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Consumers' Resistance to GM-foods:
The Role of Information in an Uncertain Environment

by

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Abstract

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During the post-World War II era, the standard of living has risen steadily in the developed countries. One reason has been the steady introduction and adoption of new goods. Consumers, however, have not accepted all seemingly useful goods,, e.g., the Ford Edsel, electricity from nuclear power, irradiated meat and poultry. Also, during the 19th century in Europe, Luddites destroyed new machines for knitting and textile manufacturing, smashed threshing machines, and pasteurized milk also experienced major opposition.

In the 21st Century, agricultural biotechnology has real potential for creating new, welfare-improving products. However, Greenpeace, Friends-of-the-Earth and other groups have been vocal in their opposition to GM-foods. This paper examines the market characteristics that push a consumer to resist GM foods, with emphasis on negative information and independent, third-party information. We show that negative GM-information pushes some consumers out of the market for GM-labeled foods and that independent third-party information dampens the effectiveness of negative information and increase the probability that consumers will value GM-foods positively.

Introduction

The standard of living in developed countries grew considerably in the twentieth century. One reason has been the steady introduction of new goods and improvement in other goods. The standard of living for the U.S. population has increased during the past century due to the invention and adoption of many new goods (and services). Because of new technology, goods have improved in quality and new goods have been introduced, both frequently increasing social welfare.

New goods and quality improvements have caused a major revision of the Consumer Price Index (CPI). The CPI was biased upwards by approximately 0.6 percent per year (Boskin *et al*, 1998, pp. 5-77), and estimates of increases in the prices of individuals goods have also been shown to be biased upwards by ignoring the effect of new products (Hausman, 1996). This bias estimate could be thought of as a lower bound on how much better off consumers are due to the introduction of new goods – which means that new goods and services alone caused welfare of U.S. citizens to (at least) double in the twentieth century.

Not all new goods, however, have adopted, presumably because consumers judged that they would not be better off with the consumption of the new good relative to the consumption of the pre-existing good. Among passenger cars, the Ford Edsel and Chevy Corvaire were major flops. Also, early prospects for nuclear power were good, but major and persistent resistance developed in developing countries to the use of electricity generated nuclear power (Grübler,1996). This resistance has carried over to irradiated meat and poultry (Fox et al). The two nuclear examples are somewhat surprising because it is generally cheaper (financially and environmentally) to produce electricity by nuclear power than by coal or oil fired generating plants. Irradiated pork and other meats are free from harmful bacteria. The good attributes not withstanding, these goods have not been able to overcome the bad negative image of nuclear energy created by environmental groups like Greenpeace and Friends of the Earth. In the United States, these groups helped increase the public's risk perception of nuclear power, forcing stringent safety standards to be enacted that contributed to a quadrupling of plant costs in just more than a decade (Ruttan, 2001). No new nuclear power plants have been ordered in the United States since 1978.

Opposition exists to other low risk technologies. In Europe, the Luddites destroyed new machinery for knitting and weaving textiles between 1811 and 1816 because of prospects of job loss by a significant share of the textile-industry workers (Grübler**,** 1996). Also, in England during the 1830s, the Captain Swing Movement attacked and smashed mechanical threshing machines. In the United States, opposition to Pasteurization in the beginning of the 20th century was widespread, with opponents saying, among other things, that pasteurization was not needed and that consumers had the "right to drink raw milk" (Hotchkiss, 2001). It is noted in Pirtle (1926) that the slow adoption of pasteurization resulted in the thousands of deaths that could have been prevented.

The use of biotechnology to create genetically modified products has been haled by some as a major new revolution in product innovation. It could be a technology that will lower the price of food in poor countries and increase nutrient intake for children in third world countries (Council for Biotechnology Education, 2002). In the United States, adoption of GM crops has been rapid. In the year 2000, 75 million acres were devoted to GM corn and soybeans, almost half of the total corn and soybeans planted (Fitzgerald, 2001).

Resistance to GM-technology exists in the U.S. and other developed countries. Anti-biotechnology groups have been vocal opponents of agricultural biotechnology, creating websites, holding protests, issuing press releases, and burning down field trials of new genetically modified crops. One argument they make is that "customers must have the right to know" what foods are genetically modified (Greenpeace, 1997). In the European Union, a moratorium has been placed on the release of new GM products, largely due the vocal and more powerful biotech antagonists (Hoban, 1998). WTO court cases will undoubtedly decide the extent of the EU's power to limit imports of GM-food products.

Because the consequences for not adopting technologies can be great, future generations may be worse off by the actions of the current generation. This paper examines the market characteristics that might push a consumer to resist genetically modified foods, with special attention given to the role of negative GM-information and third party, verifiable information. We conduct experimental auctions and examine the impact of information from anti-technology and neutral third-party groups on consumers' unwillingness to purchase genetically modified foods at any price (e.g., putting a consumer out of the market). Our paper presents two key points. First, negative information on genetically modified foods pushes some consumers out of the market for GM-labeled foods, that is where they will not demand GM foods at any price – even a price of zero, and increases the probability of the consumer being out of the market for GM-foods. Second, a third-party source providing verifiable information dampens the effectiveness of negative information and increases the probability that consumers will be in the market for GM-labeled foods. These results have tremendous importance, because if negative information can stymie technology adoption, groups that do not want new products introduced would have an incentive to disseminate negative information on a broad range of new goods, not just genetically modified foods.

Experimental Design

We design our experiment to incorporate the private-information-revealing feature of experimental auction markets (Smith 1976; Fox et al. 2001) and the rigorous randomized treatment effects of statistical experimental design. The experimental design consisted of six biotech information-labeling treatments with two replications. The treatments are randomly assigned to twelve experimental units, each consisting of 13 to 16 consumers drawn from the households of two major urban areas and who are paid to participate. Each participant participated in two trials.[i] Using randomly chosen consumers from the population of an urban area, rather than undergraduate college students at a university, is a advantage when it comes to drawing inferences from the experiments or generalizing to the Midwest or whole U.S. population.

Consumers might react differently to GM content in different types of food or they may have no demand for some food products. Using only one food item seemed unlikely to reveal enough information, given the sizeable fixed cost of conducting the experiment. Three food items were chosen: vegetable oil (made from soybeans), tortilla chips (made from yellow corn), and Russet potatoes. In the distilling and refining process for vegetable oils, essentially all of the proteins (which are the components of DNA and the source of genetic modification) are removed leaving pure lipids. Minimal human health concerns should arise from GM oil, but consumers may either worry that GM soybeans affect the environment or lack adequate information on the distilling process. Tortilla chips are highly processed foods that may be made from GM or non-GM corn, and consumers might have human health and environmental concerns. Russet potatoes are purchased as a fresh product and are generally baked or fried before eating. Similar to tortilla chips, consumers might see both human health and environmental risks from eating GM-Russet potatoes.

Auctions were conducted at two Midwestern U.S. cities: Des Moines, IA, and St. Paul, MN. Participants in the auctions were consumers in these two areas who were contacted by the Iowa State University Statistics Laboratory and agreed to participate in the study. The Statistics Laboratory obtained 1,200 to 1,500 randomly selected residence telephone numbers from each of the metropolitan areas. Employees of the ISU Statistics Laboratory called these numbers to make sure that the phone number was for a residence. The employees then asked to speak to an adult in the household (individual who was 18 years of age or older). They were told that Iowa State University was looking for people who were willing to participate in a group session in Des Moines (St. Paul) that relates to how people select food and household products. The sessions were held on Saturday, April 7th (April 21st) and participants were informed that the session would last about 90 minutes. Each participant was told that they would receive $40 in cash for their time. The sessions were held at the Iowa State University Learning Connection, 7th and Locust, Des Moines (lower level of the Classroom Office Building, University of Minnesota, St. Paul). Three different times were available each auction day, 9 a.m., 11:30 p.m., and 2 p.m., and willing participants were asked to choose a time that best fit their schedule. Participation per household was limited to two adult individuals, and they were assigned to different groups.[ii] To willing participants, the Statistics Laboratory followed up by sending a letter containing more information, including a map and instructions on when and where the meeting would be held, how to get there, and a telephone number to contact for more information.

There were twelve experimental units, six in Des Moines, and six in Minneapolis. Twelve hundred people in Des Moines were called and 99 of them agreed to participate. Of those 99 people who agreed to participate, 77 did indeed attend. For the Minneapolis experiments, 1,500 people were called and 118 people agreed to participate. Of those 118, we had 95 participants in the Minneapolis experiments. The total sample size is 172, which is large compared to most experimental auctions.

Each auction had ten steps, which are summarized in figure 1.[iii] When participants arrived at the lab, they signed a consent form to agree to participate in the auction. After they signed this form, they were given $40 for participating and an ID number to preserve their anonymity. The participants then read a brief set of instructions and filled out a questionnaire.

Step 2 introduced the auction. We used a random *n*th price auction in this experiment (Shogren et al., 2001). The advantages of the random *n*th price auction are that it is demand revealing in theory and the auction attempts to engage bidders at all locations along the demand curve.[iv] The random *n*th-price works as follows: Each of k bidders submits a bid for one unit of a good; then each of the bids is rank-ordered from highest to lowest. The auction monitor then selects a random number which is drawn from a uniform distribution between 2 and k; and the monitor sells one unit of the good to each of the (n-1) highest bidders at the *n*th-price. For instance, if the monitor randomly selects n = 5, the four highest bidders each purchase one unit of the good priced at the fifth-highest bid. Ex ante, bidders who have low or moderate valuations now have a nontrivial chance to buy the good because the price is determined randomly. This auction increases the odds that insincere bidding will lead to a loss. Participants were given detailed instructions on the random *n*th-price auction, including an example written on the board. After the participants learned about the auction, a short quiz was given to ensure that everyone understood how the auction worked.

Step 3 was the first practice round of bidding, where participants bid on a brand-name candy bar. The participants were asked to examine the product and then place a (sealed) bid on the candy bar. The bids were collected and the first round of practice bidding was over. Throughout the auction, when the participants were bidding on items in a particular round, they had no indication of what other items they may be bidding on in future rounds or if additional rounds would occur.

Step 4 was the second practice round of bidding. In this round the participants bid separately on three different items. The three products were the same brand-name candy bar, a deck of playing cards and a box of pens. The consumers were asked to examine the three products in practice round two and make bids on the products. Then the bids were collected. Only one of the two rounds was chosen as binding (valid), so that participants would not take home more than one of any product. The reason was to eliminate price reduction due to the consumer buying a larger quantity because of diminishing marginal utility of these products (i.e., lower prices due to a consumer's negatively sloped demand curve).[v] Participants were informed that only one of the two rounds would bind before step 3 and were reminded of this again before step 4.

After the two practice auction rounds were completed, the binding round and the binding *n*th-prices were revealed in step 5. All of the bids were written on the blackboard, and the *n*th-prices were circled for each of the three products. Participants could see what items they won immediately, and the market-clearing price. The participants were notified that all purchases of goods would take place after the experiment was over, so that all exchanges of money for goods would take place at the end of the session.

In step 6, information about biotechnology was released to the participants. The possible types of information a participant could receive were: (1) *the industry perspective*—a collection of statements and information on genetic modification provided by a group of leading biotechnology companies, including Monsanto and Syngenta; (2) *the environmental group perspective*—a collection of statements and information on genetic modification from Greenpeace, a leading environmental group; and (3) the *third-party, verifiable perspective*—a statement on genetic modification approved by a third-party group, consisting of a variety of individuals knowledgeable about genetically modified goods, including scientists, professionals, religious leaders, and academics, none of whom have a financial stake in genetically modified foods. To assist the participants process these different sources of information, the volume of information released of each type was limited to one 8 1/2" x 11" page, and it was organized into five categories: general information, scientific impact, human impact, financial impact, and environmental impact, to ease the information processing load on participants. Figures 3, 4, and 5 show the exact wording of the three types of information about genetically modified food.

The information was randomized to create six treatments of information combinations: pro-biotechnology information; anti-biotechnology information; both pro and anti-biotechnology information;[vi] pro-biotechnology and third party, verifiable information; anti-biotechnology and third-party,[vii] verifiable information; and pro-biotechnology, anti-biotechnology, and third-party, verifiable information. These six combinations were randomized among all twelve experimental units, with each information combination going to two experimental units.

Two auction rounds followed the distribution of information. One of the two rounds had the participants bid on food products with just a standard food label. The other round had participants bid on the same food products with the same label, except there was a sentence added indicating that the food had been genetically engineered. These labels were made as plain as possible to avoid any influence on the bids from the label design (see Figure 2). The sequencing of GM labels was randomized across experimental units. Each combination of information was given to two experimental units. One of these experimental units bid on food with the standard label in round one, and the food with the label indicating genetic modification in round two. The other experimental unit bid on food with the label indicating genetic modification in round one, and the standard label in round two. For each experimental unit, only one of the two food rounds was chosen as the binding (valid) round. This avoided the problem of bid prices being reduced as consumers moved along their demand curve.

In step 7, participants bid on three different food products: a bag of potatoes, a bottle of vegetable oil, and a bag of tortilla chips. The participants were instructed to examine the three products and then write down their (sealed) bid for each of the three goods. Participants bid on each good separately. Then the bids were collected from the individuals, and the participants were informed that they were about to look at another group of food items.

Step 8 had participants come examine the same three food products, but with the different labels (the second trial). After the participants examined the products, they were instructed to bid on the three products. Each good was bid on separately. The bids were then collected from all of the participants. Once again, consumers were informed that only one of the two trials or bidding rounds would bind before step 7, and they were told this again before step 8.[viii]

Step 9 consisted of the selection of which of the two trials would be chosen as binding, along with the binding *n*th-prices. After the binding round and binding *n*th prices were revealed, the winners were notified and the participants were asked to complete a brief post-auction questionnaire. In step 10, the participants who did not win any products were informed that they were free to leave, and the participants who won products exchanged money for their goods, and then they were free to leave.

We can examine the bids from the experimental auctions to see how information influences whether or not an auction participant was "out of the market" for GM-labeled foods. This is defined as a demand so low that the participant would not demand GM-labeled foods at any price. This will give insights into how the diffusion of technology is impacted by information.

Although we follow standard experimental auction valuation procedures (e.g., Smith 1976; Shogren et al., 1994), we make several refinements to our experimental design to better reflect consumer purchases. First, our subjects submitted only one bid per product instead of using multiple repeated trials and posted market-clearing prices to avoid affiliated values which can affect the demand-revealing nature of a laboratory auction (see e.g., List and Shogren 1999). Second, we do not endow our subjects with any food item and then ask them to "upgrade" to another food item as that can cause distorted bid prices (e.g., Lusk and Shroeder, 2002). Third, each consumer bid on three unrelated food items, such that if he or she did not have positive demand for one or two products, we could still obtain information from them on their taste for genetic modification based on the second and (or) third product. Fourth, we randomly assigned treatments to the experimental units – now estimation of treatment effect is simply the difference in means across treatments (see Wooldridge, 2001). Fifth, we use adult consumers over 18 years of age from two different Mid-western metropolitan areas that were chosen from a random digit dialing method. See figure 1 for a summary of the demographic characteristics of our sample. The demographics of our sample do not perfectly match the U.S. census demographic characteristics for these regions, but they are similar and provide a sufficient representation for our initial probe into labeling and information for GM products (see Appendix table 1for the 2002 Census of Population demographic characteristics of the areas). Although our participants are slightly skewed toward women, Katsara, *et al.* (2001) showed that women make up a disproportional share of grocery shoppers—83 percent of shoppers versus 52 percent in the U.S. Census of Population. Finally, information from our laboratory experiments is complimented by information obtained from pre- and post-experiment surveys administered to participants. The pre-auction survey allowed us to obtain socio-demographic information and information on participants' beliefs about GM and other technologies before treatment, which is useful to help explain bidder behavior.

The Model

Economic theory suggests that as a consumer receives commutative negative information about a product or process, their demand schedule shifts down, causing them to consume a lower quantity of a good at a given price. If a consumer hears enough negative information about a product or process – their demand for a product or process could be so low that they would not be willing to purchase one unit at a positive price!

Objective, verifiable information is likely to dampen the effectiveness of negative information at pushing down a consumer's demand for a product. If consumers are given verifiable information on GM foods, it is likely that some consumers who would otherwise be "out of the market" would now purchase GM-labeled foods if it was priced appropriately. Probit models are used to examine what characteristics help push a consumer out of the market, and what helps keep consumers in the market for GM foods.

We use two tests to examine the probability a consumer is "out of the market" for GM foods. The strong test assumes that a consumer is out of the market if that consumer bids zero for one unit of the GM food when they bid a positive amount for one unit of the unlabeled product. If a consumer does not have a positive willingness to pay (WTP) for one unit of a GM food when they have a positive WTP for their non-GM counterpart, this suggests they would not consume the GM variety of the product at any price. Determining what impacts the probability of being out of the market is important, because if a large share of consumers will not buy a particular food product, the grocery store will discontinue displaying/stocking/supplying the food. The weak test assumes that a consumer is "out of the market" if the price an individual bids for the GM-labeled food is less than or equal to 2/3 of the price they bid for the plain-labeled food. This weak test captures the reality that most premiums for non-GM foods do not exceed 20 percent (Kiesel, Buschena, and Smith, 2002).

We fit probit models explaining the probability that a consumer is out of the market for each of the three products used in our economics experiments – Russet potatoes, vegetable oil, and tortilla chips using both the strong test and the weak test. In this paper we summarize the results from probit models to show how anti-GM information from environmental groups and verifiable information from a third party affect the probability that a consumer is out of the market for each of the 3 GM food products. In addition, we estimate the probability that a consumer is out of the market for all 3 food products jointly. This is the probability that a consumer bid zero for every GM-labeled food product for the strong test, or bid 2/3's or less of their bid for each plain labeled product in the weak test.

Results

Part A of table 2 shows the mean bid prices for all participants. Consumers, on average, discounted GM-labeled foods by fourteen percent. Part B shows that participants who received only positive information actually put a premium on the GM-labeled food for two of the three products. This was despite the fact that the genetic modification was only used to enhance the production process, and did not give the foods any enhanced attributes. Part C shows that when consumers received only negative information, they discount the GM-labeled foods by an average of approximately thirty-five percent. Part D shows that consumers who received both positive and negative information discount the GM-labeled foods by an average of seventeen to twenty-nine percent, depending on the food product.

Third-party information has an impact on the willingness to pay for GM-labeled foods. Part E shows that consumers who received positive and third-party information discounted GM-labeled foods slightly. This is in contrast to the consumers who received only positive information who valued the GM-labeled foods more than their plain-labeled counterpart on average. Part F shows that participants who received negative and third-party information still discounted the GM-labeled foods, but by a smaller amount than the participants who received only negative information. Part G shows that participants who received negative and third-party information discounted the GM-labeled foods by an average of seventeen to twenty-two percent, depending on the product. Participants who received positive, negative and third-party information were more accepting of the GM-labeled foods than those who received only positive and negative information. The participants who received positive, negative and third-party information discounted the GM-labeled food by an average of zero to eleven percent, depending on the product.

Our results are consistent with Viscusi (1997) who found that individuals placed a slightly greater weight on negative information than positive information. In our auction, participants who received only positive information did not discount the GM-labeled food, while those who received only negative information discounted the GM-labeled food by an average of 35 percent. Those who received both positive and negative information put slightly more weight on the negative information, discounting the GM-labeled foods by 20 percent. In addition, one explanation for a moderated negative auction outcome in our experiments where participants received positive and negative GM-product information is that some individuals have an asymmetric value function giving greater weight to marginal losses than to marginal gains (Kahneman and Tvesrky 1979), for example, they do not want to bear losses.

Also, our results are in contrast to Fox *et al.*'s (2001) who obtained the result that negative information dominated positive information. They argued that one reason could be due to a "status quo bias," (or endowment effect) where participants were originally endowed with a regular pork sandwich and could bid to upgrade to an irradiated pork sandwich. Participants may have their bids biased due to being endowed with one type of sandwich.[ix]

Our auction had participants bid on items in separate rounds (trials), thus our results are not influenced by a "status quo bias."

Tables 3 and 4 show the percentage of participants who are out of the market for the GM-labeled commodities using both the strong and weak test. The number of observations differs, because if an individual bids zero for both the GM-labeled and plain-labeled versions of a commodity, they are not included in the analysis (they did not demand the product, so we cannot determine their taste for genetic modification). Similarly, when reporting on who is out of the market for all GM-labeled foods, those who bid zero for all the food products are not included.

A summary of 8 sets of probit results explaining the probability of a participant being out of the market for GM-labeled foods is presented in table 5, and the actual estimates of the coefficients in the probit models are reported in Appendix table 2 to 9 Several different specifications were used, to examine the robustness of the results. Negative information has a positive coefficient, indicating *negative information increases the probability that a consumer is out of the market*. The coefficients for these effects were consistently statistically significant, for all of the products under both the strong test and weak tests.

This result has important implications. If an anti-technology group wishes to slow scientific progress and asymmetric information exists, they could disseminate large amounts of negative information – even if the information is highly biased. They could even disguise their true intentions by telling consumers they want to keep everybody "fully informed" of the consequences of a product or technology. Yet, their negative information might help push demand down to zero for enough people that suppliers would not find it profitable to invest in the new technology. Also, even if firms do not fully believe the information, negative information will increase the uncertainty about genetic modification, which has been shown to decrease the likelihood of adoption (Purvis et al. 1995). Given that technological change is one of the driving forces behind the rising standard of living enjoyed in many developed countries, stalled progress could decrease welfare significantly over time.

This result also presents an alternative explanation for why Europeans demand for GM foods is so small. Many have hypothesized that Europeans dislike GM foods because of recent food scares like BSE, dioxin, and foot and mouth disease. Our results present an alternative explanation for the low Europeans demand for GM-labeled foods – environmental groups are more prevalent and have disseminated larger volumes of negative information about GM-technology and GM-foods and they do not have a trusted source of verifiable information.

Table 5 also shows that third party, verifiable information decreases the probability that an individual is out of the market, as these coefficients are negative under all of the model specifications, and are statistically significant at the 5 and 10 percent level in many of the models. This provides evidence that a third-party source that provides neutral, verifiable information on genetically modified foods could help prevent the market from disappearing due to lack of demand. Hence, in addition to value that verifiable information may have by providing consumers accurate information on the risks and benefits of genetic modification (estimated in Rousu et al. at $2.6 billion), verifiable information also may have value by keeping new GM food products in supermarkets, increasing the range of choices, which has a real option value.

Conclusion and Implications

Technology adoption and diffusion have dramatically increased the welfare of U.S. consumers over time. For future generations to enjoy a higher standard of living than the current generation, it is imperative that adoption of new technologies continue. Hence, discovering factors that cause the adoption or non-adoption of new products is particularly important. This paper examined the factors that increase the probability that consumers are out of the market for genetically modified foods, which could stymie the adoption of genetically modified products.

This paper reveals two key results. First, when participants receive negative information on genetically modified foods, they are more likely to be “out of the market” for GM-labeled foods, i.e. these consumers will not buy GM foods at any positive price. In Europe, where negative information from environmental groups on GM foods is more prevalent, adoption of genetically modified crops has stalled. Many have said that this is because of food safety scandals like BSE (human form of mad cow disease) or the dioxin scandal in Belgium, but this paper presents an alternative explanation for Europe’s reluctance to adopt genetically modified foods. The second result is that a third party source providing verifiable information can soften the effect of negative information and help keep consumers in the market for GM-labeled foods. This shows a benefit to verifiable information in addition to the value that it has in providing consumers with objective information.

The implications of these results are important. When technology is advancing, asymmetric information generally exists about the consequences and benefits of the products. If a group wants to stall scientific progress, they could supply negative and biased information to consumers and producers. Our results show that this will create resistance to adopting new technologies. Furthermore, welfare of society could be lowered significantly by broad non-adoption of new technologies. This presents an interesting dilemma that we will not try to answer: Should interested parties be allowed freedom of speech to disseminate negative information about new products and processes? This can happen when there are significant information asymmetries in society - as there are with the introduction of new goods into the market. Future research to examine the specific value verifiable information has in keeping consumers in the market for GM foods and therefore allowing more efficient innovations to be adopted could be quite valuable.

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Figure 1: Steps in the experiment

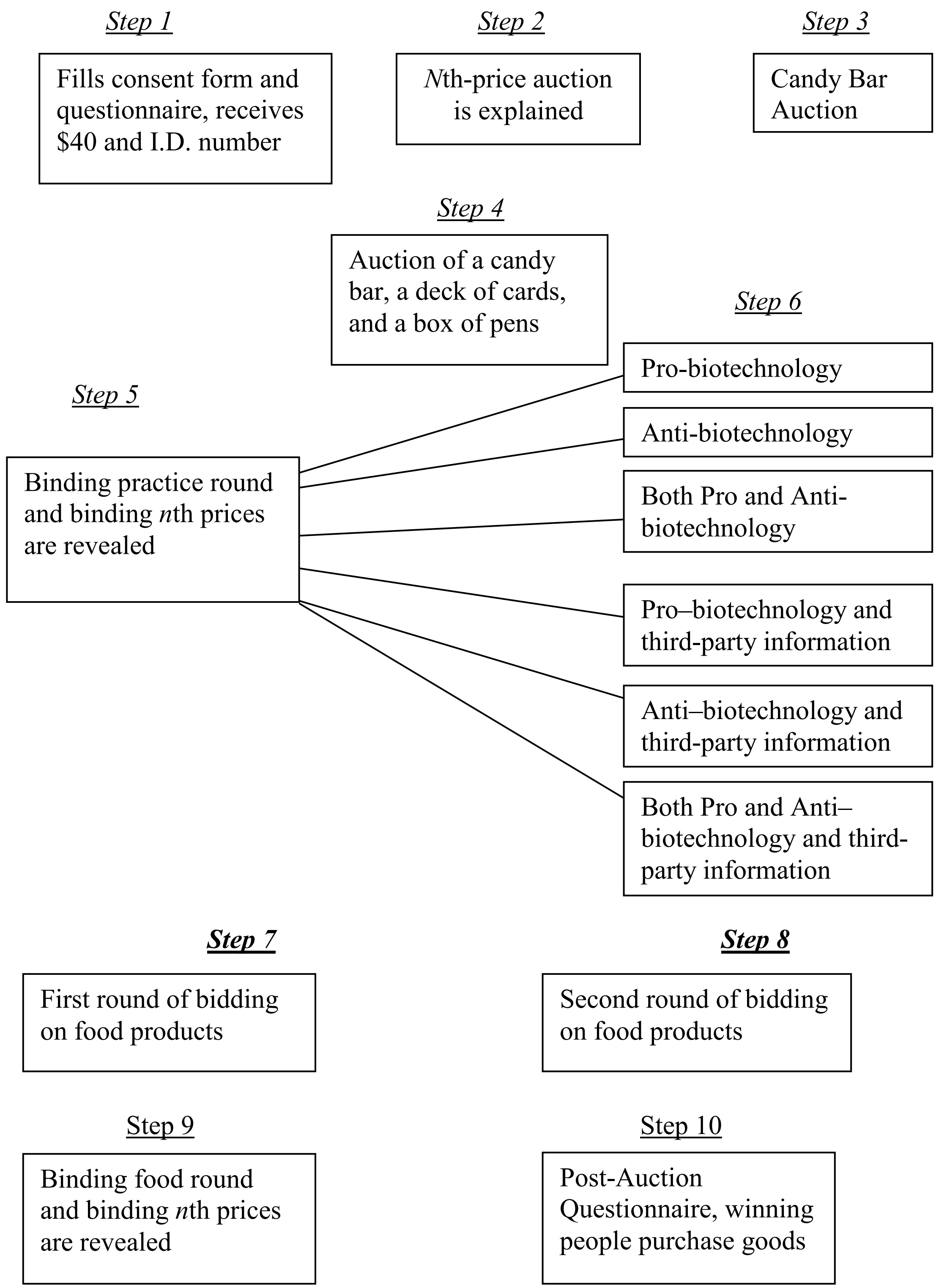

Figure 2: Labels used for the three food items

Russet Potatoes

Net weight 5 lb.

This product is made using
genetic modification (GM)

Russet Potatoes

Net weight 5 lb.

Tortilla Chips

Net weight 16 oz.
Fresh made Thursday April 5th

This product is made using
genetic modification (GM)

Tortilla Chips

Net weight 16 oz.
Fresh made Thursday April 5th

Vegetable Oil

Net weight 32 fl. oz.

This product is made using
genetically modified (GM) soybeans

Vegetable Oil

Net weight 32 fl. oz.

Figure 3: Information given to participants. Anti-biotechnology Information

The following is a collection of statements and information on genetic modification from Greenpeace, a leading environmental group.

General Information

Genetic modification is one of the most dangerous things being done to your food sources today. There are many reasons that genetically modified foods should be banned, mainly because unknown adverse effects could be catastrophic! Inadequate safety testing of GM plants, animals, and food products has occurred, so humans are the ones testing whether or not GM foods are safe. Consumers should not have to test new food products to ensure that they are safe.

Scientific Impact

The process of genetic modification takes genes from one organism and puts them into another. This process is very risky. The biggest potential hazard of genetically modified (GM) foods is the unknown. This is a relatively new technique, and no one can guarantee that consumers will not be harmed. Recently, many governments in Europe assured consumers that there would be no harm to consumers over mad-cow disease, but unfortunately, their claims were wrong. We do not want consumers to be harmed by GM food.

Human Impact

Genetically modified foods could pose major health problems. The potential exists for allergens to be transferred to a GM food product that no one would suspect. For example, if genes from a peanut were transferred into a tomato, and someone who is allergic to peanuts eats this new tomato, they could display a peanut allergy.

Another problem with genetically modified foods is a moral issue. These foods are taking genes from one living organism and transplanting them into another. Many people think it is morally wrong to mess around with life forms on such a fundamental level.

Financial Impact

GM foods are being pushed onto consumers by big businesses, which care only about their own profits and ignore possible negative side effects. These groups are actually patenting different life forms that they genetically modify, with plans to sell them in the future. Studies have also shown that GM crops may get lower yields than conventional crops.

Environmental Impact

Genetically modified foods could pose major environmental hazards. Sparse testing of GM plants for environmental impacts has occurred. One potential hazard could be the impact of GM crops on wildlife. One study showed that one type of GM plant killed Monarch butterflies.

Another potential environmental hazard could come from pests that begin to resist GM plants that were engineered to reduce chemical pesticide application. The harmful insects and other pests that get exposed to these crops could quickly develop tolerance and wipe out many of the potential advantages of GM pest resistance.

Figure 4: Information given to participants, pro-biotechnology information

The following is collection of statements and information on genetic modification provided by a group of leading biotechnology companies, including Monsanto and Syngenta.

General Information

Genetically modified plants and animals have the potential to be one of the greatest discoveries in the history of farming. Improvements in crops so far relate to improved insect and disease resistance and weed control. These improvements using bioengineering/GM technology lead to reduced cost of food production. Future GM food products may have health benefits.

Scientific Impact

Genetic modification is a technique that has been used to produce food products that are approved by the Food and Drug Administration (FDA). Genetic engineering has brought new opportunities to farmers for pest control and in the future will provide consumers with nutrient enhanced foods. GM plants and animals have the potential to be the single greatest discovery in the history of agriculture. We have just seen the tip of the iceberg of future potential.

Human Impact

The health benefits from genetic modification can be enormous. A special type of rice called "golden rice" has already been created which has higher levels of vitamin A. This could be very helpful because the disease Vitamin A Deficiency (VAD) is devastating in third-world countries. VAD causes irreversible blindness in over 500,000 children, and is also responsible for over one million deaths annually. Since rice is the staple food in the diets of millions of people in the third world, Golden Rice has the potential of improving millions of lives a year by reducing the cases of VAD.

The FDA has approved GM food for human consumption, and Americans have been consuming GM foods for years. While every food product may pose risks, there has never been a documented case of a person getting sick from GM food.

Financial Impact

Genetically modified plants have reduced the cost of food production, which means lower food prices, and that can help feed the world. In America, lower food prices help decrease the number of hungry people and also lets consumers save a little more money on food. Worldwide the number of hungry people has been declining, but increased crop production using GM technology can also help further reduce world hunger.

Environmental Impact

GM technology has produced new methods of insect control that reduce chemical insecticide application by 50 percent or more. This means less environmental damage. GM weed control is providing new methods to control weeds, which are a special problem in no-till farming. Genetic modification of plants has the potential to be one of the most environmentally helpful discoveries ever.

Figure 5: Information given to participants, independent, verifiable information

The following is a statement on genetic modification approved by a third-party group, consisting of a variety of individuals knowledgeable about genetically modified foods, including scientists, professionals, religious leaders, and academics. These parties have no financial stake in genetically modified foods.

General Information

Bioengineering is a type of genetic modification where genes are transferred across plants or animals, a process that would not otherwise occur (In common usage, genetic modification means bioengineering). With bioengineered pest resistance in plants, the process is somewhat similar to the process of how a flu shot works in the human body. Flu shots work by injecting a virus into the body to help make a human body more resistant to the flu. Bioengineered plant-pest resistance causes a plant to enhance its own pest resistance.

Scientific Impact

The Food and Drug Administration standards for GM food products (chips, cereals, potatoes, etc.) is based on the principle that they have essentially the same ingredients, although they have been modified slightly from the original plant materials.

Oils made from bioengineered oil crops have been refined, and this process removed essentially all the GM proteins, making them like non-GM oils. So even if GM crops were deemed to be harmful for human consumption, it is doubtful that vegetable oils would cause harm.

Human Impact

While many genetically modified foods are in the process of being put on your grocers' shelf, there are currently no foods available in the U.S. where genetic modification has increased nutrient content.

All foods present a small risk of an allergic reaction to some people. No FDA approved GM food poses any known unique human health risks.

Financial Impact

Genetically modified seeds and other organisms are produced by businesses that seek profits. For farmers to switch to GM crops, they must see benefits from the switch. However, genetic modification technology may lead to changes in the organization of the agri-business industry and farming. The introduction of GM foods has the potential to decrease the prices to consumers for groceries.

Environmental Impact

The effects of genetic modification on the environment are largely unknown. Bioengineered insect resistance has reduced farmers' applications of environmentally hazardous insecticides. More studies are occurring to help assess the impact of bioengineered plants and organisms on the environment. A couple of studies reported harm to Monarch butterflies from GM crops, but other scientists were not able to recreate the results. The possibility of insects growing resistant to GM crops is a legitimate concern.

Table 1. Characteristics of the Auction Participants

Variable	Definition	Mean	St. Dev
Gender	1 if female	0.62	0.49
Age	The participant's age	49.5	17.5
Married	1 if the individual is married	0.67	0.47
Education	Years of schooling	14.54	2.25
Household	Number of people in participant's household	2.78	1.65
Income	The households income level (in thousands)	57.0	32.6
White	1 if participant is white	0.90	0.30
Read_L*	1 if never reads labels before a new food purchase	0.01	0.11
	1 if rarely reads labels before a new food purchase	0.11	0.31
	1 if sometimes reads labels before a new food purchase	0.31	0.46
	1 if often reads labels before a new food purchase	0.37	0.48
	1 if always reads labels before a new food purchase	0.20	0.40
Informed*	1 if an individual considered themselves at least somewhat informed regarding genetically modified foods	0.42	0.49
Labels1	1 if the treatment bid on foods with GM labels in round 1	0.52	0.50

*Information about participant's prior beliefs; information collected from participants in pre-auction questionnaire.

Table 2. Mean bids for participants, excludes double-zero bids

A. Mean bids – all participants

	n	mean bid	std. dev.	Median	Minimum	Maximum
GM OIL	146	1.07	0.81	0.99	0	3.99
OIL	146	1.24	0.78	1.00	0	3.79
GM CHIPS	155	1.03	0.85	0.99	0	3.99
CHIPS	155	1.20	0.81	1.00	0.05	4.99
GM POTATOES	159	0.84	0.66	0.75	0	3
POTATOES	159	0.98	0.65	0.89	0	3.89

B. Mean bids when participants only received positive information.

	n	mean bid	std dev	Median	Minimum	Maximum
GM OIL	26	1.56	0.73	1.50	0	2.99
OIL	26	1.54	0.79	1.55	0	3.50
GM CHIPS	30	1.31	0.72	1.13	0	2.99
CHIPS	30	1.36	0.72	1.18	0.05	2.99
GM POTATOES	27	1.30	0.71	1.25	0	2.50
POTATOES	27	1.26	0.67	1.25	0	2.00

C. Mean bids when participants only received negative information.

	n	mean bid	std dev	Median	Minimum	Maximum
GM OIL	26	0.79	0.82	0.50	0	3.25
OIL	26	1.22	0.65	1.00	0.25	2.49
GM CHIPS	29	0.81	0.94	0.50	0	3.99
CHIPS	29	1.25	1.02	1.00	0.05	4.99
GM POTATOES	29	0.61	0.68	0.50	0	2.75
POTATOES	29	0.98	0.88	0.75	0.05	3.89

D. Mean bids when participants received both positive and negative information.

	n	mean bid	std dev	Median	Minimum	Maximum
GM OIL	24	0.68	0.55	0.50	0	1.79
OIL	24	0.90	0.72	0.85	0	3.00
GM CHIPS	23	0.68	0.74	0.35	0	2.25
CHIPS	23	0.81	0.79	0.49	0.05	2.75
GM POTATOES	26	0.50	0.39	0.50	0	1.50
POTATOES	26	0.70	0.43	0.50	0.05	1.60

E. Mean bids when participants received both positive and third-party information.

	n	mean bid	std dev	Median	Minimum	Maximum
GM OIL	26	1.12	0.62	1.00	0	2.39
OIL	26	1.14	0.57	1.00	0.10	2.39
GM CHIPS	25	1.24	0.77	1.19	0	2.79
CHIPS	25	1.33	0.73	1.16	0.20	2.89
GM POTATOES	26	0.92	0.45	0.99	0	1.85
POTATOES	26	0.93	0.39	0.99	0.25	1.90

F. Mean bids when participants received both negative and third-party information.

	n	mean bid	std dev	Median	Minimum	Maximum
GM OIL	21	1.33	1.05	1.25	0	3.99
OIL	21	1.60	0.97	1.50	0.49	3.79
GM CHIPS	25	1.12	0.97	0.99	0	3.50
CHIPS	25	1.38	0.77	1.01	0.49	3.00
GM POTATOES	27	0.89	0.77	0.89	0	3.00
POTATOES	27	1.14	0.67	0.99	0.50	3.00

G. Mean bids when participants received positive, negative and third party information.

	n	mean bid	std dev	Median	Minimum	Maximum
GM OIL	23	0.94	0.77	0.95	0	2.75
OIL	23	1.06	0.82	1.00	0.05	3.29
GM CHIPS	23	0.95	0.81	0.85	0	3.25
CHIPS	23	0.95	0.66	0.99	0.1	2.89
GM POTATOES	24	0.82	0.61	1.00	0	1.99
POTATOES	24	0.84	0.55	0.84	0.01	2.00

Table 3: Percentage of consumers who bid zero for a GM-labeled food item. (When a consumer bids zero for both GM and non-GM version of a commodity their bids are not included)

	Observations	Out of market	Percent out of market
All goods	165	17	10.3%
Vegetable Oil, only	146	13	8.9%
Tortilla Chips, only	155	20	12.9%
Potatoes, only	159	20	12.6%

Table 4: Percentage of consumers who's bid for the GM-labeled food is 2/3's the amount they bid for the plain labeled food, or lower. (When a consumer bids zero for both GM and non-GM version of a commodity their bids are not included)

	Observations	Out of market	Percent out of market
All goods	165	27	16.4%
Vegetable Oil, only	146	28	19.2%
Tortilla Chips, only	155	37	23.9%
Potatoes, only	159	35	22.0%

Table 5: Range of estimates from Probit model on probability a consumer is pushed out of the market for each of the GM-labeled foods. (TRY PROBIT WITHOUT POSITIVE INFORMATION)

Food product	Weak test – negative information	Strong test– negative information	Weak test – verifiable information	Strong test – verifiable information
Potatoes	0.73 to 1.20 ***	0.49 to 0.99 *	-0.49 to -0.71 **	-0.11 to -0.23
Tortilla Chips	0.36 to 0.54 *	0.67 to 0.98 **	-0.06 to -0.19	-0.22 to -0.48
Vegetable Oil	0.77 to 0.96 ***	0.70 to 0.93 *	-0.58 to -0.69 ***	-0.01 to -0.04
All Three Foods	0.71 to 1.20 **	0.40 to 0.76 *	-0.67 to -0.68 ***	-0.10 to -0.31

*** The coefficients for *all* alternative probit model specifications are statistically significant at the 5% level (or higher)
** The coefficients for *all* alternative probit model specifications are statistically significant at the 10% level (or higher)
* The coefficients are statistically significant (at the 10% level or higher) for *some* of the probit model specifications, but not all specifications.

Appendix Table 1. 2000 Census of Population Demographic Characteristics of Polk County, IA (including Des Moines area) and Ramsey County, MN (including St. Paul area)

Variable	Definition	Polk	Ramsey	Average
Gender	1 if female	0.52	0.52	0.52
Age	Median age	45.7	45.7	45.7
Married	1 if the individual is married *	59.5	51.4	55.5
Education	Years of schooling **	13.52	13.76	13.64
Income	The median households income level (in thousands)	46.1	45.7	45.9
White	1 if participant is white	0.9	0.8	0.85

All variables are for individuals of all ages, except for Married, which is for individuals 18 or older, Education, which is for individuals 25 or older, and age, which is for individuals 20 or older.

* The estimate of the number of married people who are 18 or older was obtained by taking the number of people married over 15 and assuming that the number of people were married at ages 15, 16, and 17 were zero – this gives the percentage of people who are married who are 18 or older.

** The years of schooling was estimated by placing a value of 8 for those who have not completed 9^{th} grade, 10.5 for those who have not completed high school, 12 for those who have completed high school but have had no college, 13.5 for those with some college but no degree, 14 for those with an associate's degree, 16 for those with a bachelor's degree, and 18 for those with a graduate or professional degree.

Appendix Table 2. Probit model: Tortilla Chips – Dependent variable = 1 if a consumer is out of the market for tortilla chips (i.e. bid = 0)
(Standard errors in parentheses, N=172)

Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	-2.045 **	-1.934 **	-1.435 **	-1.931 **	-1.876 **	-1.542 **	-2.295 **	-2.196 **
	(0.410)	(0.432)	(0.437)	(0.557)	(0.513)	(0.460)	(0.613)	(0.615)
Anti_info	0.985 **	0.963 **	0.670 *	0.791 *	0.748 *	0.692 *	0.857 **	0.874 **
	(0.441)	(0.438)	(0.394)	(0.410)	(0.409)	(0.401)	(0.044)	(0.429)
Pro_info			-0.360	-0.334	-0.318	-0.400	-0.312	-0.321
			(0.302)	(0.306)	(0.307)	(0.307)	(0.316)	(0.321)
Ver_info		-0.215						-0.475
		(0.309)						(0.294)
Income				0.0065			0.0057	0.0061
				(0.0041)			(0.0043)	(0.0043)
Labels					0.563 *		0.514 *	0.582 *
					(0.293)		(0.305)	(0.065)
Informed						0.251	0.047	0.107
						(0.277)	(0.297)	(0.303)

** Significant at the 5% level
* Significant at the 10% level

Appendix Table 3. Probit model: Potatoes - Dependent variable = 1 if a consumer is out of the market for potatoes (i.e. bid = 0)
(Standard errors in parentheses, N=172)

Regressors								
Intercept	-2.054 **	-2.119 **	-1.228 **	-1.479 **	-1.749 **	-1.438 **	-1.985 **	-1.916 **
	(0.409)	(0.451)	(0.441)	(0.554)	(0.526)	(0.473)	(0.628)	(0.632)
Anti_info	0.973 **	0.985 **	0.496	0.562	0.587	0.512	0.620	0.623
	(0.440)	(0.444)	(0.400)	(0.411)	(0.415)	(0.417)	(0.436)	(0.437)
Pro_info			-0.550 *	-0.525 *	-0.507	-0.659 **	-0.593 *	-0.604 *
			(0.304)	(0.307)	(0.310)	(0.320)	(0.326)	(0.328)
Ver_info		-0.111						-0.234
		(0.302)						(0.285)
Income				0.0032			0.0020	0.0022
				(0.0041)			(0.0043)	(0.0043)
Labels					0.638 **		0.543 *	0.565 *
					(0.305)		(0.315)	(0.318)
Informed						0.523 *	0.401	0.439
						(0.282)	(0.293)	(0.298)

** Significant at the 5% level
* Significant at the 10% level

Appendix Table 4. Probit model: Vegetable Oil - Dependent variable = 1 if a consumer is out of the market for vegetable oil (i.e. bid = 0)
(Standard errors in parentheses, N=172)

Regressors								
Intercept	-2.070 **	-2.074 **	-1.652 **	-1.936 **	-2.313 **	-1.747 **	-2.516 **	-2.499 **
	(0.407)	(0.443)	(0.530)	(0.645)	(0.652)	(0.552)	(0.741)	(0.756)
Anti_info	0.932 *	0.933 *	0.698	0.761	0.797	0.704	0.840	0.836
	(0.439)	(0.440)	(0.483)	(0.493)	(0.510)	(0.493)	(0.523)	(0.523)
Pro_info			-0.418	-0.397	-0.367	-0.471	-0.384	-0.383
			(0.339)	(0.342)	(0.352)	(0.349)	(0.364)	(0.364)
Ver_info		-0.008						-0.036
		(0.307)						(0.327)
Income				0.0038			0.0027	0.0027
				(0.0047)			(0.0049)	(0.0049)
Labels					0.810 **		0.771 **	0.772 **
					(0.377)		(0.382)	(0.382)
Informed						0.263	0.102	0.107
						(0.319)	(0.338)	(0.341)

** Significant at the 5% level
* Significant at the 10% level

Appendix Table 5. Probit model: All products - Dependent variable = 1 if a consumer is out of the market for all three products (i.e. bid = 0)
(Standard errors in parentheses, N=172)

Regressors								
Intercept	-2.045 **	-1.992 **	-1.262 **	-1.673 **	-1.818 **	-1.443 **	-2.190 **	-2.090 **
	(0.410)	(0.444)	(0.449)	(0.567)	(0.540)	(0.479)	(0.645)	(0.649)
Anti_info	0.764 *	0.753 *	0.395	0.493	0.461	0.410	0.537	0.543
	(0.448)	(0.447)	(0.406)	(0.420)	(0.525)	(0.421)	(0.445)	(0.446)
Pro_info			-0.549 *	-0.521	-0.525	-0.644 *	-0.580 *	-0.590 *
			(0.320)	(0.324)	(0.330)	(0.335)	(0.345)	(0.347)
Ver_info		-0.099						-0.307
		(0.334)						(0.297)
Income				0.0053			0.0043	0.0044
				(0.0042)			(0.0044)	(0.0042)
Labels					0.728 **		0.644 *	0.661 *
					(0.326)		(0.336)	(0.338)
Informed						0.456	0.282	0.336
						(0.290)	(0.307)	(0.313)

** Significant at the 5% level
* Significant at the 10% level

Appendix Table 6. Probit model: Tortilla Chips – Dependent variable = 1 if a consumer is are out of the market for Tortilla Chips (bid is 2/3's of bid for plain-labeled chips) (Standard errors in parenthese, N=172)

Regressors								
Intercept	-1.163 **	-1.130 **	-0.689 **	-1.083 **	-0.704 *	-0.876 **	-1.111 **	-1.057 **
	(0.231)	(0.264)	(0.346)	(0.441)	(0.376)	(0.366)	(0.461)	(0.463)
Anti_info	0.540 **	0.534 **	0.358	0.451	0.360	0.389	0.458	0.460
	(0.271)	(0.272)	(0.299)	(0.308)	(0.299)	(0.305)	(0.313)	(0.312)
Pro_info			-0.450 *	-0.426	-0.448 *	-0.501 *	-0.492 *	-0.489 *
			(0.270)	(0.273)	(0.271)	(0.275)	(0.279)	(0.280)
Ver_info		-0.061						-0.186
		(0.243)						(0.236)
Income				0.0053			0.0044	0.0046
				(0.0036)			(0.0036)	(0.0036)
Labels					0.024		-0.129	-0.117
					(0.229)		(0.244)	(0.245)
Informed						0.435 *	0.425 *	0.447 *
						(0.234)	(0.250)	(0.252)

** Significant at the 5% level
* Significant at the 10% level

Appendix Table 7. Probit model: Potatoes – Dependent variable = 1 if a consumer is are out of the market for Potatoes (bid is 2/3's of bid for plain-labeled chips)
(Standard errors in parentheses, N=172)

Regressors								
Intercept	-1.751 **	-1.238 **	-1.014 **	-0.972 **	-1.068 **	-1.238 **	-1.087 **	-0.962 *
	(0.322)	(0.337)	(0.384)	(0.482)	(0.425)	(0.413)	(0.518)	(0.529)
Anti_info	1.198 **	1.195 **	0.742 **	0.731 **	0.752 **	0.789 **	0.753 **	0.820 **
	(0.350)	(0.353)	(0.344)	(0.353)	(0.367)	(0.357)	(0.364)	(0.376)
Pro_info			-0.570 **	-0.575 **	-0.565 **	-0.638 **	-0.659 **	-0.694 **
			(0.264)	(0.266)	(0.264)	(0.270)	(0.274)	(0.282)
Ver_info		-0.493 *						-0.714 **
		(0.262)						(0.262)
Income				-0.0005			-0.0015	-0.0006
				(0.0038)			(0.0038)	(0.0039)
Labels					0.073		-0.067	-0.014
					(0.242)		(0.256)	(0.265)
Informed						0.487 **	0.519 **	0.654 **
						(0.246)	(0.259)	(0.272)

** Significant at the 5% level
* Significant at the 10% level

Appendix Table 8. Probit model: Vegetable Oil – Dependent variable = 1 if a consumer is are out of the market for vegetable oil (bid is 2/3's of bid for plain-labeled chips)
(Standard errors in parentheses, N=172)

Regressors								
Intercept	-1.574 **	-1.339 **	-1.248 **	-1.496 **	-1.200 **	-1.392 **	-1.484 **	-1.378 **
	(0.280)	(0.298)	(0.396)	(0.489)	(0.430)	(0.416)	(0.513)	(0.518)
Anti_info	0.950 **	0.958 **	0.778 **	0.829 **	0.772 **	0.791 **	0.822 **	0.864 **
	(0.313)	(0.319)	(0.347)	(0.353)	(0.348)	(0.352)	(0.357)	(0.366)
Pro_info			-0.327	-0.302	-0.334	-0.368	-0.369	-0.359
			(0.280)	(0.283)	(0.282)	(0.284)	(0.289)	(0.297)
Ver_info		-0.582 **						-0.691 **
		(0.261)						(0.277)
Income				0.0034			0.0028	0.0040
				(0.0038)			(0.0039)	(0.0040)
Labels					-0.071		-0.186	-0.143
					(0.252)		(0.264)	(0.273)
Informed						0.357	0.378	0.493
						(0.256)	(0.268)	(0.280)

** Significant at the 5% level
* Significant at the 10% level

Appendix Table 9. Probit model: All Products – Dependent variable = 1 if a consumer is are out of the market for All three products (bid is 2/3's of bid for plain-labeled chips)
(Standard errors in parentheses, N=172)

Regressors	(1)	(2)	(5)	(4)	(5)	(6)	(7)	(8)
Intercept	-2.045 **	-1.744 **	-1.198 **	-1.223 **	-1.174 **	-1.364 **	-1.258 **	-1.108 **
	(0.410)	(0.413)	(0.421)	(0.515)	(0.456)	(0.447)	(0.543)	(0.550)
Anti_info	1.204 **	1.156 **	0.718 *	0.724 *	0.714 *	0.751 *	0.735 *	0.786 *
	(0.437)	(0.429)	(0.384)	(0.391)	(0.384)	(0.394)	(0.400)	(0.408)
Pro_info			-0.613 **	-0.611 **	-0.619 **	-0.667 **	-0.687 **	-0.721 **
			(0.280)	(0.281)	(0.280)	(0.285)	(0.289)	(0.298)
Ver_info		-0.684 **						-0.666 **
		(0.309)						(0.274)
Income				0.0034			-0.0034	0.0029
				(0.0039)			(0.0040)	(0.0040)
Labels					-0.033		-0.147	-0.108
					(0.253)		(0.267)	(0.275)
Informed						0.372	0.418	0.530 *
						(0.259)	(0.273)	(0.285)

** Significant at the 5% level
* Significant at the 10% level

Endnotes

[i] This is in contrast to the tradition in experimental economics of having an individual participate in multiple trials. See Shogren (2002).

[ii] When two adults in a household participated, the Iowa State Statistics Laboratory talked to both of them separately to obtain a commitment to participate and they were told that they would be assigned to different groups.

[iii] The complete set of information given to participants is available upon request from the author.

[iv] The nth-price auction has the advantage of having an endogenous clearing price, a main feature of the Vickrey auction, and a random clearing price, a feature of the BDM auction. Thus, in many ways, it combines the best features of these two demand revealing auctions. For a more detailed description of the benefits of the random *n*th price auction, see Shogren *et al*. (2001) or Rousu *et al*. (2002).

[v] If one assumes that there is little or no income effect from the deck of cards and box of pens, the two bids on the candy bar should be the same. The reason is that since the deck of cards and box of pens are neither complements nor substitutes to the candy bar, they should not impact the bids on the candy bar. A Wilcoxon signed-rank test confirmed that the bids for the candy bars are not significantly different in the two rounds, with a test statistic of 0.03. This result does not contradict the notion that the subjects' bidding behavior was reasonable.

[vi] When a participant received both pro-biotechnology and anti-biotechnology information, the order was randomized, so that some participants received the pro-biotechnology information first, and others received the anti-biotechnology information first.

[vii] When third-party information was distributed, it always was distributed after the other information sources.

[viii] These experiments were set up to minimize endowment effects. i. e., participants were endowed at the beginning of the experiment with $40 but not GM-food. See Shogren (2002 for evidence on endowment effects.

[ix] Recall that our participants are only given money and no physical commodity, and this minimizes the endowment effects.