41717	1.37434
HEALT	2.67505	.50882	5.26	.0000	1.67777	3.67223
PRICE	.57931	.02144	27.02	.0000	.53728	.62133
Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
Marginal effects on Prob(CHOIC=0) Opt-Out						
ENVIR	-.00312	-.79396	-4.02	.0001	-.00464	-.00160
HEALT	-.00591	-1.60613	-6.31	.0000	-.00775	-.00407
PRICE	-.00071	-3.36631	-4.37	.0000	-.00103	-.00039
Marginal effects on Prob(CHOIC=1) GMO Soybean Oil						
ENVIR	.5300	.39895	49.27	.0000	.50892	.55108
HEALT	.54309	.43604	50.96	.0000	.52220	.56398
PRICE	-.05575	-.7768	-55.99	.0000	-.05770	-.05379
Marginal effects on Prob(CHOIC=2) Non-GMO Soybean Oil						
ENVIR	-.52688	-.43992	-48.98	.0000	-.54797	-.50580
HEALT	-.53718	-.47840	-50.47	.0000	-.55804	-.51632
PRICE	.05646	.87276	56.74	.0000	.05451	.05841

APPENDIX C. EXPANDED ANALYSIS OF DEMOGRAPHIC VARIABLES

Chi squared= 667.79600		Significance Level= .0000	Degrees of Freedom= 16		McFadden Pseudo R-squared= .0139330	
Variable	Coefficient	Standard Error	z	Prob. |z|>z*	95% Confidence Interval	
Characteristices in numerator of Prob(CHOIC=1) GMO Soybean Oil						
HOME	.11337	.01125	10.08	.0000	.09132	.13541
PPFH	-.11635	.03859	-3.01	.0026	-.19199	-.04071
EDUC	.17088	.01220	14.01	.0000	.14697	.19479
GEND	-.28663	.03664	-7.82	.0000	-.35843	-.21482
MAST	-.14764	.03712	-3.98	.0001	-.22040	-.07488
HOIN	-.02172	.01268	-1.71	.0869	-.04658	.00314
CHYOU	-.10804	.032777	-3.30	.0010	-.17228	-.04380
PRPU	-.63473	.04691	-13.53	.0000	-.72668	-.54278
RESID	.16862	.03196	5.28	.0000	.10599	.23125
Characteristics in numerator of Prob(CHOIC=2) Non-GMO Soybean Oil						
HOME	-.08438	.01426	-5.92	.0000	-.11233	-.05643
PPFH	-.09586	.04638	-2.07	.0387	-.18677	-.00496
EDUC	.11232	.01468	7.65	.0000	.08355	.14109
GEND	-.41703	.04373	-9.54	.0000	-.50274	-.33132
MAST	-.05142	.04471	-1.15	.2501	-.13906	.03621
HOIN	.05440	.01521	3.58	.0003	.02459	.08422
CHYOU	-.55195	.03952	-13.97	.0000	-.62941	-.47450
PRPU	-.30827	.05573	-5.53	.0000	-.41749	-.19905
RESID	.23733	.03825	6.20	.0000	.16236	.31230
Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
Marginal effects on Prob(CHOIC=0) Opt-Out						
HOME	-.01082	-.11238	-4.98	.0000	-.01507	-.00656
PPFH	.02233	.03917	3.04	.0024	.00793	.03674
EDUC	-.03105	-.43425	-13.44	.0000	-.03558	-.02652
GEND	.06616	.15448	9.47	.0000	.05246	.07985
MAST	.02402	.03754	3.39	.0007	.01013	.03791
HOIN	-.00028	-.00260	-.12	.9072	-.00503	.00446
CHYOU	.04924	.09886	7.81	.0000	.03688	.06160
PRPU	.10862	.04829	12.48	.0000	.09156	.12569
RESID	-.03843	-.05650	-6.31	.0000	-.05037	-.02648
Marginal effects on Prob(CHOIC=1) GMO Soybean Oil						
HOME	.03752	.22067	15.66	.0000	.03282	.04222
PPFH	-.01866	-.01852	-2.26	.0236	-.03482	-.00250
EDUC	.03050	.24149	11.94	.0000	.02550	.03551
GEND	-.02630	-.03476	-3.39	.0007	-.04150	-.01109
MAST	-.03132	-.02771	-3.97	.0001	-.04679	-.01584
HOIN	-.01135	-.05911	-4.22	.0000	-.01662	-.00608
CHYOU	.03303	.03753	4.78	.0000	.01949	.04656
PRPU	-.12515	-.03149	-11.89	.0000	-.14578	-.10453
RESID	.01634	.01360	2.42	.0153	.00313	.02955
Marginal effects on Prob(CHOIC=2) Non-GMO Soybean Oil						
HOME	-.02670	-.36028	-13.13	.0000	-.03069	-.02272
PPFH	-.00367	-.00837	-.54	.5863	-.01691	.00956
EDUC	.00055	.00990	.26	.7949	-.00357	.00466
GEND	-.03986	-.12085	-6.33	.0000	-.05220	-.02751
MAST	.00730	.01482	1.13	.2598	-.00540	.02000
HOIN	.01163	.13897	5.30	.0000	.00733	.01593

Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
CHYOU	-.08227	-.21447	-14.76	.0000	-.09319	-.07134
PRPU	.01653	.00954	1.94	.0527	-.00019	.03325
RESID	.02209	.04217	4.01	.0001	.01130	.03287

APPENDIX D. EXPANDED ANALYSIS OF PERSONAL PREFERENCE VARIABLES

Chi squared= 3628.05861		Significance Level= .00000	Degrees of Freedom= 116		McFadden Pseudo R-squared= .0756964	
Variable	Coefficient	Standard Error	z	Prob. |z|>z*	95% Confidence Interval	
Characteristices in numerator of Prob(CHOIC=1) GMO Soybean Oil						
CRSO	.26201	.03092	8.47	.0000	.20141	.32261
RGMS	-.17687	.01118	-15.82	.0000	-.19878	-.15496
BGMS	.07627	.01137	6.71	.0000	.05399	.09855
K	.05175	.01512	3.42	.0006	.02211	.08138
KN	-.07845	.01745	-4.50	.0000	-.11266	-.04425
KNO	-.02210	.01655	-1.34	.1818	-.05453	.01034
PIRA	-.02181	.01494	-1.46	.1444	-.05109	.00747
PIRB	.01509	.01441	1.05	.2949	-.01315	.04333
PIRC	-.09039	.01309	-6.91	.0000	-.11605	-.06474
PIRD	.04159	.01474	2.82	.0048	.01270	.07048
PIRE	.04866	.01674	2.91	.0036	.01585	.08147
PIRF	-.00038	.01443	-.03	.9792	-.02866	.02791
PIRG	.00067	.01653	.04	.9678	-.03172	.03306
PIRH	-.01278	.01664	-.77	.4422	-.04539	.01982
PIRI	.06678	.01587	4.21	.0000	.03567	.09789
PIRJ	-.02060	.01289	-1.60	.1100	-.04586	.00466
PIRK	.07632	.01212	6.30	.0000	.05257	.10007
PIRL	.07632	.01441	5.30	.0000	.04807	.10457
PIRMR	.03719	.01501	2.48	.0132	.00777	.06661
PIRNR	.05939	.01733	3.43	.0006	.02543	.09335
PIROR	-.05877	.01724	-3.41	.0007	-.09256	-.02499
PIRP	-.11769	.01624	-7.25	.0000	-.14953	-.08586
PIRQ	.03267	.01737	1.88	.0600	-.00137	.06672
PIRS	.07023	.01658	4.24	.0000	.03774	.10272
RPA	.10076	.01512	6.66	.0000	.07112	.13039
RPBR	.07340	.01386	5.30	.0000	.04624	.10056
RPCR	-.03444	.01589	-2.17	.0301	-.06558	-.00331
RPD	.02785	.01643	1.70	.0901	-.00435	.06006
RPE	.03381	.01568	2.16	.0310	.00309	.06454
RPFR	-.05970	.01487	-4.01	.0001	-.08885	-.03055
RPGR	.03576	.01544	2.32	.0206	.00548	.06603
RPH	.05160	.01562	3.30	.0010	.02098	.08223
DSSRA	-.03604	.01834	-1.96	.0494	-.07199	-.00009
DSSRB	-.02998	.02135	-1.40	.1603	-.07183	.01187
DSSRC	.00044	.01986	.02	.9825	-.03850	.03937
DSSRD	-.00052	.01831	-.03	.9772	-.03641	.03536
DSSRE	.10180	.01842	5.53	.0000	.06569	.13790
DSSIA	-.01050	.01538	-.68	.4946	-.04065	.01964
DSSIB	.04250	.01835	2.32	.0205	.00654	.07846
DSSIC	-.00640	.01618	-.40	.6926	-.03810	.02531
DSSID	.01570	.01614	.97	.3307	-.01594	.04735
DSSIE	.02865	.01567	1.83	.0675	-.00206	.05937
HECOA	.03473	.01643	2.11	.0345	.00254	.06693
HECOB	-.04408	.01666	-2.65	.0082	-.07673	-.01142
HECOC	.00747	.01612	.46	.6430	-.02412	.03905
HECOD	-.03818	.01587	-2.41	.0161	-.06928	-.00708
FTNSA	.02984	.01443	2.07	.0386	.00156	.05812
FTNSB	-.12584	.01561	-8.06	.0000	-.15643	-.09524

Variable	Coefficient	Standard Error	z	Prob. |z|>z*	95% Confidence Interval	
FTNSC	.05159	.01583	3.26	.0011	.02057	.08262
FTNSD	.02316	.01609	1.44	.1501	-.00838	.05470
FTNSE	-.06893	.01506	-4.58	.0000	-.09844	-.03942
FTNSF	-.03035	.01460	-2.08	.0376	-.05896	-.00174
FTNSG	.04088	.01515	2.70	.0070	.01120	.07057
FTNSH	.08888	.01777	5.00	.0000	.05405	.12371
FTNSI	-.07908	.01725	-4.58	.0000	-.11288	-.04527
FTNJR	-.05897	.01369	-4.31	.0000	-.08581	-.03213
FTNKR	-.03427	.01720	-1.99	.0463	-.06798	-.00056
FTNLR	-.09390	.01727	-5.44	.0000	-.12775	-.06005
FTNMR	-.07050	.01270	-5.55	.0000	-.09540	-.04560
Characteristics in numerator of Prob(CHOIC=2) Non-GMO Soybean Oil						
CRSO	.38637	.03529	10.95	.0000	.31721	.45553
RGMS	-.04867	.01351	-3.60	.0003	-.07514	-.02220
BGMS	.01735	.01356	1.28	.2006	-.00922	.04392
K	.05491	.01836	2.99	.0028	.01893	.09089
KN	.05601	.02069	2.71	.0068	.01546	.09657
KNO	.06768	.01927	3.51	.0004	.02991	.10545
PIRA	-.03277	.01816	-1.80	.0711	-.06836	.00282
PIRB	.01939	.01752	1.11	.2685	-.01495	.05373
PIRC	.00923	.01611	.57	.5665	-.02234	.04080
PIRD	-.01528	.01843	-.83	.4070	-.05139	.02084
PIRE	.01954	.02046	.96	.3396	-.02057	.05965
PIRF	-.04070	.01772	-2.30	.0216	-.07543	-.00596
PIRG	-.02962	.02026	-1.46	.1439	-.06933	.01010
PIRH	.00077	.02058	.04	.9702	-.03956	.04110
PIRI	.02045	.01951	1.05	.2945	-.01779	.05869
PIRJ	.04420	.01602	2.76	.0058	.01281	.07560
PIRK	.08604	.01494	5.76	.0000	.05676	.11533
PIRL	-.00218	.01756	-.12	.9010	-.03660	.03224
PIRMR	.05261	.01832	2.87	.0041	.01671	.08852
PIRNR	.05038	.02100	2.40	.0165	.00922	.09154
PIROR	-.12397	.02059	-6.02	.0000	-.16432	-.08361
PIRP	-.06138	.01984	-3.09	.0020	-.10027	-.02250
PIRQ	.04788	.02147	2.23	.0257	.00581	.08995
PIRS	.00258	.02066	.13	.9004	-.03790	.04307
RPA	-.01858	.01820	-1.02	.3075	-.05426	.01710
RPBR	.05470	.01716	3.19	.0014	.02107	.08832
RPCR	-.00125	.01907	-.07	.9479	-.03863	.03614
RPD	-.08174	.02001	-4.09	.0000	-.12095	-.04252
RPE	.08224	.01924	4.28	.0000	.04454	.11995
RPFR	.03832	.01838	2.08	.0371	.00229	.07435
RPGR	-.13238	.01914	-6.92	.0000	-.16989	-.09487
RPH	-.01235	.01906	-.65	.5172	-.04970	.02501
DSSRA	-.14688	.02198	-6.68	.0000	-.18995	-.10380
DSSRB	.02798	.02594	1.08	.2807	-.02286	.07882
DSSRC	-.05561	.02419	-2.30	.0215	-.10303	-.00820
DSSRD	.04345	.02262	1.92	.0548	-.00088	.08779
DSSRE	.08961	.02200	4.07	.0000	.04649	.13273
DSSIA	.08972	.01892	4.74	.0000	.05265	.12680
DSSIB	-.01431	.02220	-.64	.5191	-.05781	.02919
DSSIC	-.04992	.01997	-2.50	.0124	-.08906	-.01077
DSSID	-.02519	.01998	-1.26	.2073	-.06434	.01396
DSSIE	-.02187	.01918	-1.14	.2543	-.05947	.01573

Variable	Coefficient	Standard Error	z	Prob. |z|>z*	95% Confidence Interval	
HECOA	-.02647	.02001	-1.32	.1859	-.06569	.01275
HECOB	-.00605	.02016	-.30	.7642	-.04556	.03346
HECOC	.07740	.02047	3.78	.0002	.03727	.11752
HECOD	-.07534	.01939	-3.89	.0001	-.11335	-.03733
FTNSA	.07786	.01754	4.44	.0000	.04348	.11223
FTNSB	-.03690	.01873	-1.97	.0489	-.07361	-.00018
FTNSC	.08244	.01914	4.31	.0000	.04494	.11995
FTNSD	-.09041	.01949	-4.64	.0000	-.12860	-.05222
FTNSE	-.00896	.01836	-.49	.6258	-.04495	.02703
FTNSF	-.03070	.01783	-1.72	.0851	-.06565	.00424
FTNSG	.00374	.01864	.20	.8412	-.03280	.04027
FTNSH	.06079	.02163	2.81	.0050	.01839	.10319
FTNSI	.01534	.02105	.73	.4662	-.02592	.05660
FTNJR	-.05772	.01608	-3.59	.0003	-.08923	-.02620
FTNKR	-.03172	.02021	-1.57	.1166	-.07133	.00790
FTNLR	-.06061	.02099	-2.89	.0039	-.10175	-.01947
FTNMR	-.12860	.01568	-8.20	.0000	-.15933	-.09786
Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
Marginal effects on Prob(CHOIC=0) Opt-Out						
CRSO	-.05842	-.31247	-10.15	.0000	-.06970	-.04713
RGMS	.02763	.46440	13.34	.0000	.02357	.03169
BGMS	-.01171	-.15696	-5.58	.0000	-.01583	-.00760
K	-.01035	-.14179	-3.69	.0002	-.01584	-.00485
KN	.00794	.10348	2.47	.0136	.00163	.01424
KNO	-.00065	-.00734	-.21	.8313	-.00666	.00535
PIRA	.00490	.05902	1.76	.0786	-.00056	.01035
PIRB	-.00321	-.04399	-1.20	.2318	-.00846	.00205
PIRC	.01222	.14628	5.01	.0000	.00744	.01700
PIRD	-.00501	-.07317	-1.81	.0695	-.01042	.00040
PIRE	-.00794	-.11597	-2.55	.0108	-.01405	-.00183
PIRF	.00232	.03713	.87	.3869	-.00293	.00757
PIRG	.00155	.02206	.50	.6152	-.00451	.00761
PIRH	.00176	.02515	.57	.5697	-.00430	.00782
PIRI	-.01055	-.14953	-3.57	.0004	-.01633	-.00476
PIRJ	.00044	.00688	.18	.8539	-.00427	.00516
PIRK	-.01554	-.23766	-6.88	.0000	-.01997	-.01112
PIRL	-.01063	-.18286	-3.98	.0001	-.01587	-.00540
PIRMR	-.00817	-.12822	-2.92	.0035	-.01365	-.00268
PIRNR	-.01117	-.18030	-3.47	.0005	-.01748	-.00486
PIROR	.01518	.24499	4.74	.0000	.00891	.02145
PIRP	.02000	.34004	6.66	.0000	.01411	.02589
PIRQ	-.00727	-.11809	-2.24	.0248	-.01362	-.00092
PIRS	-.01004	-.16508	-3.25	.0012	-.01610	-.00398
RPA	-.01316	-.22476	-4.71	.0000	-.01864	-.00769
RPBR	-.01339	-.17704	-5.17	.0000	-.01846	-.00831
RPCR	.00492	.06334	1.67	.0943	-.00084	.01069
RPD	.00062	.01048	.20	.8378	-.00535	.00659
RPE	-.00934	-.15825	-3.21	.0013	-.01504	-.00364
RPFR	.00628	.08348	2.27	.0231	.00086	.01170
RPGR	.00233	.03025	.81	.4185	-.00331	.00797
RPH	-.00658	-.10759	-2.27	.0233	-.01227	-.00089
DSSRA	.01325	.24655	3.87	.0001	.00653	.01997
DSSRB	.00267	.04851	.67	.5010	-.00510	.01044

Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
DSSRC	.00303	.05625	.82	.4109	-.00420	.01026
DSSRD	-.00234	-.04392	-.69	.4901	-.00900	.00431
DSSRE	-.01933	-.36472	-5.68	.0000	-.02600	-.01266
DSSIA	-.00351	-.05806	-1.23	.2179	-.00910	.00207
DSSIB	-.00519	-.08798	-1.53	.1265	-.01185	.00147
DSSIC	.00368	.06081	1.23	.2198	-.00220	.00955
DSSID	-.00081	-.01316	-.27	.7872	-.00670	.00508
DSSIE	-.00282	-.04413	-.97	.3329	-.00853	.00289
HECOA	-.00342	-.05956	-1.12	.2621	-.00940	.00256
HECOB	.00655	.11304	2.11	.0346	.00047	.01262
HECOC	-.00536	-.09385	-1.78	.0752	-.01126	.00054
HECOD	.00957	.15999	3.25	.0012	.00380	.01534
FTNSA	-.00854	-.12857	-3.16	.0016	-.01382	-.00325
FTNSB	.01978	.30192	6.82	.0000	.01409	.02547
FTNSC	-.01186	-.19064	-4.03	.0001	-.01762	-.00609
FTNSD	.00177	.02637	.59	.5548	-.00410	.00763
FTNSE	.01021	.16244	3.66	.0002	.00475	.01567
FTNSF	.00598	.10077	2.21	.0274	.00067	.01130
FTNSG	-.00597	-.09792	-2.11	.0348	-.01151	-.00043
FTNSH	-.01591	-.26554	-4.82	.0000	-.02238	-.00943
FTNSI	.01029	.17784	3.21	.0013	.00400	.01658
FTNJR	.01152	.17180	4.56	.0000	.00657	.01647
FTNKR	.00659	.08974	2.08	.0378	.00037	.01282
FTNLR	.01660	.21866	5.17	.0000	.01031	.02290
FTNMR	.01709	.26141	7.25	.0000	.01247	.02171
Marginal effects on Prob(CHOIC=1) GMO Soybean Oil						
CRSO	.02342	.06425	3.84	.0001	.01146	.03538
RGMS	-.03883	-.33470	-16.53	.0000	-.04344	-.03423
BGMS	.01714	.11779	7.15	.0000	.01244	.02184
K	.00695	.04883	2.16	.0305	.00066	.01324
KN	-.02565	-.17144	-6.94	.0000	-.03289	-.01840
KNO	-.01285	-.07414	-3.75	.0002	-.01957	-.00613
PIRA	-.00188	-.01164	-.60	.5481	-.00803	.00426
PIRB	.00166	.01168	.55	.5848	-.00429	.00761
PIRC	-.02355	-.14451	-8.51	.0000	-.02897	-.01813
PIRD	.01203	.09010	3.86	.0001	.00592	.01814
PIRE	.01002	.07498	2.84	.0046	.00309	.01694
PIRF	.00432	.03551	1.40	.1611	-.00172	.01037
PIRG	.00338	.02461	.98	.3278	-.00339	.01015
PIRH	-.00327	-.02400	-.92	.3580	-.01025	.00370
PIRI	.01444	.10494	4.28	.0000	.00782	.02105
PIRJ	-.00993	-.07908	-3.63	.0003	-.01530	-.00457
PIRK	.00970	.07605	3.79	.0002	.00468	.01472
PIRL	.01927	.16997	6.28	.0000	.01325	.02529
PIRMR	.00357	.02871	1.13	.2576	-.00261	.00974
PIRNR	.00935	.07735	2.56	.0105	.00219	.01650
PIROR	-.00121	-.00999	-.33	.7378	-.00828	.00586
PIRP	-.02269	-.19787	-6.52	.0000	-.02952	-.01587
PIRQ	.00295	.02461	.80	.4231	-.00427	.01018
PIRS	.01724	.14533	4.88	.0000	.01031	.02416
RPA	.02715	.23769	8.46	.0000	.02085	.03344
RPBR	.01237	.08391	4.24	.0000	.00665	.01809
RPCR	-.00846	-.05579	-2.52	.0118	-.01504	-.00187
RPD	.01582	.13636	4.52	.0000	.00896	.02268

Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
RPE	-.00049	-.00426	-.15	.8835	-.00705	.00607
RPFR	-.01905	-.12984	-6.00	.0000	-.02527	-.01282
RPGR	.02328	.15515	7.10	.0000	.01685	.02971
RPH	.01421	.11907	4.29	.0000	.00772	.02070
DSSRA	.00695	.06629	1.84	.0657	-.00045	.01435
DSSRB	-.01051	-.09804	-2.32	.0201	-.01938	-.00165
DSSRC	.00614	.05842	1.46	.1449	-.00212	.01440
DSSRD	-.00485	-.04655	-1.23	.2182	-.01256	.00287
DSSRE	.01567	.15158	4.02	.0001	.00803	.02330
DSSIA	-.01236	-.10474	-3.75	.0002	-.01882	-.00589
DSSIB	.01215	.10560	3.12	.0018	.00451	.01980
DSSIC	.00382	.03239	1.10	.2725	-.00300	.01065
DSSID	.00665	.05534	1.93	.0536	-.00010	.01340
DSSIE	.00952	.07638	2.86	.0042	.00299	.01604
HECOA	.01154	.10298	3.31	.0009	.00471	.01836
HECOB	-.01034	-.09153	-2.95	.0032	-.01720	-.00347
HECOC	-.00654	-.05869	-1.88	.0595	-.01333	.00026
HECOD	-.00135	-.01155	-.40	.6901	-.00797	.00528
FTNSA	-.00101	-.00777	-.34	.7374	-.00689	.00487
FTNSB	-.02738	-.21429	-8.41	.0000	-.03377	-.02100
FTNSC	.00392	.03234	1.18	.2382	-.00260	.01044
FTNSD	.01559	.11927	4.61	.0000	.00896	.02222
FTNSE	-.01622	-.13233	-5.04	.0000	-.02253	-.00991
FTNSF	-.00424	-.03659	-1.37	1713	-.01031	.00183
FTNSG	.00979	.08238	3.07	.0022	.00353	.01605
FTNSH	.01557	.13330	4.14	.0000	.00821	.02294
FTNSI	-.02139	-.18958	-5.88	.0000	-.02852	-.01425
FTNJR	-.00845	-.06458	-2.93	.0034	-.01410	-.00279
FTNKR	-.00511	-.03563	-1.41	.1577	-.01219	.00198
FTNLR	-.01684	-.11375	-4.63	.0000	-.02398	-.00971
FTNMR	-.00363	-.02847	-1.33	.1834	-.00898	.00172
Marginal effects on Prob(CHOIC=2) Non-GMO Soybean Oil						
CRSO	.03499	.24307	7.70	.0000	.02609	.04390
RGMS	.01120	.24450	6.01	.0000	.00755	.01486
BGMS	-.00543	-.09446	-2.89	.0039	-.00911	-.00174
K	.00340	.06047	1.32	.1856	-.00163	.00843
KN	.01771	.29975	6.15	.0000	.01206	.02335
KNO	.01351	.19728	5.15	.0000	.00837	.01864
PIRA	-.00301	-.04717	-1.20	.2295	-.00793	.00190
PIRB	.00155	.02754	.64	.5251	-.00322	.00631
PIRC	.01132	.17597	5.06	.0000	.00694	.01571
PIRD	-.00702	-.13314	-2.74	.0061	-.01204	-.00200
PIRE	-.00207	-.03928	-.73	.4658	-.00764	.00350
PIRF	-.00664	-.13814	-2.66	.0077	-.01152	-.00176
PIRG	-.00493	-.09097	-1.77	.0767	-.01040	.00053
PIRH	.00151	.02811	.52	.6015	-.00417	.00719
PIRI	-.00389	-.07158	-1.42	.1544	-.00924	.00146
PIRJ	.00949	.19133	4.24	.0000	.00511	.01388
PIRK	.00584	.11603	2.81	.0049	.00177	.00992
PIRL	-.00864	-.19295	-3.51	.0004	-.01346	-.00382
PIRMR	.00460	.09379	1.82	.0690	-.00036	.00956
PIRNR	.00183	.03826	.63	.5309	-.00388	.00754
PIROR	-.01397	-.29282	-4.93	.0000	-.01952	-.00842
PIRP	.00269	.05949	.96	.3358	-.00279	.00818

Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
PIRQ	.00431	.09104	1.44	.1500	-.00156	.01019
PIRS	-.00720	-.15366	-2.49	.0129	-.01287	-.00152
RPA	-.01398	-.31003	-5.50	.0000	-.01896	-.00900
RPBR	.00101	.01742	.43	.6700	-.00365	.00568
RPCR	.00353	.05903	1.33	.1832	-.00167	.00874
RPD	-.01644	-.35891	-5.87	.0000	-.02193	-.01095
RPE	.00983	.21627	3.64	.0003	.00453	.01513
RPFR	.01277	.22039	4.95	.0000	.00771	.01782
RPGR	-.02561	-.43216	-9.62	.0000	-.03083	-.02039
RPH	-.00763	-.16181	-2.87	.0041	-.01284	-.00242
DSSRA	-.02020	-.48803	-6.81	.0000	-.02602	-.01438
DSSRB	.00785	.18527	2.17	.0300	.00076	.01493
DSSRC	-.00918	-.22097	-2.72	.0066	-.01579	-.00256
DSSRD	.00719	.17491	2.25	.0246	.00092	.01346
DSSRE	.00366	.08976	1.20	.2315	-.00234	.00966
DSSIA	.01587	.34062	5.95	.0000	.01064	.02109
DSSIB	-.00696	-.15316	-2.24	.0250	-.01305	-.00087
DSSIC	-.00750	-.16099	-2.65	.0080	-.01305	-.00195
DSSID	-.00584	-.12304	-2.08	.0374	-.01134	-.00034
DSSIE	-.00670	-.13611	-2.50	.0125	-.01195	-.00144
HECOA	-.00811	-.18343	-2.91	.0037	-.01359	-.00264
HECOB	.00379	.08498	1.36	.1740	-.00167	.00926
HECOC	.01189	.27047	4.11	.0000	.00622	.01757
HECOD	-.00822	-.17851	-3.03	.0025	-.01355	-.00290
FTNSA	.00954	.18663	3.98	.0001	.00484	.01424
FTNSB	.00760	.15057	2.96	.0031	.00256	.01264
FTNSC	.00794	.16567	3.00	.0027	.00275	.01312
FTNSD	-.01735	-.33627	-6.45	.0000	-.02263	-.01208
FTNSE	.00601	.12414	2.33	.0201	.00094	.01107
FTNSF	-.00175	-.03820	-.70	.4831	-.00663	.00314
FTNSG	-.00382	-.08145	-1.48	.1393	-.00889	.00124
FTNSH	.00033	.00725	.11	.9115	-.00557	.00624
FTNSI	.01110	.24912	3.80	.0001	.00538	.01682
FTNJR	-.00308	-.05956	-1.38	.1678	-.00745	.00130
FTNKR	-.00149	-.02630	-.53	.5944	-.00696	.00399
FTNLR	.00024	.00410	.08	.9344	-.00547	.00595
FTNMR	-.01346	-.26736	-6.08	.0000	-.01780	-.00912

APPENDIX E. EXPANDED ANALYSIS OF FIRST ROUND OF PERSONAL PREFERENCE AVERAGES

Chi squared= 2633.86210		Significance Level= .00000	Degrees of Freedom= 34		McFadden Pseudo R-squared= .0549533	
Variable	Coefficient	Standard Error	z	Prob. |z|>z*	95% Confidence Interval	
Characteristices in numerator of Prob(CHOIC=1) GMO Soybean Oil						
RGMS	-.15945	.01047	-15.23	.0000	-.17997	-.13892
BGMS	.06573	.01056	6.23	.0000	.04504	.08643
KNOWF	-.02566	.01280	-2.01	.0449	-.05074	-.00058
STFALT	.01511	.01267	1.19	.2330	-.00972	.03995
ER	.05560	.01612	3.45	.0006	.02402	.08719
CR	.15769	.02108	7.48	.0000	.11637	.19902
SQSI	-.01777	.01357	-1.31	.1904	-.04438	.00883
SQSP	.00856	.01516	.56	.5722	-.02116	.03828
RSALT	-.08607	.01481	-5.81	.0000	-.11510	-.05705
DSSIALT	.10014	.01555	6.44	.0000	.06966	.13062
DSSRALT	.08645	.01560	5.54	.0000	.05587	.11702
RP	.18713	.01988	9.41	.0000	.14817	.22609
HECO	-.06979	.01384	-5.04	.0000	-.09692	-.04266
FTNSU	-.05392	.01884	-2.86	.0042	-.09085	-.01700
FTNSR	.02336	.02202	1.06	.2888	-.01980	.06653
FTNCH	-.15452	.01426	-10.84	.0000	-.18246	-.12658
FTNSM	-.09826	.01119	-8.78	.0000	-.12018	-.07633
CRSO	.25080	.02948	8.51	.0000	.19303	.30858
Characteristics in numerator of Prob(CHOIC=2) Non-GMO Soybean Oil						
RGMS	-.05073	.01274	-3.98	.0001	-.07569	-.02577
BGMS	.02536	.01259	2.01	.0441	.00068	.05005
KNOWF	.18961	.01559	12.17	.0000	.15906	.22016
STFALT	-.00068	.01593	-.04	.9658	-.03190	.03054
ER	-.07680	.02007	-3.83	.0001	-.11613	-.03747
CR	.11253	.02541	4.43	.0000	.06272	.16234
SQSI	-.06905	.01647	-4.19	.0000	-.10133	-.03678
SQSP	.02373	.01904	1.25	.2126	-.01358	.06104
RSALT	.00014	.01782	.01	.9939	-.03478	.03506
DSSIALT	.02919	.01964	1.49	.1373	-.00931	.06768
DSSRALT	-.04214	.01954	-2.16	.0310	-.08044	-.00385
RP	-.05273	.02470	-2.13	.0328	-.10114	-.00432
HECO	-.06137	.01732	-3.54	.0004	-.09532	-.02741
FTNSU	.00831	.02319	.36	.7202	-.03714	.05376
FTNSR	.04359	.02692	1.62	.1054	-.00917	.09635
FTNCH	-.09444	.01757	-5.38	.0000	-.12888	-.06001
FTNSM	-.13857	.01398	-9.91	.0000	-.16598	-.11117
CRSO	.37373	.03352	11.15	.0000	.30804	.43943
Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
Marginal effects on Prob(CHOIC=0) Opt-Out						
RGMS	.02516	.42204	12.89	.0000	.02134	.02899
BGMS	-.01063	-.14212	-5.44	.0000	-.01446	-.00680
KNOWF	-.00726	-.09177	-3.07	.0022	-.01191	-.00262
STFALT	-.00207	-.02929	-.87	.3828	-.00672	.00258
ER	-.00337	-.05070	-1.12	.2636	-.00928	.00254
CR	-.02845	-.45441	-7.24	.0000	-.03616	-.02075

Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
SQSI	.00643	.10263	2.54	.0110	.00147	.01139
SQSP	-.00255	-.04220	-.90	.3671	-.00810	.00299
RSALT	.01201	.14394	4.36	.0000	.00661	.01741
DSSIALT	-.01565	-.25633	-5.39	.0000	-.02134	-.00996
DSSRALT	-.00966	-.18012	-3.32	.0009	-.01535	-.00396
RP	-.02311	-.34462	-6.30	.0000	-.03030	-.01592
HECO	.01325	.22781	5.13	.0000	.00819	.01832
FTNSU	.00705	.11035	2.01	.0448	.00016	.01394
FTNSR	-.00575	-.09375	-1.40	.1620	-.01382	.00231
FTNCH	.02697	.36045	10.13	.0000	.02176	.03219
FTNSM	.02164	.33039	10.36	.0000	.01755	.02574
CRSO	-.05639	-.30101	-10.26	.0000	-.06716	-.04562
Marginal effects on Prob(CHOIC=1) GMO Soybean Oil						
RGMS	-.03423	-.29834	-15.64	.0000	-.03851	-.02994
BGMS	.01362	.09466	6.13	.0000	.00927	.01797
KNOWF	-.02728	-.17912	-10.04	.0000	-.03260	-.02195
STFALT	.00385	.02829	1.42	.1554	-.00146	.00916
ER	.02233	.17461	6.53	.0000	.01563	.02904
CR	.02699	.22399	6.16	.0000	.01839	.03558
SQSI	.00316	.02623	1.11	.2691	-.00245	.00877
SQSP	-.00047	-.00407	-.15	.8847	-.00687	.00592
RSALT	-.02150	-.13396	-6.93	.0000	-.02759	-.01542
DSSIALT	.02179	.18548	6.49	.0000	.01520	.02837
DSSRALT	.02622	.25414	7.80	.0000	.01963	.03281
RP	.05252	.40707	12.09	.0000	.04401	.06104
HECO	-.01067	-.09532	-3.60	.0003	-.01648	-.00486
FTNSU	-.01438	-.11690	-3.60	.0003	-.02220	-.00655
FTNSR	.00104	.00876	.22	.8230	-.00803	.01010
FTNCH	-.02818	-.19573	-9.38	.0000	-.03407	-.02229
FTNSM	-.00928	-.07363	-3.88	.0001	-.01396	-.00460
CRSO	.02149	.05961	3.70	.0002	.01011	.03286
Marginal effects on Prob(CHOIC=2) Non-GMO Soybean Oil						
RGMS	.00906	.19282	5.09	.0000	.00557	.01255
BGMS	-.00299	-.05076	-1.69	.0917	-.00647	.00049
KNOWF	.03454	.55363	15.66	.0000	.03021	.03886
STFALT	-.00178	-.03190	-.78	.4355	-.00624	.00269
ER	-.01896	-.36190	-6.66	.0000	-.02455	-.01338
CR	.00147	.02970	.41	.6787	-.00547	.00840
SQSI	-.00959	-.19422	-4.13	.0000	-.01414	-.00504
SQSP	.00303	.06346	1.10	.2695	-.00235	.00840
RSALT	.00950	.14438	3.80	.0001	.00459	.01440
DSSIALT	-.00614	-.12756	-2.16	.0305	-.01170	-.00058
DSSRALT	-.01656	-.39182	-5.90	.0000	-.02207	-.01106
RP	-.02941	-.55643	-8.17	.0000	-.03647	-.02236
HECO	-.00258	-.05633	-1.04	.2980	-.00745	.00228
FTNSU	.00732	.14536	2.23	.0260	.00088	.01377
FTNSR	.00472	.09754	1.25	.2129	-.00271	.01215
FTNCH	.00121	.02050	.49	.6258	-.00365	.00607
FTNSM	-.01236	-.23941	-6.19	.0000	-.01628	-.00845
CRSO	.03491	.23636	7.97	.0000	.02632	.04349

APPENDIX F. EXPANDED ANALYSIS OF SECOND ROUND OF PERSONAL PREFERENCE AVERAGES

Chi squared= 2250.63758		Significance Level= .00000	Degrees of Freedom= 20	McFadden Pseudo R-squared= .0469577		
Variable	Coefficient	Standard Error	z	Prob. |z|>z*	95% Confidence Interval	
Characteristices in numerator of Prob(CHOIC=1) GMO Soybean Oil						
RGMS	-.15752	.01021	-15.43	.0000	-.17752	-.13751
BGMS	.05951	.01033	5.76	.0000	.03926	.07976
KNOWF	-.02585	.01222	-2.12	.0344	-.04980	-.00190
IRCALT	.10094	.01783	5.66	.0000	.06598	.13589
SQSALT	-.09576	.01183	-8.09	.0000	-.11894	-.07257
RP	.13966	.01793	7.79	.0000	.10452	.17481
DSSRALT	.13212	.01400	9.44	.0000	.10468	.15955
DSSIALT	.16899	.01466	11.53	.0000	.14026	.19773
HECO	-.00864	.01313	-.66	.5104	-.03438	.01709
FTNSALT	-.24619	.01880	-13.10	.0000	-.28303	-.20934
CRSO	.21869	.02891	7.56	.0000	.16203	.27536
Characteristics in numerator of Prob(CHOIC=2) Non-GMO Soybean Oil						
RGMS	-.04969	.01239	-4.01	.0001	-.07398	-.02540
BGMS	.03050	.01229	2.48	.0131	.00640	.05459
KNOWF	.21938	.01495	14.67	.0000	.19007	.24868
IRCALT	-.01171	.02147	-.55	.5855	-.05380	.03038
SQSALT	-.16715	.01419	-11.78	.0000	-.19496	-.13935
RP	-.12223	.02238	-5.46	.0000	-.16611	-.07836
DSSRALT	-.00412	.01734	-.24	.8120	-.03811	.02986
DSSIALT	.09710	.01839	5.28	.0000	.06106	.13315
HECO	-.00843	.01648	-.51	.6091	-.04073	.02388
FTNSALT	-.11727	.02311	-5.08	.0000	-.16256	-.07198
CRSO	.33968	.03295	10.31	.0000	.27510	.40425
Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
Marginal effects on Prob(CHOIC=0) Opt-Out						
RGMS	.02491	.41520	13.05	.0000	.02117	.02865
BGMS	-.01009	-.13405	-5.26	.0000	-.01385	-.00633
KNOWF	-.00902	-.11325	-3.98	.0001	-.01347	-.00457
IRCALT	-.01346	-.19556	-4.06	.0000	-.01995	-.00696
SQSALT	.02303	.36527	10.45	.0000	.01871	.02736
RP	-.01251	-.18536	-3.76	.0002	-.01903	-.00598
DSSRALT	-.01826	-.33832	-7.03	.0000	-.02334	-.01317
DSSIALT	-.02925	-.47607	-10.69	.0000	-.03462	-.02389
HECO	.00170	.02896	.69	.4901	-.00312	.00651
FTNSALT	.04122	.61829	11.77	.0000	.03435	.04809
CRSO	-.05018	-.26617	-9.28	.0000	-.06078	-.03958
Marginal effects on Prob(CHOIC=1) GMO Soybean Oil						
RGMS	-.03388	-.29644	-15.87	.0000	-.03807	-.02970
BGMS	.01151	.08032	5.28	.0000	.00724	.01579
KNOWF	-.03053	-.20124	-11.74	.0000	-.03563	-.02543
IRCALT	.02649	.20213	6.99	.0000	.01906	.03392
SQSALT	-.00557	-.04636	-2.23	.0259	-.01047	-.00067
RP	.04829	.37566	12.35	.0000	.04063	.05596
DSSRALT	.03345	.32536	11.00	.0000	.02749	.03941
DSSIALT	.03155	.26953	9.97	.0000	.02534	.03775

Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
HECO	-.00123	-.01106	-.43	.6640	-.00680	.00433
FTNSALT	-.04861	-.38278	-12.09	.0000	-.05649	-.04073
CRSO	.01734	.04827	3.03	.0025	.00611	.02857
Marginal effects on Prob(CHOIC=2) Non-GMO Soybean Oil						
RGMS	.00897	.19070	5.17	.0000	.00557	.01237
BGMS	-.00143	-.02419	-.82	.4118	-.00483	.00198
KNOWF	.03955	.63346	18.70	.0000	.03540	.04370
IRCALT	-.01304	-.24169	-4.27	.0000	-.01903	-.00705
SQSALT	-.01747	-.35328	-8.73	.0000	-.02138	-.01355
RP	-.03578	-.67636	-11.04	.0000	-.04213	-.02943
DSSRALT	-.01519	-.35904	-6.04	.0000	-.02012	-.01026
DSSIALT	-.00230	-.04765	-.86	.3876	-.00750	.00291
HECO	-.00046	-.01006	-.19	.8465	-.00514	.00421
FTNSALT	.00739	.14143	2.23	.0255	.00091	.01388
CRSO	.03285	.22223	7.57	.0000	.02434	.04135

APPENDIX G. EXPANDED ANALYSIS OF THIRD ROUND OF PERSONAL PREFERENCE AVERAGES

Chi squared= 2094.91235		Significance Level= .00000	Degrees of Freedom= 16		McFadden Pseudo R-squared= .0437086	
Variable	Coefficient	Standard Error	z	Prob. |z|>z*	95% Confidence Interval	
Characteristices in numerator of Prob(CHOIC=1) GMO Soybean Oil						
CRSO	.22587	.02867	7.88	.0000	.16968	.28205
RGMS	-.15664	.01021	-15.34	.0000	-.17666	-.13662
BGMS	.06707	.01033	6.49	.0000	.04683	.08732
KNOWF	.00977	.01160	.84	.3997	-.01296	.03250
PIRALT	.04512	.02305	1.96	.0503	-.00007	.09031
RP	.04620	.01548	2.98	.0028	.01586	.07654
DSSRALT	.11900	.01344	8.85	.0000	.09265	.14535
DSSIALT	.19919	.01417	14.06	.0000	.17142	.22695
FTNSALT	-.26871	.01890	-14.22	.0000	-.30575	-.23167
Characteristics in numerator of Prob(CHOIC=2) Non-GMO Soybean Oil						
CRSO	.35182	.03268	10.77	.0000	.28777	.41588
RGMS	-.04842	.01236	-3.92	.0001	-.07264	-.02419
BGMS	.04317	.01218	3.54	.0004	.01929	.06705
KNOWF	.26225	.01423	18.43	.0000	.23435	.29015
PIRALT	-.12610	.02785	-4.53	.0000	-.18069	-.07151
RP	-.24314	.01899	-12.80	.0000	-.28036	-.20592
DSSRALT	-.02114	.01653	-1.28	.2009	-.05353	.01126
DSSIALT	.14210	.01742	8.16	.0000	.10795	.17624
FTNSALT	-.15064	.02291	-6.58	.0000	-.19554	-.10573
Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
Marginal effects on Prob(CHOIC=0) Opt-Out						
CRSO	-.05190	-.27524	-9.70	.0000	-.06240	-.04141
RGMS	.02471	.41177	12.93	.0000	.02097	.02846
BGMS	-.01188	-.15778	-6.19	.0000	-.01564	-.00812
KNOWF	-.01650	-.20710	-7.62	.0000	-.02074	-.01225
PIRALT	.00096	.01432	.22	.8230	-.00746	.00939
RP	.00756	.11205	2.61	.0090	.00189	.01324
DSSRALT	-.01543	-.28591	-6.17	.0000	-.02034	-.01053
DSSIALT	-.03607	-.58693	-13.68	.0000	-.04124	-.03090
FTNSALT	.04629	.69423	13.14	.0000	.03939	.05320
Marginal effects on Prob(CHOIC=1) GMO Soybean Oil						
CRSO	.01777	.04952	3.11	.0019	.00658	.02897
RGMS	-.03380	-.29593	-15.95	.0000	-.03796	-.02965
BGMS	.01201	.08383	5.55	.0000	.00777	.01625
KNOWF	-.02636	-.17385	-10.85	.0000	-.03112	-.02159
PIRALT	.02512	.19651	5.14	.0000	.01554	.03469
RP	.03824	.29762	11.66	.0000	.03181	.04466
DSSRALT	.03204	.31188	11.13	.0000	.02640	.03768
DSSIALT	.03414	.29188	11.26	.0000	.02820	.04008
FTNSALT	-.05057	-.39843	-12.67	.0000	-.05839	-.04274
Marginal effects on Prob(CHOIC=2) Non-GMO Soybean Oil						
CRSO	.03413	.23063	7.87	.0000	.02563	.04263
RGMS	.00909	.19302	5.30	.0000	.00573	.01246
BGMS	-.00013	-.00226	-.08	.9378	-.00349	.00322

Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
KNOWF	.04286	.68554	21.69	.0000	.03898	.04673
PIRALT	-.02608	-.49486	-6.61	.0000	-.03381	-.01835
RP	-.04580	-.86463	-17.33	.0000	-.05098	-.04062
DSSRALT	-.01661	-.39210	-7.03	.0000	-.02124	-.01198
DSSIALT	.00193	.04000	.77	.4404	-.00297	.00683
FTNSALT	.00428	.08170	1.32	.1874	-.00208	.01063

APPENDIX H. EXPANDED ANALYSIS OF THE AGGREGATE MODEL

Chi squared= 43479.71825		Significance Level= .00000	Degrees of Freedom= 40		McFadden Pseudo R-squared= .9071679	
Variable	Coefficient	Standard Error	z	Prob. |z|>z*	95% Confidence Interval	
Characteristics in numerator of Prob(CHOIC=1) GMO Soybean Oil						
ENVIR	3.08254	.29459	10.46	.0000	2.50516	3.65992
HEALT	4.42202	.52194	8.47	.0000	3.39903	5.44501
PRICE	1.53908	.03132	49.14	.0000	1.47769	1.60047
HOME	-.10131	.05102	-1.99	.0471	-.20131	-.00131
PPFH	-.09412	.15616	-.60	.5467	-.40019	.21196
EDUC	-.01215	.05695	-.21	.8310	-.12378	.09948
GEND	-.28431	.14855	-1.91	.0556	-.57546	.00685
MAST	-.06530	.14378	-.45	.6497	-.34711	.21651
HOION	-.02353	.05055	-.47	.6416	-.12261	.07554
CHYOU	-.63699	.15508	-4.11	.0000	-.94095	-.33304
PRPU	-.72328	.20147	-3.59	.0003	-1.11816	-.32840
RESID	-.00868	.12717	-.07	.9456	-.25793	.24058
CRSO	.18936	.10397	1.82	.0686	-.01441	.39314
RGMS	-.11760	.03842	-3.06	.0022	-.19291	-.04229
BGMS	-.00354	.03955	-.09	.9287	-.08105	.07398
KNOWF	-.00601	.04449	-.14	.8925	-.09322	.08119
PIRALT	-.17103	.09534	-1.79	.0728	-.35789	.01584
RP	-.32124	.06710	-4.79	.0000	-.45275	-.18973
DSSRALT	-.02415	.05310	-.45	.6492	-.12823	.07993
DSSIALT	.14335	.05315	2.70	.0070	.03918	.24753
FTNSALT	-.23561	.07339	-3.21	.0013	-.37945	-.09177
Characteristics in numerator of Prob(CHOIC=2) Non-GMO Soybean Oil						
ENVIR	3.74271	.32506	11.51	.0000	3.10561	4.37981
HEALT	5.32071	.54066	9.84	.0000	4.26104	6.38038
PRICE	2.31937	.03515	65.99	.0000	2.25049	2.38826
HOME	-.35284	.07767	-4.54	.0000	-.50506	-.20061
PPFH	-.11694	.22541	-.52	.6039	-.55873	.32485
EDUC	-.14779	.08636	-1.71	.0870	-.31705	.02147
GEND	-.58584	.21665	-2.70	.0068	-1.01046	-.16121
MAST	.24142	.21307	1.13	.2572	-.17618	.65902
HOIN	-.01043	.07427	-.14	.8883	-.15599	.13514
CHYOU	-1.31328	.22793	-5.76	.0000	-1.76001	-.86655
PRPU	-.66210	.29591	-2.24	.0253	-1.24207	-.08212
RESID	-.05529	.18693	-.30	.7674	-.42167	.31110
CRSO	.26261	.15078	1.74	.0816	-.03292	.55813
RGMS	-.06715	.05614	-1.20	.2317	-.17719	.04289
BGMS	-.11541	.05800	-1.99	.0466	-.22909	-.00172
KNOWF	.21964	.06781	3.24	.0012	.08673	.35254
PIRALT	-.89774	.14120	-6.36	.0000	-1.17448	-.62099
RP	-1.30280	.10083	-12.92	.0000	-1.50042	-1.10517
DSSRALT	-.27839	.07954	-3.50	.0005	-.43430	-.12248
DSSIALT	.22816	.08092	2.82	.0048	.06957	.38676
FTNSALT	-.42853	.10756	-3.98	.0001	-.63934	-.21773
Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
Marginal effects on Prob(CHOIC=0) Opt-Out						
ENVIR	-.82445D-04	-1.22827	-3.75	.0002	-.12559D-03	-.39303D-04
HEALT	-.00012	-1.87859	-4.65	.0000	-.00017	-.00007

Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
PRICE	-.41620D-04	-11.47956	-3.68	.0002	-.63791D-04	-.19448D-04
HOME	.29420D-05	.32579	1.88	.0601	-.12451D-06	.60085D-05
PPFH	.25199D-05	.04710	.60	.5495	-.57320D-05	.10772D-04
EDUC	.45956D-06	.06850	.30	.7625	-.25216D-05	.34407D-05
GEND	.78473D-05	.19529	1.72	.0857	-.11034D-05	.16798D-04
MAST	.14222D-05	.02369	.37	.7111	-.61046D-05	.89491D-05
HOIN	.61100D-06	.05993	.45	.6506	-.20330D-05	.32550D-05
CHYOU	.17583D-04	.37623	2.80	.0052	.52613D-05	.29904D-04
PRPU	.19126D-04	.09061	2.53	.0115	.42956D-05	.33957D-04
RESID	.27732D-06	.00435	.08	.9345	-.63413D-05	.68960D-05
CRSO	-.50977D-05	-.27628	-1.65	.0980	-.11137D-04	.94143D-06
RGMS	.30689D-05	.52263	2.31	.0207	.46917D-06	.56687D-05
BGMS	.20696D-06	.02810	.20	.8438	-.18515D-05	.22654D-05
KNOWF	0.0	-.00880	-.06	.9537	-.23844D-05	.22471D-05
PIRALT	.52720D-05	.80239	1.82	.0689	-.40898D-06	.10953D-04
RP	.95147D-05	1.44064	3.03	.0024	.33668D-05	.15663D-04
DSSRALT	.89781D-06	.17000	.63	.5313	-.19134D-05	.37090D-05
DSSIALT	-.38887D-05	-.64670	-2.19	.0287	-.73732D-05	-.40424D-06
FTNSALT	.64456D-05	.98793	2.43	.0151	.12462D-05	.11645D-04
Marginal effects on Prob(CHOIC=1) GMO Soybean Oil						
ENVIR	-.02412	-.00991	-5.15	.0000	-.03330	-.01494
HEALT	-.03283	-.01439	-6.92	.0000	-.04213	-.02354
PRICE	-.02857	-.21732	-12.91	.0000	-.03290	-.02423
HOME	.00922	.02816	4.16	.0000	.00488	.01356
PPFH	.00083	.00043	.14	.8888	-.01086	.01253
EDUC	.00497	.02044	2.06	.0392	.00025	.00970
GEND	.01105	.00758	1.91	.0561	-.00029	.02238
MAST	-.01125	-.00517	-1.94	.0522	-.02260	.00011
HOIN	-.00048	-.00130	-.24	.8098	-.00440	.00344
CHYOU	.02478	.01462	4.00	.0001	.01263	.03692
PRPU	-.00226	-.00030	-.28	.7764	-.01787	.01334
RESID	.00171	.00074	.34	.7340	-.00815	.01156
CRSO	-.00268	-.00401	-.67	.5030	-.01052	.00516
RGMS	-.00185	-.00870	-1.22	.2210	-.00482	.00111
BGMS	.00410	.01536	2.59	.0095	.00100	.00720
KNOWF	-.00827	-.02927	-4.30	.0000	-.01205	-.00450
PIRALT	.02664	.11182	6.31	.0000	.01836	.03491
RP	.03598	.15024	10.26	.0000	.02910	.04285
DSSRALT	.00932	.04867	4.20	.0000	.00497	.01367
DSSIALT	-.00311	-.01424	-1.39	.1641	-.00748	.00127
FTNSALT	.00707	.02987	2.43	.0153	.00136	.01277
Marginal effects on Prob(CHOIC=2) Non-GMO Soybean Oil						
ENVIR	.02421	.25102	5.17	.0000	.01503	.03338
HEALT	.03295	.36447	6.95	.0000	.02366	.04225
PRICE	.02861	5.49248	12.93	.0000	.02427	.03294
HOME	-.00922	-.71079	-4.16	.0000	-.01356	-.00488
PPFH	-.00084	-.01089	-.14	.8884	-.01253	.01085
EDUC	-.00497	-.51593	-2.06	.0392	-.00970	-.00025
GEND	-.01105	-.19149	-1.91	.0560	-.02239	.00028
MAST	.01124	.13040	1.94	.0522	-.00011	.02260
HOIN	.00048	.03280	.24	.8100	-.00344	.00440
CHYOU	-.02479	-.36929	-4.00	.0001	-.03694	-.01265
PRPU	.00224	.00739	.28	.7782	-.01336	.01785
RESID	-.00171	-.01864	-.34	.7340	-.01156	.00815

Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
CRSO	.00269	.10130	.67	.5022	-.00516	.01053
RGMS	.00185	.21924	1.22	.2218	-.00112	.00482
BGMS	-.00410	-.38762	-2.59	.0095	-.00720	-.00100
KNOWF	.00827	.73879	4.30	.0000	.00450	.01205
PIRALT	-.02664	-2.82249	-6.31	.0000	-.03491	-.01837
RP	-.03598	-3.79259	-10.26	.0000	-.04286	-.02911
DSSRALT	-.00932	-1.22848	-4.20	.0000	-.01367	-.00497
DSSIALT	.00311	.35995	1.39	.1636	-.00127	.00748
FTNSALT	-.00707	-.75461	-2.43	.0152	-.01278	-.00136

APPENDIX I. EXPANDED ANALYSIS OF THE AGGREGATE MODEL WITH HEALTH CONSCIOUSNESS SCALE

Chi squared= 43479.88396		Significance Level= .00000	Degrees of Freedom= 42		McFadden Pseudo R-squared= .9071713	
Variable	Coefficient	Standard Error	z	Prob. |z|>z*	95% Confidence Interval	
Characteristices in numerator of Prob(CHOIC=1) GMO Soybean Oil						
ENVIR	3.08238	.29465	10.46	.0000	2.50488	3.65988
HEALT	4.42210	.52196	8.47	.0000	3.39907	5.44512
PRICE	1.53909	.03133	49.13	.0000	1.47770	1.60049
HOME	-.10136	.05106	-1.99	.0471	-.20143	-.00130
PPFH	-.09399	.15624	-.60	.5474	-.40021	.21223
EDUC	-.01218	.05696	-.21	.8307	-.12381	.09946
GEND	-.28421	.14860	-1.91	.0558	-.57546	.00704
MAST	-.06534	.14379	-.45	.6495	-.34715	.21648
HOIN	-.02359	.05059	-.47	.6411	-.12274	.07557
CHYOU	-.63728	.15542	-4.10	.0000	-.94190	-.33266
PRPU	-.72335	.20150	-3.59	.0003	-1.11829	-.32841
RESID	-.00878	.12723	-.07	.9450	-.25814	.24058
CRSO	.18927	.10404	1.82	.0689	-.01465	.39319
RGMS	-.11767	.03849	-3.06	.0022	-.19311	-.04223
BGMS	-.00355	.03955	-.09	.9286	-.08107	.07398
KNOWF	-.00629	.04557	-.14	.8902	-.09560	.08303
PIRALT	-.17112	.09540	-1.79	.0729	-.35811	.01587
RP	-.32132	.06717	-4.78	.0000	-.45297	-.18968
DSSRALT	-.02461	.05564	-.44	.6583	-.13367	.08445
DSSIALT	.14304	.05437	2.63	.0085	.03647	.24960
FTNSALT	-.23569	.07346	-3.21	.0013	-.37966	-.09172
HECO	.00144	.05211	.03	.9779	-.10070	.10358
Characteristics in numerator of Prob(CHOIC=2) Non-GMO Soybean Oil						
ENVIR	3.74535	.32519	11.52	.0000	3.10799	4.38271
HEALT	5.32149	.54067	9.84	.0000	4.26179	6.38119
PRICE	2.31933	.03515	65.99	.0000	2.25044	2.38822
HOME	-.35105	.07785	-4.51	.0000	-.50364	-.19846
PPFH	-.11808	.22561	-.52	.6007	-.56028	.32411
EDUC	-.14790	.08640	-1.71	.0869	-.31723	.02144
GEND	-.58708	.21673	-2.71	.0068	-1.01186	-.16230
MAST	.23903	.21323	1.12	.2623	-.17889	.65696
HOIN	-.00871	.07447	-.12	.9069	-.15467	.13724
CHYOU	-1.30781	.22861	-5.72	.0000	-1.75588	-.85974
PRPU	-.66279	.29603	-2.24	.0252	-1.24300	-.08258
RESID	-.05305	.18710	-.28	.7768	-.41975	.31365
CRSO	.26273	.15089	1.74	.0816	-.03300	.55847
RGMS	-.06664	.05619	-1.19	.2356	-.17676	.04349
BGMS	-.11529	.05804	-1.99	.0470	-.22904	-.00154
KNOWF	.22322	.06920	3.23	.0013	.08758	.35886
PIRALT	-.89724	.14131	-6.35	.0000	-1.17421	-.62028
RP	-1.30024	.10101	-12.87	.0000	-1.49822	-1.10227
DSSRALT	-.27389	.08219	-3.33	.0009	-.43497	-.11281
DSSIALT	.23599	.08412	2.81	.0050	.07111	.40086
FTNSALT	-.42749	.10765	-3.97	.0001	-.63848	-.21651
HECO	-.02191	.07759	-.28	.7777	-.17398	.13016

Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
Marginal effects on Prob(CHOIC=0) Opt-Out						
ENVIR	-.82438D-04	-1.22824	-3.74	.0002	-.12559D-03	-.39289D-04
HEALT	-.00012	-1.87862	-4.65	.0000	-.00017	-.00007
PRICE	-.41617D-04	-11.47944	-3.68	.0002	-.63789D-04	-.19444D-04
HOME	.29412D-05	.32572	1.88	.0602	-.12589D-06	.60083D-05
PPFH	.25177D-05	.04706	.60	.5500	-.57378D-05	.10773D-04
EDUC	.46013D-06	.06859	.30	.7623	-.25210D-05	.34412D-05
GEND	.78453D-05	.19525	1.72	.0859	-.11080D-05	.16799D-04
MAST	.14258D-05	.02376	.37	.7104	-.61008D-05	.89524D-05
HOIN	.61066D-06	.05990	.45	.6510	-.20352D-05	.32565D-05
CHYOU	.17583D-04	.37626	2.80	.0052	.52549D-05	.29911D-04
PRPU	.19127D-04	.09063	2.53	.0115	.42960D-05	.33959D-04
RESID	.27761D-06	.00435	.08	.9345	-.63435D-05	.68987D-05
CRSO	-.50951D-05	-.27616	-1.65	.0984	-.11138D-04	.94785D-06
RGMS	.30699D-05	.52283	2.31	.0207	.46814D-06	.56716D-05
BGMS	.20693D-06	.02810	.20	.8438	-.18516D-05	.22654D-05
KNOWF	0.0	-.00834	-.05	.9571	-.24366D-05	.23066D-05
PIRALT	.52729D-05	.80258	1.82	.0690	-.40993D-06	.10956D-04
RP	.95128D-05	1.44043	3.03	.0024	.33652D-05	.15660D-04
DSSRALT	.90470D-06	.17132	.60	.5464	-.20349D-05	.38443D-05
DSSIALT	-.38883D-05	-.64667	-2.15	.0313	-.74282D-05	-.34842D-06
FTNSALT	.64461D-05	.98807	2.43	.0151	.12454D-05	.11647D-04
HECO	0.0	-.00257	-.01	.9915	-.27264D-05	.26970D-05
Marginal effects on Prob(CHOIC=1) GMO Soybean Oil						
ENVIR	-.02420	-.00995	-5.17	.0000	-.03338	-.01503
HEALT	-.03283	-.01439	-6.93	.0000	-.04212	-.02354
PRICE	-.02854	-.21711	-12.90	.0000	-.03288	-.02420
HOME	.00914	.02792	4.12	.0000	.00479	.01350
PPFH	.00088	.00045	.15	.8828	-.01082	.01258
EDUC	.00497	.02044	2.06	.0392	.00025	.00970
GEND	.01109	.00761	1.92	.0552	-.00024	.02242
MAST	-.01115	-.00512	-1.92	.0544	-.02251	.00021
HOIN	-.00055	-.00148	-.27	.7857	-.00448	.00338
CHYOU	.02454	.01449	3.95	.0001	.01237	.03672
PRPU	-.00224	-.00029	-.28	.7787	-.01784	.01336
RESID	.00162	.00070	.32	.7472	-.00824	.01148
CRSO	-.00269	-.00402	-.67	.5021	-.01053	.00516
RGMS	-.00187	-.00879	-1.24	.2158	-.00484	.00109
BGMS	.00409	.01533	2.59	.0097	.00099	.00719
KNOWF	-.00841	-.02975	-4.30	.0000	-.01224	-.00457
PIRALT	.02659	.11163	6.30	.0000	.01832	.03487
RP	.03585	.14970	10.20	.0000	.02896	.04274
DSSRALT	.00913	.04768	4.03	.0001	.00469	.01357
DSSIALT	-.00340	-.01560	-1.45	.1470	-.00800	.00119
FTNSALT	.00702	.02967	2.41	.0159	.00131	.01273
HECO	.00086	.00412	.41	.6847	-.00327	.00498
Marginal effects on Prob(CHOIC=2) Non-GMO Soybean Oil						
ENIVR	.02429	.25209	5.19	.0000	.01511	.03347
HEALT	.03295	.36477	6.95	.0000	.02366	.04224
PRICE	.02858	5.49230	12.92	.0000	.02424	.03292
HOME	-.00915	-.70561	-4.12	.0000	-.01350	-.00479
PPFH	-.00088	-.01149	-.15	.8824	-.01258	.01081
EDUC	-.00497	-.51626	-2.06	.0392	-.00970	-.00025
GEND	-.01109	-.19235	-1.92	.0550	-.02243	.00024

Variable	Partial Effect	Elasticity	z	Prob. |z|>z*	95% Confidence Interval	
MAST	.01115	.12941	1.92	.0544	-.00021	.02251
HOIN	.00054	.03723	.27	.7859	-.00339	.00448
CHYOU	-.02456	-.36616	-3.95	.0001	-.03674	-.01238
PRPU	.00222	.00732	.28	.7806	-.01338	.01782
RESID	-.00162	-.01770	-.32	.7472	-.01148	.00824
CRSO	.00269	.10161	.67	.5013	-.00515	.01053
RGMS	.00187	.22176	1.24	.2165	-.00110	.00483
BGMS	-.00409	-.38720	-2.59	.0097	-.00719	-.00099
KNOWF	.00841	.75145	4.30	.0000	.00457	.01224
PIRALT	-.02660	-2.82031	-6.30	.0000	-.03487	-.01832
RP	-.03586	-3.78255	-10.20	.0000	-.04275	-.02897
DSSRALT	-.00913	-1.20455	-4.03	.0001	-.01357	-.00469
DSSIALT	.00340	.39450	1.45	.1465	-.00119	.00800
FTNSALT	-.00703	-.75023	-2.41	.0158	-.01273	-.00132
HECO	-.00086	-.10401	-.41	.6847	-.00498	.00327