How does biotech food labelling affect consumers' purchasing preferences and the market? Evidence from urban China

Zhong, Funing and Chen, Xi
Nanjing Agricultural University, Cornell University

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How does Biotech Food Labeling Affect Consumers' Purchasing Preference and the Market? Evidence from Urban China

FUNING ZHONG[†] XI CHEN[‡]

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ABSTRACT

This paper examines whether and how biotech labeling has an impact on Chinese consumers' vegetable oil purchasing decision using actual sales data from Nanjing and household survey data from Jiangsu province. The market share of biotech oils immediately decreased as a result, though the decrease was small in absolute terms but statistically significant. In addition, the changes of biotech oil market share were affected by the *structural effect* of the rich while there was no apparent *gross consumption effect* of the poor, which could be underestimated by a series of factors concerning the two datasets we apply.

Keywords: biotech labeling, China, actual sales data, vegetable oil, market share

JEL Classification: Q13, Q17, Q18

1. INTRODUCTION

Biotech food labeling has been involved in a fierce debate around the world, regarding whether it is necessary and what labeling policy should be adopted. Some developed economies, such as European Union, Japan, Australia, and New Zealand, and developing countries, such as India and China, have implemented mandatory labeling policy. As persistent supporters of free trade in the biotech food sector, the U.S. and Canada have adopted the voluntary labeling policy that allows each enterprise to decide whether to label biotech food (Chen et al., 2008).

China is the world's sixth-ranked country in biotech crops production (James, 2006). Similarly, China is a major importer of biotech products. The Chinese government has taken a much more cautious approach toward biotech foods by establishing a mandatory labeling

[†] Professor, College of Economics and Management, Nanjing Agricultural University, Nanjing, China; Chair Professor, Shanghai University of Finance and Economics, Shanghai, China; fnzhong@njau.edu.cn.
[‡] Ph.D. student, Department of Applied Economics and Management, Cornell University, Ithaca, USA; College of Economics and Management, Nanjing Agricultural University, Nanjing, China; xc49@cornell.edu.

regulation in March 2002, which stipulates that all products containing biotech ingredients, including seeds, animal feed, and food products, should be labeled. The biotech labeling policy has been successfully enforced in the vegetable oils industry since August 2003 under the strict supervision of central and local governments. The information provided on the label is neutral and aims at informing consumers that the product contains biotech ingredients. Hence, it provides a good chance to explore the impact of mandatory biotech food labeling policy.

The labeling regulation of China is expected to have a significant impact on both international and domestic trade of biotech products, such as herbicide-tolerant soybeans from the U.S. (Marchant et al., 2003). However, the degree of impact is largely determined by consumers' acceptance of biotech food and its labeling as well as the effect that the labeling has on consumers' attitudes and behaviors, particularly in the long run. Today, biotech foods have entered the daily diet of Chinese consumers. Survey-based studies in China repeatedly show that consumers overwhelmingly favor mandatory biotech labeling. However, some scholars believe that labeling cannot actually change consumers' attitudes toward biotech foods if it is merely a mechanism to differentiate biotech from non-biotech foods.

Accordingly, the main purpose of this paper is to investigate the impact of mandatory food labeling policy on the market share of biotech oil using actual sales data in supermarkets. A central question is: Does biotech labeling induce a switch in Chinese consumers' purchasing decision away from biotech oils? Furthermore, how do urban residents' characteristics influence their purchasing decisions?

This paper is organized as follows: section 1 briefly introduces the biotech food debate and labeling policies used by major countries especially China; section 2 presents previous studies regarding stated preference and purchasing behavior towards biotech foods; section 3 presents variables, model, and data; section 4 presents the empirical analysis using scanning sales data; section 5 presents the empirical study using household survey data and includes an initial estimation of biotech oil market share to test and discuss results in section 4; section 6 concludes with a further discussion.

2. LITERATURE REVIEW

Virtually all previous studies of consumer attitudes toward biotech foods, labeling, and willingness to pay (WTP) in China and other countries (Zhong et. al., 2002; Zhong et al., 2004; Bai, 2003; Li et al., 2003; Ding, 2004; Lin et al., 2006a) are based on surveys of

consumers' stated preferences. For example, instead of using actual purchasing decisions, relevant studies typically elicit WTP for biotech or non-biotech produce through hypothetical questions by direct interviews or through telephone interviews, which are followed by the Contingent Valuation Method (CVM[1]). However, what are perceived by survey respondents, as are conveyed by these survey studies, may not be the same as they actually purchase.

Although CVM is frequently used to obtain consumer attitudes and WTP for its low cost, there are some concerns regarding CVM and other stated preference methods. First, CVM is used to analyze consumers' willingness to pay for unrepeated purchased goods.[2] Furthermore, WTP and purchase intention obtained from CVM may not be reliable because consumers may have little information about the benefits and risks of the involved object in a hypothetical context and, therefore, they have biased WTP. The third concern is that consumers may take strategic behavior by understating or overstating WTP to influence marketing policy of the evaluated object (Nestor, 1998; Lusk, 2003). Fourth, bias arises when researchers are not neutral. As a result, while these studies have provided valuable information on consumer behaviors toward biotech foods, their actual behaviors and the impact of biotech label still remain unknown. In this sense, research into consumers' revealed preferences is preferable.

To our knowledge, this study is unique in that it is the first of its kind to address whether biotech food labeling has an impact on consumers' purchasing behavior of vegetable oil by using actual sales data in supermarket outlets. A new problem arises as the retail scanner data lacks buyers' personal information. To solve this problem, this study also tries to link the actual sales data in supermarkets to surveyed household purchasing data, connecting aggregate market share with individual purchasing decisions and personal information.

3. METHODOLOGY AND DATA

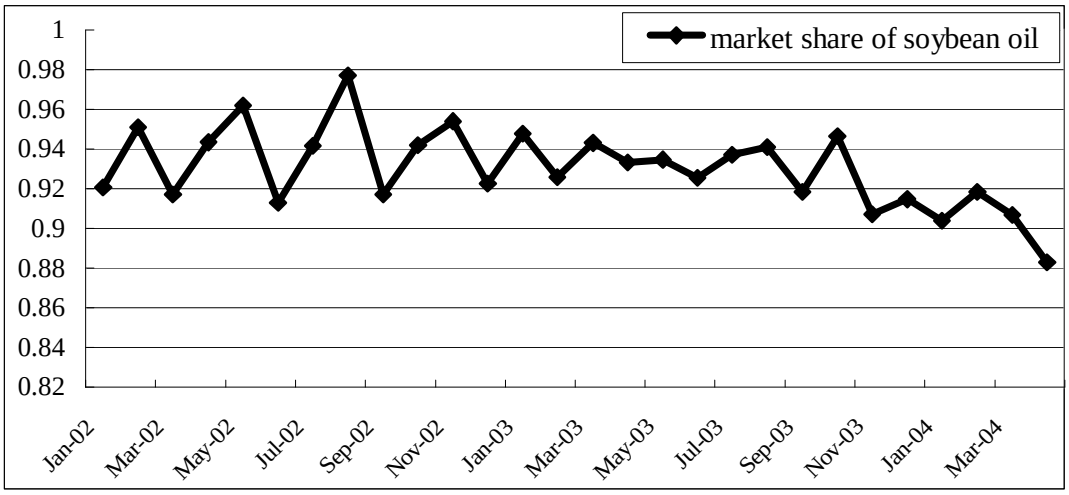
3.1 Variable Settings

Figure 1 and Figure 2 show the market share of biotech oil and major non-biotech oils.[3] During our sampling period, the quantity share of biotech oil purchased maintained a dominant level, which could be associated with its lower price. As for daily commodities,

[1] CVM is an analytical tool commonly used to elicit the public's WTP to protect non-marketed resources, such as recreation, wildlife, and environmental quality (e.g., Hanemann, Loomis, & Kanninen, 1991).
[2] If asked whether one is willing to buy goods in a certain background, the "Yes" or "No" questions do not contain information on quantity changes.
[3] The sales of vegetable oils fluctuate monthly. The sales increase substantially before some important family reunion festivals and drop sharply afterward. Therefore, we employ market share in quantities sold rather than sales volume in our study.

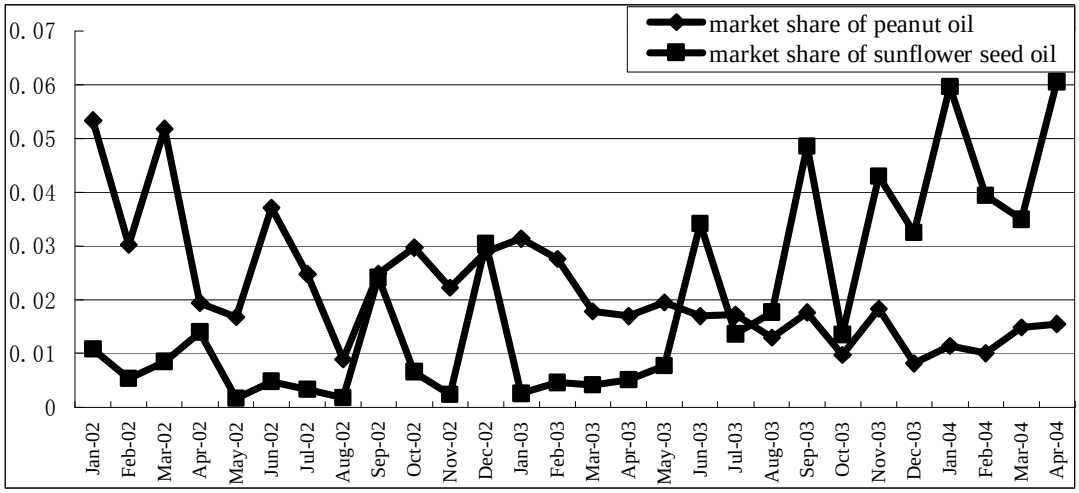
lower price would attract low income consumers and keep a high market share. Supermarkets in China are now experiencing rapid development, since millions of low income urban residents and former rural residents are becoming supermarket customers, and biotech oil is their best choice. Even if some rich consumers shift their purchasing decision to non-biotech oils, total sales volume of biotech oil and its market share may still be dominant, even with a larger market share.

Figure 1 Market Share of Biotech Oil



Source: actual sales data in supermarket.

Figure 2 Market Shares of Non-Biotech Oils

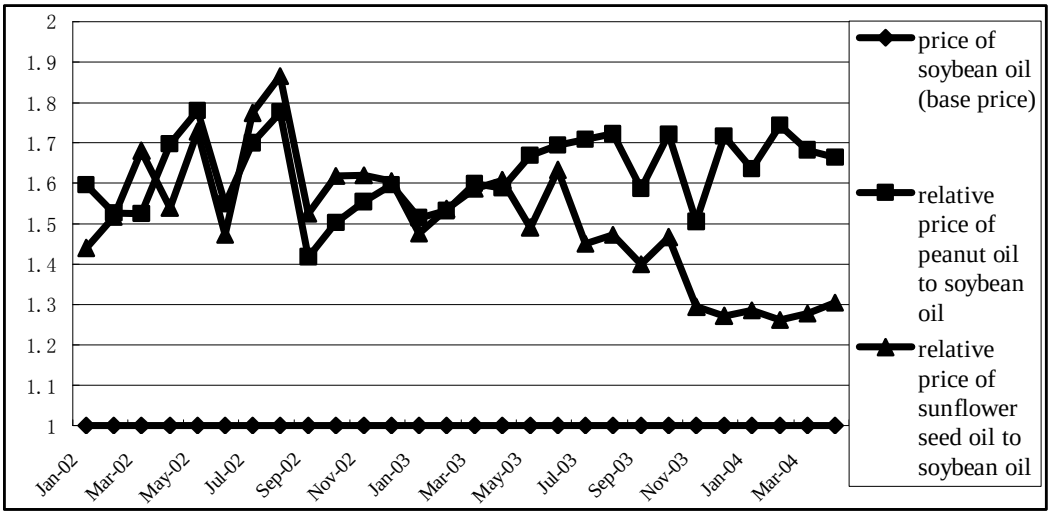


Source: actual sales data in supermarket.

However, the market share of biotech oil experienced a downward trend after August 2003, which might be caused by two reasons. One was the price change of other major vegetable oils relative to soybean oil. Consumers in supermarkets usually shift their

purchasing decisions from biotech oil to non-biotech oils or within non-biotech oils rather than transfer from non-biotech oils to biotech oil following a subtle fluctuation of relative prices. Thus, only the modest decline in relative price of sunflower seed oil could influence the market share of soybean oil. As denoted by Figure 2 and Figure 3, among major vegetable oils available at supermarkets, the price of soybean oil was the lowest and thus attracted many consumers initially. Although relative price of sunflower seed oil dropped after that, it could attract only a few consumers because of the large price gap between biotech oil and non-biotech oils at that time. This explains well why market share of soybean oil in reality dropped slowly after the strict labeling enforcement. Second, the effective enforcement of mandatory labeling policy might influence consumers' purchasing behavior, and that influence may be released several months afterwards. The increasing market share of non-biotech oils was mainly caused by sunflower seed oil.

Figure 3 Relative Prices of Major Types of Vegetable Oils Based on Soybean Oil



Source: actual sales data in supermarket.

3.2 Empirical Model

A pooled data model is used to analyze the effects of biotech labeling policy on the market share of biotech oil. As the basis for this analysis, market share is expressed as a function of relative price, labeling enforcement, and long-term trend. The regression model is given by:

$$Y_{ijk} = a_1 + a_2 D + b_1 RP_{ijk1} + b_2 RP_{ijk2} + b_3 T$$

where i defines vegetable oil category, j defines supermarket outlet stores, and k defines time period. Y_{ijk} defines the market share of i vegetable oil at k month in j store, which indicates

consumers' added-up purchasing preference. D is a dummy variable testing if market share of biotech oil went down immediately after labeling enforcement. Considering Chinese consumers know little about biotechnology and biotech food, the policy needs time to transmit in circulation sector, and consumers need time to respond. Also, media markets in China are far from complete competition. Thus, D is valued 0 before the enforcement of labeling policy and changed to 1 gradually afterwards.[4] RP_{ijk1} and RP_{ijk2} define relative price of i vegetable oil to the other two categories of vegetable oils at k month in j store. T indicates time trend and ranges from 1 to 28 consecutively since there are 28 months in the dataset. It is used to test whether market share has the same trend before and after the food labeling enforcement.

The above pooled data model captures the effects of labeling policy, long-term trend, and relative price on the aggregate market share of biotech oil, but it can not associate the change of market share with consumers' characteristics due to the limitation of data. We will further discuss the influence of consumers' characteristics on individual urban residents' behaviors towards biotech oil and the resulting market share using household survey data. Do individuals change their actual purchasing decision after labeling policy enforcement? What are the driving forces? The following empirical testing aims to answer these questions and push forward the research of this field. The binary Probit model for testing this issue is specified as follows:

$$\Pr(Y_1 = 1) = \Phi(a + b_1 Buyer + b_2 Risk + b_3 Hou)$$

$$\Pr(Y_2 = 1) = \Phi(a + g_1 Buyer + g_2 Risk + g_3 Hou)$$

The coding is as follows: Y_1=1 if the respondent currently purchases biotech oil, 0 otherwise; Y_2=1 if the respondent transfers from buying biotech oil to non-biotech oil in supermarket, 0 otherwise.[5] Factors that influence consumers' purchasing decisions are classified into four

[4] It is difficult to precisely measure how soon and stable the real impact of labeling on media and consumers' decisions was. It is not even known whether the effect had fully been realeased before the end of our sampling period, i.e., eight months after labeling enforcement. However, the setting of D can be improved a little. Lin et al. (2006c) employ in their AIDS model a D changing from 0 to 1 immediately after label enforcement. It is assumed in our empirical work that the labeling effect would be released in a few months; i.e., D changes from 0 to 1 by a rate of .2. We believe it is closer to the real world. Other possible trials are also conducted, including D changing from 0 to 1 by a stable rate 0.1 or other unstable rates. Results differ in values, but all are statistically significant. For comparison convenience, we also estimate D value using the 0-1 setting adopted by Lin et al. (2006c) and find a 1.6% immediate drop in the market share of biotech oil, which is close to their result. Further possible improvements are discussed in section 6. We appreciate the anonymous referee for pointing out this critical issue.

[5] Some consumers may diversify their purchasing decisions between biotech oils and non-biotech oils, but it is reasonable to believe that biotech oils *or* non-biotech oils should be their major choices. Because vegetable oil is

categories: buyer's demographic characteristics including gender, age, and education; risk consciousness including child and food allergy; household socioeconomic factors comprising monthly income per capita and city size; other factors including heard time.

3.3 Data Description

Two data sets are employed in this study. The retail scanner data are sampled from five outlets in Nanjing[6] belonging to a leading retail chain with more than 1100 outlets. The five outlet stores cover typical stores in size, market power, and geography. The aggregate scanning data covers monthly store level sales figures, retail selling price, and price cut information for all items of every brand of vegetable oil. Data collected consists of 20 vegetable oil brands with 142 items during a 28-month period from January 2002 to April 2004. At present, all soybean oil and blend oil containing soybean oil are biotech labeled in Nanjing. Sunflower seed oil and peanut oil dominate the non-biotech oil market of sampled outlets.

The household survey data is collected from fixed observation spots of Bureau of Statistics, Jiangsu Province. Nanjing and five other cities nearby are selected to extend our analysis. A questionnaire includes questions on vegetable oil buyers' socioeconomic background, attitudes, and behaviors towards vegetable oil. The respondents amount to 1000, among which special focus is given to 787 supermarket customers in consistency with supermarket retail scanner data (Table 2). Those supermarket customers are asked to provide purchasing decisions in early 2003 and early 2005, that is, before and after the enforcement of labeling policy. In this way, the two data sets are more comparable in describing labeling effect. However, buyers' personal information is not included in supermarket POS machines in China, so it is infeasible to follow the same samples that are in our household survey.

Table 1 Socioeconomic and Demographic Characteristics in the Household Survey

Demographic Characteristics*		Classification	Number	Percentage	Mean and Standard Deviation
Vegetable Oil Purchase	Gender	Male	353	35.3%	
		Female	647	64.7%	
	Age	20-39（youth）	281	28.1%	Mean=47.78

of daily use, and there is a significant price gap between biotech oils and non-biotech oils, diversification of purchasing decisions should largely happen within the category of biotech oils or non-biotech oils. Besides, according to our previous finding, consumers' little knowledge towards vegetable oil leads to their reliance on brand. In our survey area, there is a nearly perfect correspondence between brand of vegetable oil and whether it is biotech oil or not.

[6] Nanjing is the capital city of Jiangsu province and a major eastern city with a population of 6.4 million.

Decision Maker		40-59（middle age）	518	51.8%	Std.Dev.=12.7
		≧60（senior citizen）	201	20.1%	
	Education	Less than high school	417	41.7%	
		High school and technical school	348	34.8%	
		Junior college	146	14.6%	
		Undergraduate	85	8.5%	
		Graduate or above	4	0.4%	
Family Members	Income per capita	Less than 800RMB	335	33.5%	
		800-1500RMB	354	35.4%	
		1500-3000RMB	229	22.9%	
		3000-5000RMB	82	8.2%	
	Permanent Residents				Mean=3.095 Std.Dev.=0.98
	Having Child	Yes	507	50.7%	
		No	493	49.3%	
	Allergy	Yes	68	6.8%	
		No	932	93.2%	

Source: 2005 urban household survey data.

* Respondents' characteristic variables pass single-parameter test in accordance with aggregate socioeconomic data in *Statistic Year Book of Jiangsu 2006*.

4. BIOTECH FOOD LABELING AND MARKET SHARE OF BIOTECH OIL

This study adopts fixed effect model, and every cross-section contains an unqualified intercept. In the mean time, we use Feasible General Least Square (FGLS) estimate to minimize heteroskedasticity in each cross-section equation.

Table 2 Estimation of Regulation Policy on Market Share of Vegetable Oils

Variable	Ssoy	Spea	Ssun
SOYPEA	-0.0056 (-0.110)	--	--
SOYSUN	0.060 (1.030)	--	--
PEASOY	--	-0.0308 (-3.080)***	--
PEASUN	--	0.0306 (2.37)**	--
SUNSOY	--	--	-0.004 (-0.20)
SUNPEA	--	--	0.017 (-0.720)
D	-0.041 (-3.590)***	-0.0009 (0.20)	0.040 (4.47)***
T	0.0001 (0.260)	-0.0008 (-4.840)***	0.0001 (0.290)
Fixed Effects			
_JIANG--C	0.931	0.040	-0.003
_QI--C	0.920	0.048	-0.004

_WEI--C	0.900	0.053	0.016
_XING--C	0.911	0.042	-0.006
_ZHONG--C	0.857	0.061	0.023

Source: actual sales data in supermarket.
*, **, ***: statistically significant at 10%, 5%, and 1%, respectively.
Note: Ssoy indicates the market share of soybean oil. Spea indicates the market share of peanut oil. Ssun indicates the market share of sunflower seed oil.

In conclusion, the market share of biotech oil experienced a statistically significant drop by 4 percent after the policy enforcement. In the long run, the market share of biotech oil showed a statistically insignificant upward trend, which may result from the much lower price of biotech oil. With rapid economic growth in China, low-income residents begin to buy vegetable oil in supermarkets, and biotech oil becomes their best choice. Whether this trend actually happens in our sample needs to be further tested. Finally, the relative price of sunflower seed oil had a more significant effect on the market share of soybean oil than the relative price of peanut oil had. This may result from the significantly lower price of sunflower seed oil than peanut oil, which indicates that sunflower seed oil had a more significant substitution effect on soybean oil than peanut oil had.

5. CONSUMERS' PURCHASING BEHAVIOR AND MARKET SHARE OF BIOTECH OIL

5.1 Empirical Analysis of Consumers' Purchasing Preferences

Factors that influence consumers' current purchasing decisions are presented in Table 3. Concerning buyers' characteristics, men are more likely to buy biotech oil than women. The quadratic relation between age and purchasing decisions indicates that the young and the old are more likely to avoid buying biotech oil, as compared with the middle aged people. That may result from more sensitive attitudes towards negative information among young people while the old are more sensitive towards potential health related issues. People with higher level of education are more inclined to buy non-biotech oil. Concerning household socioeconomic factors, results show that respondents in the income category of above 3,000RMB are more likely to buy non-biotech oil. Compared with people of low income, the share of vegetable oil in total expenditure is lower among the rich, which may mean the rich pay more attention to food safety issues.

Awareness of biotech oil embodied in the two independent variables, *hear short* and *hear long*, may raise the problem of endogeneity. Media access, including internet, TV, radio, newspaper, and magazine, is employed as an instrumental variable to get unbiased estimates.

This approach recognizes that, while access to mass media would raise consumers' awareness of biotech oil, it may not directly influence consumers' purchasing behavior.

Table 3 Estimates of Consumers' Purchasing Preferences towards Vegetable Oil (2005)

Explanatory Variables	Model 1: Probit Model with IV			Model 2: Probit Model		
	Marginal Probability	Z value	P>|z|	Marginal Probability	Z value	P>|z|
Gender	.153	1.46	.145	.051	1.43	.152
Age	.073	2.88***	.004	.024	2.96***	.003
Age*Age	-.001	-3.05***	.002	-.0003	-3.14***	.002
Education	-.095	-1.68*	.093	-.033	-1.73*	.084
Having Child or not	.091	.82	.410	.026	0.72	.469
Income(800-1500)	-.162	-1.25	.210	-.054	-1.21	.226
Income(1500-3000)	-.218	-1.49	.137	-.077	-1.61	.108
Income(above 3000)	-.537	-2.65***	.008	-.178	-2.64***	.008
City size	.337	3.29***	.001	.109	3.15***	.002
Hear short	-.253	-1.96**	.050	-.065	-1.74*	.081
Hear long	-.357	-2.22**	.026	-.107	-2.06**	.039
Constant	-	-1.16	.245	-	-1.21	.226
	Wald chi2(11) = 47.37 Prob > chi2=0.0000			LR chi2(11) = 47.92 Prob > chi2=0.0000		

*, **, ***: statistically significant at the 0.10, 0.05, and 0.01 level, respectively.

What makes people shift from buying biotech oil to non-biotech oils?[7] As presented in Table 4, respondents in the above 1500RMB income groups are statistically significant in shifting. Consumers who have heard of biotech oil shortly are more likely to change their decisions than those who have never heard of it. With labeling policy being enforced for roughly two years since 2003, lots of people have been informed for less than two years up to the year 2005.[8] This implies that labeling could trigger a significant decrease in purchasing biotech oil in the short run, which is consistent with our findings that the market share of biotech oil reduced by 4 percent shortly after the labeling enforcement.

Table 4 Estimates of the Change of Consumers' Purchasing Preferences towards Non-biotech Oils in Supermarket （2003-2005）

Explanatory Variables	Model 1: Probit Model with IV			Model 2: Probit Model		
	Marginal Probability	Z value	P>|z|	Marginal Probability	Z value	P>|z|
Gender	-.042	-.25	0.802	-.002	-.07	.943

[7] 548 samples in our survey purchased biotech oil in supermarkets in 2003, which changed to 560 samples in 2005. 78 consumers switched their purchasing decisions to non-biotech oil in supermarkets.

[8] 52.6% of respondents in the sample have heard of biotech oil. Among them, respondents who have heard of biotech oil for less than two years account for 78%.

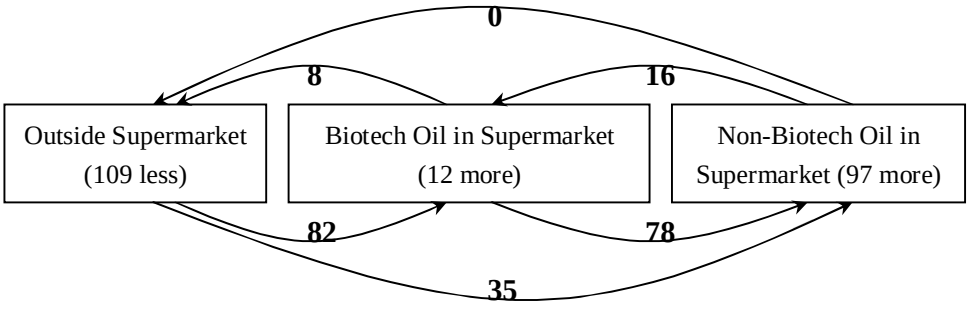
Age	-.107	-3.03***	0.002	-.018	-2.90***	.003
Age*Age	.001	3.11***	0.002	.0002	3.10***	.002
Education	.035	.44	0.661	.006	.45	.652
Having child or not	.138	.84	0.402	.026	.87	.384
Income(800-1500)	.497	2.25**	0.024	.092	2.11**	.035
Income(1500-3000)	.616	2.58***	0.010	.118	2.70***	.007
Income(above 3000)	1.034	3.61***	0.000	.187	3.51***	.000
City size	.181	1.19	0.235	.034	1.33	.183
Hear short	.363	2.06**	0.039	.060	2.05**	.040
Hear long	.563	2.00**	0.046	.074	1.90*	.058
Constant	-	.32	0.745	-	.18	0.861
	Wald chi2(11) = 46.16			LR chi2(11) = 51.26		
	Prob > chi2=0.0000			Prob > chi2=0.0000		

*, **, ***: statistically significant at the 0.10, 0.05, and 0.01 level, respectively.

5.2 Market Share of Biotech Oil in Supermarkets: An Initial Estimate

Consumers can be supermarket customers or not. As income rises, more people start buying biotech oil in supermarkets. This continuing trend, namely *gross consumption effect*, would drive up the market share of biotech oil. Simultaneously, another trend is that supermarket customers shift from buying biotech oil to non-biotech oils as income further increases. This ongoing trend, namely *structural effect*, would reduce the market share of biotech oil. The two contradictory trends jointly shape the market share of biotech oils in supermarkets. There is structural effect as long as more people switch from buying biotech oil to non-biotech oil than the reverse, but for gross consumption effect a precondition must be satisfied that market share of biotech oil for newcomers is larger than the original market share of biotech oil in supermarkets.

Figure 4 All Types of Purchasing Decisions and Their Changes



Source: 2005 urban household survey data.

To identify structural effect and gross consumption effect and their influences on the market share of biotech oil, we simply calculate the number and ratio of consumers who followed the two effects (Figure 4). The result is consistent with Zhong et al. (2006) that sales

volume of biotech oil in supermarkets kept on increasing after labeling enforcement. Meanwhile, the enlargement of supermarket size and share of non-biotech oils were much faster, which brought down the market share of biotech oil. Overall, structural effect existed with no significant gross consumption effect.

The estimate of market share of biotech oil proves the significantly downward share of biotech oil in the short run after the labeling enforcement, but it goes against our previous finding that the market share of biotech oil would follow an insignificantly long-term increasing trend. It comes out of the difference between the two datasets. First, the actual sales data comprise all individual buyers and other social entities while household survey data only include individual consumers. Also, large volume purchases by enterprises often crowd out the relevant expenditure of their employees before festivals. Thus, the fact that social entities are prone to buy cheaper biotech oil may underestimate the market share of biotech oil. Second, consumers of high income might occasionally buy vegetable oils made out of diversified materials (including biotech oil) due to nutritional considerations though they may respond that they buy non-biotech oil. This would significantly undervalue our estimate. Furthermore, with rapid income growth, more and more people dine out Household vegetable oil consumption is reducing due to this structural change. The shrinking family size in modern society also contributes to this process. Fourth, the accelerating urbanization would induce more supermarket customers, and millions of former rural residents are among them.

6. CONCLUSIONS AND FURTHER DISCUSSION

The main purpose of this study is to investigate the impact of mandatory food labeling policy on the market share of biotech oil. Further, we explore the market trend of biotech oil and its micro level contributing factors. Finally, we draw a comparison between the aggregate level analysis and individual level study.

Results using retail scanner data in supermarkets show that the market share of biotech oil decreased roughly 4 percent as a result, though the decrease was small in absolute terms but statistically significant. Besides, in the long run, biotech oil would keep on a dominative market share, though small and statistically insignificant in its growing trend. Results based on urban household survey tell us that the changes of biotech oil market share were affected by the structural effect of the rich while there was no apparent gross consumption effect of the poor.

The estimate of market share of biotech oil proves the significantly downward trend of

biotech oil in the short run after the enforcement of labeling policy. Nevertheless, the absence of long-term increasing share of biotech oil and a much lower market share of biotech oil might come out of the difference between the two datasets we apply, which could be followed by underestimation of a series of factors.

However, Chinese consumers' attitudes and purchasing decisions towards biotech foods are not stable and prone to change. To study whether the influence of regulation policy on the market share would stabilize, we need to further extend the duration of the sampling time period, which can be followed by a developed setting of labeling variable with consumers' perception theory and media response theory. Otherwise, a sensitivity analysis can be conducted with a longer sampling period and diversified settings of labeling variable as prerequisites; besides, the structure of supermarkets in China is experiencing rapid changes. Differences in the structure of supermarkets across locations suggest an expansion of this kind of analysis to other cities. It is believed that the labeling impact would be smaller if this analysis is extended to include consumers in smaller-sized cities and rural areas in China. Other marketing strategies taken by stores and manufacturers that may affect the sales of vegetable oil have not been considered due to limitation of data.

In addition, the distinction between household survey data and actual sales data reminds us that the share of eating at home in total food budget is continuously decreasing as incomes increase, and people are more prone to dine out. Also, the faster pace of life style has brought supermarket expansion, offering more diversified food products and more ready-to-eat processed products in the interest of convenience for consumers. Decisions regarding category, quality, price, and quantity can be quite different between dining out and eating at home. It is increasingly biased if we simply infer overall food demand from household survey data. Therefore, it is important to examine the applicability of household food survey data at hand before inferring the aggregate market trend involving collective consumption and dining out.

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