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Influence of external information on consumers' purchase behaviour of genetically modified food

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Abstract

This paper examines the influence of external information on their purchase behaviour of GM food. Data are gathered from auction experiments. The results show that external information affects the purchase behaviour of consumers. Participants who receive single negative information from environment groups discount GM foods more highly than those who receive other information combinations. The positive information provided by biotechnology companies can increase participants' bid price of GM food compared to negative information. Objective information provided by the third party organizations can not significantly affect the consumer behaviour of GM food in this study. These results have implications for information policies.

JEL classification numbers: M31
Keywords: GM food, purchase behaviour, external information, auction experiments

1 Introduction

The application of the transgenic technology in food and the potential risks of GM food have become the main content of the food industry and the hot spot the society concerns. Since the mid-1980s, biotechnology has been the key topic

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of research and development in China. And since 1996, GM crops have realized the large-scale commercial cultivation because of the benefits of GM food. With the development of the transgenic technology, the world food shortage of conflict can be alleviated and nutrition level of food can be improved. However, since the autumn of 1998, a series of events has emerged, which indirectly revealed that GM foods existed potential health and environmental risks. Therefore, external information becomes a very important factor to help consumers to assess GM food which will directly affect their willingness in the debate about the "benefits" and "risk".

The objective of this study is to examine the influence of three kinds of external information on the consumers' purchase behaviour of GM food in an experimental auction-market setting. Two problems are discussed. First, does the existence of external information affect the consumers' purchase behaviour of GM food? Second, how does diverse information from interested parties and third party affect consumers' purchase behaviour of GM food? To solve these two problems, auction experiments are designed and conducted.

2 Literature Review

2.1 Purchase behaviour of GM food

In Europe, many studies about ten years ago suggested that consumers were very difficult to accept GM food (Macer and Ng, 2000; Grimsrud et al., 2002). But Martha (2010) recently commented the debate of UK consumers for GM food, and believed that part of UK consumers had positive attitude toward GM foods. These studies demonstrated that the negative attitude of Europe consumers was changing and they gradually began to accept GM food. A consumer survey carried out under the auspices of Greenpeace and several other studies had shown that Chinese consumers were fairly skeptical of GM foods (Ma, 2004; Liu, 2010). But many Chinese consumers were ready to purchase GM food in the future (Zhang, 2004).

In order to further explore the consumers' purchase behaviour of GM food besides consumers' attitude, scholars have focused on factors influencing purchase behaviour. These factors included: information, social economic and value characteristics of the consumers, the level of understanding of GM foods, evaluation of risks and benefits of GM food, and so on. Some literature empirically studied the impact of these factors on willingness to pay (Chen and Chern, 2002; Grimsrud, 2002; James and Burton, 2003; Kaneko and Chern, 2003; VanWechel, 2003; Chen, 2004). Part of them was supported by significant empirical evidence.

2.2 External information of GM food

The sources of information about GM food in previous studies were different. Rousu (2002) and Huffman (2003) referred to the information which was provided by the environmental organization and third party organizations. Wallace (2006) mentioned two kinds of information: interested and third parties, in which the variety of external information was comprehensive. In his study, the interested parties were the agricultural biotech industry (positive information provider) and environment groups (negative information provider) such as, Greenpeace, Friends of the Earth, and Action Aid, which always disseminated anti-biotech information. The third kind of information is objective information from the third parties (including scientists and academic institutions).

In US, the negative information provided by the environmental organizations could make consumers exit the market of GM foods, but verifiable information from third-party groups could partially offset the impact of negative information (Rousu, 2002; Huffman, 2003). In China, the influence of information on consumer attitude had ever been confirmed (Ma, 2011). The information provided by the media and the government was very crucial to Chinese consumers' attitudes toward GM food (Huang, 2007). In these studies, the importance of information from the government was confirmed. And the government needs to realize the influence of three kinds of external information on consumers' purchase behaviour of GM food to make policy.

3 Method

3.1 Experimental Design

The experiment is organized in two steps:

Step 1 : *no external information test*

In this step, 154 consumers participated in an auction. All participants are divided into twelve experimental units randomly. Two practice rounds of bidding are conducted before formal auction. In the first round, participants need to bid on three food products: potato chip, instant noodle and tomato, which are all labeled GM. Then the participants write down the bid for each of the three goods according the random nth-price auction mechanism. The monitor collects the bids from the participants.

Step 2: *external information test*

In the second auction, participants also have to bid on the same three food products, each also with a GM label. They are randomly provided with one of six kinds of information combinations. Information providers are the agricultural biotech industry, environment groups and the third parties. The agricultural biotech industry provides single positive message, and environment groups single negative information, and the third parties single objective message (Wallace,

2006). In total, there are six kinds of information combinations: (1)single objective information, (2)negative plus objective information combination, (3)positive plus negative and objective information combination, (4)single positive information, (5)single negative information, (6)positive plus negative information combination. Given one kind of information combinations, the participant bid three prices for three GM products: instant noodle, potato chip, tomato.

3.2 Participants

One-hundred and fifty four students from Jinan University, South China University of Technology, South China Agricultural University, South China Normal University etc. in Guangzhou, are recruited. These experiments are held at the laboratory of Management School of Jinan University. The participants consist of 52.3% males and 47.7% females. Of the group, 53.6% of them are undergraduate student, and 46.4% are postgraduate student.

3.3 Product

In this study, instant noodle, potato chip and tomato are chosen as the objects of auction. On one hand, the participants of the study are college students, and these products are usual to them. On the other hand, these three products embody three different forms of application of the transgenic technology in food. Tomato is directly cultivated by the transgenic technology without processed. Potato chip which is cultivated by transgenic potato is processed, but it always retains its original shape. Transgenic wheat can not been seen in instant noodle. In this study, those three products will be used to examine the influence of external information, and then compared.

3.4 Analysis Method

Participants are involved in two steps of the experiment, and are asked to bid for potato chips, tomato and instant noodle with GM label twice under different information environment. The bid prices show the participant's purchase decision for these products with GM label. The comparisons of bid prices of participants between not given information and given information can confirm whether the external information could affect consumers' purchase behaviour of GM food. The multiple comparisons of differences between no information and under given information combination can show the impact of single external information. The *t* tests and one-way analysis of variance are processed with the SPSS software ver16.0.

4 Result

4.1 The influence of external information

A paired-samples *t* test is carried out on the bid prices to compare the means of three pairs of variables. It computes the difference between the two variables for each case, and tests to see if the average difference is significantly different from zero. Table 1 shows the means of bid prices of three pairs and the results of 2-tailed *t* test. Results show that the average differences of three pairs are significant (t=2.799, P=0.006<0.05; t=3.447, P=0.01<0.05; t=2.113, P=0.036<0.05). It means that the existence of information significantly affects the consumers' purchase behaviour of GM food.

Table1: The means of bid prices and the results of 2-tailed *t* test

		Mean	t	df	Sig.
Pair 1	tomato no info- info	0.33987	2.799	152	0.006
Pair 2	potato chip no info- info	0.49477	3.447	152	0.001
Pair 3	instant noodle no info- info	0.24771	2.113	152	0.036

4.2 The effect of diverse information combinations

The one-way analysis of variance is carried out on the differences of bid prices of three products. Table 2 shows that the variances of the bid differences of tomato and potato chip are equal, and the difference of instant noodle is not equal. It demonstrates the method of LSD is suitable for tomato and potato chip, and the method of Tamhane could be used to analyze data of instant noodle.

Table 2: The result of the test of homogeneity of variances

Products Results	Levene Statistic	df1	df2	Sig.
tomato	1.344	5	147	0.249
Potato chip	1.764	5	147	0.124
Instant noodle	3.339	5	147	0.007

As Table 3 show, among all participants and products, the multiple comparisons of the differences of three pairs of information combinations are significant. The bid prices of single positive information are significantly higher than those of single negative information. Prices of single negative information are significantly lower than those of positive & objective information combination and positive & negative & objective information combination.

The mean differences of bid prices between single positive information and other mixed information combinations are not significant. But single negative information could significantly decrease the bid prices than most of mixed information combinations. And obviously the bid price of single negative information group is significantly less than the bid prices of single positive information group. The influence of the objective information could also be examined. The addition of objective information to positive and negative information combination could not significantly affect the bid prices. And also the addition of objective information could not significantly affect the bid prices of participants who just receive signal positive information and who just receive the signal negative information. In this analysis, the results of these three products were generally consistent.

Table 3: The results of multiple comparison of each information

(I) kind	(J) kind	Mean Difference (I-J) of Tomato (LSD)	Mean Difference (I-J) of potato chip (LSD)	Mean Difference (I-J) of instant noodle (Tamhane)
posi	posi+objec	0.02800	0.08157	0.13391
	nega+objec	0.52617	0.75367	0.27250
	posi+nega+objec	0.19943	0.22629	0.14929
	nega	0.94400*	1.64000*	1.25200*
	posi+nega	0.08629	0.91200	0.61714
nega	posi+objec	-0.97200*	-1.55843*	-1.11809*
	nega+objec	-0.41783	-0.88633	-0.97950
	posi+nega+objec	-1.14343*	-1.41371*	-1.10271
	posi+nega	-0.85771*	-0.72800	-0.63486
posi+nega	posi+nega+objec	-0.28571	-0.68571	-0.46786

*. The mean difference is significant at the 0.05 level.

5 Discussion

The results of 2-tailed *t* test of three pairs of food products show that external information would affect bidding behaviour of consumers who participate in our auction market experiments for GM food in China. It supports previous studies in China, which showed that the existence of information could affect the consumer behaviour of GM food (Ma, 2011). This reveals that information is obviously an important influencing factor to consumers' purchase behaviour of GM food.

From the results of multiple comparisons of information combinations, it is found that three kinds of single external information differently affect purchase behaviour of consumers for GM food. Influence of single negative information on purchase price of GM food is the most significant. No matter what information combination participants receive, the bid price of participants who only receive negative information is less than others. The influence of negative information is in line with the results of the previous literature (Huffman, 2007), which showed that the control of negative information played a very important role in the information management. This can be explained by Prospect Theory, which reveals that consumers' sensitive degree of loss and gain are different, and people are more sensitive to the loss than the the gain. Therefore, compared with positive information, people often pay more attention to the negative information.

However, the role of positive information is relatively less than negative information. Because, it does not mostly significantly affect consumers' purchase behaviour of GM food, all but compared with the single negative information. Meanwhile, objective information has no significant influence on consumers' purchase behaviour of GM food compared with other information combinations. The explanation is possibly that the objective information is from scientists and academic institutions, and in China the trust of consumers in experts is missed. There are many reasons for this, including society and culture. Therefore, for the consumer, whether it is single information or a combination of information, the key is to consider the single information.

6 Conclusions

The study aims to examine the influence of external information on consumers' purchase behaviour of GM food. The results of the paired-samples *t* test and one-way analysis of variance show that information indeed influences the consumers' purchase behaviour of GM food. The negative information most significantly decreases consumers' purchase price of GM food. But positive and objective information play a less important role in purchase behaviour of GM food.

Practical implications are pointed out according to the findings of this study.

For government, how to create a fair information environment for consumers to ensure the truthfulness and comprehensiveness of information is urgent. On one hand, in current society, it's obvious that consumers have no way to know accurate information. Too much negative information which has not been proved is easily gained on the Internet. On the other hand, comprehensiveness of information should be noted. If consumers receive all information, positive, negative and objective information combination, the purchase price is not significantly different from others who received other information combinations. It is also worthy to note that negative information will significantly affect the consumers' purchase behaviour of GM food, and decrease the purchase price. Therefore, it's a very important to ensure the truthfulness of negative information. Meanwhile, it is also what the environment groups who provide negative information should do.

Surely, these results have implications for information strategy of agricultural biotech industry, who can try to manage information to achieve private objectives. Most of Chinese consumers receive much single negative information about GM food and are fairly skeptical of GM foods (Ma, 2004; Liu, 2010). For this situation, agricultural biotech enterprises are necessary to attach importance to relevant information publicity. The results of positive information show that the agricultural biotech industry should disseminate positive information even after negative information is relieved to consumers. And in practice, agricultural biotech enterprises should seek the group who are sensitive to positive information, and promote the sales of GM food, through the full use of positive information.

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