



KRANNERT GRADUATE SCHOOL OF MANAGEMENT

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Do Consumers Not Care About Biotech Foods or Do
They Just Not Read the Labels

by

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Abstract

We conduct an experiment to study the discrepancy between European public opinion concerning the use of genetically modified organisms in the food supply, which is overwhelmingly negative, and the results of studies of consumer purchase behavior that suggest that consumers are indifferent to GMO's. The results of our experiment, which account for this discrepancy, suggest that consumers are typically unaware of the labeling indicating GMO content and thus are unaware that the product itself contains GMO's.

1. Introduction

In all Western countries, labeling of food products is strictly regulated. Labeling is required to be informative in that it must provide the consumer correct and useful descriptions of the characteristics of the products. Labeling is not allowed to be misleading, in the sense that it should not induce the consumer to make errors. Obviously, however, producers have an incentive to make the labels indicating their products' positive characteristics as prominent and those revealing the unfavorable characteristics as discreet as possible. In response, regulators have imposed strict conditions on the size, color, and positioning of information on packaging.

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The rules for disclosing that a product contains genetically modified organisms (GMO)'s constitute an example. At the present time in Europe, when a product is classified under current law as containing GMO's, it must carry in its list of ingredients the statement "produced from genetically modified ...". A note at the end of the list of ingredients, specifying the genetically modified origin, is also considered sufficient, as long as it is easily legible. The size of the letters must be at least as large as those in the list of ingredients.

The large food producers have put a few products containing GMO's on the market to gather data to estimate the impact of the labeling on their sales. The studies indicate that despite the hostility toward GMO's that is ubiquitous in survey data,¹ sales do not decrease when the label reveals that the product contains GMO's. Can we conclude that there is a large difference between opinions and behaviors when it comes to products containing GMO's? Does the hostility of the "citizen", become attenuated when he is placed in the role of a "consumer"?

The research reported here argues that this is not the case. We use an economic experiment to show that the absence of a reaction in demand to the current labeling of products likely is due to the fact that most customers do not notice the labeling, and thus do not realize that the product they are purchasing contains GMO's. We also find, for the product we study, that the willingness-to-pay of the average consumer declines by 30% when he becomes aware that the product contains GMO's.

2. Methodology

The participants in our experiment² were a demographically representative sample of consumers in the Grenoble, France area. 112 subjects took part in the experiment, each one taking part in exactly one of the 16 sessions. The sessions were conducted between June 7th and July 1st, 1999, and in each session between 5 and 9 subjects participated. The ages of the subjects ranged from 18 to 74 years, and averaged 33 years. 53.6% were female. At the time of recruitment, subjects were invited to come to the laboratory to sample food products for a government research project.³ They were not aware that GMO's were to be involved.

¹ See for example, the Eurobarometer survey commissioned by the European Union or the survey results reported in Noussair et al (2001).

² The experiment that produced the data we report in this paper had several objectives, but the others had nothing to do with GMO's, two series of sales with increasing information took place. In both cases, the central task was to compare the hedonic rating that subjects assigned to products with their revealed willingness to pay in the Vickrey auctions. The second objective is to observe the effect on bids of the revelation of information about the quality of products (place of origin, official classification of quality, brands, etc...), and these results are not presented here.

³ We screened for participants who made the food purchasing decisions in the household.

We used Vickrey auctions to elicit willingness-to-pay information. In a Vickrey auction, each subject simultaneously submits a bid to purchase a good. No communication between subjects is allowed during the bidding process. The agent who submits the highest bid wins the auction, and pays an amount equal to the second highest bid among the bidders in the auction. The other bidders do not receive items and pay zero. Each bidder has a dominant strategy to truthfully bid an amount equal to his willingness-to-pay (Vickrey, 1961).

Despite this, however, previous studies (see Kagel, 1995) have shown that untrained subjects often submit bids that differ from their valuations, and we included a training phase, in part to make the demand-revealing property more transparent. At the beginning of a session, each subject received 150 francs (roughly US\$21) in cash. Subjects then participated in several auctions in which they bid for fictitious items, which the winners could redeem from the experimenter for cash. The ability to redeem the items from the experimenter induces a valuation for the item sold in the auction (see Smith, 1982 for a discussion of induced valuations).

After the subjects submitted their bids, the experimenter wrote all of the valuations and bids on the blackboard. He then asked the following questions to the group of subjects, who were free to engage in open discussion on the topic (the experimenter did not participate in the discussion beyond posing the initial question). a) Which bid was yours? b) Which bidder won the auction? c) How much did the winner pay? c) Do you regret the bids you submitted, now that you know how much the others bid? After the discussion, the winner received an amount of money equal to his induced valuation minus the price he was required to pay. The cash was physically placed on the desk in front of the subject after the auction. A series of identical auctions was conducted using the same procedure, but with new randomly chosen induced values each time. The auctions continued until at least 80% of their bids were within 5% of valuations, typically 3-5 auctions.

In the three periods of interest, the sequence of activity was as shown in table 1. Each period consisted of the revelation of some information about the products, followed by an auction for the products. Four chocolate bars were auctioned each period, including two identical bars, called S and U. The products are made by a world leader in the food industry and are widely available in grocery stores and supermarkets in Europe.

At the beginning of period 1, subjects each received a sample of each of the four products to taste, without its packaging or labeling. Then a simultaneous Vickrey auction for each of the four goods took place.

Table 1: Sequence of events in phase three of an experimental session

Period 1	<ul style="list-style-type: none"> - Blind tasting of the products U, and S, along with other products - Hedonic recording of evaluation of the four products - 1st auction
Period 2	<ul style="list-style-type: none"> - The products are distributed to subjects with their original packaging and labeling - 2nd auction.
Period 3	<ul style="list-style-type: none"> - Slides with the exact labels on each product is projected on a large Screen. Subjects are invited to read the labels - 3rd auction

At the beginning of period 2, we distributed one unit of each of the products to each subject in its original packaging (with the price removed). Subjects then had three minutes to study the products. A second auction was then conducted for each of the goods. At the beginning of period 3, we magnified and projected the list of ingredients of each product, exactly as it appeared on the packaging, and invited subjects to read the list of ingredients. The list is shown in figures 1a and 1b⁴. Subjects then bid in the final round of auctions.

Figure 1a: Label of Product S

**Ingrédients : Petales de maïs 36% (maïs, sucre, sel, malt),
chocolat 24%, sucre, graisse végétale, émulsifiant : lécithine,
arôme : vanilline.**

Figure 1b: Label of Product U

**Ingrédients : Petales de maïs 38% (maïs génétiquement modifié, sucre, sel, malt),
chocolat 25%, sucre, matières grasses végétales, émulsifiant : lécithine de soja**

⁴ The ingredients listed in the label of product S are “corn flakes 36% (corn, sugar, salt, malt), chocolate 24%, sugar, vegetable fat, emulsifier: soy lecithin”. For product U they are “corn flakes 38% (genetically modified corn, sugar, salt, malt), chocolate 25%, sugar, fatty vegetable matter, emulsifier: soy lecithin”.

Results

Figure 1 shows the average bid over all subjects⁵ for each of the three periods of the purchase stage. The data in the figure are calculated by taking each individual's bid in period 1 as the base equaling 100, tracking that individual's bids over time relative to his bid in period 1, and averaging across all individuals in each period. Table 1 contains the variance of prices and the actual unnormalized average bids.

In period 2, subjects observe the products as they are seen in the supermarket. Presumably, we have created favorable conditions for the subjects to read and study the labels because they are seated and have no alternative activities for 3 minutes other than to study the label. What is not read in the laboratory will probably not be read in the supermarket. However, we observe that bids do not change in period 2 from their levels in period 1. A pooled variance t-test fails to reject that the normalized average bids are different between periods 1 and 2 ($t = .071$ for S and $t = .070$ for U). We also cannot reject that the bids are different from each other ($t = 1.53$). We thus replicate the result obtained by the private corporate econometric studies of consumer behavior, that the labeling of products as containing GMO's does not affect the willingness to pay of consumers.

However, the data change radically in period 3, in which subjects bid while able to view the list of ingredients on large overheads. The average willingness to pay for a product labeled as "containing GMO's" decreases by 27.3% compared to the previous period. The decrease is statistically significant (a pooled variance t-test for a difference in sample means between periods 2 and 3 for product U yields $t = 2.40$). In contrast, an identical product without any indication of GMO content (product S) experiences an insignificant average decrease of 3% from the previous period ($t = .271$). The bids for the two products, S and U, are significantly different from each other in period 3 ($t = 10.37$). Thus the impact of the labeling "contains GMO's", when it is actually legible, induces a substantial decrease in willingness to pay that is specific to that product.

⁵ Among the 112 subjects in the experiment, 10 did not submit bids in the first period and 27 submitted bids of zero to at least one of the two identical products. After eliminating these 37 from our data, we have 75 observations.

Figure 1: Average Bids for the Two Identical Chocolate Bars in Period 1-3

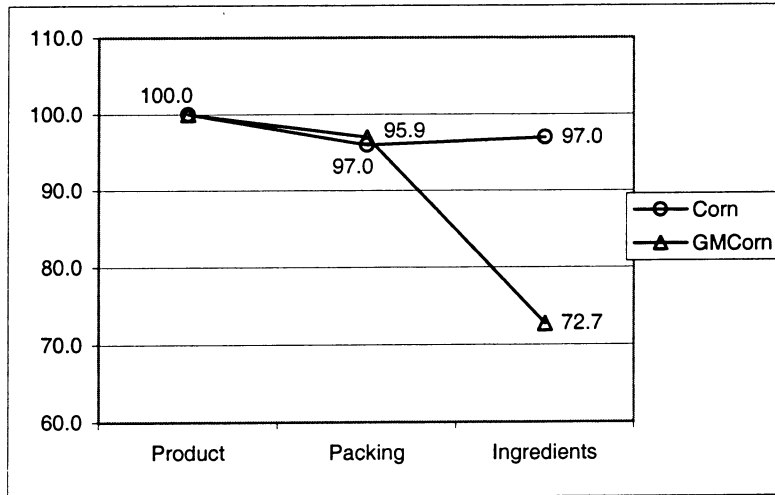


Table 1: Average Bid and Variance of Bids, Periods 1 – 3

	Period 1 Blind	Period 2 Packaging and Labelling	Period 3 Labels Projected
N “GMO Free”	8.04FF (0.74)	7.80FF (0.75) [-3.0%]	5.67FF* (1.13) [-27.3]
S “With GM Corn”	7.90FF (0.70)	7.58FF (0.80) [-4.1%]	7.35FF (0.84) [-3.1%]

(...): variance, [...]: increase from previous period, *: significantly different at 5% level from previous period (to be done).

Table 2 shows the direction of individuals’ changes in bids between periods two and three. The first two columns contain the product name, and the unnormalized average bid in period 2 (in French francs). The third column, entitled Percentage Boycotting, indicates the percentage of our participants that boycott a product by bidding 0 in period 3 after having submitted a positive bid in period 2. The last three columns display the percentages decreasing, holding constant and increasing their bids from periods 2 to 3. We classify any increase or decrease of 5% or less as a holding constant.

The bids for product S indicate that there is disagreement about how to interpret the labeling information. Roughly one-third of bidders increase their bid, one-third lowers it, and the remaining third does not change it. However, upon learning that product U contains GM corn, 22% of our subjects boycott the product entirely by bidding zero, and 60% lower their bid by at least 5%.

Table 2: Percentage Boycotting and Decreasing, Increasing, and Holding Constant Their Bids After Learning GM Corn Content

Product	Average previous bid for the product	Percentage Boycotting	Bid decrease	Bid unchanged	Bid increase
S: No label	(8.18FF*)	1.4% (3.50FF) (-3.50FF) [-100%]	33% (8.19FF) (-2.40FF) [-29,3%]	32% (9.54FF) (-0.01FF) [-0%]	33% (6.74FF) (1.76FF) [+26,1%]
U: "With GM Corn"	(8.41FF*)	22% (7.86FF) (-7.86FF) [-100%]	38% (8.02FF) (-2.62FF) [-32.7%]	25% (7.75FF) (-0.14FF) [-1.8%]	16% (11.11FF) (3.00FF) [+27%]

...%: share of subjects in the category, (...): Average bid for the previous auction French Francs, (...): absolute decrease or increase in FF, [...]: average bid increase [+] or decrease [-] (n = 75).

Conclusion

This paper uses experimental economic methods to present evidence that the absence of a negative effect on demand in reaction to products containing GMO's is in large measure due to the fact that customers do not notice the labeling. Consumers appear not to note labels that they are not looking for in the first place. The use of a standardized logo, such as for example the French recyclable label, might be one method of concisely transmitting information.

The paper illustrates the impact on consumer behavior of becoming aware of the fact that a food product contains GMO's. We show that the impact is considerable, leading to an average decrease of offer prices by about 30%. Most French consumers do require lower prices to buy products with GMO's. The hostility toward GMO's evident in public opinion surveys does appear, at least to some extent, in consumer behavior. However, since almost 80% of our subjects were willing to buy the product at some positive price, the market does appear to moderate opposition to GMO's.

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Instructions

You have agreed to participate in a study about the behavior of consumers of food products. These instructions will allow you to understand the procedures in today's session. The instructions are the same for all participants. The experimenter will read them aloud. After the instructions are read, we will answer your questions. During the session, which will take approximately 2 to 1/2 hours, you will have the opportunity to earn money, taste products, and evaluate them. Also, several units of the products will actually be made available for purchase.

At the beginning of the session, we gave each of you 150 FF. This money is yours, but you can use some or all of it to purchase products later in the session.

An identification letter has been assigned to you. This will serve as your identification for the duration of the experiment.

It is important for the results of our study that you do not communicate among yourselves. Please do not do so.

The experiment will take place in two successive phases. The first part of the instructions, given below, describes the first phase. Other instructions will be distributed to you after the first phase.

Phase 1

General principle

The purpose of phase 1 is to familiarize you with a particular method of selling, "**the sealed bid second price auction**". This is the type of auction we will use to sell all of the products that are for sale in this session.

How the auction works

During each of the auctions in the first phase, the experimenter will sell a good to the market in the following manner.

- Each participant writes down a bid. All of you write down your bids at the same time, without being able to communicate with each other.
- The good is sold to the participant who bids the highest price. The sale price is the bid made the person who offers the second highest price, that is the price closest to the winner's bid.

Example:

Four participants, A, B, C, and D offer the following prices:

A: 7F, B: 12F, C: 15F, D: 5F

C, who offered the highest price, 15F, wins the auction. He is the one who purchases the item. C pays 12 francs, the second highest bid.

To familiarize you with this type of auction, we will conduct several of them. During each auction, we will sell a token. The token has a “**Redemption Value**” for each of you. This “Redemption Value” corresponds to the actual price that the experimenter will repurchase it from you if you can buy it in the auction. The redemption value is different for each participant. The redemption values are determined at random before each auction, so that they change from auction to auction. You will be the only one to know your own redemption value. You will not know the redemption values of other participants.

Example: Suppose the redemption value of a token is 12 FF for you. If you purchase the token for 8 FF, you earn $12 \text{ FF} - 8 \text{ FF} = 4 \text{ FF}$.

Timing of Phase 1

A **Record Sheet – Phase 1** has been given to you. Please record the earnings you receive in phase 1 on the sheet.

Phase 1 consists of several periods. Each period consists of an auction for the sale of one token. Each period proceeds in the following manner.

1. Each participant will **draw at random** an **Auction Sheet** from the basket that will be passed around to you. This sheet indicates the redemption value of the token for you in the current period.
2. Each participant records on his **Auction Sheet** his letter of identification and his **bid** (the bid has to be rounded to the nearest 10 centimes).
3. The experimenter collects the Auction Sheets of all of the participants, and then writes all of the Redemption Values and the bids on the board. He identifies **who** wins the auction (the person who made the highest bid) and at what **price** (the second highest bid).
4. The winner records his earnings for the period on his **Record Sheet**. We then proceed to the next period. The experimenter gives out new Auction Sheets to participants.

Phase 1 will begin with period 0. This is a practice period that will not count toward your earnings.

When the experimenter announces the end of phase 1, each participant calculates the total earnings for the first phase.

Remember, if you purchase a token at a price higher than your Redemption Value, you will make a loss.

Do you have any questions about phase 1?

INSTRUCTIONS FOR PHASE 2

A **Record Sheet – Phase 2** has been distributed to you. On the Record Sheet, please record the purchases that you make over the course of phase 2.

General principle of phase 2

Phase 2 begins by taste-testing four chocolate bars. You will have the opportunity to record how much you like the taste of each product. The bars will then be sold in auctions using the same kind of rules as the auction presented during phase 1.

Timing of phase 2

Tasting and Evaluation

During this phase we will ask you to taste four chocolate bars that will be identified by the following codes:

24u

59d

47f

32s

After each tasting, please give a rating for the chocolate bar that you have just tasted on your **Evaluation Sheet**, which contains the following scale.

I do not like
it at all

I like it
very much

--

Please mark an X on the on the scale like the bar. If you especially liked the chocolate bar, please mark an X at the right end of the scale. If you especially disliked the bar, mark the X at the left end of the bar. In general, place the X between the two extremes depending on how much you like the chocolate bar.

Auctions

We will then put up for sale, using the auction procedure that we used in phase 1, the four chocolate bars. We will conduct a sequence of periods. During each period, each of the four bars will be sold.

More precisely, each period will proceed in the following manner.

1. Each participant records on his auction sheet his identification letter and his bid for each bar.
2. The experimenter collects the auction sheets from all participants and determines who wins the auction and what price he pays.

3. The experimenter then returns the auction sheets to the participants. The participant who makes a purchase records on his Record Sheet – Phase 2 the code name of the bar and the price he pays for it. The bars that were purchased will be given to the buyers at the end of the session, at which time they will have to actually hand the money to the experimenter.

4. The experimenter then announces that the next period has begun.

Phase 2 consists of 3 successive auctions for four products. During each period, each of four chocolate bars will be put up for sale. At the end of phase 2, each participant calculates the total amount he has spent, and records this amount on the Record Sheet - Phase 2 in the row marked Expenditures at the End of Phase 2.

Do you have any questions about phase 2?

Evaluation Sheet for Bar 24u

Name :

Identification letter. :

I don't like it
at all

I like it
very much

--

Evaluation Sheet for Bar 59d

Name :
.....

Identification letter. :

I do not like
it at all

I like it
very much

--

Evaluation Sheet for Bar 47f

Name :
.....

Identification Letter. :

I do not like
it at all

I like it
very much

--

Evaluation Sheet for Bar 32s

Name :
.....

Identification Letter. :

I do not like
it at all

I like it
very much

--

Record Sheet

Phase 1

Name :
.....

Identification Letter. :

	Earnings in Francs by period
Period 0	
Period 1	
Period 2	
Period 3	
Period 4	
Period 5	
Period 6	
Period 7	

Earnings in Francs at the end of phase 1	
---	--

Total earnings for all periods of phase 1
(except for period 0)

Record Sheet

Phase 2

Name :

Identification Letter. :

Francs at the beginning of phase 2	
---	--

	Code name of chocolate bar	Bought Yes/No	Price if purchased
Period 1	24u		
	59d		
	47f		
	32s		
Period 2	24u		
	59d		
	47f		
	32s		
Period 3	24u		
	59d		
	47f		
	32s		

Expenditures at the end of phase 2	
---	--

Total for all purchases in phase 2

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