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Does Mandatory Labeling of Genetically Modified Food Grant Consumers the Right to Know? Evidence from an Economic Experiment

Astrid Dannenberg, Sara Scatasta,
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ZEW
Zentrum für Europäische Wirtschaftsforschung GmbH
Centre for European Economic Research

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Non-technical Summary

The aim of this paper is to analyze consumer acceptance of genetically modified (GM) foods in Germany and the impact of different labeling schemes on the ability of consumers to express their preferences for GM foods. For this purpose we conducted a laboratory experiment with a sample of the resident population of Mannheim, Germany. Overall, 164 subjects took part in the experiment. Participants bid in real auctions for GM and non-GM food products. The results show that consumers demonstrably favor non-GM over GM foods and require an average price discount of approximately 50 % to buy GM foods. Thus, if properly discounted from their non-GM counterparts, GM foods can find purchasers in the German food market. Consumers' preferences appear to be relatively stable with respect to the level of information. Reading neutral information about potential costs and benefits of using biotechnology in food production does not change consumers' aversion to GM food.

Since GM content cannot be identified by consumers through taste or appearance, without labeling consumers will not have enough information to express their true preferences for this attribute in their purchasing behavior. However, the choice of the labeling scheme, mandatory or voluntary, is a highly controversial issue. Opponents of the voluntary labeling scheme for genetically modified food products often argue that consumers have the "right to know" and therefore advocate mandatory labeling. Our results make a case against this line of reasoning. When a second (redundant) label which indicates that a product is GM-free enters the market consumers lose trust in the mandatory labeling scheme. This means that both labeling schemes generate uncertainty among consumers and therefore do not enable consumers to express their preferences for GM foods. There are, in principle, two possibilities of reducing the observed uncertainty in the mandatory labeling scheme. The first option is to enhance consumers' confidence in food labeling through a specific information policy. The second option is to introduce a uniform labeling rule for all GM-free products.

Das Wichtigste in Kürze

Die vorliegende Arbeit untersucht, ob genetisch veränderte Lebensmittel in Deutschland eine Absatzchance haben und ob die unterschiedlichen Kennzeichnungssysteme, freiwillig oder verpflichtend, es den Konsumenten ermöglichen, ihre Präferenzen zu offenbaren. Zu diesem Zweck haben wir ein Laborexperiment mit einer Stichprobe der Mannheimer Bevölkerung durchgeführt. Insgesamt nahmen 164 Personen an dem Experiment teil. Im Mittelpunkt der Untersuchung standen Auktionen, in denen die Teilnehmer reale Kaufgebote für Lebensmittel mit genetisch veränderten und nicht veränderten Inhaltsstoffen abgaben. Die Ergebnisse zeigen, dass die Teilnehmer die nicht genetisch veränderten Lebensmittel deutlich bevorzugen. Im Durchschnitt verlangen sie einen Preisabschlag von etwa 50 %, um genetisch veränderte Lebensmittel zu kaufen. Demnach haben genveränderte Lebensmittel durchaus eine Absatzchance in Deutschland, sofern sie deutlich billiger sind als die konventionell erzeugten Produkte. In unserer Untersuchung waren die Zahlungsbereitschaften der Teilnehmer für die Produkte relativ stabil. Eine neutrale Information über potentielle Vor- und Nachteile der Nutzung von Biotechnologie in der Lebensmittelproduktion hat die Zahlungsbereitschaften der Konsumenten nicht signifikant beeinflusst.

Da die Konsumenten die Existenz genveränderter Inhaltsstoffe nicht am Aussehen oder am Geschmack der Lebensmittelprodukte erkennen können, ist ein Kennzeichnungssystem erforderlich, um die Konsumenten über die Existenz oder auch Nichtexistenz solcher Zutaten zu informieren und es ihnen zu ermöglichen, ihre Präferenzen durch ihr Kaufverhalten auszudrücken. Strittig ist allerdings, welches der beiden möglichen Kennzeichnungssysteme, freiwillig oder verpflichtend, für diesen Zweck besser geeignet ist. Gegner der freiwilligen Kennzeichnung argumentieren häufig, Konsumenten hätten das „Recht zu Wissen“ und fordern die verpflichtende Kennzeichnung aller genetisch veränderten Lebensmittel. Bei einer verpflichtenden Kennzeichnung müssen alle genveränderten Produkte als solche gekennzeichnet sein. Demnach enthält ein Produkt ohne eine solche Kennzeichnung keine genveränderten Inhaltsstoffe. Unsere Ergebnisse zeigen jedoch, dass diese Argumentation unter bestimmten Umständen nicht zielführend ist. Wenn am Markt ein zweites (redundantes) Kennzeichen vorhanden ist, welches ein Produkt als explizit nicht genverändert ausweist, verlieren die Konsumenten das Vertrauen in die verpflichtende Kennzeichnung. Das heißt, beide Kennzeichnungssysteme, freiwillig und verpflichtend, erzeugen Unsicherheit bei den Konsumenten und ermöglichen es ihnen nicht, ihre tatsächlichen Präferenzen zu offenbaren. Für die Politik bedeutet dies, dass entweder das Vertrauen der Konsumenten in die

existierende Kennzeichnungspflicht erhöht oder eine einheitliche Kennzeichnungsregelung für nicht genveränderte Produkte eingeführt wird.

Does Mandatory Labeling of Genetically Modified Food Grant Consumers the Right to Know?

Evidence from an Economic Experiment

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Centre for European Economic Research

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Abstract
Opponents of the voluntary labeling scheme for genetically modified (GM) food products often argue that consumers have the "right to know" and therefore advocate mandatory labeling. In this paper we argue against this line of reasoning. Using experimental auctions conducted with a sample of the resident population of Mannheim, Germany, we show that the quality of the informational signal generated by a mandatory labeling scheme is affected by the number of labels in the market. If there are two labels, one for GM products and one for non-GM products, mandatory and voluntary labeling schemes generate a similar degree of uncertainty about the quality of products that do not carry a label.

JEL classification: C91, Q18, Q51
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1. Introduction

The introduction of genetically modified (GM) content in food products has been the object of highly controversial debates in several countries for over a decade. Opponents, such as Greenpeace International, warn against potential dangers to the environment and human health that arise from growing and consuming GM crop (e.g. Greenpeace International 2008). They emphasize unknown health risks, such as allergic reactions, and environmental risks, such as pest resistance and loss of biodiversity, and denounce the absence of long-term studies investigating those risks. On the other hand, proponents, such as the Council for Biotechnology Information, believe that the approval process in place for the commercialization of GM foods can be trusted and that GM crops can have positive environmental impacts due to reduced pesticide and herbicide use, positive social impacts due to an increase in farmland productivity and positive health impacts, since they reduce farmers' exposure to toxic substances, especially in developing countries (e.g. Council for Biotechnology Information 2008).

The distribution of conflicting pieces of information by the biotechnology industry on the one hand and environmental groups on the other hand increases consumers' fears, thus leading to continuous resistance to the products of agricultural biotechnology. This phenomenon can be observed not only in countries with a low rate of adoption of GM crops, such as European countries, but – albeit to a lower extent – also in countries that are large GM adopters such as the United States. Consumers' resistance continues to be observed although several scientifically grounded opinions from the European Food and Safety Authority (EFSA) state that GM products are *"unlikely to have any adverse effect on human and animal health or on the environment in the context of its intended uses"* (EFSA 2007, p. 2).

Given the marked contrast between scientific judgement and public opinion on GM foods, politics is facing the huge problem of how to regulate this market. There are mainly three options (Noussair et al. 2008): (i) banning GM foods, (ii) allowing GM foods without segregation from their conventional counterparts and (iii) allowing GM foods with segregation from their conventional counterparts. The first two policies have serious potential drawbacks. Banning GM products may be inefficient as potential welfare gains from the use of biotechnology will not be realized. On the other hand, allowing the introduction of GM foods into the food chain without segregation reduces consumer choice and, given consumers' strong resistance, may cause the collapse of entire market segments. The third option implies the creation of two separate production tracks and the introduction of a labeling scheme

allowing consumers to choose between GM and non-GM food products. The underlying motivation of a labeling scheme in this case is to avoid adverse selection due to asymmetric information (Caswell and Mojduska 1996, Golan et al. 2001). Since GM content is a credence attribute that cannot be identified by consumers through taste or appearance, without labeling consumers will not have enough information to express their true preferences for this attribute in their purchasing behavior. While segregation and labeling of GM products is beyond dispute the choice of labeling scheme, mandatory or voluntary, is a highly controversial issue, and its dimensions increase proportionally to the spread of GM products into the food chain. Some countries, such as the U.S. and Canada, have opted for a voluntary labeling scheme arguing that the market will offer the right labeling incentives and produce the optimal degree of segregation among products without the unnecessary costs a mandatory scheme would imply. Other countries, such as European Union member states, Australia, New Zealand and Japan opted for a mandatory labeling scheme arguing that consumers have the right to know. A basic difference between voluntary labeling and mandatory labeling is in the amount of labeling and segregation costs they generate. While under a mandatory labeling scheme all products must be tested, under a voluntary labeling scheme only producers who want to place a label on their products need testing. Economic arguments in favor of voluntary labeling are based on this difference. In Germany, as in most other countries with mandatory labeling schemes, GM-labeled products are virtually nonexistent. In countries with voluntary labeling schemes GM products are available but they are unlabeled and therefore indistinguishable from their conventional counterparts. In both situations, researchers wanting to investigate consumer preferences in relation to GM products have to rely on data derived from stated-preference surveys or laboratory experiments. Laboratory experiments in particular are an appropriate tool because this methodology confronts participants with real purchase decisions and provides a controlled environment to measure individual preferences (e.g. Shogren 2005). Experimental studies allow, for example, controlling for information given about product characteristics, the direct comparison of different labeling schemes for GM foods and the factoring out of variety effects that may bias the results (Scatasta et al. 2007), which is not possible in the field.

In this paper we use laboratory experiments to investigate (i) consumers acceptance of "first generation" GM foods[1] in Germany, (ii) the effect of neutral information on consumer acceptance of GM foods, (iii) the existence of a hypothetical bias when consumer preferences

[1] The benefits of "first generation" GM products are primarily agronomic through the reduction of costs or losses, whereas "second generation" GM products directly benefit the consumer through enhanced product characteristics. See Gaisford et al. (2001).

are elicited in the absence of an actual purchase, and (iv) the impact of different labeling schemes on the ability of consumers to express their preferences for GM foods. For this purpose we conducted experimental auctions for GM and non-GM food products with a random sample of the resident population of Mannheim, Germany. Participants in our sample generally preferred non-GM to GM products and discounted GM food products between 47 % and 59 %. We contribute to the empirical literature on the existence of hypothetical bias finding a significant upward bias in valuations elicited in a hypothetical scenario. We do not find significant impacts of neutral information on consumer valuation of GM products. Finally, our analysis suggests that under mandatory labeling consumers seem to lose trust in the labeling scheme when a second redundant (GM-free) label enters the market. In other words, the quality signaling in a mandatory labeling scheme depends on the number of labels in the market. This effect has not been investigated in the existing literature. Further research should be carried out on this subject, given that, in Europe, both labels (GM and GM-free) are readily observable in the market.

The paper is structured as follows. Section 2 gives a short review of the relevant literature. In section 3 we describe the design and the implementation of the experiment. In section 4 we explain the hypotheses regarding the expected behavior of subjects. Section 5 presents the results and section 6 summarizes our findings and concludes.

2. Background

Reviewing the literature on consumers' preferences for GM food we are able to identify the following stylized facts. Firstly, consumers normally value non-GM foods higher than GM foods. They only value the presence of GM ingredients when it comes along with certain benefits, e.g. increased shelf life or better taste (e.g. Noussair et al. 2002, Loureiro and Bugbee 2005). Secondly, the WTP varies with country or region. Lusk et al. (2003, 2004), for instance, show that there are not only considerable differences between U.S. and European consumers but also between European countries. Thirdly, the WTP varies with product and type of genetic modification. For example, the aversion to GM foods is higher when animal genes are involved (e.g. James and Burton 2003, Kaneko 2005). Fourthly, attitudinal variables, such as concerns for health and environment, generally seem to be more important for the valuation of GM foods than socioeconomic variables, such as gender or age (e.g. Chen and Chern 2002, Kimenju and De Groote 2008). Finally, the comparison of different valuation methods suggests that there is some disparity depending on whether consumers are

confronted with hypothetical questions or real purchase decisions (Noussair et al. 2001, Lusk 2003). This supports the finding that hypothetical surveys place respondents in the role of an ethical observer judging matters from society's point of view rather than in the role of a consumer who makes individual purchase decisions.

Polls among German consumers confirm a very high degree of hostility to the use of genetic modification in the nation's food supply (GfK 2007, BMU 2006, COM 2006, forsa 2005). Quantitative stated-preference surveys confirm this result (Gath and Alvensleben 1998, Lusk et al. 2003). To our knowledge, however, there has been no experimental study in Germany that confronted the participants with real purchase decisions on GM and non-GM products. Furthermore there is no study that investigates whether and how German consumers respond to neutral information about potential costs and benefits of GM food. In our opinion this is a very interesting question due to the fact that the German mass media do not provide a balanced dispute about risks and chances of GM foods but rather focus on spectacular actions and campaigns of some environmental groups.[2]

While the need for a labeling scheme for GM foods is beyond dispute, the choice of the scheme is highly controversial. A label can be considered a market product for which consumers are willing to pay a premium and producers have to sustain a certain amount of costs to supply. If the market for such a label has no failures, voluntary labeling will produce the socially optimal outcome. Imposing mandatory labeling in this situation would impose unnecessary labeling and testing costs to society (Giannakas and Fulton 2002, Huffman et al. 2002, Bansal and Ramaswami 2007). Only a market failure in this market would justify government intervention in the form of a mandatory labeling regime. Veyssiere and Giannakas (2006) identify two sources of market failure: weakness or lack of intellectual property rights and market power of life science companies. Huffman et al. (2002) suggest instead imperfect quality signals of the labeling scheme. Using experimental auctions with only one label in the market they find that consumers can accurately read the signals under both labeling schemes and therefore conclude that the voluntary labeling scheme leads to higher social welfare. Several theoretical studies assign the optimal choice of labeling scheme, among other factors, to the degree of consumer aversion to GM products (Crespi and Marette 2003, Fulton and Giannakas 2004, Veyssiere and Giannakas 2006). Therefore a regulator who tries to maximize social welfare by choosing the appropriate policy design needs to know consumer preferences in relation to GM foods.

[2] In September 2006, for instance, Greenpeace caused quite a stir with the detection of unlicensed GM rice in a large German supermarket (SZ 2006).

3. The experiment

This section presents the experimental procedure. It describes at first the auction mechanism. Descriptions of the concrete implementation and the design of the treatments follow.

Auction Mechanism

Experimental studies have employed a wide variety of incentive compatible mechanisms to elicit willingness-to-pay (WTP) for goods. Thereby, a mechanism is considered as incentive compatible if an individual's dominant strategy is to bid in such a manner that valuations are truthfully revealed. For example, the following incentive compatible procedures have been used in recent literature: Vickrey 2nd price auction (e.g. Noussair et al. 2002, Hayes et al. 1995), random *n*th price auction (e.g. List 2003, Huffman et al. 2007), and Becker-deGroot-Marschak mechanism (e.g. Noussair et al. 2004, Lusk and Fox 2003). In our study, we decided to use the Vickrey 2nd price auction (Vickrey 1961). In this auction, each subject simultaneously submits a sealed bid to purchase a good. 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. Selecting the mechanism to elicit individuals' WTP, we had to account for the heterogeneity of the subject pool in our experiment. In particular, we had to ensure that the mechanism rules are comprehensible also to people who are not familiar with the rather artificial decision situation in the experiment. For our experiment, the 2nd price auction seems to be appropriate, as this mechanism is relatively simple and creates an endogenous price within a transparent competitive environment. In order to avoid the influence of possibly affiliated beliefs on subjects' bids (Harrison et al. 2005) we allowed only for one-shot bidding on a single product.

Implementation

For subject recruitment 2000 residents, randomly drawn from the telephone book of Mannheim, had been called and asked to take part in the experiment. In addition, around 2000 letters of invitation had been randomly distributed in the city centre. The information people had got at this stage was that there would be a form of survey in which they could buy products and that they would receive a show-up fee of € 50.00. We used a relatively high show-up fee in order to avoid underrepresentation of people with high opportunity costs of

time. The experiment took place in November 2007 on the premises of the Centre for European Economic Research (ZEW) in Mannheim, Germany. A total of 164 participants took part in the experiment. At the beginning of each session participants individually drew lots to determine their ID number (which was kept private) and chose a table. The tables had screens on every side to ensure private answers. Participants were not allowed to talk to each other. If they had questions, the experimenter answered them privately.

Experimental sessions lasted between 40 and 70 minutes. At first, all participants obtained detailed instructions[3] about the course of the experiment and, in case of the auction treatments (see next section), guidance for the 2nd price auction. Participants in the auction treatments additionally saw a presentation of a concrete example of the 2nd price auction and had to fill out a short quiz that checked their comprehension. Before they bid for the products of interest, namely the GM and non-GM foods, they bid for chewing gums and cookies. Although participants did not know, the purpose of these auctions was solely to understand and exercise the auction mechanism. The results of the try-out auctions, namely the bids of all participants as well as the ID number of the winner and the price to be paid, were written on a blackboard. The presentation of the concrete example as well as the try-out auctions included all features that were relevant for the proper auctions. Participants in all treatments filled out a two-part questionnaire, one part before the auction – or respectively the collection of hypothetical WTP – and the other part afterwards. The first part contained questions about their socio-economic characteristics and questions about general consumption habits. The second part consisted of questions about their attitude toward GM foods and several other qualities of food products as well as questions about their state of knowledge concerning GM foods. Participants also had the chance to comment on the experiment and to give reasons for their bidding behavior.

For GM and non-GM foods products we took soy bean oil and chocolate bars. We had to use products that are available in a GM and non-GM version and, moreover, both versions should look similar and contain the same ingredients. We bought GM soy bean oil in Asian shops in Germany where it is labeled as such according to the EU mandatory labeling scheme. Non-GM soy bean oil, equal to the GM oil in terms of appearance, quantity and ingredients, is available in several German supermarkets. The GM chocolate bar was a chocolate bar from the United States. Due to the U.S. voluntary labeling scheme it was not labeled as GM but

[3] The instructions were based on the instructions used by Rousu et al. (2007) and changed for our purposes. They are available (in German) on request.

several indications led us to assume that it contained GM ingredients.[4] The non-GM chocolate bar was very similar in terms of appearance, quantity and ingredients. Prior to the auctions or respectively the collection of the hypothetical WTP the products were given to participants who could examine them and read the labels. We removed the original label and in the case of the chocolate bar also the original packing and affixed our own labels which varied between treatments. The labels in the four auction treatments always gave the type of product (chocolate bar or soy bean oil), the quantity and the ingredients. In most of our treatments (see next section) they included also the information whether or not the product contained GM ingredients. Participants were not allowed to open the packing or taste the foods. After each auction products were recollected. When participants had finished the second part of the questionnaire we asked them to individually leave the room. Outside each participant received his or her show up fee. People who had purchased products by auction got their product(s) and paid the price.

Treatments

Our experiment contains five different treatments: four auction treatments, named "Baseline", "Info", "Mandatory" and "Voluntary", in which products were sold in real auctions and one hypothetical treatment, named "Hypothetical", in which participants did not buy any goods but only gave their hypothetical WTP. In the following we describe the five treatments in more detail (see Figures 2 – 5 in the appendix). In the Baseline treatment participants first bid on the GM soy bean oil and the GM chocolate bar (round 1) and afterwards on the non-GM version of both products (round 2).[5] All products in this treatment had labels including the information whether or not it contained GM ingredients. In order to avoid saturation effects only one of both rounds was binding, i.e. people could win at most one chocolate bar or one bottle of soy bean oil. The Info treatment was the very same except that before the auctions participants received a sheet containing neutral information about GM food. The specifications derived from a U.S. study (Teisl et al. 2003) included all possible assets and drawbacks of the use of biotechnology in the field of food production. The sequence of the specification randomly varied between the sheets.

[4] The chocolate bar is on the Greenpeace list of GM food sighted in Germany (Greenpeace 2008). Furthermore, the producer of the chocolate bar told us per e-mail that the company uses GM ingredients in some of its products.

[5] Some subjects in the Baseline and the Info treatment first obtained the non-GM products and afterwards the GM products so that we were able to control for sequence effects. In both treatments the comparison of subjects who received first the GM products with subjects who received first the non-GM products does not show significant differences neither for the oil nor for the chocolate bar (MWU test, $p>0.05$).

The aim of the treatments Mandatory and Voluntary was to examine the effects of different labeling schemes. Both treatments were conducted solely with chocolate bars and not with soy bean oil. The Mandatory treatment represented the situation in a mandatory labeling scheme. Subjects in this treatment were told in advance that they would give their auction bids under the conditions of a mandatory labeling scheme, i.e. that all GM products would be labeled as such. In the first round participants bid (in parallel) on a labeled GM chocolate bar (chocolate bar A) and an unlabeled non-GM chocolate bar (B). In the second round participants bid again on chocolate bars A and B and additionally on a labeled non-GM chocolate bar (C). Only one of the overall five auctions was binding so that participants could win at most one chocolate bar. The Voluntary treatment imitated the situation under a voluntary labeling scheme. Subjects in this treatment were told in advance that they would give their bids under the conditions of a voluntary labeling scheme, i.e. that products with GM ingredients need not to be labeled as such. They were additionally informed that if they purchased an unlabeled product, i.e. without information whether or not the product contained GM ingredients, at the end of the experiment they would receive the GM version (or the non-GM respectively) by lot and the true information about the GM content. This means that to the time of the bidding participants did not know whether unlabeled products contained GM ingredients. The probability of buying a GM (or non-GM) chocolate bar was 50 %. In the first round of this treatment a labeled non-GM chocolate bar (A) and an unlabeled chocolate bar (B) were auctioned. Both chocolate bars were again auctioned in the second round besides a labeled GM chocolate bar (C). Only one of the five auctions was binding. The introduction of a third product in the Voluntary and Mandatory labeling treatments was dictated by the fact that in Europe we observe a proliferation of products voluntarily labeled by firms as GM-free, although a mandatory labeling scheme for GM products is in place. The analysis of this third option has not been taken into consideration in previous studies.

The Hypothetical treatment had two objectives. The first objective was to test whether participants value the two chocolate bars and the two bottles of soy bean oil equally from appearance. This test is very important since we cannot attribute the difference in WTP between the two chocolate bars solely to the fact that one is GM if, for instance, people prefer the non-GM version merely because of its look. The two chocolate bars and the two bottles of oil looked very similar but they were not identical. Therefore in the first round of this treatment we asked subjects to give their hypothetical WTP for the two chocolate bars and the two bottles of soy bean oil without information except for the type of product and the

quantity.[6] The second objective was a between-subjects test of hypothetical bias. In the second round of the Hypothetical treatment participants received information about the GM content of the chocolate bars and soy bean oil and gave again their hypothetical WTP. To analyze and quantify hypothetical bias these hypothetical WTP are compared with the real bids in the Baseline treatment.

4. Hypotheses

Considering the previous literature on preferences for GM foods and the theoretical rationale for labeling schemes we can derive the following hypotheses regarding the expected behavior of subjects in our experiment:

Hypotheses 1

a. WTP for non-GM foods is higher than WTP for GM foods.

b. WTP in the Hypothetical treatment is higher than WTP in the Baseline treatment.

Hypotheses 2

a. Under both labeling schemes the introduction of a third product does not change the WTP for the two initially available products.

b. Voluntary and mandatory labeling schemes should exhibit the same informational content, i.e. ceteris paribus the WTP are the same in both treatments.

c. As in the second round of the Mandatory treatment the non-GM-labeled and the unlabeled product are both non-GM, the WTP for these two products should be the same.

Regarding the effect of information on consumer behavior we are not able to formulate a hypothesis. Given the restricted and rather unbalanced discussion concerning the introduction of GM foods in Germany the effect of neutral information on consumer behavior is open.

[6] The WTP for the two versions do not significantly differ, neither for the oil (Wilcoxon test, p=0.7634) nor for the chocolate bar (p=0.2429). Therefore we can assign the differences between the two versions of each product solely to fact that one version is GM.

However, our experiment delivers information as to what effects neutral information may have on different groups of consumers.

5. Results

In this section we present the results of the experiment. In the first part we describe the subject pool and subjects' answers to the questionnaires. The second part presents the results of the conditional analysis based on non-parametric tests. Finally we show the results of the unconditional analysis based on linear regression models.

Subject pool

Table 1 represents participants' socioeconomic characteristics.[7] Although the subject pool covers all required age groups (from 18 to 75 years) for men as well as for women, it is not perfectly representative of the resident population of Mannheim (StaLa BWL 2007). The hypothesis of equal relative frequencies for male and female age groups between the subject pool and the resident population was rejected (chi squared test, p=0.0371). For this reason we will give the mean bid differences between non-GM and GM products also as weighted means according to the resident population.

Participants' responses to the questionnaires are displayed in the appendix (Tables 6 – 9). Almost all participants (96 %) are responsible for purchasing the groceries in their household or are at least considerably involved in it. Over a half (53 %) read always or often the product information on the package prior to the purchase. Almost two-thirds (62 %) purchase always, often, or sometimes food products that have just appeared in the market and over two-thirds (69 %) have recently acquired innovative products such as digital cameras or MP3 players. About a quarter (24 %) purchase always or often organic food compared to their overall food consumption. The information level is rather low. Only 20 % state that they are well or very well informed about GM foods. As expected, consumers are very skeptical of GM foods. The vast majority (79 %) considers the food characteristic "free of GM ingredients" to be important or very important and, contrary to what the EFSA has concluded about GM foods commercialized in Europe for human consumption, about the half think that the production and consumption of GM foods have highly negative effects on the environment (55 %) and on human health (45 %).

[7] The data of three persons had to be left out from the analysis due to unrealistically high bids (in the Hypothetical treatment) or an obvious lack of understanding. The total number of observations is therefore 161.

Table 1: Socioeconomic characteristics of participants

Variable	State	Frequency abs.	Frequency in %
Gender	Male	77	47.83
	Female	84	52.17
Age	18 – 25	24	14.91
	26 – 40	57	35.40
	41 – 65	71	44.10
	66 – 75	9	5.59
Family Status	Married	39	24.22
	Unmarried with partner	50	31.06
	Single	61	37.89
	Other	10	6.21
	No answer	1	0.62
Children	Yes	28	17.39
	No	133	82.61
Religion	Catholic	46	28.57
	Evangelic	62	38.51
	Muslim	5	3.11
	Other	10	6.21
	No religion	37	22.98
	No answer	1	0.62
Graduation	University	41	25.47
	Gymnasium (12 years of education)	50	31.06
	Realschule (10 years of education)	28	17.39
	Hauptschule (9 years of education)	20	12.42
	Other	20	12.42
	No graduation	1	0.62
	No answer	1	0.62
Nationality	German	142	88.20
	Turkish	4	2.48
	Croatian	3	1.86
	Other	11	6.83
	No answer	1	0.62
Household net income	< 1.000 €	46	28.57
	1.000 – 2.500 €	78	48.45
	2.500 – 4.000 €	26	16.15
	4.000 – 5.500 €	8	4.97
	> 5.500 €	2	1.24
	No Answer	1	0.62
	Σ	161	100.00

Non-parametric tests

Leaving out the Hypothetical treatment and omitting the data of all subjects who bid zero for both the GM and the non-GM version of a product leaves a total of 61 real purchase observations for the soy bean oil and 98 observations for the chocolate bar. In the case of the soy bean oil, 80 % of participants preferred the non-GM oil to the GM oil, 8 % bid more for the GM oil, and 12 % were indifferent between both versions. The difference between bids for non-GM oil and GM oil is highly significant (Wilcoxon test[8], p=0.0000) and amounts on average to € 0.56. The weighted mean difference between non-GM and GM oil is € 0.56, too.

[8] If not stated otherwise, all tests are two-sided.

As the mean bid for the non-GM oil is € 1.20 we observe that consumers demand an average price discount of 47 % to buy GM soy bean oil.[9]

Considering the chocolate bar, 86 % of participants bid more for the non-GM version, 8 % preferred the GM version, and 6 % were indifferent between both versions. The bid difference between the non-GM chocolate bar and the GM chocolate bar is also highly significant (Wilcoxon test, p=0.0000). The mean bid difference is € 0.26 and the weighted mean difference is € 0.24. As the mean difference and the weighted mean difference between non-GM and GM are equal or almost equal we conclude that participants' age and gender do not play an important role for their acceptance of GM foods. We will return to this aspect in the regression analysis. For the chocolate bar consumers demand on average a price discount of 59 % to accept GM ingredients. Hence, for both products our expectation stated in hypothesis 1a is fulfilled. The summary statistics for the bidding behavior are displayed in Table 2.

Table 2: Summary statistics of bid differences between non-GM and GM products

Treatment	Baseline	Info	Mandatory[2]	Voluntary[2]	All real[3]	Hypothetical[2]
No. of participants	39	44	26	26	135	26
Oil						
No. of observations	26	35	0	0	61	26
Diff. (non-GM – GM)						
Mean [€]	0.64	0.51			0.56	1.19
Std. Dev.	0.64	0.57			0.60	1.25
Min [€]	-0.50	-0.82			-0.82	-1.00
Max [€]	2.00	1.89			2.00	4.00
Discount[1]	0.52	0.43			0.47	0.54
Chocolate bar						
No. of observations	23	34	19	22	98	25
Diff. (non-GM – GM)						
Mean [€]	0.24	0.21	0.28	0.33	0.26	0.43
Std. Dev.	0.21	0.22	0.52	0.30	0.31	0.39
Min [€]	0.05	-0.10	-0.30	-0.05	-0.30	0.00
Max [€]	0.76	0.80	2.10	0.80	2.10	1.50
Discount[1]	0.57	0.55	0.55	0.72	0.59	0.61

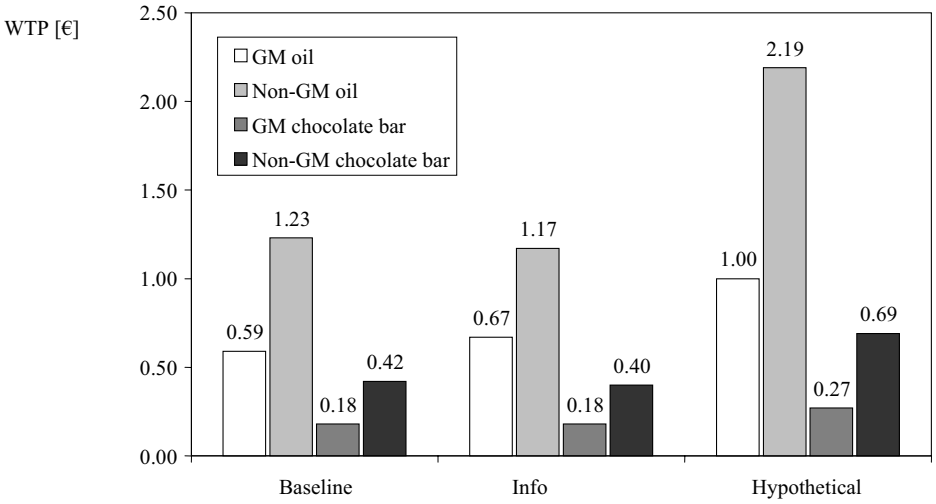
Notes:
[1)] Discount computed as difference (non-GM – GM) divided by non-GM.
[2)] Calculation was made with bids for labeled (non-GM and GM) products.
[3)] All treatments with real purchase decisions (Baseline, Info, Mandatory, and Voluntary).

In order to examine whether the distribution of information about the potential costs and benefits of GM foods affects consumers' acceptance of GM foods we apply a between-

[9] The market prices for the experimental products were € 1.40 for the GM chocolate bar, € 0.65 for the non-GM chocolate bar, € 2.29 for the GM soy bean oil and € 1.59 for the non-GM soy bean oil (all prices in € 2007). Interestingly the GM versions were higher in price, we assume, due to import costs and commercial structures of the seller.

subjects test comparing the bidding in the Baseline treatment with the bidding in the Info treatment (see Figure 1). For both products, we do not find significant differences between the two treatments neither for the GM versions nor the non-GM versions (MWU test, $p>0.05$). As previous experiments often showed that the impact of information depends on the subjects' initial knowledge about GM foods or on their attitude toward GM foods (Lusk et al. 2004, Wachenheim et al. 2007) we apply additional tests using the statements participants made in the questionnaire.

Figure 1: Mean bids in Baseline, Info and Hypothetical treatments



The analysis shows that buyers of organic food (who always, often, or sometimes buy organic food) respond more to the information than non-buyers (who rarely or never buy organic food). After reading the information organic food buyers bid three times more (€ 1.09) for the GM oil than the non-buyers (€ 0.35). We can reject the hypothesis that the information affects buyers and non-buyers of organic food in equal measure (MWU test $p=0.0149$). What is more, organic food buyers who received the information bid significantly more for the GM oil than organic food buyers who did not read the information (€ 0.47) (MWU test, $p=0.0263$). This is an interesting result though we can only speculate about reasons. In Germany, environmental groups have effectively prevented the selling of GM foods by disseminating information about the risks of biotechnology. Therefore German consumers are more likely to be aware of potential costs rather than of potential benefits of GM foods. Hence it was probably the information about potential benefits that was new to our participants. Organic food consumers are generally anxious for a healthy and eco-friendly diet. Therefore, it might

be that they react more sensitively than others to the information that GM foods can also be beneficial to health and environment.

We also use a between-subjects design to test for hypothetical bias. For this purpose we compare subjects' bidding behavior in the Baseline treatment with subjects' hypothetical statements in the second round of the Hypothetical treatment (see Figure 1). Regarding the two GM products we cannot reject the hypothesis that the bids in the Hypothetical treatment equal the real bids in the Baseline treatment (MWU test, oil: $p=0.1995$, chocolate bar: $p=0.5139$). In contrast, for the non-GM products the hypothetical bids significantly exceed the real bids (MWU test, oil: $p=0.0006$, chocolate bar: $p=0.0092$). Participants in the Hypothetical treatment bid on average 78 % more for the non-GM oil and 64 % more for the non-GM chocolate bar than participants in the Baseline treatment, which is in line with our expectation stated in hypothesis 1b. Hypothetical bias is often observed in the case of public goods (Nyborg 2000). From the viewpoint of someone who is rather skeptical of GM foods, a food product guaranteed free from GM ingredients can be characterized as a public good because it prevents society from bearing potential risks of the use of biotechnology. Participants in our experiment demonstrably prefer non-GM to GM foods so that it is not surprising that the hypothetical WTP for non-GM foods exceeds the bids in real purchase decisions.

The treatments Mandatory and Voluntary are designed in order to investigate the effects of different labeling schemes. Both treatments contain two rounds of bidding. Table 3 shows the mean bids in both rounds of the two treatments. At first we present test results for the Mandatory treatment, followed by results for the Voluntary treatment and the comparison between the two treatments. In the first round of the Mandatory treatment bids for the GM-labeled chocolate bar and bids for the unlabeled chocolate bar are significantly different (Wilcoxon test, $p=0.0011$). In the second round bids for all three products significantly differ from each other ($p<0.05$), although the non-GM-labeled and the unlabeled product are equal. This contradicts hypothesis 2c. The comparison between first and second round shows that the difference between first round and second round bids for the GM-labeled product is not significant ($p=0.3173$), which is in line with hypothesis 2a. In contrast, we observe significant differences between first round and second round bids for the unlabeled chocolate bar ($p=0.0258$), which contradicts hypothesis 2a. Differences between first round bids for the unlabeled chocolate bar and second round bids for the non-GM-labeled chocolate bar are weakly significant ($p=0.0828$). These results suggest that under mandatory labeling the presence of a product labeled as non-GM seems to shake consumers' confidence in the labeling scheme. In other words, in a mandatory labeling scheme the quality of the

informational signal is affected by the number of labels in the market. Note that this effect would not emerge if subjects fully trusted the labeling scheme.

Table 3: Mean bids in the Mandatory and Voluntary treatments

Treatment	Mandatory			Voluntary		
Label	GM-label	No label (non-GM)	Non-GM-label	Non-GM-label	No label (50:50)	GM-label
1st round [€]	0.23	0.50		0.46	0.29	
2nd round [€]	0.21	0.46	0.51	0.45	0.27	0.13

Tests with the data from the Voluntary treatment show significant differences between first round bids for the non-GM-labeled chocolate bar and the unlabeled chocolate bar and significant differences between second round bids for all three products ($p<0.05$). Comparing the first with the second round displays significant differences between first round bids for the unlabeled chocolate bar and second round bids for the GM-labeled chocolate bar ($p=0.0102$). We do not find significant differences between first round and second round bids for the non-GM-labeled chocolate bar ($p=0.9738$) as well as between first round and second round bids for the unlabeled chocolate bar ($p=0.5640$). Hence, as the introduction of a third product does not change the valuation of the two initially available products, subjects' behavior in the Voluntary treatment is in line with hypothesis 2a. These results suggest that under a voluntary labeling scheme consumers are able to accurately interpret labeling signals independently from the number of labels. Participants on average bid the highest amount for the non-GM product, they bid the lowest amount for the GM product, and they value the product with uncertain GM content in between. As the bids for the chocolate bar with uncertain GM content – which is GM with a probability of 50 % – lie almost exactly between the bids for the GM and the non-GM chocolate bar subjects seem to be on average risk neutral.

We now compare the bidding behavior between the two labeling schemes. Considering the first round we do not find significant differences between bids for the unlabeled non-GM product in Mandatory and the bids for the non-GM product in Voluntary (MWU test $p=0.5818$). Also in the second round we do not find significant differences between the labeled non-GM products ($p=0.6125$) and between the labeled GM products ($p=0.2734$). These results support hypothesis 2b which says that WTP for GM and non-GM products are the same under both labeling schemes. However, when we compare the bids for the two unlabeled products we find weakly significant differences in the first round ($p=0.0735$) but no significant differences in the second round ($p=0.1803$), although these products differ in their

GM content. This confirms our finding that under mandatory labeling consumers lose trust in the labeling scheme when a second label enters the market.

Regression models

Tables 4 and 5 present the results of a linear regression model for each product. The dependent variable is the (absolute) bid difference between non-GM and GM. In both models we display all independent variables that have at least a weakly significant influence on the dependent variable.

Table 4: Linear regression model for soy bean oil

Oil	Coef.	Robust Std. Err.	P > |t|
hypothetical	0.5265	0.2001	0.010
age	0.0002	0.0001	0.019
degree	0.4655	0.1636	0.006
innovation	0.3031	0.1676	0.074
gmo	0.4464	0.1496	0.004
organic	0.8006	0.3006	0.009
info_organic	-1.0932	0.3913	0.007
knowledge	0.4045	0.2025	0.049
constant	-0.4224	0.1989	0.037
Number of obs. = 87	F (8,78) = 5.59	Prob > F = 0.0000	R-squared = 0.4264

Estimation method: OLS.
Variable definition: Dependent variable is the bid difference between non-GM oil and GM oil.
Except 'age' all independent variables are dummy variables:
- hypothetical: subjects in the Hypothetical treatment,
- degree: subjects with 12 or more years of education,
- innovation: subjects who bought recently digital camera, MP3 player or flat screen,
- gmo: subjects who find the absence of GM ingredients important or very important,
- organic: subjects who always or often buy organic food,
- info_organic: organic food buyers in the Info treatment,
- knowledge: subjects who regard themselves as well informed or very well informed about GM food.

The price difference between non-GM and GM oil (Table 4) is significantly larger for individuals in the Hypothetical treatment than for the subjects in all other treatments. This supports our findings of the non-parametric tests regarding hypothetical bias. The price difference between non-GM and GM increases with age. Though this effect is statistically significant it is very small compared to the other effects. Furthermore, the price difference is larger for higher educated individuals and for people who recently bought innovative products such as digital cameras or MP3 players. The latter result is somewhat surprising because we expected those individuals to be more open-minded toward the use of biotechnology than others. This effect however is only weakly significant. A higher price difference between non-GM and GM oil is furthermore found for individuals who regard the absence of GM ingredients to be an important food quality, for organic food buyers, and for people who

regard themselves as well informed about GM foods. Due to the results of the non-parametric test regarding the information effect we insert an interaction dummy to the regression for organic food buyers who received the information about the potential costs and benefits of GM foods. The regression model confirms that for these subjects the price difference between non-GM and GM is significantly lower than for organic food buyers who did not receive the information. Thereby the influence of information overruns the effects of organic food buying which in general increases the price difference.

Table 5: Linear regression model for chocolate bar

Chocolate bar	Coef.	Robust Std. Err.	P > |t|
hypothetical	0.1387	0.0757	0.070
income	-0.1175	0.0632	0.065
degree	0.1084	0.0594	0.071
innovation	0.0908	0.5729	0.115
organic	0.2086	0.9457	0.029
info_organic	-0.2381	0.1246	0.059
knowledge	0.1713	0.0935	0.069
trust	0.1678	0.0575	0.004
constant	0.0003	0.0702	0.996
Number of obs. = 122	F (8,113) = 2.78	Prob > F = 0.0076	R-squared = 0.2514

Estimation method: OLS.
Variables definition: Dependent variable is the bid difference between non-GM chocolate bar and GM chocolate bar.
All independent variables are dummy variables:

- hypothetical: subjects in the Hypothetical treatment,
- income: subjects whose net income of the household exceeds € 2500 per month,
- degree: subjects with 12 or more years of education,
- innovation: subjects who bought recently digital camera, MP3 player or flat screen,
- organic: subjects who always or often buy organic food,
- info_organic: organic food buyers in the Info treatment,
- knowledge: subjects who regard themselves as well informed or very well informed about GM food,
- trust: subjects who think ecological groups are trustworthy or very trustworthy and the government is hardly trustworthy or not trustworthy concerning their statements about GM food.

The regression model for the chocolate bar (Table 5) confirms these results for subjects in the Hypothetical treatment, higher educated subjects, knowledgeable subjects, organic food buyers and organic food buyers who received the information, though most of the effects are only weakly significant. Other things being equal the price difference between the non-GM and the GM chocolate bar is lower for people with a relatively high net household income. This effect, too, is only weakly significant. The price difference is significantly greater for people who trust ecological groups and mistrust the government concerning their statements about GM foods. This effect is not surprising since ecological groups usually emphasize the risks of GM food more than the government.

6. Summary and Conclusion

In this paper we use laboratory experiments to investigate (i) consumers acceptance of GM foods in Germany, (ii) the effect of neutral information on consumer acceptance, (iii) the existence of a hypothetical bias when consumer preferences are elicited in the absence of an actual purchase, and (iv) the impact of different labeling schemes on the ability of consumers to express their preferences for GM foods.

Based on elicited consumer willingness to pay for GM and non-GM soy bean oil and chocolate bars, our analysis concludes that residents of Mannheim, Germany, who took part in our experiment demonstrably favor non-GM over GM foods and require an average price discount of 47 – 59 % to buy GM foods. Yet, not all subjects prefer non-GM foods. Six to twelve percent of participants are indifferent between GM and non-GM products and 8 % prefer the GM version to the non-GM version. Thus, if properly discounted from their non-GM counterparts, "first generation" GM foods could find purchasers in the German food market. Regression models for both products show that the (absolute) price difference between the non-GM and the GM version is significantly greater for highly educated individuals, for individuals who regard themselves as well informed about GM foods and for organic food buyers.

Regarding the general attitudes of German consumers to GM foods we find it remarkable that, contrary to what the EFSA has concluded about GM foods commercialized in Europe for human consumption, 45 % respectively 55 % of participants believe GM foods have highly negative impacts on human health respectively on the environment. This observation suggests that the information policy of the EFSA and corresponding institutions in Germany was not successful. Only 20 % of participants feel that they are well informed about GM foods, but the vast majority (79 %) considers the food characteristic "free of GM ingredients" to be important or very important, which suggests that releasing more neutral information about advantages and disadvantages of using biotechnology could be welfare improving. Yet, reading neutral information about potential costs and benefits of GM foods does not significantly change consumer acceptance of GM foods in our sample. Information matters only to organic food buyers who bid significantly more for GM soy bean oil when given additional neutral information than organic food buyers who did not read information. The regression analysis confirms this result also for the chocolate bar, although the evidence is somewhat weaker in this case.

We find evidence in favor of an upward hypothetical bias. When asked hypothetically subjects bid significantly more (between 64 – 78 %) for the non-GM products than they bid in real purchase decisions. The hypothetical bias is also found in the regression analysis. The disparity between real and hypothetical bids supports the finding that hypothetical questions about the WTP for public goods often place respondents in the role of an ethical observer judging matters from a society's point of view rather than in the role of a consumer who makes personal purchase decisions. Real auctions therefore appear to be more suitable to reveal participants' individual preferences for environmentally relevant goods such as GM foods than polls or stated-preference surveys, at least for absolute estimates of the WTP.

Regarding the bidding behavior under different labeling schemes our results support the findings of Huffman et al. (2002) that consumers are able to correctly read and trust labeling signals when the market contains only one labeled and one unlabeled product. Our paper contributes to the existing literature by investigating the effect of a second (redundant) label in a mandatory labeling scheme. Our results suggest that when such a second label enters the market consumers lose trust in the mandatory labeling scheme and are willing to pay more for the labeled non-GM product than for the unlabeled non-GM product. For producers as well as for regulators this may be important information. The introduction of the second label generates a negative externality for producers of non-GM products who market their products without a label. The lack of trust in the mandatory labeling scheme may also affect consumers' confidence in food labeling as a whole (e.g. nutrition facts and additives), which represents an important public good for food manufacturers. We think that this aspect of the quality of informational signals generated by labeling schemes deserves further research.

According to our results, under a voluntary labeling scheme consumers are able to correctly read signals independently of the presence of a second label. Consumers value unlabeled products, which had a 50 % chance of being GM, exactly between the value they placed on non-GM and GM labeled products, i.e. our values suggest average risk neutrality. We have to bear in mind, however, that in the Voluntary treatment the size of uncertainty is restricted in two ways: participants knew the probability of the unlabeled chocolate bar being GM and they knew they would get to know the exact GM content of the chocolate bar before eating it. Further research should be conducted to investigate whether the size of uncertainty about the quality of unlabeled products affects consumer attitudes towards risk.

Finally, we would like to point out that reading signals of the voluntary labeling scheme correctly does not mean that consumers are able to express their true preferences for the actual

GM content of the purchased product. On the contrary, under a voluntary labeling scheme the true GM content of unlabeled products is either GM or non-GM. This means that consumers who prefer non-GM to GM products systematically undervalue the unlabeled products when their true content is non-GM and overvalue it when it is GM. Unfortunately, we find that the same is true for mandatory labeling schemes when some non-GM products are labeled as such. In this case consumers systematically undervalue the unlabeled product. Although the probability of the unlabeled product being GM in Mandatory is zero and in Voluntary is 50 %, we do not find significant differences in the WTP across treatments. This suggests that both labeling schemes do not enable consumers to express their true preferences for GM content when the product does not carry a label. In other words, both labeling schemes generate uncertainty among consumers and a bias in consumer valuation. Therefore, we have to state that mandatory labeling does not grant consumers the right to know when there is more than one label in the market. Given the fact that we do observe GM-free food labels in Europe, where GM food products are virtually nonexistent, this result may become even more important when GM products will actually be offered and suppliers have more incentives to voluntarily label their non-GM food products.

Summarizing, our results show that there can be significant uncertainty regarding the presence of GM content in unlabeled products in both labeling schemes: voluntary and mandatory. To reduce this uncertainty, the first option is to enhance consumers' confidence in the mandatory labelling scheme through a specific and effective information policy. The second option is to introduce a uniform labeling rule for all GM-free products. Further research is needed to show which strategy is socially preferable and how such policy has to be designed.

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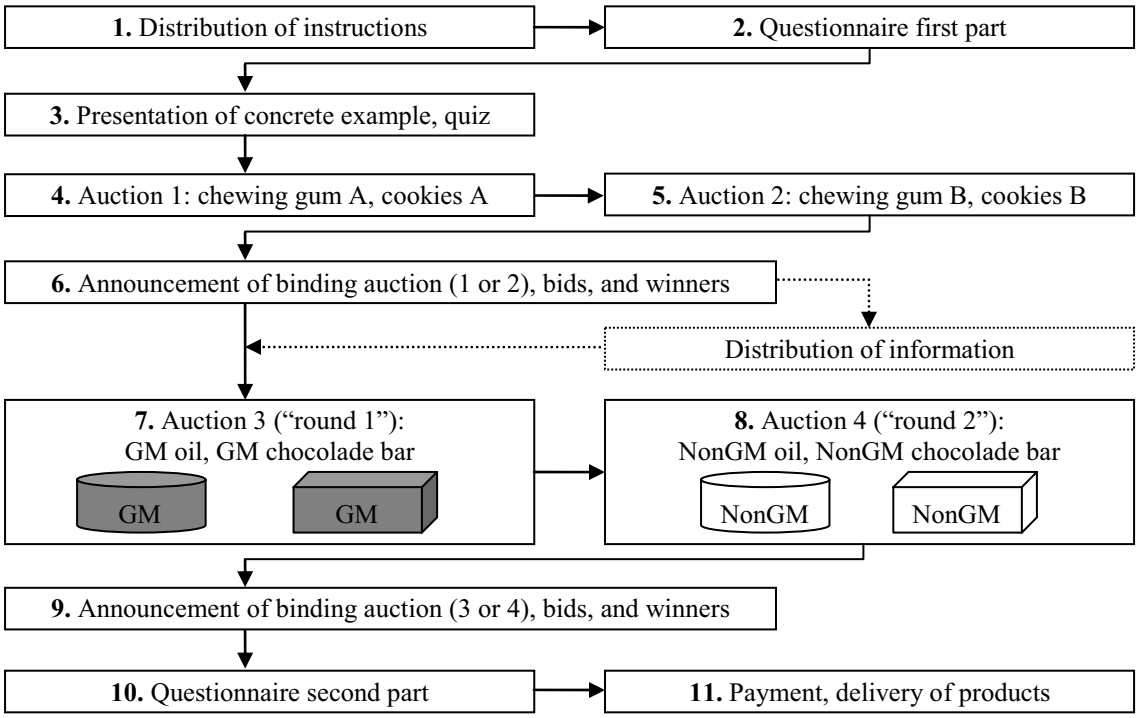
Appendix

Figure 2: Treatments Baseline and Info



Notes:

1. Treatment Info is identical to treatment Baseline except for the fact that subjects is given information after step 6 (indicated with dotted lines).
2. For graphical presentation, oil is depicted as round shape and chocolate bar as rectangular shape. White indicates non GM products and dark gray (light gray) indicates GM products (50% probability for GM).

Figure 3: Treatment Hypothetical

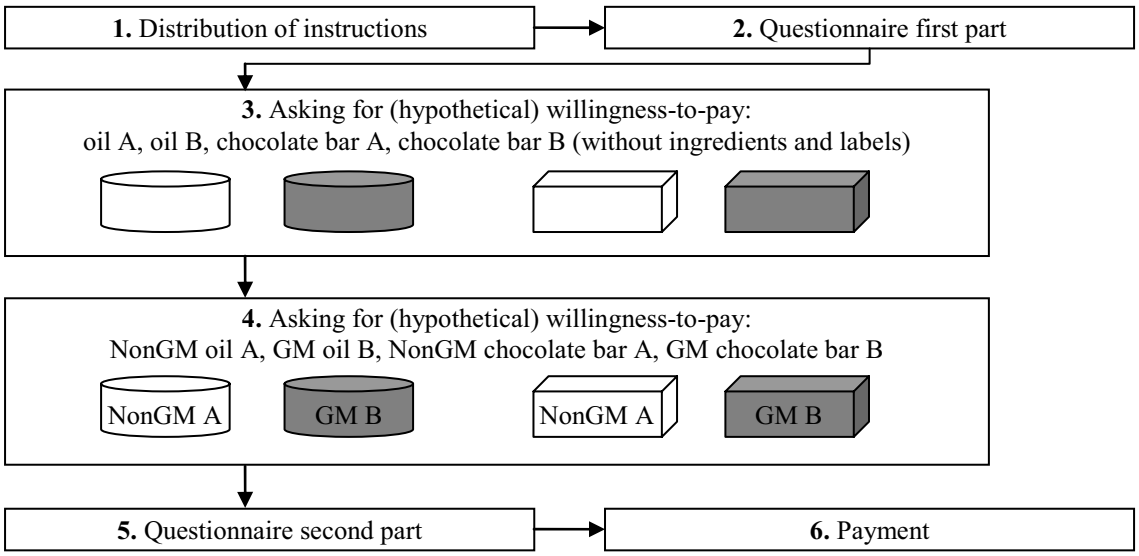


Figure 4: Treatment Mandatory

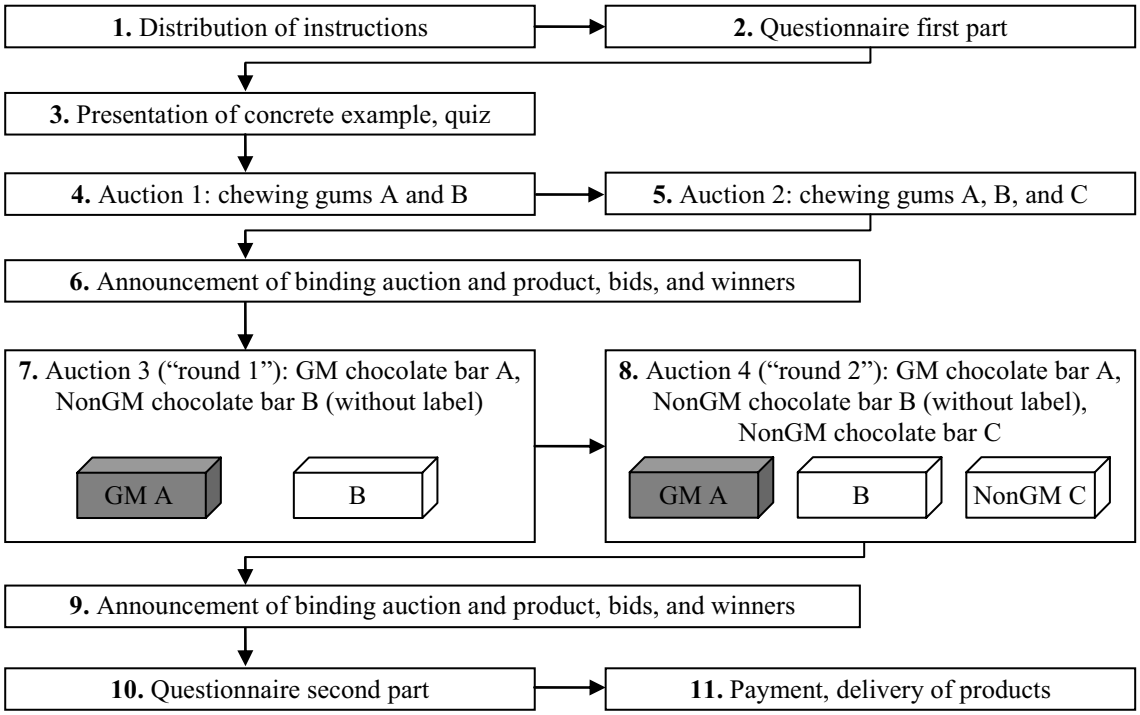


Figure 5: Treatment Voluntary

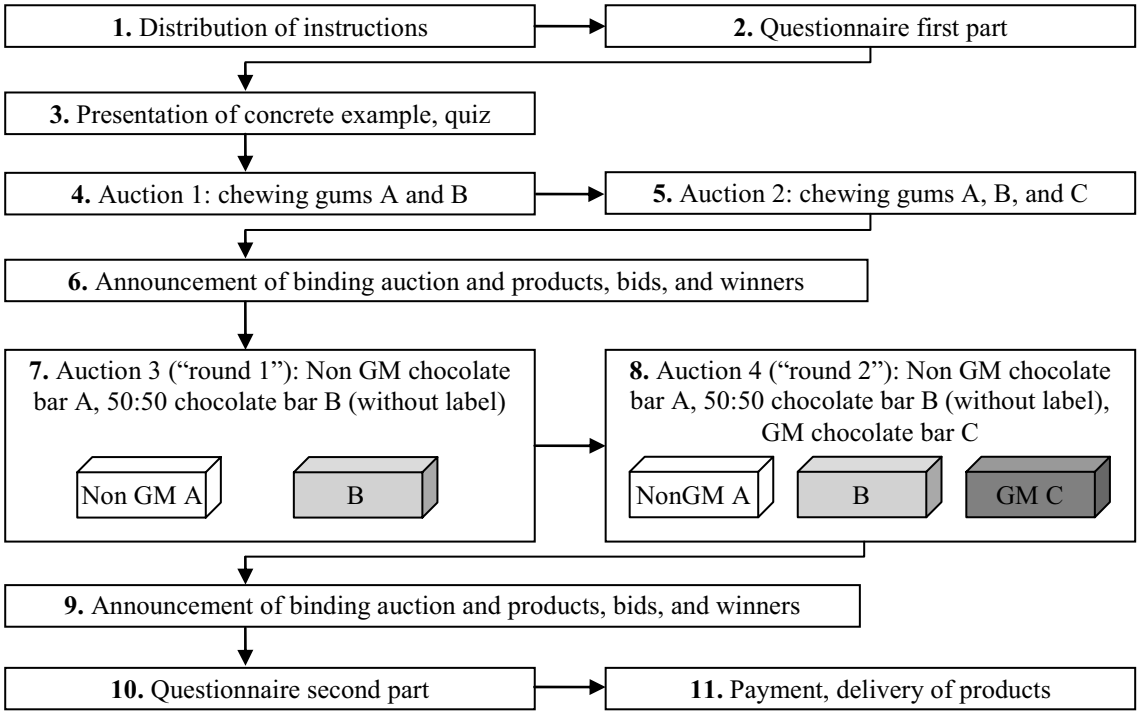


Table 6: Questionnaire before auctions

Question	Answer	Frequency abs.	Frequency in %
(1) Do you work in the field of agriculture, chemistry or in the food industry?	Yes	9	5.59
	No	150	93.17
	No answer	2	1.24
(2) Are you a member of an ecology group?	Yes	10	6.21
	No	150	93.17
	No answer	1	0.62
(3) In your household, are you responsible for purchasing the groceries or are you at least considerably involved in it?	Yes	154	95.65
	No	6	3.73
	No answer	1	0.62
(4) When buying food products for the first time, how often do you read the product information on the package prior to the purchase?	Never	5	3.11
	Rarely	37	22.98
	Sometimes	33	20.50
	Often	53	32.92
	Always	33	20.50
	No answer	0	0
(5) How often do you purchase organic foods, compared to your overall food consumption?	Always	1	0.62
	Often	38	23.60
	Sometimes	43	26.71
	Rarely	62	38.51
	Never	15	9.32
	No answer	2	1.24
(6) How often do you purchase food products, which have just appeared on the market?	Always	1	0.62
	Often	15	9.32
	Sometimes	84	52.17
	Rarely	58	36.02
	Never	1	0.62
	No answer	2	1.24
	∑	161	100.00

Table 7: Questionnaire after auctions – Part I

Question		Answer	Frequency abs.	Frequency in %
(1) Have you or any other person in your household acquired one of the following products over the course of the past two years?	Digital camera	Yes	74	45.96
		No	82	50.93
		No answer	5	3.11
	MP3-Player	Yes	71	44.10
		No	78	48.45
		No answer	12	7.45
	Flat-screen television set	Yes	28	17.39
		No	118	73.29
		No answer	15	9.32
(2) How well informed would you estimate yourself to be concerning genetically manipulated foods?		Very well informed	1	0.62
		Well informed	31	19.25
		Somewhat informed	71	44.10
		Not well informed	46	28.57
		Not at all informed	11	6.83
		I do not know	1	0.62
		No answer	0	0
(3) Did you know the Centre for Economic Research (ZEW) prior to this study?		Yes	82	50.93
		No	78	48.45
		No answer	1	0.62
(4) Which party would you vote for if the parliamentary elections were to be held next Sunday? Please bear in mind: Your indications will not be published or delivered to third party.		CDU/CSU	22	13.66
		Die Linke	10	6.21
		FDP	14	8.70
		Grüne	26	16.15
		SPD	38	23.60
		Other parties	5	3.11
		I would not vote	26	16.15
		No answer	20	12.42
(5) The cultivation and consumption of genetically modified foods can have positive and negative effects on the environment. What would you estimate is the extent of these effects?	Negative effects	None	0	0
		Minor	8	4.97
		Average	34	21.12
		High	88	54.66
		I do not know	28	17.39
		No answer	3	1.86
	Positive effects	None	36	22.36
		Minor	47	29.19
		Average	23	14.29
		High	7	4.35
		I do not know	36	22.36
		No answer	12	7.45
(6) The cultivation and consumption of genetically modified foods can have positive and negative effects on human health. What would you estimate is the extent of these effects?	Negative effects	None	2	1.24
		Minor	18	11.18
		Average	32	19.88
		High	73	45.34
		I do not know	33	20.50
		No answer	3	1.86
	Positive effects	None	46	28.57
		Minor	42	26.09
		Average	19	11.80
		High	4	2.48
		I do not know	38	23.60
		No answer	12	7.45
		∑	161	100.00

Table 8: Questionnaire after auctions – Part II

Question		Answer	Frequency abs.	Frequency in %
(7) How important do you consider the following characteristics of food products to be? Please mark with a cross.	Appearance of the package	Unimportant	19	11.80
		Hardly important	68	42.24
		Important	56	34.78
		Very important	12	7.45
		No answer	6	3.73
	Taste	Unimportant	1	0.62
		Hardly important	0	0
		Important	33	20.50
		Very important	125	77.64
		No answer	2	1.24
	Nutritional values, content of vitamins and minerals	Unimportant	0	0
		Hardly important	9	5.59
		Important	61	37.89
		Very important	88	54.66
		No answer	3	1.86
	Free from colorants and preservatives, flavor enhancers and other additives	Unimportant	3	1.86
		Hardly important	33	20.50
		Important	56	34.78
		Very important	68	42.24
		No answer	1	0.62
	Free from genetically manipulated ingredients	Unimportant	2	1.24
		Hardly important	26	16.15
		Important	35	21.74
		Very important	92	57.14
		No answer	6	3.73
	Made in Germany	Unimportant	34	21.12
		Hardly important	62	38.51
		Important	48	29.81
		Very important	17	10.56
		No answer	0	0
	Eco-friendly fabrication	Unimportant	1	0.62
		Hardly important	17	10.56
		Important	75	46.58
		Very important	67	41.61
		No answer	1	0.62
		∑	161	100.00

Table 9: Questionnaire after auctions – Part III

Question		Answer	Frequency abs.	Frequency in %
(8) Different institutions publish information on the advantages and disadvantages of genetically manipulated foods. How trustworthy do you think is this information by the following persons? Please mark with a cross.	Government representative	Not trustworthy	45	28
		Hardly trustworthy	82	51
		Trustworthy	28	17
		Very trustworthy	3	2
		No answer	3	2
	Scientist	Not trustworthy	4	2
		Hardly trustworthy	21	13
		Trustworthy	88	55
		Very trustworthy	47	29
		No answer	1	1
	Consumer protection	Not trustworthy	1	1
		Hardly trustworthy	12	7
		Trustworthy	92	57
		Very trustworthy	55	34
		No answer	1	1
	Ecology group	Not trustworthy	1	1
		Hardly trustworthy	41	25
		Trustworthy	85	53
		Very trustworthy	32	20
		No answer	2	1
	Food manufacturer	Not trustworthy	66	41
		Hardly trustworthy	78	48
		Trustworthy	9	6
		Very trustworthy	7	4
		No answer	1	1
		∑	161	100.00