Do Consumers Really Care about Biotech Food Label? What Do We Know? What Else Should We Know?

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Selected Paper prepared for presentation at the Southern Agricultural Economics Association Annual Meeting, Atlanta, Georgia, January 31-February 3, 2009

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ABSTRACT

This paper employs household survey data to further examine whether biotech food labeling has an impact on consumers' vegetable oil purchasing decision. Direct variables indicating consumers' response to label regulation are employed to test label effect. Endogeneity issues impeding label effect measurement are especially addressed. The empirical results support our previous finding that in the short run the market share of biotech oil decreased significantly by a small amount as a result of label enforcement. To capture a comprehensive picture of the role played by biotech food label and the market trend in the long run, major concerns and needs for the future are raised including a series of data issues and a special focus on who make purchasing decision.

Keywords: biotech labeling, actual sales data, household survey data

JEL Classification: Q13, Q17, Q18

This paper is Selected for presentation at the Southern Agricultural Economics Association Annual Meeting, Atlanta, Georgia, January 31-February 3, 2009. The research is partially funded by ERS/USDA China Project and Social Science Fund of Jiangsu Province in China. The authors are grateful for comments from Dr. William Lin and Dr. Francis Tuan at ERS/USDA, and Prof. Loren Tauer at Cornell University. All errors are those of the authors.

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1. INTRODUCTION AND LITERATURE

Recently, there have been fierce debates among different countries, environmental protection agencies, consumers groups and scholars regarding whether biotech food labeling is necessary and what kind of labeling policy should be adopted. Some countries or economies, such as the European Union, Japan and China, have implemented mandatory labeling policy. Other countries, such as the U.S. and Canada, have adopted voluntary labeling policy that leaves the decision whether to label biotech food to each enterprise.

The mandatory labeling of biotech food aims to provide consumer choice. Even among those countries that have adopted mandatory labeling policy, the market performances are very much differentiated. In the European Union, biotech food with mandatory labeling has disappeared from the retail shelves. Additional evidence in Japan shows that it is difficult (if not impossible) to find retail food products labeled as containing biotech ingredients. Mandatory labeling also exists in Australia and New Zealand, where there is no much choice at the retail level (Carter, C.A. et al., 2003). Unlike the above-mentioned countries, markets for some biotech products are developing rapidly. China has established a mandatory labeling regulation since March 2002 which stipulates that all products containing biotech ingredients should be labeled, including seeds, animal feed and food products. The biotech labeling policy has been successfully enforced in the vegetable oil industry after August 2003 under the strict supervision of central and local governments. Nowadays, market share of biotech oil still maintains a dominant level in urban China, except in the northeast region where there is vast arable land growing non-biotech soybean.

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, Zhong et al. (2004) believe that labeling cannot actually change consumers' attitudes toward biotech foods if it is merely a mechanism to differentiate biotech from non-biotech foods. 1999 and 2002 AFIC surveys even find that consumers do not check food labels for information on biotechnology.[1]

As we know, the information provided on the label is neutral aimed at informing consumers the product they see contains biotech ingredients. Hence, it provides a good chance to explore the impact of mandatory biotech food labeling policy. However, 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; AFIC, 2004; IFIC, 2004; Chen et al., 2004; Li et al., 2003; Ding, 2004; Hou et al., 2004; Lin et al., 2006a) are based on surveys of consumers' stated preferences, which may be subject to several serious problems (Zhong et al., 2006). As a result, while these studies have provided valuable information about consumer behaviors toward biotech foods, the actual behavior of consumers on biotech foods and the impact of biotech label on consumers' behavior still remain unknown.

Since then, researches into consumers' revealed preferences are preferable. Zhong et al. (2006) employs supermarket retail sales data to show that the market share of biotech oils significantly decreased 4 percent as a result of biotech label enforcement. Besides that, in the long run, biotech oil would sustain a dominative market share, though small and statistically insignificant in its growing trend. Lin et al. (2006c) find a similar result that the market share of biotech oil decreased 2 percent after labeling enforcement. The two studies differentiate with each other in three aspects; first, Zhong et al. use partial equilibrium model with one econometric equation, while Lin et al. apply a demand system named AIDS; second, Zhong et al. apply sales volume to measure market share, while Lin et al. use sales value. The results would be different

[1] 98% of Chinese respondents checked food labels regularly. Most common label items checked were expiry date, ingredients and nutritional value. Only 2% of Chinese survey respondents checked for presence of biotech ingredients. When asked what additional information they would like to see on food labels, presence of biotech ingredients was not mentioned by any of the respondents.

with the change of relative price between biotech oil and non-biotech oil; third, Zhong et al. assume that labeling effect would be released in a few months, much longer than Lin et al.

To further explain individuals' behavior and the trend of resulting aggregate market share, Zhong et al. (2008a) employ an urban household survey data[2] to calculate the number and ratio of consumers who follow the structural effect[3] and gross consumption effect[4] and their influences on the market share of biotech oil. Results show that the changes of biotech oil market share are affected by the structural effect of the rich, while there is no apparent gross consumption effect of the poor. Because of the similar data length, starting point, and ending point compared to retail sales data, the estimate of market share of biotech oil using household survey data further proves the significantly downward trend of biotech oil *in the short run* after the enforcement of labeling policy.

However, both Zhong et al. (2008a) and Zhong et al. (2008b) do not adopt in the household survey data a variable directly describing the effect of labeling effect, which actually leaves the label effect evaluation unfinished. Meanwhile, the evaluation of the targeted labeling variable serves as the key to credibly link the aggregate retail sales data and micro household survey data. Accordingly, a central question to be addressed here is: based on household survey data, is there any direct evidence supporting the role played by biotech labeling? Further, after a series of researches, it is right time to consider the need for the future.

This paper is organized as follows: section 1 presents the labeling policy debate around the world and what we have learned from previous studies; section 2 presents variables, model, and data; section 3 presents empirical analysis using household survey data and deals with the issue of endogeneity; section 4 presents what else should we know about biotech label and the market in the long run. All of the

[2] Confining their research focus on consumers who purchase vegetable oil in supermarkets in consistency with previous actual sales data, Zhong et al. are able to explain what makes people choose biotech oil in supermarket

[3] As Income increases for most consumers in recent years, more and more people start buying vegetable oil in supermarket, and biotech oils of lower price are their best choices. This continuing trend, namely *gross consumption effect*, would drive up the market share of biotech oil.

[4] Consumers in supermarket transfer from buying biotech oil to non-biotech oil as income increases further. This ongoing trend, namely *structural effect*, would definitely reduce the market share of biotech oil.

remaining issues are followed by a further discussion.

2. METHOD AND DATA

The remaining questions are all from individual consumers' perspective, including whether biotech labeling induces a switch in consumers' purchasing decision away from biotech oil, whether it will last long, and what are the major influencing factors behind the market trend? To address these issues, the following empirical tests are employed to push forward the research of this field. The binary Probit model is specified as follows:

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

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

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 categories: buyer's demographic characteristics including gender, age and education; risk consciousness including child, food allergy, concern over biotech label and concern over biotech material; household socioeconomic factors comprising monthly income per capita and city size.

Concern over biotech label that is embodied in the dummy variable "whether to look at biotech label when making purchasing decisions" may raise the problem of endogeneity. That is, *Concern over biotech label* in the purchasing preference equation becomes interdependent with the error term, which gives rise to biased estimates (Maddala, 1997). The above ordinary Probit model is extended to include the use of an *instrumental variable* method. Media access including internet, TV, radio, newspaper, and magazine are employed as an instrumental variable to obtain unbiased estimates. This approach recognizes that while access to mass media would raise consumers' concern over biotech label, it may also influence consumers' purchasing behavior. This is especially true in China where mass media is controlled

[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 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' low level of perception towards vegetable oil leads to their reliance on brand. In our survey area, there is a nearly perfect correspondence between brand of vegetable oils and whether they are biotech oils or not.

by the government.

A regression equation for the *concern over biotech label* is first estimated. Then predicted values of the *concern* variable obtained from the first-stage Probit analysis are used as an instrumental variable to replace the actual values in estimating the second-stage purchasing choice equation (Berndt, 1991).

The same set of data used by Zhong et al. (2008a) is employed. It is collected from household buyers in urban Jiangsu province[6] in close cooperation with the Team of Urban Survey in Jiangsu Bureau of Statistics[7]. Nanjing, Wuxi, and Zhenjiang in south Jiangsu, Taizhou in central Jiangsu and Lian Yungang and Suqian in north Jiangsu are selected according to their disposable income per capita, geographic distribution, population and balance among sample size of different cities. A questionnaire is developed that includes questions on consumers' attitudes and behaviors towards buying vegetable oil, perception, WTP for labeling and respondents' socioeconomic background. The effective sample size amounts to 1000. We focus on the household buyers who purchase vegetable oil in supermarkets in consistency with empirical test using supermarket actual sales data. Gender ratio, average age, education background, income per capita, occupation and average family size are tested before further study, and some of the numbers are compared with aggregate socioeconomic data in Jiangsu province. All of them pass single-parameter test and are reliable and consistent with the overall conditions in Jiangsu province[8].

3. BIOTECH LABEL AND CONSUMERS' PURCHASING BEHAVIOR: AN INDIVIDUAL CONSUMERS' PERSPECTIVE

3.1 Descriptive Analysis of Consumers' Concern over Biotech Food Label

Table 1 presents the general distributions of characteristics of our respondents.[9] It

[6] Jiangsu is selected for at least other four advantages besides its consistency with supermarket scanning sales data: First, sub-regional development pattern in Jiangsu is similar to the case of China; second, consumers' in jiangsu relatively know more about biotech foods, and their response is more valuable; coastal provinces such as Jiangsu is densely populated, and the ratio of urban residents to total population is relatively higher. Its population density and urbanization is typical in future all over China; given the limited sample size, a research conducted in a specific region is more valuable than a countrywide study, because limited sample volume in several regions may result in larger research bias.

[7] Respondents are largely drawn from fixed observation spots of provincial bureau of statistics, and the deficient samples are drawn using the method of interval sampling and from different communities according to their population weighting.

[8] Please refer to the *Statistic Year Book of Jiangsu 2006* and Chen (2007).

[9] 787 samples out of 1000 samples in our survey purchased vegetable oil in supermarket in 2005.

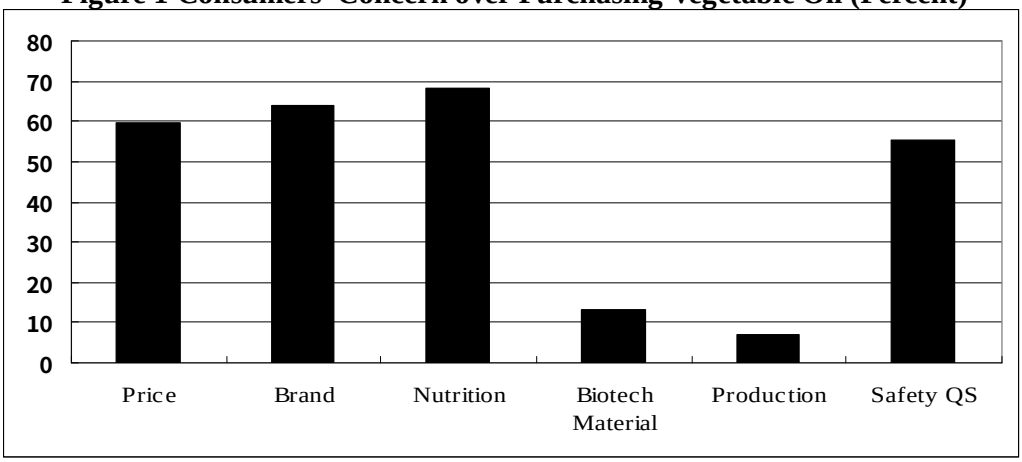
include all the consumers who buy vegetable oil in supermarket or not.

Table 1 Distributions of Socioeconomic and Demographic Characteristics of Urban Residents in the Household Survey (n=1000)

Demographic Characteristics	Classification	Number	Percentage	Mean and Standard Deviation
Gender	Male	353	35.3%	
	Female	647	64.7%	
Age	20-39（youth）	281	28.1%	Mean=47.78 Std.Dev.=12.7
	40-59（middle age）	518	51.8%	
	≧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%	
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 or not	Yes	507	50.7%	
	No	493	49.3%	
Allergy or not	Yes	68	6.8%	
	No	932	93.2%	

Source: calculated from 2003-2005 urban household survey data

Figure 1 Consumers' Concern over Purchasing Vegetable Oil (Percent)

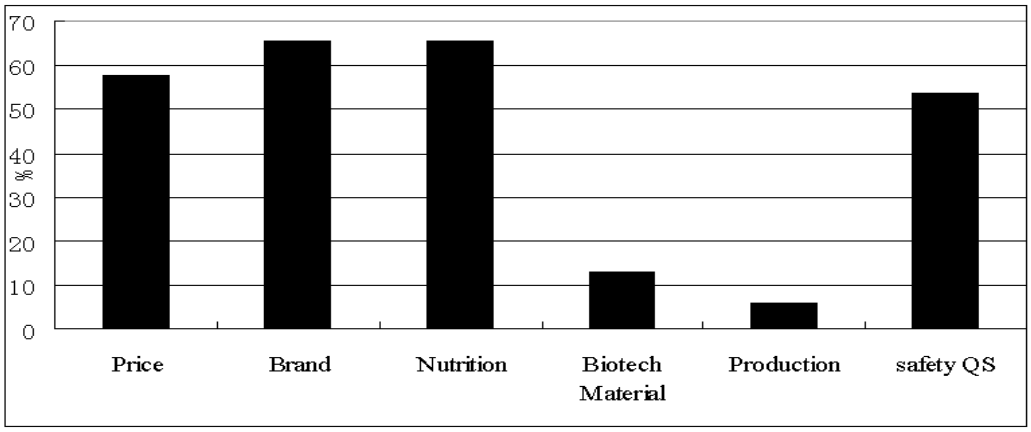


Source: calculated from 2003-2005 urban household survey data

Considering consumers in supermarkets, only 13.2 percent of consumers have concern over biotech material when making their purchasing decisions, lower than

concern over price, brand, and nutritional ingredients. Similarly, 86 percent of consumers in supermarket have concern over food label, but among them only 13 percent have concern over biotech material information printed on the label, much lower than concern over price label, brand label, and nutritional ingredients label. If concern over biotech material and concern over biotech food label are significant in influencing consumers' decision making, we can expect a mild decrease in the market share of biotech oil as the result of label enforcement. Fortunately, this anticipation has been verified in the analysis of aggregate sales data in supermarkets (Zhong et al., 2006). Whether it is true with individual consumers' survey data still needs to be tested, which summarizes our work followed by.

Figure 2 Consumers' Concern over Food Label (Percent)



Source: calculated from 2003-2005 urban household survey data

3.2 Empirical Analysis: An Instrumental Variable Approach

Confining our research focus on consumers in supermarkets in consistency with previous actual sales data, we are able to draw much more valuable conclusions linking individual level data and market level data. Regression equations for the concern over biotech label and concern over biotech material are first estimated respectively through a first-stage Probit model (Model1-Model4). Explanatory variables include consumers' demographic and socio-economic variables, size of the residing city, as well as access to mass media (Mdaccess), including internet, TV, radio, newspaper, and magazine. Model 1 and Model 2 are the first-stage equation used to describe the consumers' choice in 2005, after the enforcement of biotech labeling policy. Model 3 and Model 4 are used to describe consumers' choice change from the absence of biotech labeling in 2003 to 2005.

Access to mass media is the most significant variable affecting consumers' concern over biotech label and biotech material (Table 2). That is, consumers having convenient access to media are more likely to have special concern over biotech label and biotech material. In addition, the higher income level (i.e. above 3000RMB household income per capita) is associated with greater concern over biotech label and material. People who have received higher Education are more likely to have some concern over biotech label. The young and the old people have statistically significant concern over biotech label and material. Wald test of exogeneity for all the four models reject the exogeneity of *concern over biotech label* (Gmolabel) and *concern over biotech material* (Gmo), which means endogeneity significantly bias our statistical estimation.

Table 2 First-Stage Estimation on Concern over Biotech Label and Biotech Material

Explanatory Variable	Dependent Variable			
	Model 1 Gmolabel	Model 2 Gmo	Model 3 Gmolabel	Model 4 Gmo
Gender	-.0234 (-0.96)	-.0223 (-1.01)	-.0226 (-0.76) ***	-.0079 (-0.30)
Age	-.0110 (-1.77) *	-.0143 (-2.56) ***	-.0126 (-1.66) *	-.0172 (-2.56) ***
Age*Age	.0001 (1.60)	.0001 (2.37) **	.0001 (1.50)	.0002 (2.40) **
Education	.0244 (1.78) *	.0049 (0.39)	.0308 (1.85) *	.0019 (0.13)
Child	-.0042 (-0.16)	-.0060 (-0.26)	-.0204 (-0.65)	-.0065 (-0.24)
Income1	.0280 (0.94)	.0250 (0.93)	.0177 (0.49)	.0195 (0.61)
Income2	.0267 (0.78)	-.0265 (-0.87)	.0344 (0.83)	-.0037 (-0.10)
Income3	.0980 (1.98) **	.0428 (0.96)	.1069 (1.76) *	.0368 (0.69) ***
Bigcity	-.0172 (-0.72)	.0073 (0.34)	-.0019 (-0.06)	.0133 (0.51)
Mdaccess	.1262 (5.11) ***	.0944 (4.24) ***	.1257 (4.21) ***	.0978 (3.72) ***
_cons	.2872 (1.80) *	.4018 (2.80) ***	.3276 (1.69) *	.4604 (2.70) **
Number of Obs.	n=787	n=787	n=570	n=570

Source: calculated from 2003-2005 urban household survey data
Note: *, **, and *** denote statistically significant at 10%, 5%, and 1%, respectively. Figures in parentheses are absolute values of t-ratio.

The second-stage models on purchasing decisions are estimated through binary Probit analysis using predicted values of the variable *concern over biotech label* or *concern over biotech material* from the first-stage equations. The instrumental variable *access to media* is chosen so that it is highly correlated with the *concern* variables but not correlated with the error term in the purchasing decisions equations.

As are shown in Table 3, Model 5, Model 6, Model 7, and Model 8 are used to describe how relevant factors influence consumers' decisions. Concerning buyers' characteristics, contrary to statements in the literature, men are not shown to be prone to buy biotech oil compared with 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. It may result from more sensitive attitudes towards negative information among young people, while the old are more sensitive towards potential health related issues. Concerning household socioeconomic factors, results show that respondents in higher income categories are more likely to buy non-biotech oil. Compared with people of low income, the budget share of vegetable oil in total expenditure is lower among the rich, which may make the rich choose non-biotech oil.

Our focus in this paper is whether there is evidence from individual consumers' perspective that the enforcement of labeling policy has had effect on consumers' purchasing choice. It is found that consumers who have special concern over biotech food label or biotech material when making their purchasing decisions are prone to choose non-biotech oil. This also implies that consumers' attitudes towards biotech foods are not only affected by their immediate economic interests, but their inclination to avoid risks (Hallman et al., 2002). Results of the instrumental variable approach show larger beta-coefficients of the *concern* variables than those obtained from the conventional Probit model, where actual values of the *concern* variables are used in estimating the likelihood of consumers' purchase of biotech oils. However, standard errors of the coefficients obtained from the instrumental variable are larger than those obtained from the conventional approach. Finally, concerns over biotech label and biotech material are used to validate each other, because they should have effects upon consumers' purchasing decisions in the same direction.

Table 3 Second-Stage Estimation on Consumers' Purchasing Decisions in 2005

Explanatory Variable	Dependent Variable			
	Buygm			
	Model 5 Probit	Model 6 IV Probit	Model 7 Probit	Model 8 IV Probit
Gender	.1363	.1023	.1314	.0865
	(1.31)	(1.02)	(1.26)	(0.86)
Age	.0697	.0452	.0673	.0309
	(2.76) ***	(1.63)	(2.65) ***	(1.01)
Age*Age	-.0007	-.0005	-.0007	-.0004
	(-2.92) ***	(-1.84) *	(-2.82) ***	(-1.21)
Education	-.1153	-.0471	-.1200	-.0753
	(-2.08) **	(-0.75)	(-2.17) **	(-1.29)
Child	.0625	.0678	.0634	.0604
	(0.57)	(0.66)	(0.58)	(0.59)
Income1	-.1650	-.0952	-.1609	-.0823
	(-1.28)	(-0.75)	(-1.24)	(-0.65)
Income2	-.2481	-.1487	-.2639	-.2433
	(-1.71) *	(-1.01)	(-1.82) *	(-1.77) *
Income3	-.5714	-.3262	-.5791	-.3819
	(-2.84) ***	(-1.41)	(-2.88) ***	(-1.70) *
Bigcity	.3031	.2674	.3138	.3031
	(3.00) ***	(2.66) ***	(3.09) ***	(3.09) ***
Gmolabel	-.2235	-1.6596	-	-
	(-1.59)	(-2.85) ***		
Gmo	-	-	-.3658	-2.128
			(-2.35) **	(-3.08) ***
_cons	-.7273	.4018	-.6500	.2017
	(-1.12)	(2.80) ***	(-1.00)	(0.28)
Number of Obs.	n=787	n=787	n=787	n=787
Prob > chi2	0.0000	0.0000	0.0000	0.0000

Source: calculated from 2003-2005 urban household survey data
Note: *, **, and *** denote statistically significant at 10%, 5%, and 1%, respectively. Figures in parentheses are absolute values of t-ratio.

What make people change from buying biotech oil to non-biotech oil?[10] Due to the similar length, starting point, and ending point of household survey data as compared with retail sales data, the estimate of individual consumers' decisions and their changes using household survey data acts as a further proof of the results we obtained from actual sales data. As are presented in Model 9, Model 10, Model 11, and Model 12, respondents in higher income categories are statistically significant in shifting from biotech oil to non-biotech oil. Besides, the statistic significance of concern over biotech food label and biotech material both imply that labeling could trigger a decrease in purchasing biotech oil, which is consistent with our findings that the

[10] 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.

market share of biotech oil reduced by 4 percent right after the labeling enforcement. However, the supermarket industry in urban China boom rapidly, which means more and more consumers start buying vegetable oil in supermarket. This ongoing trend will certainly dampen the decreasing market share of biotech oil, as those newcomers have relatively lower income and prefer biotech oils to non-biotech oils. We will come to this issue later.

Table 4 Second-Stage Estimation on Changes of Consumers' Purchasing Decisions between 2003 and 2005

Explanatory Variable	Dependent Variable			
	Gmnongm			
	Model 9 Probit	Model 10 IV Probit	Model 11 Probit	Model 12 IV Probit
Gender	-.0175	.0037	-.0176	-.0172
	(-0.12)	(0.03)	(-0.12) ***	(-0.13)
Age	-.0948	-.0583	-.0900	-.0371
	(-2.67) ***	(-1.48)	(-2.52) **	(-0.85)
Age*Age	.0010	.0006	.0009	.0004
	(2.76) ***	(1.62)	(2.60) ***	(0.98)
Education	.0422	-.0408	.0724	.0316
	(0.53)	(-0.51)	(0.93)	(0.44)
Child	.1762	.1528	.1599	.1133
	(1.10)	(1.06)	(0.99)	(0.79)
Income1	.4995	.3629	.4915	.3315
	(2.26) **	(1.69) *	(2.22) **	(1.52)
Income2	.6443	.4357	.6647	.5015
	(2.71) ***	(1.74) *	(2.80) ***	(2.07) **
Income3	1.093	.6558	1.1187	.7556
	(3.74) ***	(1.73) *	(3.84) ***	(2.07) **
Bigcity	.2101	.1422	.2017	.0989
	(1.41)	(1.02)	(1.35)	(0.69)
Gmolabel	.5556	2.1972	-	-
	(3.14) ***	(3.54) ***		
Gmo	-	-	.6785	2.6487
			(3.45) ***	(3.75) ***
_cons	.0853	-.4454	-.0751	-.9793
	(0.10)	(-0.54)	(-0.08)	(-1.13) **
Number of Obs.	n=570	n=570	n=570	n=570
Prob > chi2	0.0000	0.0000	0.0000	0.0000

Source: calculated from 2003-2005 urban household survey data
Note: *, **, and *** denote statistically significant at 10%, 5%, and 1%, respectively. Figures in parentheses are absolute values of t-ratio.

Table 5 shows marginal effects of the explanatory variables that are relatively significant on the probability of purchasing biotech oils and decision change from

buying biotech oil to non-biotech oil. The marginal effects are the impacts of a per-unit change in explanatory variables on the probability of change in dependent variable, measured at mean values of the dependent and explanatory variables. In general, consumers who have concern over biotech food label are 7.5 percent less likely to buy biotech oil, and they are 10.5 percent more likely to change from buying biotech oil to non-biotech oil. Similarly, concern over biotech material lowers the likelihood of buying biotech oil by 12.3 percent, and increase the probability of decision change by 12.7 percent.

Table 5 Marginal Effects-Changes in the Probability of Purchasing Decisions Associated with Explanatory Variables

Explanatory Variable	Marginal Effects			
	Model 6	Model 8	Model 10	Model 12
Gender	-	-	-	-
Age	.0234	.0226	-.0178	-
Age*Age	-.0003	-.0002	.0002	-
Education	-	-	-	-
Child	-	-	-	-
Income1	-	-	.0939	.0919
Income2	-	-.0886	.1211	.1243
Income3	-.1920	-.1944	.2055	.2093
Bigcity	.1018	.1054	-	-
Gmolabel	-.0751	-	.1045	-
Gmo	-	-.1228	-	.1269

Source: calculated from 2003-2005 urban household survey data

4. BIOTECH LABEL AND MARKET TREND: WHAT SHOULD WE KNOW

First of all, what kind of data is in greater need to capture consumers' actual choices and market situation? Empirical results employing stated preferences might show discrepancy between concern over food safety and purchasing behavior. Attempts to infer market trend from concerns over food safety induce biases. Previous studies find that consumers in China express even greater concern over food safety than their counterparts in developed countries. However, a large portion of them choose to buy food in the market which they believe unsafe. Factors other than concern over food safety, such as belief in governmental food safety regulation and food label, concern over price, knowledge of biotech food, strategic behavior, and convenient to buy food or not, also play important roles. All these factors are revealed in consumers' actual choices, but might not in their stated preferences. Thus, empirical researches applying actual sales (purchasing) data deliver more reliable policy implications.

However, in some circumstances we have to apply survey data of stated preferences, which leads us to consider factors influencing the discrepancy between stated preferences and revealed preferences and make proper adjustment before thinking of policy implications. If we believe that the discrepancy comes from differences in consumers' abstract cognition and their real world perception, then we need to further explore the effect of consumers' socioeconomic characteristics and concern over food safety on the probability of discrepancy. For instance, higher level of education and/or more similar beliefs in food safety across different market channels might be accompanied by larger discrepancy. Distinguishing questions targeting consumers' abstract cognition and their real world perception is crucial when researchers design questionnaires. An update of this kind of analysis is also needed as stated preferences and revealed preferences might get closer.

This paper pays special attention to the effect of biotech food label. Following actual sales (purchasing) data, can we conclude that consumers care about biotech food label? It is found that in the short run concern over biotech food label and biotech material lower individual consumers' probability of purchasing biotech oil and increase their likelihood of purchasing decision change from biotech oil to non-biotech oil. This situation occurs after the label enforcement, as is shown in our 2003-2005 urban household survey data. With a test of individual consumers' decision-making, our results show direct support to a series of studies such as Zhong et al. (2006a) and Lin et al. (2006c). However, do those compatible findings reflect the overall market trend in the long run? Unfortunately, it might not be the case.

The urban household survey data employed here cannot convincingly imply the market trend in the long run. First, it only covers time period between 2003 and 2005, which is also the case for the actual sales data obtained from urban supermarkets, a few months before and after the labeling enforcement (Zhong et al. 2008b and Lin et al. 2006c). In contemporary China, 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 expend the duration of this sample. Meanwhile, rapid structural change over time in China supermarket industry catering to consumers' needs is another reason behind the

expansion of the sample duration.

Second, the structure of supermarkets in China is experiencing an uneven change. Structural differences in supermarkets across locations suggest an expansion of this kind of analysis to other regions. 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.

Third, the available datasets still cannot satisfy the prerequisite of studying different consumer groups and their overall effect towards the market trend. Consumers are classified into two categories: one is supermarket customers; the other is informal market customers. With the accelerating urbanization in China, low-income residents begin to buy vegetable oil in supermarkets, and biotech oil becomes their best choice. As are extensively discussed in our literature review, evidence from household survey data show that the changes of biotech oil market share are affected by the structural effect of the rich, while there is no apparent gross consumption effect of the poor, which means a lower market share of biotech oil in the long run (Zhong et al. 2008b). Evidence from actual sales data shows an insignificant long term increase in the market share of biotech oil. The contradiction between the two available datasets captures the fact that there remains a lot of work to be done concerning data compatibility.

Our two datasets available are still away from compatible mainly because of four reasons. To begin with, the actual sales data in supermarkets comprises all individual buyers and other social entities, while household survey data only includes individual consumers; second, large volume purchases from enterprises often crowd out buying activities of individuals; third, consumers of high income would diversify their vegetable oil consumption. This nutritional consideration will definitely complex the calculation of market trend. Furthermore, with rapid income growth, more and more people dine out. This gradual structural change of food consumption would be followed by the reduction of household vegetable oil consumption. Finally, the shrinking family size in modern society also contributes to this process. Overall, the lack of considering other social entities purchasing decisions, crowd out effect, consumption diversification, dining out trend, and family size shrinking effect would

lower the market share of biotech oil (Zhong et al., 2008b).

A crucial question here is who make consumption decisions. All the above-mentioned points except the third one affect consumers' decisions. Researches might not simply assume that consumers themselves make all independent decisions any more. Therefore, it is important to examine the applicability of household food survey data at hand before inferring the aggregate market trend involving collective consumption, dining out and so on.

Finally, biotech food labeling is only one way to provide information, other marketing policies taken by stores and manufacturers that may affect the sales of vegetable oils have not been considered due to limitation of datasets. This includes advertisement, sales promotion and so on. We should study all the major marketing policies and their impacts on the market before drawing final conclusions.

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