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Analysis of Consumers' Attitudes toward Traceability System on Dairy Products in China

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Dairy industry has a large potential in China. However, recent food safety problems occurred in the livestock sector in China has somehow negatively affected consumer's confidence in food purchase. A traceability system can be one of the ways to provide consumers information about the food they purchase. In this research, consumers' attitudes toward traceability system are examined. A choice modeling technique is the tool to examine what kinds of information are significant determinants on the value people place on non-market goods i.e. traceability label on dairy products. A conditional logit model is used to analyze the data.

In conclusion, a traceability system is not familiar with many consumers in China. However, most of the consumers would like to accept traceability system and were willing to pay extra money for milk with a traceability system. The consumers are concerned on the information of animal medicine usage record especially on antibiotic and willing to pay more for receiving the information. Providing this information may increase consumers' confidence on the food they consume. A traceability system could be a way to provide information of production and avoid information asymmetry, and help consumers to rebuild the confidence.

INTRODUCTION

Research background

Dairy industry has a large potential in China. The production and consumption of milk in China have increased dramatically especially since 2000. However, recent food safety problems occurred in the livestock sector in China have somehow negatively affected consumers' confidence in purchasing foods. Food safety problems in dairy industry have created lack of confidence among the public in buying dairy products.

The new approach (A traceability system) to ensure the food safety is concerned by the government, producers and even consumers. Traceability system could be a new way to respect consumers' right to choose safe and high quality food, and to provide production information to consumers, which may help consumers to have the confidence on the food they consume. Basically, one of the functions of traceability system is to monitor food producers in order to avoid food safety problems such as misuse of veterinary medicines and so on.

In China, traceability system is been in the processing of introduction, which initially focused on the food safety during the Olympic Game 2008 but not only for Olympic Game (Fig. 1)

At present, the traceability system can be found in some supermarkets and hyper marts in China, which mainly used on vegetable (Fig. 2).



Source: <http://www.safefood.gov.cn/index.html>

Fig. 1. The Traceability System in China.



Source: self photographs



Fig. 2. The Traceability System in Beijing.

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Research objectives

A traceability system is a new thing to Chinese consumers and consumers' attitude towards traceability system is not clear yet. In this study, the main research objectives are to examine consumers' purchasing behavior on milk, to study consumers' response to food safety issues, to investigate the consumers' awareness of a traceability system, and to study consumers' willingness to pay (WTP) on a traceability system.

DATA AND METHODOLOGY

Survey and data

To examine consumers' attitude toward traceability system, a face to face interview was conducted from September to October 2008, and 209 samples were collected in Beijing (Fig. 3). Another self survey data in Beijing July 2008 by Nanseki *et al.* (2008) is also used for analysis in this paper. In this survey, a face to face interview was conducted and 214 samples were collected.

Beijing is one of the biggest cities in China, while Beijing is one of the highest milk average consumption zone in China (Fig. 4). Also, Beijing is the centre of Beijing Olympic Game; a traceability system has been already applied in some supermarkets, so Beijing was chosen as the research area.

Table 1 presents the demographic and socio-economic characteristics of the respondents or consumers that took part in the survey in September to October, 2008. 68.9 percent of the respondents are female while 31.1 percent are male. Woman usually is the person who used to do shopping in a household.

Model and analysis

This study applied a choice modeling (CM) technique in examining which attributes are significant determinants of the values people place on non-market goods i.e. a traceability system. CM or stated preference (SP) that used attribute based technique was first applied by

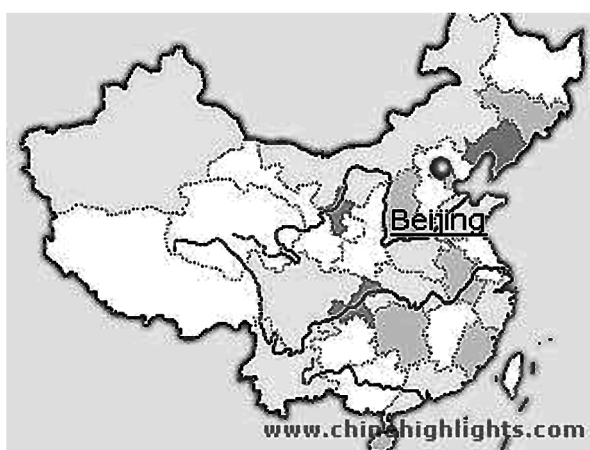
Louviere and Hensher (1983), Louviere and Woodworth (1983), and Adamowicz *et al.* (1998). This technique was originated in market research and transport literatures and recently applied to the valuation of non-market goods. In this survey, attributes and levels were used to create choice sets using $3^3 \times 6$ orthogonal effects design which produced 36 choice sets and were divided into six versions. CM techniques requires respondent to compare and select one option out of three in all the choice sets. Conditional Logit Model (CLM) is used to analyze the data.

The option chosen by the respondents in the CM were modeled in random utility framework which was

Table 1. Socio-economic Characteristics across Treatments

	Category	%
Sex	Male	31.14%
	Female	68.86%
Age	under 18	1.44%
	19–25	23.44%
	26–35	29.19%
	36–45	20.57%
	46–55	15.31%
	56–65	7.18%
	over 66	2.87%
Education	primary school	0.96%
	junior high school	5.26%
	senior high school	16.75%
	College	28.23%
	University	48.80%
Household income	<1000	3.83%
	1000–3000	19.62%
	3000–6000	28.71%
	6000–10000	24.88%
	10000–15000	11.48%
	15000–20000	4.31%
	>20000	3.83%
	No re	2.87%

Source: Self Survey Data 2008 (September)



Source: Source: Chinahighlights(2009)

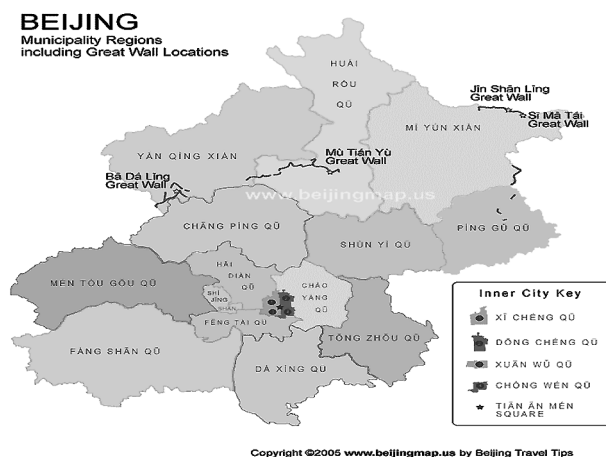
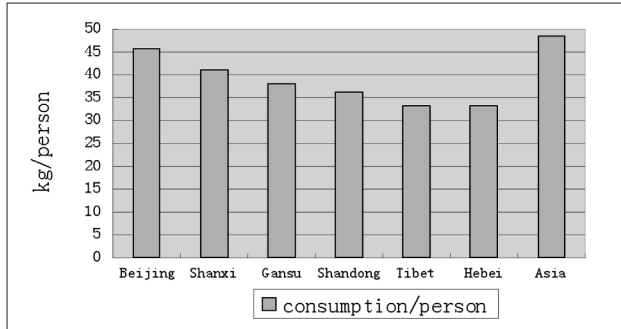


Fig. 3. Map of Research Area.

Table 2. Choice and Set

	Choice A	Choice B	Choice C
Farm and/or farmer	Information+Pictures	Information	
Veterinary medicine use	All medicine record	Without record	
Processing plantings	Information	Information+Pictures	I would buy my usual brand of milk.
Price of 250 ml milk	No change	¥0.20more expensive	



Source: Ministry of Agriculture(2008)

Fig. 4. The Average Consumption of Dairy Products in China.

expressed as the summation of systematic component. The utility obtained by individual i from choosing alternative j in a choice set can be expressed as:

$$U_{ij} = V_{ij} + \varepsilon_{ij} \quad (1)$$

Where V_{ij} denotes the observable portion of the utility and ε_{ij} indicates error term. Option j is chosen over alternative h of $U_{ij} > U_{ih}$. The probability if individual i chooses option j is defined as follow:

$$\pi_{ij} = \Pr\{V_{ij} + \varepsilon_{ij} \geq V_{ih} + \varepsilon_{ih}; \forall h \in C\}, \quad (2)$$

Where C_i is the choice set for individual i . V_{ij} is a conditional indirect utility function and has a linear form,

$$V_{ij} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n, \quad (3)$$

Where $\beta_1 - \beta_n$ is vector of coefficient attached to the vector of attributes X . Assuming that the error terms are Gumble distributed the probability of choosing option j is

$$\pi_{ij} = \frac{\exp(v_{ij})}{\sum_{j \in C} \exp(v_{ij})} \quad (4)$$

The marginal value of a change within a single attribute can be represented as ratio of coefficients as follow;

$$MWTP = \frac{-\beta_{attribute}}{\beta_{price}} \quad (5)$$

Option C was coded as zero value and alternative specific constants were equal to 1 either option A and B was selected (Bateman *et al.*, 2002). In this study the software package LIMDEP 9.0 NLOGIT4.0 was used to estimate Conditional Logit Model (Greene, 2002).

RESULT AND DISSION

Consumers' milk purchasing behavior and reaction on food safety issues

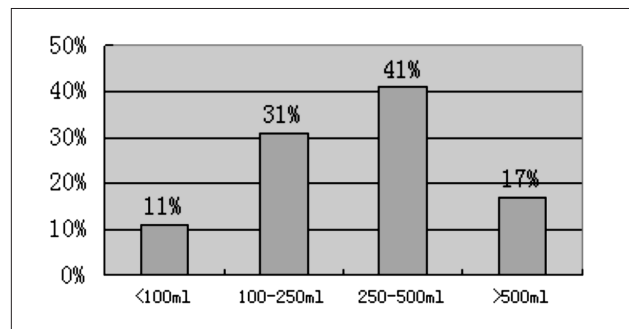
The survey was carried out in Beijing in 2008. As one of the highest milk average consumption zone in China, the consumers' milk purchasing behavior also was examined.

As the modern supply chain developed, supermarkets became the most popular place for people to buy dairy goods. So people in Beijing used to buy milk and other dairy products in supermarket. Besides buying at the supermarket, milk delivery service is also common.

For many families, milk is consumed everyday. Some people have milk as breakfast; others have milk at night before sleep, or both (About 250 ml –500 ml per day). A few people have milk as drink, and drink milk very often (More than 500 ml per day). For old people and young children, milk, yogurt and other dairy products are the main source of calcium. Nearly 60% of the families used to consume more than 250 ml of milk per day per person,



Source: Self Survey 2008 (September)

Fig. 5. Main Milk Purchasing Place.

Source: Self Survey 2008 (September)

Fig. 6. Milk Consumption per Household per Day.

around 17% of the families use to have more than 500 ml of milk per day. Around 11% of the respondents rarely drink milk everyday (Fig. 6).

However, a number of food safety incidents has negatively affect consumers' confidence on the food they consume, for example, the milk powder incident happened in China 2008. Before the incident happened, most people felt the milk was safe to consume, but after the incident happened, the situation totally changed (Xu *et al.*, 2010, Fig. 7).

After the incident happened, respondents' views on safety become more important than price. Most respondents thought the safety is much more important than milk price (Xu *et al.*, Fig. 8)

After the incident happened, most respondents wanted more severe supervision on milk production; some people needed more production information, while some people would stop purchasing milk (Fig. 9).

According to the survey in July 2008, the respond-

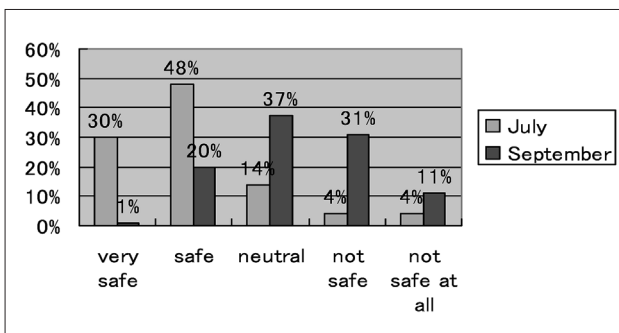
ents thought most milk safety problems happened in farm, also in processing factory (Xu *et al.*, 2010). Only very few respondents thought milk safety problems happened in transportation or wholesale stage (Fig. 10).

Consumers' awareness of traceability system

As a new system to ensure food safety, traceability system is only known by few people. There are only around 42% of the respondents had heard about food traceability system before, and more than half of the respondents were the first time to know this system. However, around 87% of the respondents thought traceability system was necessary to ensure food safety. Even people never heard about traceability system before the survey, they still felt it was necessary and would be a way to ensure food safety and food quality (Table 3).

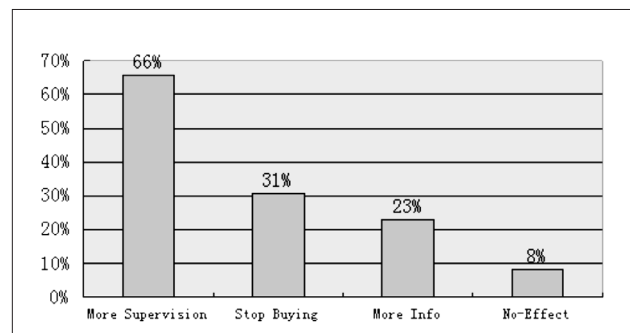
This result showed that most of the consumers accept traceability system, no matter they had heard traceability system or not.

But, there were still around 13% of the respondents



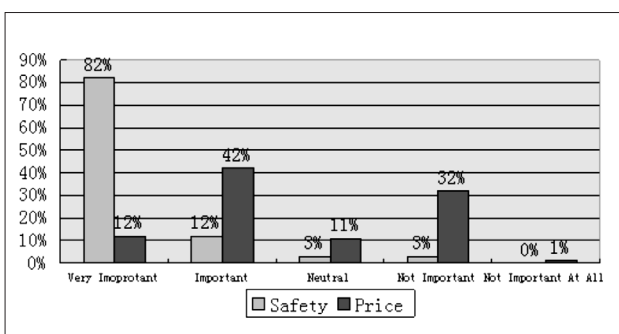
Source: Self Survey 2008 (July and September), Nanseki *et al.* (2008)

Fig. 7. Consumer's Confidence and Milk Safety Incidents.



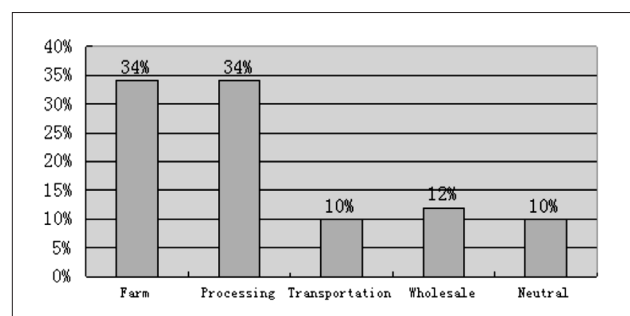
Source: Self Survey 2008 (September)

Fig. 9. The Consumers Response to Milk Safety Incidents.



Source: Self Survey 2008(July), Nanseki *et al.* (2008)

Fig. 8. Consumer's point of View on Safety and Price of Milk.



Source: Self Survey 2008(July), Nanseki *et al.* (2008)

Fig. 10. The Most Milk Safety Problem Happen Place that Respondents Think.

Table 3. Consumers Awareness of Traceability System

	Necessary	Unnecessary	Total	% of Necessary
Heard about traceability system	78	11	89	87.64%
Not heard about traceability system	104	16	120	86.67%
Total	182	27	209	87.08%
% of heard about traceability system	42.86%	40.74%	42.58%	

Source: Self Survey 2008 (September)

Table 4. The Reasons Why People Do Not Choose Traceability System

The reason traceability system is thought to be unnecessary	% of total responses
a. Higher price	3.70%
b. Do not trust the information	55.56%
c. Do not care about traceability system	37.04%
d. Others	3.70%

Source: Self Survey 2008 (September)

did not approve traceability system. Distrusting the information was the main reason. Also, there were some respondents who did not care about the traceability system. They thought the traceability system were not perfect enough to ensure food safety and food quality. Only small amount of the respondents viewed possible higher price as the reason they would not choose traceability system. At present, traceability system is a hot topic in China; there are some researches about traceability system on consumers' attitude, but on other products. This result was similar with a research on pork. According to Song (2008), the reason for respondents who would not choose pork with traceability system was that people were worried about possible false information.

In 182 respondents, 30% of them would accept traceability system if the price would not change. Around 70% of the respondents would accept increasing in price of milk with traceability system. But most of them only accepted a limited amount of increasing in price which was no more than one time of original price (1.7RMB/250 ml). Only nearly 4% of the respondents were willing to pay a high price for the milk with traceability system (3 or 4 times more expensive than original price of 250 ml normal milk). This result showed that consumers were willing to afford a part of the cost of traceability system, but limited, and most of the part should be afforded by governments and producers. Government should take the responsibility to ensure the basic food safety (Table 5).

Table 5. Amount of WTP for Milk with Traceability System

Price	n	%
1.70rmb*(No change in price)	56	31.11%
1.90rmb	62	34.44%
2.20rmb	25	13.89%
2.50rmb	20	11.11%
2.80rmb	8	4.44%
3.20rmb	2	1.11%
3.60rmb	1	0.56%
4.00rmb	0	0.00%
4.6rmb	3	1.67%
5.20rmb	2	1.11%
6.00rmb	0	0.00%
over 6.00rmb	1	0.56%
Total	182	100%

Source: Self Survey 2008 (September)

*Note: we set the basic price of a 250 ml of milk is 1.70 Rmb.
And 1Rmb=0.13\$

Consumers' willingness to pay on a traceability system

Table 6 shows the estimation result of CLM. According to table6, we can find that respondents need all the information except processing information with pictures. The reason might be that people were more familiar with these famous processing companies, they already got much information about these processing enterprises through many channels; while on the other hand, most consumers did not have a clear mind of farms information, breeding information and animal medicine use.

About farm information, consumers had a higher marginal willingness to Pay (MWTP) on information with pictures than only information, which was 2.28RMB and 2.03RMB of 250 ml milk. For consumers, the more information is better. Besides, consumers were willing to pay about 3.69RMB for 250 ml milk with traceability system which included antibiotics usage record and only 2.95RMB for all animal medicine usage record. This was a very high marginal willingness to pay, especially on antibiotics usage. It was more than twice higher than original price. It implicated that consumers were more concerned on animal medicine use, especially antibiotics usage record. However, the survey was carried out right after the milk powder incident happened, so that the result might have bias and be higher estimated than the real willingness to pay. When consumers were asked about processing factory information, consumers showed a lower MWTP than other attributes and levels, only 0.87 RMB while the processing information with pictures were not significant in statistic.

Table 6. Estimation of CLM

Variables	Coefficient	Std. Error	t-sta
ASC [#]	-0.6749***	0.1618	-6.936
FARM INF	0.6599***	0.1217	5.333
FARM INF+PIC	0.7414***	0.1226	6.03
ANTIBIOTIC RECORD	1.2027***	0.1234	9.727
ALL MEDICINE RECORD	0.9619***	0.1232	7.798
PROCESSING INF	0.2829*	0.1167	2.385
PROCESSING INF+PIC	0.1272	0.1198	0.967
PRICE	-0.3257***	0.0302	-10.548

Source: Self Survey 2008 (September)

Note: ***, **and * denote statistically significant at 1%, 5% and 10%, respectively.

means Alternative Specific Constants

Table 7. Estimation MWTP on the Information That Traceability System Provide

Variables	MWTP (RMB)	90% C.I.*	
ASC*	-2.07	-3.498	-0.642
FARM INF	2.03	1.111	2.949
FARM INF+PIC	2.28	1.347	3.213
ANTIBIOTIC RECORD	3.69	2.596	4.784
ALL MEDICINE RECORD	2.95	1.914	3.986
PROCESSING INF	0.87	0.004	1.736
PROCESSING INF+PIC	ns		

Source: Self Survey 2008 (September)

Note: # means Alternative Specific Constants

* Confidence intervals have been calculated employing the delta method, where

$$\text{var}\left(\frac{-\alpha}{\beta}\right) = \frac{1}{\beta^2} \left[\left(\frac{\alpha}{\beta}\right)^2 \text{var}(\beta) + \text{var}(\alpha) - \left(\frac{\alpha}{\beta}\right) \text{cov}(\alpha, \beta) \right]$$

CONCLUSION

The results showed that consumers in Beijing were used to consume milk in daily life. However, the food safety incidents happened in 2008 has negatively affected consumers' confidence on the food they consume. The results also suggested that even more than half of the respondents had never heard about traceability system before the survey, most consumers thought food traceability system is necessary to ensure the food safety and to avoid information asymmetry, although they are willing to pay for only a limited amount for traceability system. Most consumers were able to accept traceability system and willing to afford a small part of cost. On the other hand, government and producers need to afford most of the cost. However, consumers were worried about the information that traceability system provides is true or not. Severe supervision is important to make people trust the information and to avoid false or fake information. It is hard to control people's behavior, but severe supervision can reduce the risk of cheating in information.

Consumers are concerned on the information of animal medicine usage record especially on antibiotics and willing to pay more for the information. Besides, people also care about the farm information. Processing factories information is viewed as least preferred. As consumers concern on the products information, especially the information in farm level and other information that consumers are not familiar with, provide these information can help them to build the confidence on the food they consume.

This research was carried out just after the milk powder incident 2008 in China. Therefore, the results obtained in this research could be affected by the incident. Another research similar to this research is needed

in the future to estimate the effects of the milk powder incident on the consumers' attitude toward milk traceability system.

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