Effectiveness of quality signalling: brand versus certification

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Abstract

Consumer demand for high quality food products continues to grow. However, consumers'

ability to choose preferred products can be undermined by asymmetric quality information. This

study investigates the influences of brand and certification on Chinese consumers' choices of milk

products as well as the determinants of consumers' reactions to these different quality signals. Our

results indicate that Chinese consumers tend to buy branded rather than non-branded milk

products and that milk products carrying quality certifications are preferred. Regarding

interrelationships between different quality signals, we find substitution effects between brand

and certification, indicating that non-branded products benefit more from certification than do

branded products. Results from the latent class model reveal two latent consumer groups. One

consists of habitual buyers, for whom brand has stronger impacts than certification. Consumers in

the second group tend to make tradeoffs between different milk product characteristics.

Respondents who exhibit higher levels of trust and education are more likely to be in this group.

 Keywords: quality signalling; brand; certification; milk; Chinese consumers

This paper is intended for the topic of "consumer behavior: preference analysis".

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Introduction

As income grows, consumer demand for high quality food products also grows. However, individual's ability to choose preferred products can be undermined by asymmetry in quality information between buyers and sellers. Approaches to quality signalling to counteract negative effects of asymmetric information on consumers have been developed. The most common approaches include building sellers' reputation (Klein and Leffler, 1981; Diamond, 1989), offering warranties (Grossman, 1981), seeking certification (Anderson et al, 1999), and providing information on quality.

Several studies have examined how quality signalling influences consumers' food choices. These indicate that brands, quality certification and retailer's reputation have positive effects on consumers' food purchasing decisions (Roosen et al., 2003; Zhang et al., 2010; Bai et al., 2013). Comparison of the effectiveness of different quality signals, Roosen et al. (2003) found that origin labels tend to have stronger impacts on purchasing decisions than do private brands and product specific labels. Zhang et al. (2010) found brand and retailer reputation to be more effective influences on Beijing consumers' choices of milk products than certification.

It is common for products to have multiple quality signals. Even so, the ways in which consumers form their expectations of product quality when faced with multiple quality signals have largely been unexplored. This study aims to contribute to a better understanding of how consumers respond to different quality signals. Specifically, we examine how brand and certification affect a sample of urban Chinese consumers' choices of milk products by analyzing

the interrelationships between brand and certification and how individuals' trust and consumption habits affect their reactions to the identified quality signals.

Food safety is currently seen as one of the most important social concerns of Chinese consumers (Bai et al., 2013). A number of studies have concluded that Chinese consumers are willing to pay a premium to ensure food quality (Zhang et al., 2012; Ortega et al., 2011). Quality signaling is important to enable consumers to choose their preferred products. Moreover, with effective quality signaling, firms have more incentives to improve product quality and differentiate their products. The findings from this study are expected to shed light on mechanisms by which quality signals affect consumers' decision making and to provide empirical evidence for decision makers on the effective use of quality signals.

The dairy industry in China

The dairy industry in China has grown rapidly during the past decade. The market value of the total outputs of China's dairy industry surged from CNY 19.54 billion in 2000 to CNY 194.95 billion in 2010 (Yu, 2014). During this time period, per capita consumption of milk products grew from 9.94kg in 2000 to 13.98kg in 2010, an increase of 40.6% (Yu, 2014). Nonetheless, the quality of dairy products has been of great concern to Chinese consumers. There have been frequent milk-related food safety incidents in China. The most publicized of these was seen in the 2008 evidence of melamine-contaminated infant formula which sickened tens of thousands babies in China (Wang et al., 2013). Since then, Chinese consumers have remained suspicious of milk quality. The Chinese government has taken measures to improve food safety which range from stricter food safety laws to policies intended to strengthen food inspection and monitoring. In March 2013 multiple overlapping food regulatory agencies were restructured as the new

China Food and Drug Administration (CFDA), to provide centralized leadership in setting food safety standards and seeking compliance with those standards.

The market for liquid milk products is a major dairy product segment dominated by a number of large companies. These include large national companies, specifically Mengniu and Yili (both of which are headquartered in Inner Mongolia) and Bright Dairy (which is Shanghai-based). Local companies, such as Sanyuan in Beijing and New Hope in Sichuan, also account for significant market shares. Reflecting low consumer confidence in domestic milk products, China's demand for imported dairy products continues to grow and a number of multinational companies have invested in the dairy industry in China, typically in the form of joint ventures with Chinese partners.

Dairy companies tend to compete through differentiating their products using various quality signalling strategies. Branding is one common approach to signaling product quality. The credibility of brands is generally developed through considerable efforts by individual firms and is often based on consumers' personal experience over time. In addition to investing resources to build brand equity, some dairy companies also seek quality certification. For example, Yili obtained HACCP (Hazard Analysis Critical Control Point) certification for some of its milk products in 2002 (Wang et al., 2008), while Mengniu teamed with AsureQuality, a global expert in food safety and quality, to obtain "world class" food safety skills in 2013. Chinese milk products now routinely carry labels indicating multiple signals of various quality standards. Although dairy companies attempt to differentiate their products using various quality signaling strategies, the effectiveness of these strategies is an empirical issue. This study focuses on two common quality signals, brand and certification, in the context of liquid milk products, by

investigating how these affect consumers' purchasing decisions and whether there are any joint effects between brand and certification.

Conceptual and econometric models

We adopt random utility models (RUMs) to investigate the impacts of quality signals on consumers' decision-making in the context of liquid milk products. These assume that individual n chooses alternative i if this provides the greatest utility among the j alternatives. Each alternative is defined by a number of attributes. The utility that individual n obtains from alternative i (U_{ni}) is composed of a deterministic component (V_{ni}) and a stochastic component (ε_{ni}). V_{ni} is a function of the attributes of alternative i and the characteristics of individual n. ε_{ni} captures the unobservable factors that affect utility. In this study, V_{ni} is defined as a linear function of the attributes of a milk product. Assuming that the error terms (ε_{ni}) are independently identically distributed (iid) extreme values, the conditional logit (CL) probability of consumer n choosing milk i is:

$$P_{ni} = \frac{e^{\beta' x_i}}{\sum_j e^{\beta' x_j}} \qquad (1)$$

where β denotes a vector of parameters to be estimated and x indicates the bundle of attributes associated with a milk product.

Accommodating taste variation, the random parameters logit (RPL) probability takes the form:

$$P_{ni} = \int \left(\frac{e^{\beta' x_{ni}}}{\sum_j e^{\beta' x_{nj}}} \right) f(\beta) d\beta \qquad (2)$$

where $f(\beta)$ is a density function.

The latent class (LC) model is similar to the random parameters model. In the LC model, preference heterogeneity is modeled by assuming the existence of several latent classes which are not observable to the researchers. Consumer preferences are homogeneous within each of the classes, but differ across classes. Assuming there are m classes, the probability of individual n choosing milk i is:

$$P_{ni} = \sum_{m=1}^{M} s_{nm} \left(\frac{e^{\beta_m' x_i}}{\sum_j e^{\beta_m' x_j}} \right) \tag{3}$$

where s_{nm} denotes the probability that individual n is in class m, and β_m represents a vector of parameters specific to class m.

Assuming that the class membership (s_{nm}) is determined by an individual's socioeconomic characteristics (Z_n), the multinomial logit form of the probability that individual n belongs to class m is given by:

$$s_{nm} = \frac{e^{\lambda_m' Z_n}}{\sum_{m=1}^{M} e^{\lambda_m' Z_n}} \tag{4}$$

In this study, we employ the CL and RPL models to examine both the impacts of brand and certification on consumers' milk purchasing decisions and the joint effects between brand and certification. We expect both brand and certification to have positive effects on consumers' purchasing decisions and non-branded products to benefit more from certification than branded ones. We also expect that some consumers are loyal to brands and that consumers who report a higher level of trust in the food system are less likely to stay with one specific brand. These hypotheses are tested using a latent class model.

Data

Data employed in this study were collected through consumer surveys in five major cities in China in 2014. Local college students majoring in economics were hired and trained as enumerators to administer the surveys in Beijing, Shanghai, Guangzhou, Chengdu and Hangzhou. Respondents were recruited, using intercept methods, at selected large shopping malls and food stores located in different districts of the identified cities. Efforts were made to select a reasonably representative sample from residents of these cities. The survey consists of five sections. The first section contains questions that focus on different measures of trust and risk preferences. This is followed by a group of questions on respondents' milk consumption habits and their knowledge of different quality signals. The collection of data to enable analysis of the influence of quality signals on consumers' food choices are the focus of the third part of the survey; this is undertaken using an experimental simulation of market purchases of milk products bearing multiple quality signals. The attributes considered in this stated choice experiment are brand, organic certification, ISO9001 certification, HACCP (Hazard Analysis Critical Control Point) certification and price. The attributes and attribute levels are given in Table 1. We employ a fractional factorial experimental design which considers both the main effects and two-way interactions between the attributes. This design generates 32 choice sets. Each of these presents respondents with a choice from three options: two are milk products that differ in their attributes; a no-purchase option is also available. An example choice question is given in Figure 1. The 32 choice sets were grouped into four blocks, each of which contained 8 choice sets and each survey participant was randomly assigned to respond to one of the four blocks. The fourth survey section consists of questions on respondents' trust in the food system. We examined consumers' trust in four agents involved in the food system: government, farmers, food manufacturers and retailers. Following previous studies (De Jonge et al., 2010; De Jonge et

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al., 2007), trust in each of these agents is measured based on the three dimensions of competency, honesty and public interest using Likert scales. Respondent's social-economic and demographic characteristics are queried in the last section of the questionnaire.

Attributes	Attribute levels
Brand	Mengniu; Bright; New Hope; Unknown brand
Organic certification	Organic certification; Without organic certification
ISO9901 certification	ISO9901 certification; Without ISO9901 certification
HACCP	HACCP certification; Without HACCP certification
Price	CNY 8/liter; CNY 15/liter; CNY 22/liter; CNY 28/liter

Table 1. Attributes and attribute levels employed in the choice experiment on milk products

Product A	Product B
CNY 15/liter	CNY 8/liter

☐   Choose Product A

☐   Choose Product B

☐   No Purchase

Figure 1: An example choice question

We initially pre-tested the draft questionnaire in Chengdu and revised this based on the pre-test data. The recruited sample consists of people aged 18 years or older who buy milk products from time to time. The aggregated sample contains 1,213 complete surveys. Comparing the characteristics of the sample to the Chinese urban population using 2010 Census statistics, indicates that the sample is reasonably representative of the urban Chinese urban population. The average age of the survey respondents is 36.18 while the corresponding value for the urban population is 35.68 (National Bureau of Statistics of the People's Republic of China, 2010). Male respondents constitute 47 % of the sample, whereas, overall, males account for 51 % of the Chinese urban population. This gender bias may reflect women's somewhat higher involvement than males in food shopping. The sample is also somewhat biased toward individuals with higher levels of education than for the population. This may reflect the feature that the cities where the surveys were conducted are homes to many universities, leading the percentage of university graduates in our sample to be higher than for the nation.

Results and discussion

Consumer preferences for brands and certifications

Table 2 reports the results of the CL and RPL models. The CL model assumes homogenous consumer preferences while the RPL model takes preference heterogeneity into account. As seen in Table 2, the findings from these two models are generally consistent. The coefficient on the alternative specific constant of the no purchase option is positive and significant suggesting that consumers prefer not to make an expenditure if they are not satisfied with either of the two product alternatives. Coefficients on the brands are all positive, indicating that consumers are willing to pay a premium for branded products. Among the three brands employed in the choice experiment, Mengniu and Bright are national brands, while New Hope is a regional brand of

Sichuan province. Since we conducted surveys in five major cities in China and only Chengdu is in Sichuan province, it is not surprising to find that Mengniu and Bright have much stronger positive impacts than New Hope. Product certifications also add value to milk products, as seen by the significant positive coefficients on all the certification mechanisms considered (Organic, ISO, HACCP). Comparison of branding effects and certification effects indicate that brands have more influence on consumers' choices than certification. As expected, the price effect is negative and significant, suggesting that cheaper products are preferred. Results from the RPL model are generally similar, except that the magnitudes of the various influences differ. The significance of the standard deviation of preferences for each attribute indicates significant preference heterogeneity among consumers.

It is common to see branded milk products carrying multiple certifications by third parties. A question of interest is whether or not and to what extent certifications add value to branded milk products. Since both brand and certification signal a product of high quality, these overlap each other to some extent. Consequently, we expect to see a substitution effect between brands and certifications. This hypothesis is tested by examining the interaction term between brand and certification in the two models. As can be seen in Table 2, the coefficient on the interaction term is significantly negative in both the CL and the RPL models, suggesting evidence of substitution between brand and certification. Even so, the substitution effect is relatively small in comparison to the positive influences of brands and certifications, suggesting that a product with an established brand can also benefit from quality certification, but to a less extent than for a generic (i.e., unbranded) product.

	Conditional logit model		Random parameters logit model	
	Coefficient	Standard error	Coefficient	Standard error
No purchase	1.0528***	0.0721	0.6694***	0.1516
Mengniu	1.8264***	0.0887	2.8930***	0.1511
Bright	1.7101***	0.0976	2.6686***	0.1602
New Hope	1.0637***	0.0932	1.5933***	0.1478
Organic	0.5270***	0.0360	0.8620***	0.0607
ISO	0.4520***	0.0323	0.7291***	0.0556
HACCP	0.3914***	0.0347	0.6109***	0.0575
Price	-0.0103***	0.0021	-0.0197***	0.0038
Brand*Certification	-0.1772**	0.0890	-0.2530*	0.1409
Derived standard deviation of parameter distributions				
Sd-No purchase			2.9361***	0.1268
Sd-Mengniu			1.5650***	0.1095
Sd-Bright			1.5257***	0.0937
Sd-New Hope			1.1613***	0.1101
Sd-Organic			0.8562***	0.0684
Sd-ISO			0.6821***	0.0804
Sd-HACCP			0.5527***	0.0852
Sd-Price			0.0753***	0.0046
Sd-Brand*Certification			0.8700***	0.0946
Log-likelihood	-9074.2744		-7320.2971	
Pseudo-R ^{2}	0.1095		0.3134	

***,**,*represent significance levels of 1%, 5% and 10% respectively.

Table 2. Results of conditional logit model and random parameters logit models

The influence of habit and trust on consumers' preferences for quality signals

We employ a LC model to assess how habit and trust affect consumers' uses of quality signals.

Many consumer behaviors are habitual. We expect that there exists a brand loyalty consumer

segment as some consumers tend to continue to buy the same brand of milk products.

Individual's trust in the food system may also affect preferences for quality signals. We expect

that consumers who are more trusting are less likely to stay with a specific brand but will tend to

make trade-offs between the various attributes of a milk product. The results of the LC model are

presented in Table 3.

Estimation results of the LC model show two latent consumer segments. One striking feature

of segment 1 is that the alternative specific constant of the no purchase option is negative and its

absolute value is small relative to the other segment. The negative sign indicates that this group of consumers are averse to not purchasing any milk products, while the relatively small influence of this constant suggests that for these consumers, choices of a milk product are mainly determined by the attributes of the product. As can be seen, all the attribute variables are statistically significant, suggesting that consumers trade off all attributes considered when they make choices. Moreover, our results show consumers in this segment take into account the overlapping effect between brand and certification as the coefficient on the interaction term is negative. Habit has a positive influence in choosing a brand that an individual previously bought, but that influence is fairly small. Consequently, we name consumers in this segment "rational buyers". The striking feature of segment 2 is that habit has a strong positive effect on consumers' choice, since consumers in this group tend to habitually choose the same brand. We term the consumers in segment 2 "habitual buyers".

Relating an individual's segment membership to his/her socioeconomic characteristics, we find that those consumers who exhibit higher levels of trust in the food system are less likely to be habitual buyers. Consumers with a university degree or higher level of education are more likely to be rational buyers, while consumers with a higher level of income are less likely to be rational buyers.

	Class 1	Class 2
	(Rational buyers)	(Habitual buyers)
No purchase	-0.7629***	3.1084***
	(0.1256)	(0.2043)
Mengniu	1.7936***	1.7853***
	(0.1208)	(0.2345)
Bright	1.6648***	1.8882***
	(0.1298)	(0.2508)
New Hope	1.2652***	1.0170***
	(0.1235)	(0.2433)
Organic	0.6284***	0.5123***
	(0.0467)	(0.0897)
ISO	0.5143***	0.4620***
	(0.0407)	(0.0810)
HACCP	0.4919***	0.3216***
	(0.0445)	(0.0872)
Price	-0.0048*	-0.0301***
	(0.0025)	(0.0055)
Brand*Certification	-0.4603***	0.1254
	(0.1278)	(0.1833)
Habit	0.4394***	1.8563***
	(0.0571)	(0.0936)
Constant	0.7206***	
	(0.1927)	
University	0.5571***	
	(0.1397)	
High income	-0.3983**	
	(0.1976)	
Middle income	-0.1977	
	(0.1533)	
Trust in the food system	0.3795**	
	(0.1929)	
Risk aversion	-0.2546	
	(0.1649)	
Class probability	0.668	0.332
Log-likelihood	-7526.6154	
Pseudo-R^2	0.2940	

***,**,*represent significance levels of 1%, 5% and 10% respectively; Standard errors are given in parentheses.

Table 3. Results of the latent class model

Conclusions

This study examines how brand and certification affect Chinese urban consumers' food

purchasing behavior in the context of liquid milk products. We find that Chinese consumers tend

to buy branded rather than non-branded milk products and that milk products carrying quality

certifications are preferred. Regarding interrelationship between different quality signals, we find

a substitution effect between brand and certification, indicating that non-branded products benefit more from certification than do branded products.

The results from the latent class model reveal two latent consumer groups. One consists of habitual buyers, for whom brand has stronger impacts than certification. Consumers in the second group tend to make tradeoffs between different milk product characteristics. Respondents who exhibit higher levels of trust and education are more likely to be in this group.

In markets characterized by asymmetric information, effective quality signaling is important for both consumers and producers. The findings from this study shed some light on how quality signals affect consumers' food choices and provides information that may be useful for effective use of quality signals. Overall, the food market in China is characterized by low product quality, fragmented production and processing sectors, and ineffective monitoring systems (Wang et al., 2013). In these circumstances, effective use of accurate quality signals should enable consumers to distinguish higher quality products from those of lower quality. This can be expected to motivate firms to increase the quality of their products, which, over time, should help to restore consumers' confidence in China's food system.

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Variables	Definitions
No purchase	alternative specific constant of the no purchase option
Mengniu	1 if the brand is Mengniu; 0 otherwise
Bright	1 if the brand is Bright; 0 otherwise
New Hope	1 if the brand is New Hope; 0 otherwise
Organic	1if carrying "Organic" certification; 0 otherwise
ISO	1if carrying "ISO" certification; 0 otherwise
HACCP	1if carrying "HACCP" certification; 0 otherwise
Price	prices in Chinese yen per liter
Brand	1 if the brand is Mengniu or Bright or New Hope; 0 otherwise
Certification	1 if carrying a certification; 0 otherwise
Habit	1 if the brand of a product is the brand that a respondent often buys; 0 otherwise
University	1 if a respondent has a university degree or higher; 0 otherwise
High income	1 if a household's annual income is above 150,000; 0 otherwise
Middle income	1 if a household's annual income is between 50,000 and 150,000; 0 otherwise
Trust in the food system	1 if a respondent reported a higher level of trust in the food system; 0 otherwise
Risk aversion	1 if a respondent reported to be risk averse; 0 otherwise

Table A1.Definitions of the variables