



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

## **Chinese Consumers' Preferences for Livestock Products**

### **Authors**

**Xuehua Peng**

### **Contact Information**

Department of Agricultural Economics  
University of Kentucky  
326 C. E. Barnhart Bldg.  
Lexington, KY 40546-0276  
Tel: (859) 257-7272 ext. 278  
Fax: (859) 257-7290  
Email: [xpeng3@uky.edu](mailto:xpeng3@uky.edu)

**Mary A. Marchant**

Department of Agricultural Economics  
University of Kentucky  
314 C. E. Barnhart Bldg.  
Lexington, KY 40546-0276  
Tel: (859) 257-7260  
Fax: (859) 257-7290  
Email: [mmarchan@uky.edu](mailto:mmarchan@uky.edu)

**Xiang Dong Qin**

Department of Economics  
Shanghai JiaoTong University,  
Shanghai, P. R. China  
Tel: (86) 21-62933200 ext. 8614  
Fax: (86) 21-62932982  
Email: [xdqin@sjtu.edu.cn](mailto:xdqin@sjtu.edu.cn)

**Jun Zhuang**

Department of Agricultural Economics  
University of Kentucky  
328 C. E. Barnhart Bldg.  
Lexington, KY 40546-0276  
Tel: (859) 257-7272 ext. 270  
Fax: (859) 257-7290  
Email: [jzhua3@uky.edu](mailto:jzhua3@uky.edu)

***Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Montreal, Canada, July 27-30, 2003***

*Copyright 2003 by Xuehua Peng, Mary A. Marchant, Xiang Dong Qin and Jun Zhuang. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.*

# Chinese Consumers' Preferences for Livestock Products

Xuehua Peng, Mary A. Marchant, Xiang Dong Qin and Jun Zhuang\*

**Abstract:** *Based on a consumer survey with over 700 observations, Chinese consumer preferences of livestock product attributes were evaluated using factor analysis and probit models. Regional and time differences were examined. Empirical results provide U.S. exporters with valuable information on China's emerging livestock market, its potential, and market access strategies.*

## Introduction

China's food production and distribution systems realized remarkable development over the past two decades. Chinese consumers have gradually shifted their food consumption from basic staple foods to more protein-rich livestock products (Qin, et al., 2002; Peng, 2002). Additionally, the *quantity* of food available is no longer in short supply for most Chinese consumers, especially for urban residents. With rapid livestock supply growth, stimulated by the profound transformation in China's livestock product retail markets, Chinese consumers have more freedom to make consumption choices in terms of their own preferences. This research examines these preferences for China's livestock products.

Even in the early 1990s, dominant retail outlets in China consisted of wet markets<sup>1</sup> and non-staple food stores. However, in recent years the introduction of supermarkets and convenience store chains has fundamentally changed the Chinese market outlet structure (Moustakerski, 2001). Supermarkets are now common throughout China. According to China's

---

\* Xuehua Peng and Jun Zhuang are graduate research assistants and Mary A. Marchant is a professor in the Department of Agricultural Economics, University of Kentucky. Xiang Dong Qin is an associate professor in the Department of Economics, Shanghai Jiaotong University in China.

<sup>1</sup> Wet markets are open-air stalls where Chinese consumers have traditionally shopped for fresh vegetables, meat and seafood. Wet markets sell locally grown produce almost exclusively.

Chain Store Association (Bean, et al., 2002), as of 2001 there were 91 retail chain store companies in China with total sales revenue of 116 billion Yuan RMB.<sup>1</sup> The total number of stores equaled 7,953, of which 3,328 were supermarkets, 271 hypermarkets, 3,342 convenience stores and 60 warehouse stores. Over half of China's convenience stores were located in Shanghai.

The above transition of China's retail market promises great sales potential for frozen and chilled livestock products, especially as refrigerator ownership increases in China. The proportion of households nationally that purchase frozen foods grew from 13% in 1994 to 38% in 1998 (Lyon and Durham, 1999). In urban areas, frozen food purchases are even higher. 20% of Chinese consumers purchase livestock products from supermarkets and food stores (Reynolds, 1998). This 20% represents a growing market since these consumers are newly enriched Chinese (middle class group) who are willing to pay more for quality products and convenience.

Livestock products sold in Chinese supermarkets and food stores command a 10%-plus price premium compared to products sold on the wet market. This price premium stems from special product attributes (e.g., clear labeling, customized cuts, and packaging) that wet market products do not possess. It is crucial for U.S. exporters to know how and why these attributes are evaluated by Chinese consumers since most U.S. meat exports to China are chilled or frozen, and sold in supermarkets and food stores (Lyon and Durham, 1999).

However, Chinese consumers' evaluation of frozen and/or chilled livestock product attributes is not extensively discussed in the literature and is mainly anecdotal. Previous studies have found that socioeconomic, geographic and demographic variables can be important factors

---

<sup>1</sup> The current exchange rate is about 8.27 Yuan RMB : 1 U.S. dollar.

in determining consumers' preferences toward meat consumption (Senauer, et al., 1992; Cui, 1997). Hui et al., (1995) suggested examining the relationship between consumers' importance ratings of meat attributes and variables representing their socioeconomic, geographic and demographic backgrounds.

The overall objective of this research is to evaluate Chinese consumers' preferences on frozen and/or chilled livestock products purchased in supermarkets and food stores, which can ultimately help livestock distributors, including U.S. livestock exporters, better understand the Chinese livestock market. To obtain this overall objective, the following specific objectives are included:

1. to detect the interrelationship between initially selected product attributes using the factor analysis methodology,
2. to estimate a series of ordered-probit models for different groups of consumers, and
3. to examine the regional differences and time trend by conducting statistical tests.

This paper is organized as follows: First, we describe our Chinese consumer preference survey including the 7 attributes associated with livestock purchases and their corresponding importance ratings. Information from our consumer survey is used in two methodologies – factor analysis and a probit model. Our factor analysis uses a latent variable technique to determine the interaction between the importance ratings of each attribute. Results will tell us what attributes will reflect the same latent factor of consumers' preferences and which latent factor will be the most important in determining consumers' livestock purchasing preferences. The probit analysis uses the socioeconomic, demographic and geographic variables from our survey to assess their influence on the importance ratings given by consumers on each livestock

product attribute. Finally, implications from our results are drawn for livestock distributors, focusing on U.S. livestock exporters to China.

### **Consumer Preference Survey**

Following up on our 2001 pre-test survey of Chinese consumer preferences survey (Qin, et al., 2002), an administrative survey was conducted in the summer of 2002. In the design of this survey, consumers' perception of selected livestock product attributes was assumed to be elicited by their importance ratings of each selected attribute, using a scale from 1 to 5 (1 being not important at all and 5 being extremely important). The selected attributes associated with frozen/chilled livestock products purchased from supermarkets and food stores were (1) *product quality*, (2) *labeling*, (3) *price*, (4) *packaging*, (5) *brand name* (6) *cooking convenience* and (7) *the shopping environment*.

The total observations analyzed in this study equaled 784, among which 384 observations (218 from Shanghai and 166 from Nanjing) were in 2001 and 400 observations (200 from both cities) in 2002. Respondents' background information is listed in Table 1. As shown in the table, about 75% of respondents come from small-sized households, which have 3 or fewer persons. This might result from China's strict "only one child" policy.

About 70% of families in Nanjing and about 80% of families in Shanghai have an average household monthly income of more than 1,500 Yuan RMB. And this percentage continues to increase over time. Such data indicates that Chinese consumers, especially those in urban areas, have the potential to buy high valued frozen/chilled livestock products. This is consistent with other reports that there is a large population of middle class with high disposable

**Table 1: Background Information of Respondents**

|  |                   | 2001    |       |          |       | 2002    |       |          |       | Total  |       |
|--|-------------------|---------|-------|----------|-------|---------|-------|----------|-------|--------|-------|
|  |                   | Nanjing |       | Shanghai |       | Nanjing |       | Shanghai |       |        |       |
|  |                   | Number  | %     | Number   | %     | Number  | %     | Number   | %     | Number | %     |
| <b>Gender</b>                                      |                   |         |       |          |       |         |       |          |       |        |       |
|  | Male              | 72      | 43.11 | 92       | 42.20 | 57      | 28.50 | 65       | 32.50 | 286    | 36.43 |
|  | Female            | 95      | 56.89 | 126      | 57.80 | 143     | 71.50 | 135      | 67.50 | 499    | 63.57 |
|  | Total             | 167     |       | 218      |       | 200     |       | 200      |       | 785    |       |
| <b>Age</b>   |                   |         |       |          |       |         |       |          |       |        |       |
|  | 25&Less           | 34      | 20.36 | 32       | 14.68 | 15      | 7.50  | 18       | 9.00  | 99     | 12.61 |
|  | 25-39             | 75      | 44.91 | 82       | 37.61 | 78      | 39.00 | 69       | 34.50 | 304    | 38.73 |
|  | 40-49             | 26      | 15.57 | 68       | 31.19 | 45      | 22.50 | 55       | 27.50 | 194    | 24.71 |
|  | 50-65             | 30      | 17.96 | 32       | 14.68 | 49      | 24.50 | 49       | 24.50 | 160    | 20.38 |
|  | Above65           | 2       | 1.20  | 4        | 1.83  | 13      | 6.50  | 9        | 4.50  | 28     | 3.57  |
|  | Total             | 167     |       | 218      |       | 200     |       | 200      |       | 785    |       |
| <b>Marital Status</b>                              |                   |         |       |          |       |         |       |          |       |        |       |
|  | Single            | 43      | 25.75 | 52       | 23.85 | 23      | 11.50 | 31       | 15.50 | 149    | 18.98 |
|  | Married           | 123     | 73.65 | 160      | 73.39 | 175     | 87.50 | 164      | 82.00 | 622    | 79.24 |
|  | Widow/divorced/   | 1       | 0.6   | 6        | 2.75  | 2       | 1.00  | 5        | 2.50  | 14     | 1.80  |
|  | Total             | 167     |       |          |       | 200     |       | 200      |       | 785    |       |
| <b>Average Household Monthly Income (Yuan RMB)</b> |                   |         |       |          |       |         |       |          |       |        |       |
|  | Less than 800     | 7       | 4.19  | 15       | 6.88  | 15      | 7.50  | 4        | 2.00  | 41     | 5.22  |
|  | 800-1499          | 47      | 28.14 | 44       | 20.18 | 60      | 30.00 | 34       | 17.00 | 185    | 23.57 |
|  | 1500-2499         | 63      | 37.72 | 66       | 30.28 | 60      | 30.00 | 52       | 26.00 | 241    | 30.70 |
|  | 2500-3499         | 37      | 22.16 | 52       | 23.85 | 36      | 18.00 | 43       | 21.50 | 168    | 21.40 |
|  | 3500&Above        | 12      | 7.19  | 41       | 18.81 | 26      | 13.00 | 67       | 33.50 | 146    | 18.60 |
|  | Total             | 166     |       | 218      |       | 197     |       | 200      |       | 784    |       |
| <b>Education Level</b>                             |                   |         |       |          |       |         |       |          |       |        |       |
|  | Below High school | 28      | 16.77 | 51       | 23.39 | 35      | 17.50 | 38       | 19.00 | 152    | 19.36 |
|  | High School       | 47      | 28.14 | 70       | 32.11 | 91      | 45.50 | 83       | 41.50 | 291    | 37.07 |
|  | College           | 87      | 52.10 | 84       | 38.53 | 71      | 35.50 | 75       | 37.50 | 317    | 40.38 |
|  | Master & Above    | 4       | 2.40  | 13       | 5.96  | 3       | 1.50  | 4        | 2.00  | 24     | 3.06  |
|  | Total             | 166     |       | 218      |       | 200     |       | 200      |       | 784    |       |
| <b>Household Size</b>                              |                   |         |       |          |       |         |       |          |       |        |       |
|  | 1                 | 11      | 6.59  | 4        | 1.83  | 8       | 4.00  | 3        | 1.50  | 26     | 3.31  |
|  | 2                 | 32      | 19.16 | 20       | 9.17  | 24      | 12.00 | 27       | 13.50 | 103    | 13.12 |
|  | 3                 | 80      | 47.90 | 120      | 55.05 | 118     | 59.00 | 108      | 54.00 | 426    | 54.27 |
|  | 4                 | 27      | 16.17 | 51       | 23.39 | 19      | 9.50  | 28       | 14.00 | 125    | 15.92 |
|  | 5                 | 8       | 4.79  | 23       | 10.55 | 22      | 11.00 | 31       | 15.50 | 84     | 10.70 |
|  | 6                 | 6       | 3.59  | 0        | 0     | 9       | 4.50  | 3        | 1.50  | 18     | 2.29  |
|  | Total             | 164     |       | 218      |       | 200     |       | 200      |       | 782    |       |

income available for discretionary spending (Reynolds and Hatfield, 1996; *The Economist*, 1999).

In China, shopping is traditionally considered as the responsibility of the mother/wife in China. Occasionally, the father/husband alone or the father/husband together with his wife shop. This is reconfirmed by our survey results that more than 60% of respondents who were randomly selected in the supermarket were female.

The survey results indicate that an increasing number of consumers shop at supermarkets and food stores to buy livestock products. About 53% of respondents in 2001 chose supermarkets as their main source for livestock products. In 2002, this number increased to 66%. Some respondents stated that supermarkets ensure higher hygienic standards for livestock products, and also provide a better shopping environment. During the summer, due to the shortage of cold storage facilities, meat in wet markets is easily spoiled. Therefore, consumers are more willing to pay a premium for higher quality livestock products. This signifies a great market potential for U.S. livestock products, which are generally considered high quality products by Chinese consumers.

### **Research Methodologies**

This analysis on consumer preferences stems from Lancaster's characteristics methodology (Lancaster, 1991). According to Lancaster's perspective, consumption utility is derived directly from the characteristics of goods and indirectly from the consumed goods. Utility or preference ordering is assumed to rank collections of characteristics directly and goods are ranked indirectly through the characteristics they possess. With respect to Chinese



consumers' livestock product consumption behavior, this methodology enables us to analyze Chinese consumers' preferences on selected livestock product attributes, which shape their shopping behavior.

A consumer's utility function associated with the purchase of frozen/chilled livestock products from supermarkets or food stores is postulated in terms of importance ratings of selected product attributes, and is hypothesized that these importance ratings are determined by a vector ( $X$ ) of the consumers' socioeconomic, geographic and demographic factors.

### *Factor Analysis*

To get an overall image of Chinese consumers' preferences on the seven selected attributes, a factor analysis is conducted to detect the interrelationship between consumers' ratings on each attribute. Essentially, factor analysis assumes that the observed variables  $y_i$  are related to a set of unobserved latent variables  $z_i$  (or "factors"). The relationship between vectors and is stochastic and may be expressed by a conditional probability function  $p(Y|Z)$  being the distribution of  $Y$  given  $Z$ . A crucial assumption with factor analysis is that of conditional independence, which means that the observed dependence among the  $y_i$  is wholly explained by their dependence on the  $z_i$ . The formal expression of the hypothesis is that the observed variables are describable in terms of a smaller number of latent dimensions. After determining the latent variables, we may map the observed variables  $y_i$  space to the latent variables  $z_i$  space via the conditional distribution of  $Y$  given  $Z$ . No single value of  $Z$  is associated with a given  $Y$ , but it is reasonable to obtain some measure of location of the distribution as a typical value of  $Z$  for that  $X$  (Bartholomew, 1980). In practice, this is done by deriving the "factor scores."

Factor analysis in this study was conducted through four steps:

(1) Data preparation and generation of the correlation matrix. In this study, a  $784 \times 7$  matrix was submitted to a factor analysis procedure in order to detect the structure of the relationships between the 7 selected product attributes from 784 observations. If the number of factors is determined to be 4, a  $7 \times 4$  factor-loading matrix will be generated, which represents the relationship among the observed variables (the 7 attributes) and the 4 latent factors.

(2) Extraction of the initial factor solution. A common criterion for determining the number of factors is whether the “eigenvalue greater than 1”. However, for common factor analysis (instead of principal factor analysis), the average or positive eigenvalues (instead of 1) may be used as the criterion to extract the latent factors.

(3) Varimax rotation of factors to clarify the structure of product attributes. The fundamental theorem of factor analysis is invariant with rotations. That is, the initial factor pattern matrix is not unique. Rotation of the reference axes of the factor solution can simplify the factor structure and achieve a more meaningful and interpretable solution. A number of orthogonal rotation procedures have been proposed by statisticians, in which the angle between the reference axes of factors is maintained at 90 degrees. The VARIMAX method is used in this study, which has been the most widely used orthogonal rotation procedure.

(4) Construction of factor scores. Factor scores are the estimated values of the retained latent factors. It can quantify individual cases on a latent continuum using a scale which ranges from approximately -3.0 to +3.0 (Johnson and Wichern, 2002).

### *Ordered-Probit Model*

#### Theoretical Model

In addition to the above factor analysis, a series of ordered-probit models were used to assess the determinants of Chinese consumers' importance ratings for livestock product attributes. Consumers' preferences are hypothesized to be represented by their importance ratings of livestock product attributes and their ratings are determined by a vector (X) consisting of consumers' socioeconomic, geographic and demographic factors. A consumer utility function (U) is used to reflect the vector of attribute ratings, R using a scale of 1 to 5 (1—not important at all, 2—not very important, 3—somewhat important, 4—important, 5—extremely important). The vector R comprises responses of each survey participant and is expressed as an ordinal importance rating based on individual utility function. Survey questions are listed with ordered categories and with a clear rating among the categories. Ordinal probit models have been widely used for analyzing such categorical data (Maddala, 1983; McKelvey and Zavoina, 1975). In this research, a series of ordered-probit models are used to assess the determinants of importance ratings of attributes for frozen/chilled livestock products purchased from supermarkets and food stores.

The general model can be specified as

$$(1) \quad U = \mathbf{bX} + \mathbf{e}, \mathbf{e} \sim N(0,1).$$

$U$  is unobservable utility. However, the attribute ratings are observable as

$$(2) \quad \begin{aligned} R &= 1 \text{ if } U \leq \mathbf{m}_1, \\ &= 2 \text{ if } \mathbf{m}_1 < U \leq \mathbf{m}_2, \\ &\dots \\ &= j \text{ if } \mathbf{m}_{j-1} \leq U, \end{aligned} \quad (j = 1, 2, \dots, 5)$$

The  $\mathbf{m}_j$ 's, also called threshold coefficients that provide the rating of alternatives, are unknown parameters to be estimated along with  $\beta$ 's. The error term,  $e$ , is assumed to have standard normal distribution across observations. The following probabilities can then be observed:

$$(3) \quad \begin{aligned} P_1 &= \Phi(\mathbf{m}_1 - \beta'X) \\ P_2 &= \Phi(\mathbf{m}_2 - \beta'X) - \Phi(\mathbf{m}_1 - \beta'X), \\ &\dots \\ P_j &= 1 - \Phi(\mathbf{m}_{j-1} - \beta'X), \end{aligned}$$

where  $P_j$  is the probability of  $R = j$ ,  $\Phi(\cdot)$  is the cumulative probability function of a normal distribution for the range of consumers' utility. Typically, the first threshold parameter  $\mathbf{m}_1$  is normalized to zero providing one less parameter to estimate. Therefore, we estimate

$$(4) \quad \begin{aligned} \Phi^{-1}(P_1) &= -\beta'X, \\ \Phi^{-1}(P_1 + P_2) &= \mathbf{m}_2 - \beta'X, \\ &\dots \\ \Phi^{-1}(P_1 + \dots + P_j) &= \mathbf{m}_{j-1} - \beta'X, \\ \text{and } P_1 + P_2 + \dots + P_j &= 1, \end{aligned}$$

where  $\Phi^{-1}$  is the inverse of the cumulative standard normal distribution function.

### Empirical Model

As discussed above, socioeconomic, geographic and demographic factors are important variables in determining consumers' preferences for meat consumption (Senauer, et al., 1992; Cui, 1997). Therefore, we can select a set of socioeconomic, geographic and demographic variables as our explanatory variables  $x$ 's to estimate on empirical model.

The selected socioeconomic, geographic and demographic factors include household income, year, region, age, household size, gender, education, and marital status. All explanatory variables are expressed as dummy variables with the exception of household size. Using these

variables, our econometric model on the importance ratings for specific Chinese livestock product attributes can be written as

$$(5) \Phi^{-1}(P_1) = u_{10} + u_{11}YEAR + u_{12} REGION + u_{13}GENDER + u_{14}YAGE + u_{15}MAGE \\ + u_{16}MARRIED + u_{17}LINCOME + u_{18}MINCOME + u_{19}LEDUC \\ + u_{110}MEDUC + u_{111}HOMESIZE$$

$$\Phi^{-1}(P_1+P_2) = u_{20} + u_{21}YEAR + u_{22} REGION + u_{23}GENDER + u_{24}YAGE + u_{25}MAGE \\ + u_{26}MARRIED + u_{27}LINCOME + u_{28}MINCOME + u_{29}LEDUC \\ + u_{210}MEDUC + u_{211}HOMESIZE$$

$$\Phi^{-1}(P_1+P_2+P_3) = u_{30} + u_{31}YEAR + u_{32} REGION + u_{33}GENDER + u_{34}YAGE + u_{35}MAGE \\ + u_{36}MARRIED + u_{37}LINCOME + u_{38}MINCOME + u_{39}LEDUC \\ + u_{310}MEDUC + u_{311}HOMESIZE$$

$$\Phi^{-1}(P_1+P_2+P_3+P_4) = u_{40} + u_{41}YEAR + u_{42} REGION + u_{43}GENDER + u_{44}YAGE + u_{45}MAGE \\ + u_{46}MARRIED + u_{47}LINCOME + u_{48}MINCOME + u_{49}LEDUC \\ + u_{410}MEDUC + u_{411}HOMESIZE$$

and  $P_1 + P_2 + P_3 + P_4 + P_5 = 1$ ,

where:

$P_i$ : Probability of importance ratings of “ $i$ ” on livestock product attributes

YEAR: Year variable, 2002 = 1 and 2001 = 0

REGION: Regional dummy variable, Shanghai = 1 and Nanjing = 0

GENDER: Gender of respondents, Male = 1, Female = 0

YAGE: Young age category, 39 and Less = 1, otherwise = 0

MAGE: Middle age category, 39 to 49 = 1, otherwise = 0

MARRIED: Marital status, Married = 1, otherwise = 0

LINCOME: Low income category, Less than 800 Yuan = 1, otherwise = 0

MINCOME: Middle income category, 800 to 2499 Yuan = 1, otherwise = 0

LEDUC: Low education category, high school and less = 1, otherwise = 0

MEDUC: Middle education category, College = 1, otherwise = 0

HOMESIZE: Household size, continuous variable.

$u_{ij}$ : coefficients to be estimated.

By conducting t-tests on the estimated coefficients for the two dummy variables, *YEAR* and *REGION*, the time trend and regional differences underlying Chinese consumers' preferences can be examined.

## **Empirical Modeling Results**

### *Factor Analysis*

Factor analysis results show that there are three factors which could be retained for their eigenvalues are positive. A large first eigenvalue (1.2985) and a much smaller second eigenvalue (0.3147) suggest the presence of a dominant global factor.

Since the purpose of using factor analysis in this study is to find out the structure of consumers' preferences, only the factor pattern matrix are reported in Table 2, which was used to interpret the meaning of the factors. The values in this matrix are the standardized regression coefficients, which map a variable to the factor holding other factors constant. Therefore, a value in this matrix represents the individual and non-redundant contribution that each factor is making to predict an observed variable. The number of retained latent factors equaled 3. The regression coefficients greater than 0.25 are underlined to assist in interpretation.

The product attributes significantly loaded on the first factor are *brand name*, *packing*, *cooking convenience* and *shopping environment*. The common characteristic among these product attributes is that each captures the external elements of livestock products. Before consumers actually consider shopping for any specific livestock product, these product attributes may attract their attention or interest first. Therefore, the first factor may be named "External Image."

**Table 2. Rotated Factor Pattern Matrix (Standardized Regression Coefficients)**

|                             | <i>Factor 1</i> | <i>Factor 2</i> | <i>Factor 3</i> |
|-----------------------------|-----------------|-----------------|-----------------|
| <b>Quality</b>              | -0.0357         | 0.0300          | <u>0.2872</u>   |
| <b>Label</b>                | 0.2484          | <u>-0.3458</u>  | 0.0372          |
| <b>Price</b>                | 0.1463          | <u>0.3618</u>   | 0.1100          |
| <b>Brand Name</b>           | <u>0.5471</u>   | 0.0163          | 0.0159          |
| <b>Packing</b>              | <u>0.6195</u>   | -0.0114         | -0.0493         |
| <b>Eating Convenience</b>   | <u>0.4228</u>   | 0.1064          | -0.0124         |
| <b>Shopping Environment</b> | <u>0.4413</u>   | -0.1372         | 0.0606          |

The second factor identifies the product attributes for *labeling* and *price* and the third factor identifies only *quality*. Attributes on *labeling* provide detailed important information such as nutrition content, production place, expiration time, which reflect the intrinsic value of the product. Attribute of *price* inform the consumer how much the product is worth of. Attribute of *quality* is also a key determinant of the intrinsic value of the product. Therefore, it is reasonable to cluster these three product attributes together as a new factor which may be named “Intrinsic Value.”

#### *Ordered-Probit Model*

Estimation results of the ordered-probit models of selected livestock product attributes are reported in Table 3. The log-likelihood test was applied to assess the overall significance of the independent variables in explaining the variations in the importance ratings in each model. All test statistics reject the null hypotheses of  $\mathbf{b} = 0$  at the 95% confidence level except for the price attributes at the 90% confidence level. This implies that our model can be used to explain the variation in Chinese consumers’ importance ratings on selected livestock product attributes.

Related to equations (1) and (2), estimated coefficients with a negative sign indicate that on average consumers will achieve a greater utility level and therefore are more likely to give

**Table 3. Estimates of the Ordered Probit Model on the Importance Ratings for Selected Livestock Product Attributes**

| Explanatory Variables   | Effects Importance Ratings of Livestock Product Attributes |                        |                        |                        |                        |                       |                       |
|-------------------------|--|------------------------|------------------------|------------------------|------------------------|-----------------------|-----------------------|
|                         | (1) <sup>a</sup>   | (2)                    | (3)                    | (4)                    | (5)                    | (6)                   | (7)                   |
| <b>YEAR</b>             | 0.3341 <sup>b**</sup><br>(8.6946) <sup>c</sup>             | -0.7776**<br>(84.2469) | 0.9770**<br>(134.4825) | 0.1605**<br>(4.1572)   | 0.1969**<br>(6.1438)   | 0.4392**<br>(30.3693) | -0.1122<br>(2.0436)   |
| <b>REGION</b>           | 0.1671<br>(2.2185)   | -0.0726<br>(0.7697)    | -0.2992**<br>(13.7058) | -0.4074**<br>(26.2099) | -0.3483**<br>(18.8584) | -0.2074**<br>(6.8360) | -0.1364*<br>(2.9924)  |
| <b>GENDER</b>           | -0.1699*<br>(2.2347)                                       | -0.1044<br>(1.5270)    | -0.1014<br>(1.5057)    | -0.0361<br>(0.1991)    | -0.0326<br>(0.1595)    | -0.1291<br>(2.5285)   | -0.1990**<br>(6.0569) |
| <b>YAGE</b>             | -0.1610<br>(1.3339)  | -0.1942*<br>(3.2534)   | 0.1249<br>(1.4411)     | -0.1315<br>(1.6597)    | -0.1074<br>(1.0856)    | -0.2481**<br>(5.8689) | -0.1334<br>(1.7181)   |
| <b>MAGE</b>             | -0.3290**<br>(4.3971)                                      | -0.0179<br>(0.0237)    | 0.0504<br>(0.1960)     | -0.1369<br>(1.5138)    | 0.0737<br>(0.4288)     | -0.1996*<br>(3.2042)  | -0.1053<br>(0.9027)   |
| <b>MARRIED</b>          | -0.1688<br>(1.3725)  | -0.1723<br>(2.5318)    | -0.0587<br>(0.3072)    | -0.3118**<br>(8.9652)  | 0.1885*<br>(3.2662)    | 0.0350<br>(0.1128)    | 0.2018*<br>(3.7544)   |
| <b>LINCOME</b>          | -0.3218<br>(1.6545)  | 0.0261<br>(0.0188)     | -0.3382*<br>(3.1313)   | 0.2261<br>(1.5207)     | 0.0427<br>(0.0532)     | -0.2659<br>(2.0660)   | -0.3673**<br>(3.9604) |
| <b>MINCOME</b>          | 0.2992**<br>(5.4891)                                       | 0.0832<br>(0.8217)     | -0.1141<br>(1.6303)    | 0.1505*<br>(2.9499)    | 0.0593<br>(0.4518)     | -0.0710<br>(0.6528)   | -0.0645<br>(0.5445)   |
| <b>LEDUC</b>            | 0.5003<br>(1.3878)   | 0.4595*<br>(3.4821)    | 0.2286<br>(0.9209)     | 0.6538**<br>(7.8404)   | 0.3147<br>(1.8882)     | 0.3185<br>(1.8953)    | 0.3289<br>(2.0558)    |
| <b>MEDUC</b>            | 0.3229<br>(0.5941)   | 0.3482<br>(2.1079)     | 0.3286<br>(2.0064)     | 0.3706*<br>(2.6626)    | 0.0909<br>(1.669)      | 0.1575<br>(0.4893)    | 0.00954<br>(0.0018)   |
| <b>HOMESIZE</b>         | -0.0593<br>(1.2217)  | -0.0472<br>(1.3857)    | -0.0729*<br>(3.5008)   | -0.0147<br>(0.1484)    | -0.0495<br>(1.6533)    | -0.0668*<br>(3.0460)  | 0.00342<br>(0.0080)   |
| <b>Model Chi-Square</b> | 60.6339**  | 96.4146**              | 56.6292*               | 79.2756**              | 84.6860**              | 49.8457**             | 93.7056**             |

Note: a Product attributes include: (1) Quality, (2) Labeling, (3) Price, (4) Brand Name, (5) Packing (6) Cooking Convenience; (7) Shopping Environment;

b Coefficient estimates

c Chi-Square value for the variables

\*90% significance level

\*\* 95% significance level



higher importance ratings  $R$  on the product attributes with the increased level or presence of  $x_i$ , holding other variables constant. Some selected coefficients and their signs are discussed below.

The estimated coefficients for *YEAR* are statistically significant at the 95% significance level in all models except for the *shopping environment*. Compared to 2001, survey participants in 2002 were less sensitive to attributes of *quality*, *price*, *brand name*, *packing* and *cooking convenience* and more sensitive to *labeling* attributes. This may result from the further implementation of the government's labeling regulations on food products, especially on imported products.

The estimated coefficients for *REGION* are statistically significant at the 95% significance level in models for the following attributes: *price*, *brand name*, *packing* and *cooking convenience* and at the 90% significance level for the *shopping environment* model. The negative coefficients indicate that on average Shanghai consumers are more likely to give higher importance ratings on these product attributes. The insignificant coefficients for the *quality* and *labeling* variables imply that Shanghai and Nanjing consumers have similar preferences.

The variable *GENDER* is only significant in the *quality* and *shopping environment* models, which implies that there are no preference differences on *labeling*, *price*, *brand name*, *packing* and *cooking convenience* between males and females. The negative estimated coefficients of *Gender* for *quality* and *shopping environment* implies that male consumers pay more attention to product quality and the shopping environment than female consumers.

The variable *YAGE* is the only significant variable in *cooking convenience* models, which implies that *young consumers'* preferences differ with other age groups only with respect to

cooking convenience. The negative sign signifies that young consumers are more concerned about cooking convenience. The reason for this difference may be that the proportion of young consumers who are full time workers is higher than that of other age groups. Therefore, on average young consumers are more time-constrained shoppers.

The variable *MAGE* is statistically significant at the 95% significance level in models for *Quality*. Its negative sign indicates that *middle-aged consumers* are more concerned about product quality. A possible reason may be that family cooking responsibility is realized by mothers and/or fathers, who are primarily middle-aged. To ensure reasonable nutrient intake, they may pay more attention to product quality.

The variable *LINCOME* is statistically significant at the 95% significant level in the *shopping environment* models. The negative sign indicates that *low-income consumers* give high importance ratings on the shopping environment compared with higher income consumer groups. This outcome was not expected. A possible explanation for this may be that the marginal utility from the improvement of shopping environment for low-income consumers is higher than that for higher income consumers. Therefore, low-income consumers place a higher value on the shopping environment.

The variable *MINCOME* is significant at the 95% confidence level in models for *quality* with a positive sign. This implies that on average *middle-income consumers* are less likely to give high importance ratings for product quality compared to the reference category for high-income consumer groups. The significant positive coefficient associated with the *LEDUC* variable in the *brand name* models implies that *low educated consumers* place lower importance ratings for brand name products.

## **Implications**

New diet and food purchasing habits have set the stage for major changes in China's food industry, including livestock product distribution. The profound transformation in China's livestock product retail sector and Chinese consumers who have realized improved incomes present a significant market potential for U.S. livestock exporters. Supermarkets and food store chains have been very important retail outlets for frozen/chilled livestock product. As supermarkets, hypermarkets and convenience store chains have been making considerable inroads into wealthy second-tier Chinese cities such as Qingdao, Dalian and Shenzhen on China's coast, this trend becomes clearer.

Our factor analysis results show that external image (brand name, packing, cooking convenience and the shopping environment) instead of intrinsic value (label, price and quality) of livestock products is the key determinant of Chinese consumer preferences in supermarkets and food stores. This means that traditional marketing strategies which focus solely on price and quality competition may no longer be successful in today's Chinese markets. Therefore, even most Chinese consumers consider U.S. livestock products as high quality, this may not be translated into a real advantage according to our factor analysis results. Our findings indicate that to create an excellent external livestock product image which is acceptable and recognizable to Chinese consumer is crucial for U.S. livestock exporters. Marketing strategies to consider include building a brand name for the product, designing attractive package and suitable size, making products easy to cook and creating a comfortable shopping environment.

Many socioeconomic, demographic and geographic factors are significant in our ordered-probit model, which confirm the heterogeneity of Chinese livestock retail markets. It is realistic to segment Chinese consumers into different categories by examining these factors.

The research also finds that more young female consumers take the responsibility for family food shopping. They tend to have high education and income level. Therefore, they are more likely to purchase high quality livestock products imported from the United States. Most face time constraints when shopping. Thus cooking convenience becomes a very important factor affecting their shopping decisions. This young female consumer group and their preferences should be the focus of marketing strategies by U.S. livestock exporters.

## References

- Bartholomew, D. J. "Factor Analysis for Categorical Data." *Journal of the Royal Statistical Society. Series B (Methodological)*, 42:3 (1980):293-321.
- Bean, Ralph, and Wei Min. "Retail Food Sector Report in China: 2002." USDA/Global Agriculture Information Network (GAIN) Report #CH 2834, 2002.
- Cui, Geng. "The Different Faces of the Chinese Consumer." *China Business Review*. 24 (2) July/August, 1997.
- Hui, J., P.E. McLean-Meynsse, and D. Jones. "An Empirical Investigation of Importance Ratings of Meat Attributes by Louisiana and Texas Consumers." *Journal of Agricultural and Applied Economics*. 27:2 (1995):636-643.
- Johnson, R. A. and D. W. Wichern. *Applied Multivariate Statistical Analysis*, 5<sup>th</sup> ed. Englewood Cliffs, N.J.: Prentice-Hall, 2002.
- Lancaster, Kelvin. *Modern Consumer Theory*. Aldershot UK: Edward Elgar Publishing, 1991.
- Lyon, Carmi and Catherine Durham. "Refrigeration and Food Demand in China, Can Refrigerator Ownership Help Predict Consumption of Food Products in China?" *Chinese Agriculture and the WTO*, Proceedings of WCC-101 Meeting, Seattle, WA, December 2-3, 1999.
- Maddala, G S. *Limited-Dependent and Qualitative Variables in Econometrics*. Cambridge: Cambridge University Press, 1983.
- McKelvey, R. D., and W. Zavoina. "A Statistical Model for the Analysis of Ordinal Level Dependent Variables." *Journal of Mathematical Sociology*, 4 (1975):103-120.
- Moustakerski, Peter. "Retail Food Report in China, 2001." USDA/Global Agriculture Information Network (GAIN) Report #CH1810, 2001.
- Peng, Xuehua. "Chinese Livestock Market and Consumer Preferences." Master thesis, North Carolina Agricultural and Technical State University, 2002.
- Qin, Xiang Dong, Xuehua Peng, and Mary A. Marchant. "New Insights of Chinese Livestock Consumers." Paper presented at the annual meeting of the American Agriculture Economics Association (AAEA), Long Beach, CA., July 27-31, 2002.
- Reynolds, Scott. "Shanghai Consumer Food Purchasing Habits." Foreign Agricultural Service, US Department of Agriculture, People's Republic of China Market Brief, Attaché Report No. CH8817, Aug. 1998.

Reynolds, Scott and Alcinda Hatfield. "Shanghai's Rising Tide of Consumerism Means Food Export Opportunities." *Ag. Exporter*, Page 10, October, 1996.

Senauer, Ben, Elaine Asp, and Jean Kinsey. *Food Trends and the Changing Consumer*. St. Paul, Minnesota: Eagan Press, 1992.

*The Economist*. "Not Quite a Billion," January 2, 1999, page 56.