Consumer Preferences for U.S. Pork in Urban China

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Selected Paper prepared for presentation at the Agricultural & Applied Economics Association 2009 AAEA & ACCI Joint Annual Meeting, Milwaukee, Wisconsin, July 26-29, 2009

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Introduction

As China makes its transition from a developing economy to a developed one, the world will notice that 20% of its population is becoming wealthier, demanding more goods, and eating more high quality food. Pork, being the primary meat in Chinese diets, will face a demand surge that will need to be met by increasing supply and an efficient supply-chain. This creates opportunities for domestic Chinese pork producers as well as pork imports from major hog producing countries around the world.

Pork has historically been the primary animal protein source in Chinese diets, and its consumption level has tripled between 1980 and 2003. Chinese consumers are earning higher incomes and shifting consumption away from grains and legumes toward meats and animal proteins; a variation of Bennett's Law, which states that as incomes increase, the source of calories shifts from carbohydrates to animal proteins. This is a phenomenon observed in many developing countries. In 2003, the average Chinese citizen consumed approximately 35.3 kilograms of pork, compared to 12.0 kilograms in 1980. Today, per capita pork consumption is estimated to be much higher as pork continues to be the primary meat consumed in China.

In the recent past, China has prohibited the importation of pork from the U.S., due to the use of ractopamine (RAC), a water-soluble feed additive that promotes lean meat production. However, rising costs of animal feed, land resources, veterinary supplies, and fuel as well as food inflation, are putting increasing pressure on China to negotiate trade deals with the U.S. and other countries. Although a potential market for pork exporting countries exists in China, little is known about Chinese consumer preferences and attitudes. Because most of the increase in pork consumption is expected around large cities, this study focuses on urban consumers.

The objective of this study is to assess and measure consumers' preferences and attitudes towards U.S. pork. This paper is organized as follows: first, Chinese pork demand and related consumer preference studies will be reviewed. Second, an overview of the survey conducted, data collected and methodology will be given. Third, a description of the models developed will be presented. Finally, implications of the econometric results are discussed.

Literature Review

There are several differences in the type of pork demanded by consumers in China, the U.S. and Europe. Chinese consumers place higher value on pork cuts considered less desirable by western standards. For example, internal organs (offal) sell at a premium compared to lean muscle meat in the same market. A second difference deals with the amount of external fat present in the meat. Chinese consumers prefer pork with a certain fat content as opposed to western consumers who are drawn to leaner cuts (Wang *et al.*, 1998). Studies have also found that pork in China is considered a necessity and is own-price elastic (Zhuang and Abbott, 2007).

Previous Chinese consumer preference studies have looked at consumer preferences for western-style convenience foods and consumer attitudes towards genetically modified foods in China (Curtis *et al.*, 2007 and Li *et al.*, 2002). Although previous work on Chinese urban demand for pork has been published, there are obvious omissions in this literature, especially with regards to imported pork. Specifically, no quantitative study was found that investigated Chinese consumers' food safety concerns with regards to pork and their acceptance of the hog-feed additive, ractopamine. In addition, there is a lack of information on factors that determine consumers' willingness-to-pay for U.S. pork.

Data

Consumer Survey

This research uses primary data collected from face-to-face interviews in Beijing and Shanghai in May 2008. A pilot survey was pretested on Chinese graduate students in the United States. The survey was conducted in eight separate locations including supermarkets, local stores and open markets within Beijing and Shanghai to appropriately represent the views of Chinese urban shoppers. The survey was administered primarily by graduate students from China Agricultural University and Shanghai Jiaotong University.

In accordance with previous studies that elicit consumers' willingness-to-pay for various products, the data was collected at the place where actual purchasing decisions are made (Curtis *et al.,* 2007). The survey locations, which were selected randomly, vary from wet markets and local butcher shops to domestic and international supermarkets. To better represent the views of the Chinese urban population, the survey was administered on various days of the week and at various times throughout the day. Survey participants were selected randomly and compensation was offered as an incentive for completing the survey. 165 valid observations were obtained.

Survey Design

The survey used in this study follows the format of previous questionnaires used to elicit consumers' willingness-to-pay and perceptions of various products. Survey participants were asked regarding their demographic characteristics such as gender, age, household income, education level, and number of children living in the household. Careful attention was used when arranging the order of the questions to ensure that the answer of one question would not

influence the response of a following question. With this in mind, participants were asked regarding their shopping habits and past purchasing behavior of imported products, meat products, pork products and specifically U.S. pork products.

In an effort to measure the impact of the use of RAC on consumers' pork purchasing behavior, participants were asked whether they would purchase RAC-fed pork. In addition, respondents were asked to rate several different types of pork cuts according to their preference and were asked to report the amount of each cut that they purchased per week.

To elicit and measure a consumer's willingness-to-pay (*WTP*) for U.S. pork, a dichotomous, double-bounded question format was used. The respondents were first asked if they were willing to pay the same price for U.S. pork as for domestic pork. In this model the initial bid, B_0, represents no price difference between U.S. and domestic pork. The second bid is dependent on the response to the first bid. It will be a discount bid (B_D) [1] if the respondents answer that they would not buy U.S. pork at the same price as domestic pork. If they answer that they would buy U.S. pork at the same price as domestic pork, a premium bid (B_P) is offered. Based on the answers to the dichotomous questionnaire the following *WTP* levels were constructed:

Level 1 $WTP < B_D$

Level 2 $B_D \leq WTP < B_0$

Level 3 $B_0 \leq WTP < B_P$

Level 4 $B_P \leq WTP$

[1] When asking these double-bounded questions, a 5% discount or premium was used to distinguish in an ordinal way between willingness-to-pay levels. The use of a large percentage discount or premium would have distorted or highly influenced the respondent's answers to the follow up questions.

Survey Results

The majority of survey respondents were the primary food buyers of their households (92%) and female (73%). The mean age of the respondents was 48.16 years and their average education level was equivalent to a high school degree. Their average annual household income fell in the range of 50,000 to 70,000 RMB[2]. The mean number of people living in the respondent's household was 3.48 and 53% of individuals had seen their household income increase over the past two years. A concise description and breakdown of basic demographic characteristics can be found in Table 1.

With regards to shopping behavior and preferences, the average consumer shopped for groceries 2-5 times per week. 18% of respondents indicated that they purchase most of their meat at wet/farmer's markets, 6% at local meat stores, 51% at domestic supermarkets[3] and 25% at international supermarkets. 19% of respondents stated that they had purchased imported meat products in the past and 4% indicated that they had either purchased or eaten U.S. pork (a figure that is indicative of very little U.S. pork being imported into China). In addition, 48% of consumers stated that they had purchased frozen pork. With regards to food safety, 70% of participants viewed low food safety risk as more important than lower food costs. Table 2 shows a complete list of shopping behavior and preference statistics.

[2] Equivalent to $6,795-$9,513 US Dollars.
[3] A Chinese domestic supermarket is similar to a grocery store in the U.S. or Europe.

Table 1. Demographic Statistics (n=165).

Variable	Description	Distribution (%)	Model Code
Age	Age as of May 2008	Mean= 48.16 S.d. = 14.04	AGE
Gender	Male=1, Female =0	27%	GEN*
Primary Shopper	Yes=1, No=0	92%	N/A**
Education	1. Primary school 2. Junior middle school 3. Senior high school 4. 4-year college or university 5. Adv. or professional degree	3% 12% 42% 30% 13%	EDU
Household Income	1. < 10K RMB 2. 10K-30K RMB 3. 30K-50K RMB 4. 50K-70K RMB 5. 70K-100K RMB 6. > 100K RMB	3% 15% 22% 18% 18% 26%	INC
Income change (past 2 years)	1. Increased 2. Decreased 3. Stayed about the same	54% 5% 42%	N/A**
Children	1 if children in household 0 if otherwise	34% 66%	CHI*
Household Size	People living in household	Mean= 3.49 S.d. = 1.26	HHS

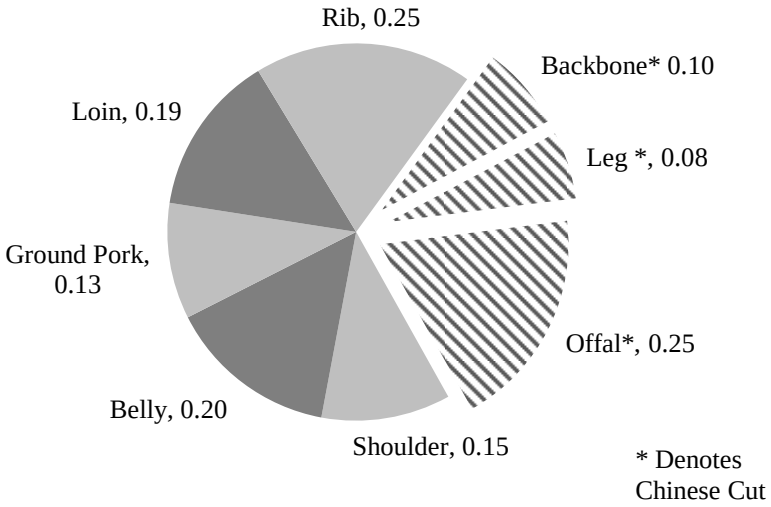
* Denotes dummy variables. ** Denotes the variable is not used in the model.

Table 2. Shopping Behavior and Preference Statistics (n=165).

Variable	Description	Distribution (%)	Model Code
Shopping Frequency	1. Daily	35%	SHF
	2. 2-5 times per week	36%	
	3. Once a week	22%	
	4. Once every two weeks or <	7%	
Purchase Location	1. Intl. chain supermarket	25%	MKTI*
	2. Domestic chain supermarket	51%	MKTD*
	3. Local meat store	6%	} Default
	4. Wet/Farmers' market	18%	
Food safety risks vs. food cost	1. Low food safety risks all important	41%	FSP
	2. Food safety > food cost	29%	
	3. Food safety = food cost	27%	
	4. Food cost > food safety	2%	
	5. Low food cost all important	1%	
Imported Meat	1. Have bought	19%	N/A
	2. Have not bought	71%	
	3. Don't know	10%	
Most Important Pork Attribute	1. Fat Content	38%	ATTF*
	2. Color	56%	ATTC*
	3. Other	6%	Default
U.S. pork	1. Have purchased or eaten	4%	N/A
	2. Have not purchased or eaten	83%	
	3. Don't know	13%	
Frozen pork	1. Have purchased	48%	FRZ*
	2. Have not purchased	52%	Default
RAC pork	1. Would purchase RAC pork	22%	RAC
	2. Would not purchase RAC pork	78%	

* Denotes dummy variables. ** Denotes the variable is not used in the model.

The amount of pork purchased by each individual was divided into either a western-style cut or a traditional Chinese cut (Figure 1)[4]. The most purchased pork cut was rib meat (.25 kg per week) followed by belly (.20 kg per week) and loin (.19 kg per week). From the point of view of international hog producers, overall Chinese pork demand is complementary to that of western consumer demand. Western consumers prefer lean muscle meat, while Chinese consumers welcome fatty meat cuts, backbones, feet tail and offal (internal organs).



Source: Survey Data.

Figure 1. Avg. per Capita Weekly Purchase of Pork in kg.

Methodology

Three separate types of models were developed to explain consumer preferences and attitudes towards U.S. pork. First, a willingness-to-pay model was used to determine the factors that influence urban Chinese consumers' willingness-to-pay for U.S. pork. The model was estimated using both pooled and city-specific data to examine the regional effects from the cities

[4] Western-style cuts in China are not necessarily perceived to be 'western.'

of Beijing and Shanghai. Second, a binary model was created to determine the factors that affect consumers' acceptance of RAC-fed pork. Last, a proportionate linear model was created to identify factors that affect consumer purchasing behavior of western-style pork cuts versus traditional Chinese cuts.

WTP Models

Given the discrete and ordered nature of the survey data, an individual's willingness-to-pay (*WTP)* for U.S. pork can be modeled using an ordered logit model. An individual's *WTP* can be modeled as a linear function of the observable explanatory variables,x, including a constant, and the unobservable variables, ε (Greene, 2003).

$$WTP = x\beta + \varepsilon \qquad (1)$$

Although unobserved, an individual's *WTP* can be grouped into four categories based on his/her answers to the dichotomous questions in the survey. What we observe is:

$y = 1$	when $WTP < 0.95P$		$WTP^* < 0$
$y = 2$	when $0.95P \leq WTP < P$	OR	$0 \leq WTP^* < \alpha_1$
$y = 3$	when $P \leq WTP < 1.05P$		$\alpha_1 \leq WTP^* < \alpha_2$
$y = 4$	when $1.05P \leq WTP$		$\alpha_2 \leq WTP^*$

where $WTP^* = WTP - 0.95P$, and P is the price of the contrast or default commodity, domestic pork in this case.

The unknown parameters, α's, are estimated jointly with the utility parameters in the vector β. We assume that ε is logistically distributed across observations and the α's are restricted so that $\alpha_1 < \alpha_2$. The log-likelihood function can be obtained and the four probabilities are:

$$Prob\ (y = 1|\ x)\ =\ F\ (-x\ \beta),\qquad (2)$$

$$Prob\ (y = 2|\ x)\ =\ F\ (\alpha_1 - x\ \beta) - F\ (-x\ \beta),$$

$$Prob\ (y = 3|\ x)\ =\ F\ (\alpha_2 - x\ \beta) - F\ (\alpha_1 - x\ \beta),$$

$$Prob\ (y = 4|\ x)\ =\ 1\ - F\ (\alpha_2 - x\ \beta)$$

where *F*(.) is the standard logistic distribution with mean zero and standard deviation $\pi/\sqrt{3}$.

Model (1) can be expressed specifically as (3) for the pooled Beijing and Shanghai data estimation,

$$WTP = \beta_0\ +\ \sum_{i=1}^{n}(\beta_i x_i) +\ \varepsilon \qquad (3)$$

where β_i represents the combined Beijing and Shanghai effect of the explanatory variables on *WTP*. A dummy variable for Shanghai, *S*, is added to the equation to capture the differences between Beijing and Shanghai consumers as in (4).

$$WTP =\ \beta_0 + S\ \beta'_0\ +\ \sum_{i=1}^{n}(\beta_i x_i +\ \beta'_i\ S\ x_i\ ) + \varepsilon \qquad (4)$$

where β_i is the coefficient that captures the Beijing effect of the explanatory variables on *WTP* and β_i'captures the additional effect from the city of Shanghai for the corresponding explanatory variables.

Ractopamine Model

To further examine the factors that affect Chinese consumers' preferences for U.S. pork, a binary choice, logit model was used to determine whether consumers are willing to purchase

RAC-fed pork. For this model, the survey participants reported that they would purchase (Y=1) or they would not purchase (Y=0), so that

$$Prob\ (Y = 1) = \ F\ (x, \beta)$$
$$Prob\ (Y = 0) = 1 - F\ (x, \beta) \qquad (5)$$

The set of parameters β reflects the impact of changes in x on the probability of purchasing RAC-fed pork.

Pork Cuts Model

A linear regression model is used to look at the factors that explain the purchasing behavior of western-style cuts. In this model, the dependent variable, y, represents the percent of western-style cuts purchased,

$$y = \frac{Quantity\ of\ Western\ \ Cuts}{Quantity\ of\ Western\ Cuts + Quanity\ of\ Chinese\ Cuts} \qquad (6)$$

Both a pooled and a city-specific version of the model were estimated.

Model Results and Discussion

Estimation results for the *WTP* model are presented in Table 3. The aggregate model reveals that age had a negative effect on *WTP* for U.S. pork, relative to domestic or Chinese pork. It is plausible that older Chinese citizens are more reluctant to purchase foreign produced goods because they are either less understanding of imported food products or due to nationalistic and patriotic reasons. Younger Chinese individuals are considered more progressive and have favorable views towards American products. In addition, having previously purchased frozen pork had a significant, positive effect on *WTP* for U.S. pork. Although recent shipments

of U.S. pork to China have been chilled instead of frozen, Chinese consumers perceive that pork imported from the U.S. must be frozen. In general, Chinese consumers prefer meat, poultry, and fish as fresh as possible, which is evidenced by the fact that many of these commodities are on display live at wet markets and restaurants. However, with busier urban life, people tend to shop less frequent and make more use of their freezers at home, which has resulted in higher acceptance of frozen meat. Almost half of the survey respondents had purchased frozen meat, and were more willing to pay for imported meat.

The aggregate model also indicated that individuals that shop at international supermarkets have a higher willingness-to-pay for U.S. pork. This can be attributed to the fact that individuals who shop at international chain stores place higher trust on international sources of foods than those who shop mostly at domestic stores or local markets.

The food safety variable is insignificant in the *WTP* model, indicating that consumers have not established a clear link between U.S. pork and food safety issues. Although we will show that this variable does significantly influence aggregated consumers' acceptance of RAC and they perceive it as unsafe, there must exist other food safety advantages to U.S. pork that offset disadvantages such as the use of antibiotics, a common issue seen in Chinese domestic livestock production.

Table 3. Parameter Estimates for the U.S. Pork WTP Model .

Variable	Aggregate Model		City-Specific Model	
	Coefficient	S.E.	Coefficient	S.E.
CONS	1.77**	1.07	1.44*	1.31
GEN	N/A	N/A	N/A	N/A
AGE	-0.03***	0.01	-0.01	0.01
INC	0.07	0.12	0.14	0.16
EDU	-0.05	0.19	-0.05	0.24
HHS	-0.13	0.16	-0.45***	0.21
CHI	0.07	0.42	0.63	0.51
FRZ	0.68***	0.32	0.88***	0.39
FSP	0.08	0.18	0.03	0.22
ATTF	-0.25	0.63	-0.42	0.75
ATTC	-0.88	0.61	-1.00	0.75
MKTI	0.80*	0.50	0.97**	0.58
MKTD	0.49	0.42	0.38	0.52
S			2.86	2.65
SGEN			N/A	N/A
SAGE			-0.07***	0.03
SINC			-0.28	0.26
SEDU			-0.20	0.51
SHHS			0.47	0.41
SCHI			-0.90	1.25
SFRZ			-0.68	0.88
SFSP			0.83**	0.51
SATTF			1.00	1.44
SATTC			0.08	1.45
SMKTI			-1.25	1.81
SMKTD			0.44	0.98
Log Likelihood	-186.50		-177.05	
α_1	0.77***	0.14	0.85***	0.15
α_2	2.21***	0.25	2.43***	0.27

Note: Single, double, triple asterisks (*) denote significance at the .15, .10, and .05 levels, respectively. “S” in front of a variable denotes that variable has been multiplied by the Shanghai dummy.

The city-specific model revealed that consumers in the two cities respond similarly to U.S. pork except with respect to two variables: age and food safety. The model explained that the aggregated age impact was primarily due to Shanghai consumers, while the effect was not significant among Beijing consumers. The raw survey data indicates that young Shanghai consumers have on average the highest *WTP* level for U.S. pork out of the entire survey sample. The city-specific model also revealed that food safety was a significant variable for Shanghai consumers; this was not the case for Beijing consumers. The more (less) individuals in Shanghai cared about food safety, the lower (higher) their *WTP* for U.S. pork. Although the model revealed that Shanghai consumers have food safety concerns regarding U.S. pork, U.S. products in China enjoy a general good reputation in terms of safety and quality relative to domestic products. These results clearly indicate that information is very important in influencing consumption and food purchasing decisions. The city-specific model also predicted that household size in Beijing had a negative impact on consumers' *WTP* for U.S. pork. Larger households tend to be more budget conscious and will typically purchase a cheaper domestic option.

The estimation results for the RAC acceptance model can be found on Table 4. The only significant variable affecting consumer acceptance of RAC in the aggregate model was food safety. Comparing this result with that of the city-specific RAC model, we see that this effect is primarily attributed to Shanghai consumers. The more (less) Shanghai consumers care about food safety, the less (more) likely they are to accept or purchase RAC-fed pork. In addition, education was found to have a negative effect on RAC acceptance. Although a brief explanation and description of RAC was provided to the survey participants, it is worth noting that in China RAC is perceived to be highly associated with the lean-meat drug Clenbuterol. In 2006, over 330

Chinese individuals were reported to have been poisoned by eating pork contaminated with Clenbuterol[5]. This incident has exposed many loopholes in China's food safety inspection system and has made citizens more skeptical about lean meat additives, and more concerned about meat safety issues. The city-specific model also found that in Shanghai income had a negative effect on RAC acceptance.

The results of the pork cuts model are presented in Table 5. An ordinary least square regression was used and the Breusch-Pagan and Cook-Weisberg tests revealed no heteroscedasticy problems. The aggregate model found that age, income, education, and food safety concerns were all factors that influenced the types of pork cuts individuals purchased. The older and more educated consumers were, the more western-style pork cuts they purchased. Western-style pork cuts on average contain less fat and tend to be healthier. Older individuals are more health conscious and thus purchase leaner cuts of meats. In addition, this result reinforces other studies that show that more educated individuals tend to make healthier food purchase decisions.

Household income had a significant, negative impact on the percentage of western-style pork cuts purchased. This can be explained by the fact that Chinese demand for pork is complementary to that of western demand. That is Chinese households tend to place higher value on the less desirable western cuts and discount the traditional U.S./European cuts. Traditional Chinese pork cuts are limited in supply relative to western cuts and are considered a luxury in China. The city-specific model revealed that household income from Shanghai had a greater negative effect than Beijing, the only difference in cut preference between the two cities.

[5] Both Clenbuterol and Ractopamine are beta-agonists and enhance protein accretion in animals by diverting energy to the production of muscle tissue versus fat. The important difference is that Clenbuterol is fat-soluble and thus is deposited in fat tissues of the animal and remains there for long periods of time where Ractopamine is water-soluble and disappears from the animal within 24 hours of withdrawal thus nearly eliminating the risk of human exposure from pork consumption.

Table 4. Parameter Estimates for the RAC Model.

Variable	Aggregate Model		City-Specific Model	
	Coefficient	S.E.	Coefficient	S.E.
CONS	-0.70	1.31	0.29	1.50
GEN	-0.45	0.52	-0.26	0.60
AGE	-0.02	0.02	-0.02	0.02
INC	0.00	0.15	0.33*	0.22
EDU	-0.34	0.24	-0.68***	0.34
HHS	0.26	0.20	0.02	0.27
CHI	-0.65	0.55	-0.94*	0.66
FRZ	N/A	N/A	N/A	N/A
FSP	0.48***	0.21	0.18	0.28
ATTF	N/A	N/A	N/A	N/A
ATTC	N/A	N/A	N/A	N/A
MKTI	N/A	N/A	N/A	N/A
MKTD	N/A	N/A	N/A	N/A
S			-1.50	3.30
SGEN			-0.24	1.81
SAGE			0.00	0.04
SINC			-0.87***	0.39
SEDU			-0.27	0.76
SHHS			0.83	0.67
SCHI			0.14	1.71
SFRZ			N/A	N/A
SFSP			1.61***	0.75
SATTF			N/A	N/A
SATTC			N/A	N/A
SMKTI			N/A	N/A
SMKTD			N/A	N/A
Log Likelihood	-74.36		-66.44	
α_1	N/A		N/A	N/A
α_2	N/A		N/A	N/A

Note: Single, double, triple asterisks (*) denote significance at the .15, .10, and .05 levels, respectively.

Table 5. Parameter Estimates for the Pork Cut Purchase Model.

	Aggregate Model		City-Specific Model	
Variable	Coefficient	S.E.	Coefficient	S.E.
CONS	72.23***	10.49	73.75***	13.46
AGE	0.35***	0.11	0.29***	0.14
INC	-2.82***	1.11	0.29	1.55
EDU	3.76***	1.81	2.24	2.31
HHS	-1.13	1.32	-1.60	1.71
SHF	-2.18	1.82	-3.10	2.18
ATTF	-6.77	6.66	-8.84	8.41
ATTC	-7.90	6.42	-11.70	8.20
MKTI	5.94	4.99	5.72	5.75
MKTD	4.72	4.03	0.85	5.15
FSP	-4.99***	1.75	-4.41***	2.16
S			8.03	22.46
SAGE			-0.08	0.25
SINC			-5.76***	2.34
SEDU			2.20	4.21
SHHS			-0.48	2.78
SSHF			5.31	4.54
SATTF			10.26	13.79
SATTC			10.68	13.19
SMKTI			-5.48	13.87
SMKTD			4.66	8.53
SFSP			0.60	4.18
Adjusted R-Squared	0.16		0.17	

Note: Single, double, triple asterisks (*) denote significance at the .15, .10, and .05 levels, respectively.

Summary and Conclusions

This study examines urban consumer preferences and attitudes towards U.S. pork. Age, household size, previous purchase of frozen pork and food safety concerns were all significant variables in determining a consumer's *WTP* for U.S. pork. This research is one of the first to implement a consumer survey regarding preferences and attitudes towards U.S. pork in China. Our study revealed that Chinese consumers are reluctant to accept pork that contains lean-meat additives. This is an issue tied specifically to a lack of consumer confidence on the Chinese food inspection system due to a previous lean-meat additive scare.

This study also found that Chinese consumers have a positive perception of U.S. pork. The survey was conducted only a few months before the infamous melamine tinted infant formula scandal. Right after this scandal, imported baby formula led by U.S. top brands quickly sold out in Chinese markets. This shows that food-safety-sensitive Chinese consumers place trust on U.S. products. Given that younger individuals have a higher *WTP* for U.S. pork, the outlook for imported pork in China remains optimistic. Factors that influence the purchasing decision of different pork cuts were also investigated. It was found that older and more educated individuals purchased more western-style pork cuts. Higher incomes were found to have a negative effect on western-style pork consumption, reaffirming existing literature on Chinese pork demand.

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