# NEW INSIGHTS OF CHINESE LIVESTOCK CONSUMER

**BY**

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## INTRODUCTION

As the Chinese economy continues to grow, Chinese consumers have gradually shifted their food consumption from basic staple food to more protein rich livestock products. This transition has prompted reforms in livestock market structure and government policy implementation.

China's livestock market development can be roughly divided into four stages:

(1) Stage one, the Pre-reform Era, is from 1949 to 1978. Before the Open Door Reform was adopted in 1978, China's livestock production and distribution were tightly controlled by the central government. Inefficient production technology led to low output. In 1978, per capita annual output of pork, beef and mutton was only 17.9 kg (SSB, 1984).

During the pre-reform era, livestock products were distributed by wholesalers under the Ministry of Commerce's Non-Staple Food Corporation. There was little or no competition among different wholesalers. Each wholesale "station" sold their products at set prices to specified groups of wholesalers or retailers that made up the next tier of distribution.

Because of insufficient supply, urban and township consumers were required to use ration coupons to buy meat from specific food markets. The quantity rationed to each urban resident was fixed and varied with a consumer's age and occupation. Consumers usually had to wait in a long queue when they had a chance to buy meat. They did not have many choices on the quantity and the quality of those products, let alone the shopping environment and other services.

(2) Stage two, the Initial Reform Stage, is from 1978 to 1984.

In 1978, the Chinese government initiated the experiment of "planned economy supplemented by market force adjustment." The national economy was adjusted by both government planning and market forces. The Household Responsibility System (HRS) was experimented on a trial basis in selected rural areas in 1979. Under this system, farmers were given much more freedom to make production decisions upon fulfilling the government's procurement requirement. The government also provided huge subsidies to the livestock producers to stimulate livestock production and to lower the food cost to urban residents. The system proved to be successful and then was expanded nationwide in 1981.

Table 1 indicates that producer prices were much higher than the consumer prices for livestock products during the initial reform stage. The difference between producer costs and consumer prices were compensated by government subsidies. Livestock production was driven

up both by price increases and government subsidies. In 1984, total meat output exceeded 16,900 KMTs.

During this time, the government began to tolerate the development of free market. The number of urban and rural free markets increased from 2,226 in 1979 to 6,144 in 1984, and from 33,302 in 1978 to 50,356 in 1984, respectively (SSB, 1998). Beginning in 1981, individuals were allowed to establish small-scale private business to distribute livestock products.

Table 1: Average Producer Prices and Consumer Prices for Pork and Beef 1978-1987 (1978=100)

| | 1980 | 1982 | 1984 | 1985 | 1987 |
|---|---|---|---|---|---|
| Pork | | | | | |
| Producer Prices | 155 | 166 | 167 | 224 | 256 |
| Consumer Prices | 125 | 131 | 141 | 169 | 215 |
| Beef | | | | | |
| Producer Prices | 153 | 225 | 248 | 330 | 399 |
| Consumer Prices | 148 | 169 | 210 | 268 | 381 |

Source: SSB. Statistical Yearbook of China, Chinese Edition, Beijing, 1988

Consumers meanwhile had more choices for livestock products. In addition to using ration coupons, they could also buy meat from free markets. However, free markets were still constrained by inadequate infrastructure. As a result, only limited quantities of livestock products were available at free markets and prices were much higher in free markets than that in other state markets.

(3) Stage three, In-depth Reform Stage, is from 1985 to 1991.

Since 1985, China gradually intensified market reforms and stepped into a comprehensive reform and development stage. During this stage, the government carried out an agricultural product price reform by gradually deregulating the prices of non-grain food commodities. This policy resulted in high inflation in non-staple foods. In 1985, the procurement prices for meat increased 24.1 percent while procurement prices of grain and edible vegetable oil increased only by 1.8 percent and 4.3 percent, respectively. Livestock production continued to grow steadily (see Table 2).

Table 2. China's Major Livestock Outputs, 1985-1991 (Unit: 1,000 MTs)

| Year | Total Meat Output | Red Meat | Beef | Mutton | Poultry |
|---|---|---|---|---|---|
| 1985 | 19,270 | 17,610 | 471 | 590 | 1,600 |
| 1986 | 21,120 | 19,170 | 591 | 620 | 1,880 |
| 1987 | 22,160 | 19,860 | 791 | 720 | 2,190 |
| 1988 | 24,800 | 21,940 | 961 | 800 | 2,740 |
| 1989 | 26,290 | 23,260 | 1,071 | 960 | 2,820 |
| 1990 | 28,570 | 25,140 | 1,261 | 1,070 | 3,230 |
| 1991 | 31,440 | 27,240 | 1,541 | 1,080 | 3,950 |

Source: Tuan et al. 2001 and China's Statistical Yearbook.

Rationing of 15 non-staple commodities was finally eliminated in 1987. Consequently, the distorted prices under the old system were adjusted principally by supply and demand forces in the market. In 1988, the retail prices for pork rose by 33 percent. To compensate for this drastic increase, each urban resident received a lump sum subsidy in lieu of the subsidy on products. Per capita urban pork consumption increased from 16.8 kilograms in 1985 to 20.6 kilos in 1991.

Under the pressure of market forces, numerous free markets flourished in urban areas. State run markets started to lose ground in the competition because of price-caps and poor management. Consumers had a chance to compare and choose quality and price mixes that met their preferences.

(4) Stage four, Comprehensive Reform Stage, is from 1992 to present.

Since 1992, China has decided to establish a socialist market economy as its chief objective. At the 14$^{th}$ National Congress of the Communist party of China, the central government ratified a resolution, which asked for reforms in the existing commodity circulation system. Following the prototype of Chengdu Meat Wholesale Market in 1991, another meat wholesale market was put in place in Shanghai in 1993. These markets promoted more interregional livestock trade that satisfied consumer demands from most parts of the country.

In July 1992, the State Council issued permits to 20 pilot foreign companies to participate in retailing or wholesaling in 11 selected cities. In June 1995, the central government further opened up the retail industry to foreign investment. For the first time, the State Council listed retail and wholesale sectors in the Directory for Foreign Investment, although they were still under the "restricted" category.

The new policy has propelled a fundamental transformation of the Chinese retail industry. Although the food market remains the primary outlet for the daily food needs for most households, the use of food markets for household food shopping has become a matter of choice, rather than convenience. Retailers start to show more interests in consumers' desires and begin to respond to those preferences.

## PREVIOUS STUDIES

Research conducted over the past 15 years has greatly enhanced our understanding of changes in China's livestock sector (Fang, 1991; Lin, 1992, 1997; Rozelle et al., 1996; Rozelle et al., 1997). However, most of the past works have focused on China's livestock production structure, potential growth and/or future trade pattern (Fuell and Zhang, 1997; Wang et al., 1998; Amponsah and Qin, 2000; Tuan et al., 2001).

Some researchers have analyzed the livestock market system (Wu, 2000). Others have mainly examined the Chinese consumer's food consumption pattern (Chern, 1997a, 1997b; Chern et al., 1994; Gao et al., 1996; Fan et al., 1997). There is insufficient information on Chinese consumer preferences on livestock product, which may potentially shape their shopping

behavior. China's current livestock market is different from that of the early stages of reform. In a remarkably speedy turnaround, Chinese consumers today enjoy a bountiful variety of foods from which to choose.

Cai et al., (1998) pioneered a study about Chinese attitudes to beef consumption. They found that there were many issues involved in Chinese attitudes to beef consumption, which were not common in Western societies. There were cultural, historical, traditional and social influences at both individual and societal level to be considered as well as demographic changes.

But little work has been done to link Chinese consumer preferences for livestock products with a specific mode of shopping. For livestock producers, processors and distributors, it is not enough to know about the overall demands and demand changes, they also want to discern consumers' preferences so that they can tailor their production and marketing strategies to satisfy their targeted consumer groups.

Based on a consumer preference survey, this study attempts to analyze the Chinese consumers' preferences for frozen and/or chilled livestock products purchased at food stores and supermarkets. Most interregional and international traded livestock products are frozen and/or chilled, and are sold at food stores or supermarkets, which have become a trend in the livestock products retail industry. In order to analyze the specific attributes of the livestock products that appeal to the shoppers, this study uses a decomposed approach to investigate the impact of having different social and demographic backgrounds on the preferences of those attributes.

## THEORETICAL FRAMEWORK

The basic theory about the attributes of a product stems from Lancaster's study on consumer preferences. Lancaster (1991) thinks that it is the properties or characteristics of the goods from which utility is derived. In his analysis, consumption is considered as an activity in which goods, singly or in combination, are inputs and in which the output is a collection of characteristics. Utility or preference ordering is assumed to rank collections of characteristics and only to rank collections of goods indirectly through the characteristics that they possess.

If the consumer's utility function is separable, the consumer first allocates his budget optimally between broad groups of goods, and then optimizes again within these groups. For example, the typical consumer might first allocate his income between broad categories such as food, entertainment, communication, transport etc. The consumer repeats this process until he ultimately makes a choice from within a particular "*goods group.*" This is a defined as a subset of goods possessing the same characteristics, but in different proportions, most of which are not shared by goods outside the group (Lancaster, 1991). The consumer then chooses from within the goods group, the good (or combination of goods if joint consumption is possible), which maximizes his utility at least cost (Lancaster, 1991).

Figure 1 explains the consumer's choice of goods within a goods group. The goods group here is defined by the characteristics C1 and C2 from which the consumer derives utility. There are three goods, represented by the rays $G_1$, $G_2$ and $G_3$, respectively. These goods produce the

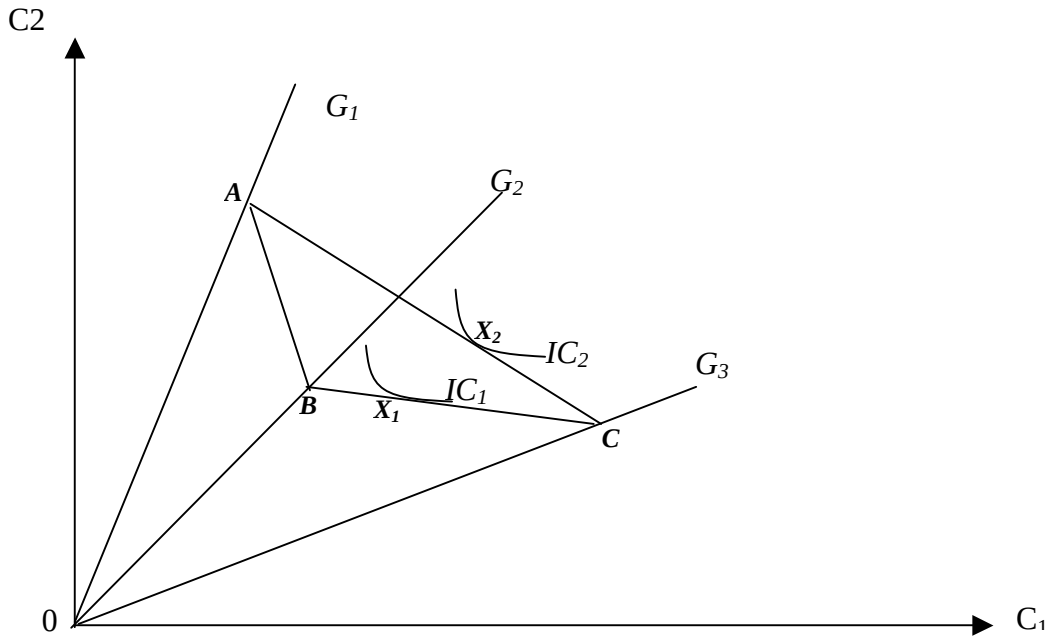


Figure 1. Consumer Choice of Different Characteristics

characteristics C1 and C2 according to their consumption technology. The consumer faces a budget constraint such that if he spends his budget solely on $G_1$ , he can obtain the combination of characteristics represented by point A. For goods 2 and 3, the points are B and C, respectively.

The intervals AB, BC and AC represent the characteristics which can be obtained using the individual's budget when consuming combinations of goods ($G_1$,$G_2$), ($G_2$,$G_3$) and ($G_1$,$G_3$). The consumer maximizes his utility by the combination of goods $G_1$ and $G_3$ represented by $X_2$ since this places the consumer on his highest indifference curve. This represents the consumer's *efficient consumption* choice. Other consumption choices, such as choosing point $X_1$ , are considered to be *inefficient consumption* choices, since they place the consumer on a lower level of utility.

One of the major advantages of the consumer choice approach is that it provides insight into the impact on consumers of changes in the characteristics of goods and services attributable to changes in outside environment and a firm's marketing activities.

Extending this analysis then, the cost of a good to a consumer is made up of the explicit "price" of the good, plus any information costs associated with obtaining information about the characteristics of the good (See Figure 2).

With zero information costs, the cost of the goods to the consumer is the same as the explicit price. The consumer is able to consume on his true efficiency frontier ABCD in Figure 2.

However, where obtaining information about characteristics of goods is not cost free, then the consumer will be restricted to a lower frontier and will be consuming at a point inside his true efficiency frontier.

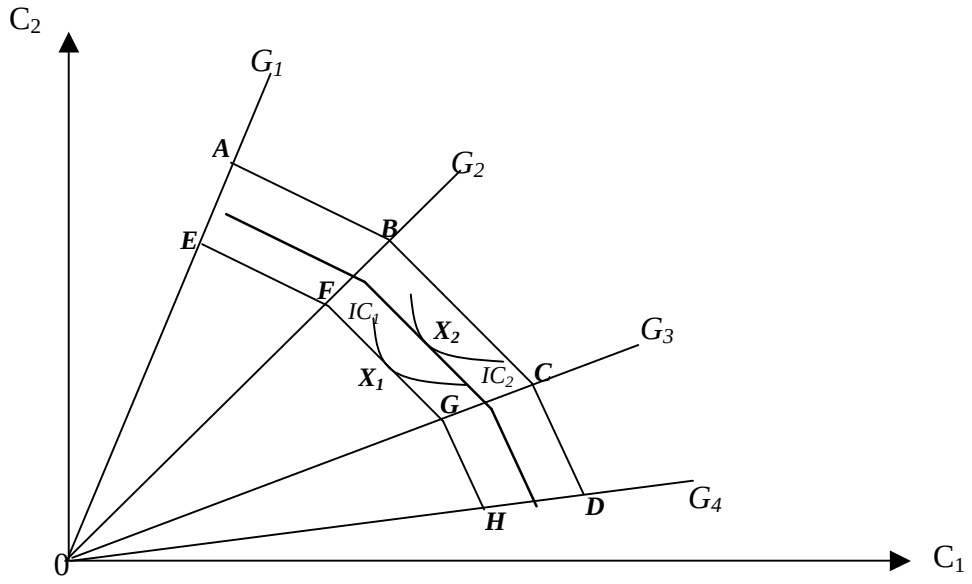


Figure 2. Information Costs and Consumer Education

If the cost of obtaining information about each characteristic is the same, then the effect on the efficiency frontier of including information costs will be a uniform shift inwards of the frontier, such as EFGH in Figure 2. Because of the information costs, consumers now maximize at $X_1$, which is a point on the frontier EFGH.

The information costs associated with both characteristics can be lowered by a government consumer education campaign. The result is to shift the consumer's frontier outwards from EFGH, to the frontier represented by the dashed line. As a result of this consumer education, the consumer shifts his consumption from $X_1$ to the point $X_2$, associated with indifference curve $IC_2$ and a higher level of utility. The consumer thus could benefit from the education and awareness policy.

## CONSUMER PREFERENCE SURVEY

Previous studies have found that geographic, demographic and socioeconomic variables can be important factors in determining consumers' preference toward meat consumption (Senauer et al, 1992 and Hui et al., 1995). Hui et al., (1995) suggested examining the relationship between consumers' importance ratings of meat attributes and their geographic, demographic, and socioeconomic characteristics. This study follows Hui et al.'s approach to obtain an insight into the relationship between Chinese consumers' preferences of frozen and/or chilled meat attributes and their geographic, demographic and socioeconomic backgrounds.

A consumer's utility function associated with the purchase of frozen/chilled livestock products from food stores or supermarkets is postulated in terms of importance rankings for selected product attributes, and it is hypothesized that these are determined by a vector (**X**) of the consumers' geographic, socioeconomic and demographic factors. The selected attributes associated with frozen/chilled livestock products purchased from food stores and supermarkets are (1) *Product Quality*, (2) *Labeling*, (3) *Price*, (4) *Packaging*, (5) *Brand Name* (6) *Cooking Convenience* and (7) *Shopping Environment*.

To elicit information on consumers' perception of these attributes, the self-explication approach is adopted in the survey. The nature of the self-explication procedure is that respondents are first asked to evaluate the importance level (rating) of each attribute, using a scale from 1 to 5. Respondents are then asked to compare all attributes and rank the importance of each attribute.

The survey was conducted in Nanjing and Shanghai in the summer of 2001. Nanjing is the provincial capital of Jiangsu Province, which is a main livestock-producing province. Shanghai is the commercial center of China. To ensure the equal representation of the survey, survey participants were chosen randomly. First, food stores or supermarkets were chosen according to their geographic location. Two food stores and supermarkets were chosen randomly from the Eastern, Southern, Western and Northern areas in each city. By doing so, the random effect of other factors such as unequal income distribution was eliminated. Then 20 survey participants were chosen randomly in each of those supermarkets. During the sampling procedures, some consumers refused to be interviewed. Therefore, the final sample size for each destination is a little different. The chosen survey participants were shoppers of frozen and chilled livestock products or potential shoppers who hang around the livestock counter and showed some interests in buying the products.

The survey was conducted person by person. Every respondent was given a small gift to encourage them to be more forthcoming in the interview. The final sample size collected was 385, with 167 from Nanjing and 218 from Shanghai.

## STATISTICAL ANALYSIS OF SURVEY RESULTS

Background information was listed in Table 3. As shown from the table, most respondents come from households of small size. More than half of the families had three persons, which might be the result of China's "only one child" policy.

Shopping is normally considered the responsibility of the mother/wife in China, although father/husband alone or husband and wife together are, on occasions, reported as assuming the responsibility for shopping. Compared to Nanjing, the Shanghainese family shows that a higher proportion of husbands/fathers are responsible for shopping. More than seventy percent of the families reported have an average household income of more than 1500 RMB. Because Chinese urban residents still enjoy some subsidies, urban consumers have stronger purchasing power than their rural counterparts. It is estimated that in Purchasing Power Parity (PPP) terms, the per capita GDP of China is more than five times greater than the US dollar value would suggest

Table 3: Background information of Respondents

| | Nanjing | | Shanghai | | Total | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| Household Size | | | | | | |
| 1 | 11 | 6.7 | 4 | 1.8 | 15 | 3.9 |
| 2 | 32 | 19.5 | 20 | 9.2 | 52 | 13.6 |
| 3 | 80 | 48.8 | 120 | 55.1 | 200 | 52.4 |
| 4&above | 41 | 25.0 | 74 | 33.9 | 115 | 30.1 |
| Total | 164 | | 218 | | 382 | |
| Sex | | | | | | |
| Male | 72 | 43.1 | 92 | 42.2 | 164 | 42.6 |
| Female | 95 | 56.9 | 126 | 57.8 | 221 | 57.4 |
| Total | 167 | | 218 | | 385 | |
| Marital Status | | | | | | |
| Single | 43 | 25.7 | 52 | 23.9 | 95 | 24.7 |
| Married | 123 | 73.7 | 160 | 73.4 | 283 | 73.5 |
| Widow/divorced/separated | 1 | 0.6 | 6 | 2.8 | 7 | 1.8 |
| Total | 167 | | 218 | | 385 | |
| Age | | | | | | |
| 25&Less | 34 | 20.4 | 32 | 14.7 | 66 | 17.1 |
| 25-39 | 75 | 44.9 | 82 | 37.6 | 157 | 40.8 |
| 40-49 | 26 | 15.6 | 68 | 31.2 | 94 | 24.4 |
| 50&Above | 32 | 19.2 | 36 | 16.5 | 68 | 17.7 |
| Total | 167 | | 218 | | 385 | |
| Average Household Income (RMB) | | | | | | |
| Less than 800 | 7 | 4.2 | 15 | 6.9 | 22 | 5.7 |
| 800-1499 | 47 | 28.3 | 44 | 20.2 | 91 | 23.7 |
| 1500-2499 | 63 | 38.0 | 66 | 30.3 | 129 | 33.6 |
| 2500&Above | 49 | 29.5 | 93 | 42.7 | 142 | 37.0 |
| Total | 166 | | 218 | | 384 | |
| Education Level | | | | | | |
| High School & Below | 75 | 45.2 | 121 | 55.5 | 196 | 51.0 |
| College | 87 | 52.4 | 84 | 38.5 | 171 | 44.5 |
| Master & Above | 4 | 2.4 | 13 | 6.0 | 17 | 4.4 |
| Total | 166 | | 218 | | 384 | |
| Member responsible for Household shopping | | | | | | |
| Husband | 16 | 9.6 | 26 | 11.9 | 42 | 10.9 |
| Wife | 59 | 35.3 | 87 | 39.9 | 146 | 37.9 |
| Husband & Wife | 34 | 20.4 | 41 | 18.8 | 75 | 19.5 |
| Father | 5 | 3.0 | 16 | 7.3 | 21 | 5.5 |
| Mother | 9 | 5.4 | 31 | 14.2 | 50 | 13.0 |
| Whole Family | 28 | 16.8 | 12 | 5.5 | 40 | 10.4 |
| Other | 6 | 3.6 | 3 | 1.4 | 8 | 2.1 |
| Total | 167 | | 218 | | 385 | |

Source: Survey Data

(Steele, 2000). This indicates that Chinese consumers, especially those in urban areas, have the potential of buying more high valued frozen/chilled livestock products.

Fifty percent of people surveyed still keep the habit of shopping for their food on a daily base. Thirty percent of respondents shop for food more than once a week. This indicates Chinese consumers keep high shopping frequencies. One hundred and ninety-one of 385 respondents buy fresh livestock products more than once a week. One hundred and seventy-seven of 385 buy frozen/chilled livestock products once or more than once a week. Other respondents indicated that they bought frozen/chilled livestock products once every two or three weeks.

The survey results indicate that more and more consumers go to food stores and supermarkets to buy livestock products (see Figure 3). About 53 percent of respondents chose supermarkets as their main shopping markets for livestock products. Meanwhile, wet markets still play an important role in livestock products markets. About 35 percent of those surveyed buy livestock products more often from wet markets. Some respondents explained that supermarkets could provide livestock products with higher hygienic standards and have a better shopping environment. In the summer, due to shortage of cold storage facilities, meat in the wet markets is easily spoiled. Therefore, consumers are more willing to buy them from supermarkets.

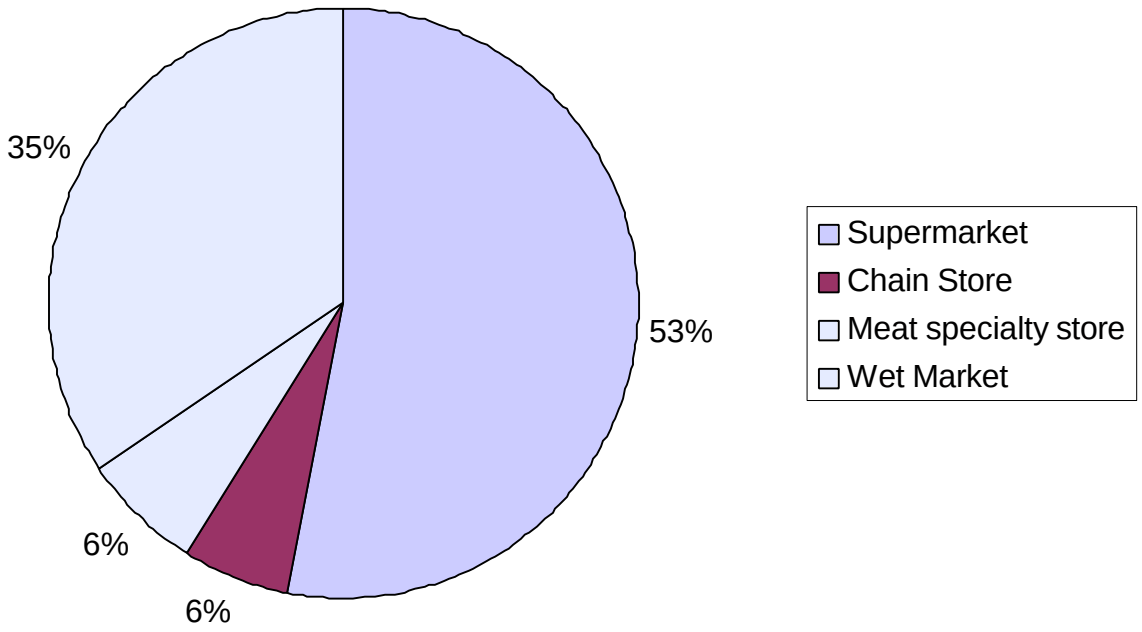


Figure 3: Livestock Products Type of Market Share
Source: Survey Data

**Kruskal-Wallis Test**

The Kruskal-Wallis test is used to test whether respondents differentiated mean importance ratings among the selected meat attributes. In particular, the hypothesis is stated as:

$H_0$: The mean importance ratings of 7 selected frozen/chilled livestock products attributes are identical.
$H_a$: At least one of the mean importance ratings of 7 selected frozen/chilled livestock products attributes is different from others.

The calculated H statistics is 931.791 and the tabulated $x^2_{? ?0.01}$ is 18.55. Since H > 18.55, the null hypothesis is rejected and there is sufficient evidence to conclude that the mean importance ratings of 7 selected frozen/chilled livestock products attributes are different.

**Dunn Test**

A simultaneous multiple comparison (SMC) method is used to test the difference between the mean ranks to identify the importance order of attributes of livestock products. The specific method is the Dunn procedure. Dunn (1964) proposed a single-step test procedure that is based on joint rankings of observations from all the treatments. The computed mean ranks for livestock products attributes are listed in Table 4.

The statistical results for importance ratings indicate that consumers ranked "product quality" as the most important attribute among the 7 selected attributes of livestock products. The "price of livestock products" was ranked as the second most important attribute. "Labeling" was found to be the third most important factor, while "brand name" and "cooking convenience" follow as the fourth most important factor. The importance orders for the rest of the meat attributes were "shopping environment" and "packing".

Table 4: Dunn Test Result for Attributes Importance Rankings

| Livestock Products Attribute | Mean Ranks for Livestock Products Attributes | Multiple Comparison of k Sample Mean Ranks (a=0.01) | |
|---|---|---|---|
| Quality | 2308.51 | A | 1 |
| Price | 1696.39 | B | 2 |
| Labeling | 1421.65 | C | 3 |
| Brand Name | 1118.88 | D | 4 |
| Cooking Convenience | 1116.39 | D | 4 |
| Shopping Environment | 864.01 | E | 5 |
| Packing | 535.31 | F | 6 |

Source: Survey Data

## EMPIRICAL MODELS

The consumer utility function (U) in this study is to reflect the vector of attribute ratings, R (where R=1, 2, … j). The vector R comprises responses of each survey participant and is expressed as an ordinal importance ranking based on individual utility function. The survey

questions are listed with ordered categories with a clear ranking among the categories, but the differences among adjacent categories are not treated as the same.

Ordinal logit and probit models have been widely used for analyzing such data (Maddala, 1983; McKelvey and Zavoina, 1975). The only difference between the ordinal logit and the ordinal probit model is in their distribution functions (Liao, 1994). In this study, a series of ordered-probit models (Green, 1993) are employed to assess the determinants of importance rankings of attributes of frozen/chilled livestock products purchased from food stores and supermarkets.

The general model is specified as:

$$U = ?\boldsymbol{X} + ?, \; ? \sim N(0,1). \qquad (4\text{-}1)$$

$U$ is unobserved. What can be observed is

$$\begin{aligned} R &= 1 \text{ if } U \; ? \; ?_1, \\ &= 2 \text{ if } ?_1 < U \; ? \; ?_2, \\ &\; . \\ &\; . \\ &\; . \\ &= j \text{ if } ?_{j-1} \; ? \; U, \end{aligned} \qquad (4\text{-}2)$$

which is a form of censoring. The $?_j$'s are unknown parameters to be estimated along with $?$. They are also called cut-off points that provide the rating of alternatives. $?$ is the error term, and is assumed to have normal distribution across observations with mean and variance of 0 and 1. With the normal distribution, the following probabilities can be observed:

$$\begin{aligned} P_1 &= ? \; (?_1 - ?'\boldsymbol{X}) \\ P_2 &= ? \; (?_2 - ?'\boldsymbol{X}) - ? \; (?_1 - ?'\boldsymbol{X}), \\ &\; . \\ &\; . \\ &\; . \\ P_j &= 1 - ? \; (?_{j-1} - ?'\boldsymbol{X}), \end{aligned} \qquad (4\text{-}3)$$

where $P_j$ is the probability of R = j, $?$ (.) is the cumulative probability function of a normal distribution for the range of consumers' utility.

The first threshold parameter $?_1$ is typically normalized to zero so that there is one less parameter to estimate. This is feasible because the scale is arbitrary and can start or finish with any value.

Therefore, there are

$$?^{-1}(P_1) = -?'\boldsymbol{X},$$

$$? ^{-1}(P_1+P_2) = ?_2 - ?'\boldsymbol{X}, \qquad (4\text{-}4)$$

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$$? ^{-1}(P_1+\ldots+P_j) = ?_{j-1} - ?'\boldsymbol{X},$$

and $P_1 + P_2 + \ldots + P_j = 1,$

where $? ^{-1}$ is the inverse of the cumulative standard normal distribution function. The maximum likelihood technique is employed in estimation, and the log-likelihood function becomes:

$$\ln L = ?_i \ln L_i = ?_i \ln P\,(R_i = j).$$

The selected geographic, socioeconomic and demographic characteristics include age, household income, household size, gender, education, marital status and region. All explanatory variables are expressed as dummy variables with the exception of household size. Then the specific econometric models on the importance ratings of specific livestock products attribute can be written as:

$$\begin{aligned}? ^{-1}(P_1) = {} & u_{10} + u_{11}REGION + u_{12}GENDER + u_{13}YAGE + u_{14}MAGE \\ & + u_{15}MARRY + u_{16}LINCOME + u_{17}MINCOME \\ & + u_{18}LEDUC + u_{19}MEDUC + u_{110}HDSIZE\end{aligned}$$

$$\begin{aligned}? ^{-1}(P_1+P_2) = {} & u_{20} + u_{21}REGION + u_{22}GENDER + u_{23}YAGE + u_{24}MAGE \\ & + u_{25}MARRY + u_{26}LINCOME + u_{27}MINCOME \\ & + u_{28}LEDUC + u_{29}MEDUC + u_{210}\,HDSIZE\end{aligned}$$

$$\begin{aligned}? ^{-1}(P_1+P_2+P_3) = {} & u_{30} + u_{31}REGION + u_{32}GENDER + u_{33}YAGE + u_{34}MAGE \\ & + u_{35}MARRY + u_{36}LINCOME + u_{37}MINCOME \\ & + u_{38}LEDUC + u_{39}MEDUC + u_{310}\,HDSIZE\end{aligned}$$

$$\begin{aligned}? ^{-1}(P_1+P_2+P_3+P_4) = {} & u_{40} + u_{41}REGION + u_{42}GENDER + u_{43}YAGE + u_{44}MAGE \\ & + u_{45}MARRY + u_{46}LINCOME + u_{47}MINCOME \\ & + u_{48}LEDUC + u_{49}MEDUC + u_{410}\,HDSIZE\end{aligned}$$

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

where: Pi: Probability of importance ratings of "i" on livestock products attributes;

REGION: Regional dummy variable, Nanjing = 0 and Shanghai = 1;
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;
MARRY: Marital status, Married = 1, otherwise = 0;
LINCOME: Low income category, Less than 800 = 1, otherwise = 0;
MINCOME: Middle income category, 800 to 2500 = 1, otherwise = 0;
LEDUC: Low education category, high school and less = 1, otherwise = 0;

MEDUC: Middle education category, College = 1, otherwise = 0;
HDSIZE: Household size, continuous variable.
$u_{ij}$ : coefficients to be estimated.

Statistically significant results of the ordered probit models of selected livestock products' attributes are reported in Table 5.

The log-likelihood test is applied to assess the overall significance of the various independent variables in explaining the variations in the importance ratings in each model. The results suggest that Chinese consumers could not be treated as a homogenous group in livestock marketing.

The test failed to reject the null hypotheses of ? = 0 for the attributes of product quality and cooking convenience at the confidence level of 90%. The reason for that insignificance may be that all consumers are similar in their concerns for the livestock product's quality despite their different geographic, socioeconomic and demographic backgrounds.

Table 5. Estimates of the Ordered Probit Model on the Importance Ratings for the Selected Livestock Products Attributes

| Explanatory Variables | Effects on Importance Ratings on Livestock Products Attributes | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1)[a] | (2) | (3) | (4) | (5) | (6) | (7) |
| REGION | 0.0053[b] (0.0009)[c] | 0.5439*** (19.9439) | -0.0133 (0.0129) | 0.4281*** (13.7980) | 0.1065 (0.8554) | 0.0228 (0.0390) | 0.2056* (3.2133) |
| GENDER | -0.0880 (0.2639) | -0.0579 (0.2398) | -0.2161* (3.5482) | -0.0511 (0.2079) | -0.0775 (0.4719) | -0.2579** (5.1320) | 0.0050 (0.0020) |
| YAGE | 0.5348** (5.0526) | -0.0307 (0.0323) | 0.3253** (3.8630) | 0.4091** (6.4003) | 0.3420** (4.4183) | 0.2765* (2.8860) | 0.2342 (2.0761) |
| MAGE | 0.4210* (2.7450) | -0.0088 (0.0023) | -0.0347 (0.0386) | 0.1685 (0.9508) | 0.1188 (0.4660) | 0.0230 (0.0175) | -0.1070 (0.3773) |
| MARRI-AGE | 0.3819* (3.1795) | 0.2288 (2.4689) | 0.1657 (1.3626) | 0.3914*** (7.8493) | 0.1709 (1.4892) | -0.0186 (0.0175) | -0.0325 (0.0551) |
| LINCOME | 0.2067 (0.2511) | 0.8011*** (8.1044) | 0.2534 (0.9898) | -0.3514 (2.0253) | 0.2785 (1.2349) | 0.2084 (0.7048) | -0.1594 (0.4120) |
| MINCOME | -0.1058 (0.3043) | 0.2716** (4.3420) | 0.1295 (1.0410) | -0.1043 (0.7091) | 0.1577 (1.5999) | 0.2075* (2.7779) | -0.0946 (0.5840) |
| LEDUC | -0.2742 (0.3157) | -0.4765 (2.5232) | -0.4435 (2.3518) | -0.7599*** (7.0541) | -0.2952 (1.1048) | -0.3393 (1.4151) | -0.4692* (2.8643) |
| MEDUC | -0.1696 (0.1274) | -0.3976 (1.8962) | -0.3817 (1.8787) | -0.4212 (2.3379) | -0.1752 (0.4201) | -0.1070 (0.1515) | -0.3290 (1.5225) |
| FAMILY | 0.0521 (0.3726) | 0.1641*** (7.4096) | 0.1353** (5.3707) | 0.0480 (0.7142) | 0.1336** (5.4132) | 0.0012 (0.0005) | 0.1519*** (7.0879) |
| Model Chi-Square | 8.39 | 45.50*** | 17.99* | 42.94*** | 13.23 | 17.99* | 25.21*** |

Note: *a* (1) Quality; (2) Price; (3) Labeling; (4) Brand Name; (5) Cooking Convenience; (6) Shopping Environment; (7) Packing.
*b Estimates of coefficients*

*c Chi-Square for the variables*

* Significant on the level of 0.10; ** Significant on the level of 0.05;
***Significant on the level of 0.01

Estimated coefficients with a positive sign indicates the likelihood of the response increasing with the level or presence of $x_i$, holding other variables constant, and vice versa. Some selected coefficients and their signs are discussed as follows.

The estimated coefficients of region variables are significant at the 99% confidence level in equations for "price" and "brand name" and 90% confidence level in equations for "packing." However, the region variable is not significant in the rest of the attributes equations. The positive and significant coefficients of region in equations indicate that Shanghai residents are likely to give higher importance ratings on "price," "brand name" and "packing" than Nanjing residents do.

Estimated coefficients of gender are significant at the 90% confidence level in equations for "labeling" and 95% confidence level in equations for "shopping environment," but not significant in the rest of the attributes equations. The negative and significant coefficients of gender imply that female consumers are more concerned about "labeling" and "shopping environment." Importance ratings on other attributes are not significantly different between male and female consumers.

Variable low income is significant in the equations for the attributes of "Price" at 99% confidence level and variable middle income is significant in equations for the attributes of "Price" at 95% confidence level and significant in equations for the attributes of "Shopping Environment" at 90% confidence level. Lower income consumers' consumptions are more constrained by their income level and therefore they are more concerned about the cost of the products. This is consistent with the significant positive coefficients of low income and middle income.

In equations (4-4), the threshold coefficients for importance ratings can be calculated by subtracting the first equation from the subsequent equations:

$$? _2 = ? ^{-1}(P_1+P_2) - ? ^{-1}(P_1)$$
$$? _3 = ? ^{-1}(P_1+P_2+P_3) - ? ^{-1}(P_1)$$
$$? _4 = ? ^{-1}(P_1+P_2+P_3+P_4) - ? ^{-1}(P_1)$$

Threshold coefficients for importance ratings are listed in Table 6.

Table 6: Threshold Coefficients for Importance Ratings on Frozen/Chilled Livestock Products Attributes

| Threshold Coefficients | Importance Ratings on Livestock Products Attributes | | | | | | |
|---|---|---|---|---|---|---|---|
| | (1)[a] | (2) | (3) | (4) | (5) | (6) | (7) |
| $u_{i2}$[b] | -- | 0.6399* | 0.9837* | 1.0583 | 0.8711 | 0.8880* | 1.2391 |
| $u_{i3}$ | 0.8457* | 1.5327 | 1.7899 | 1.9666 | 1.8914 | 1.9519 | 2.2281* |
| $u_{i4}$ | 1.6692 | 2.982* | 3.0255* | 3.0782* | 3.1473* | 3.0673* | 2.9914* |

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

*b* $u_{i2}$ is the second threshold coefficient for importance ratings on the *i*th attribute.

Generally, the marginal effect of changes in the responses can be calculated by taking the partial derivatives:

$$\frac{?P(R\ ?\ j)}{?x_k} \; ? \; \begin{matrix} ? & ? \\ ?? & ?? \\ ? & ? \end{matrix}_{j?1} \; ? \; \overset{k}{\underset{k?1}{?}} \; ?_k x_k \begin{matrix} ? \\ ? \\ ? \end{matrix} ? \; ? \; \begin{matrix} ? \\ ?? \\ ? \end{matrix}_{j} \; ? \; \overset{k}{\underset{k?1}{?}} \; ?_k x_k \begin{matrix} ?? \\ ??? \\ ?? \end{matrix}_{k},$$

where $x_k$ is the specific independent variable k. Except the variable being estimated, all other variables are held at their mean values. Liao (1994) suggested that the partial derivative method would lead to noticeable bias for dummy variables. However, calculating predicted probabilities and then taking the difference to derive the change in probability is relatively straightforward for dummy variables. There is no significant difference between these two methods with respect to continuous variables.

To facilitate interpretation, the predicted probabilities are calculated at complete category ("0" and "1" for dummy variable) of all explanatory variables except family size, with other explanatory variables valued at their means. Because most of the Chinese family consumers are from the three-person families (see the Table 5), the predicted probabilities for three-person family and four-person family are calculated and the differences between the probabilities are taken as their marginal effects. The results are reported in Table 7 and Table 8.

The results indicate that young consumers tend to have higher probabilities of giving higher importance ratings on the attributes of "Quality," "Labeling," "Cooking Convenience" and "Shopping Environment." Marginal effects of region on attributes of "Price" signifies that Shanghai consumers would be more likely to give higher importance ratings than Nanjing consumers do, and thus have higher price elasticity.

Also, as consumers' income increases, they tend to giver lower importance ratings (category 1, 2 and/or 3) on attributes of "Price" and "shopping Environment." As family size increases, there are higher probabilities of giving higher importance ratings on attributes of "Price," "Cooking Convenience" and "Packing."

## IMPLICATIONS AND CONCLUDING REMARKS

This study applies econometric models to study Chinese consumers' preferences on attributes associated with livestock products in food stores and supermarkets. Food stores and supermarkets are become more and more popular throughout China; livestock distributors should increase their marketing effort to focus upon these expanding markets.

Chinese consumers for livestock products are found not to be homogenous. Different geographic, socioeconomic and demographic backgrounds have significant impacts on their preferences for attributes of livestock products purchased from food stores and supermarkets. For livestock products distributors to maintain or gain more market shares, it is important for them to cater to the local preferences.

Table 7. Predicted Probabilities of Importance Ratings on Frozen/Chilled Livestock Products Attributes

| Attributes | Prob(R=1) | Prob(R=2) | Prob(R=3) | Prob(R=4) | Prob(R=5) |
|---|---|---|---|---|---|
| Quality | | | | | |
| YAGE = 0 | 0.0049 | - | 0.0362 | 0.1392 | 0.8197 |
| = 1 | 0.0009 | - | 0.0106 | 0.0621 | 0.9263 |
| MAGE = 0 | 0.0026 | - | 0.0233 | 0.1052 | 0.8689 |
| = 1 | 0.0007 | - | 0.0083 | 0.0525 | 0.9385 |
| MARRIAGE = 0 | 0.0045 | - | 0.0341 | 0.1341 | 0.8273 |
| = 1 | 0.0014 | - | 0.0145 | 0.0767 | 0.9075 |
| Price | | | | | |
| REGION = 0 | 0.0125 | 0.0421 | 0.1847 | 0.5313 | 0.2294 |
| = 1 | 0.0027 | 0.0133 | 0.0892 | 0.4728 | 0.4220 |
| LINCOME = 0 | 0.0062 | 0.0251 | 0.1350 | 0.5182 | 0.3155 |
| = 1 | 0.0005 | 0.0034 | 0.0345 | 0.3359 | 0.6258 |
| MINCOME = 0 | 0.0084 | 0.0315 | 0.1552 | 0.5273 | 0.2777 |
| = 1 | 0.0039 | 0.0176 | 0.1075 | 0.4958 | 0.3752 |
| FAMILY = 3 | 0.0059 | 0.0242 | 0.1319 | 0.5163 | 0.3216 |
| = 4 | 0.0036 | 0.0169 | 0.1045 | 0.4925 | 0.3824 |
| Labeling | | | | | |
| GENDER = 0 | 0.0074 | 0.0655 | 0.1855 | 0.4631 | 0.2785 |
| =1 | 0.0131 | 0.0947 | 0.2250 | 0.4563 | 0.2108 |
| YAGE = 0 | 0.0155 | 0.1049 | 0.2365 | 0.4506 | 0.1924 |
| =1 | 0.0065 | 0.0605 | 0.1774 | 0.4622 | 0.2933 |
| FAMILY = 3 | 0.0101 | 0.0801 | 0.2067 | 0.4618 | 0.2413 |
| = 4 | 0.0070 | 0.0631 | 0.1817 | 0.4628 | 0.2854 |
| Brand Name | | | | | |
| REGION = 0 | 0.0459 | 0.2192 | 0.3454 | 0.3075 | 0.0819 |
| = 1 | 0.0173 | 0.1283 | 0.2959 | 0.3911 | 0.1675 |
| YAGE = 0 | 0.0455 | 0.2183 | 0.3452 | 0.3085 | 0.0825 |
| = 1 | 0.0179 | 0.1311 | 0.2983 | 0.3889 | 0.1637 |
| MARRIAGE = 0 | 0.0506 | 0.2301 | 0.3477 | 0.2966 | 0.0751 |
| = 1 | 0.0212 | 0.1443 | 0.3090 | 0.3781 | 0.1474 |
| LEDUC= 0 | 0.0103 | 0.0943 | 0.2596 | 0.4135 | 0.2223 |
| = 1 | 0.0601 | 0.2500 | 0.3500 | 0.2762 | 0.0637 |
| Cooking Convenience | | | | | |
| YAGE = 0 | 0.0306 | 0.1278 | 0.3493 | 0.3911 | 0.1011 |
| = 1 | 0.0134 | 0.0762 | 0.2839 | 0.4512 | 0.1753 |
| FAMILY = 3 | 0.0203 | 0.0995 | 0.3184 | 0.4262 | 0.1356 |
| = 4 | 0.0146 | 0.0806 | 0.2911 | 0.4469 | 0.1668 |
| Shopping Environment | | | | | |
| GENDER = 0 | 0.0220 | 0.1080 | 0.3450 | 0.3788 | 0.1462 |
| = 1 | 0.0395 | 0.1530 | 0.3849 | 0.3276 | 0.0950 |

| | | | | | |
|---|---|---|---|---|---|
| YAGE = 0 | 0.0404 | 0.1549 | 0.3860 | 0.3254 | 0.0933 |
| = 1 | 0.0215 | 0.1066 | 0.3434 | 0.3802 | 0.1482 |
| MINCOME = 0 | 0.0368 | 0.1470 | 0.3809 | 0.3347 | 0.1005 |
| = 1 | 0.0230 | 0.1109 | 0.3484 | 0.3756 | 0.1421 |
| Packing | | | | | |
| REGION = 0 | 0.1094 | 0.3944 | 0.3372 | 0.1200 | 0.0390 |
| = 1 | 0.0756 | 0.3467 | 0.3638 | 0.1541 | 0.0598 |
| LEDUC = 0 | 0.0564 | 0.3080 | 0.3752 | 0.1804 | 0.0799 |
| = 1 | 0.1321 | 0.4167 | 0.3181 | 0.1028 | 0.0304 |
| FAMILY = 3 | 0.0935 | 0.3744 | 0.3503 | 0.1345 | 0.0473 |
| = 4 | 0.0706 | 0.3375 | 0.3673 | 0.1604 | 0.0643 |

Table 8. Marginal Effects on Importance Ratings

| | Prob(R=1) | Prob(R=2) | Prob(R=3) | Prob(R=4) | Prob(R=5) |
|---|---|---|---|---|---|
| Quality | | | | | |
| YAGE | -0.0040 | | -0.0256 | -0.0770 | 0.1066 |
| MAGE | -0.0020 | | -0.0149 | -0.0527 | 0.0696 |
| MARRIAGE | -0.0031 | | -0.0197 | -0.0574 | 0.0802 |
| Price | | | | | |
| REGION | -0.0098 | -0.0289 | -0.0954 | -0.0585 | 0.1925 |
| LINCOME | -0.0057 | -0.0217 | -0.1005 | -0.1824 | 0.3103 |
| MINCOME | -0.0045 | -0.0139 | -0.0477 | -0.0315 | 0.0975 |
| FAMILY | -0.0022 | -0.0074 | -0.0274 | -0.0238 | 0.0608 |
| Labeling | | | | | |
| GENDER | 0.0058 | 0.0291 | 0.0395 | -0.0068 | -0.0676 |
| YAGE | -0.0090 | -0.0444 | -0.0591 | 0.0116 | 0.1009 |
| FAMILY | -0.0031 | -0.0170 | -0.0250 | 0.0009 | 0.0441 |
| Brand Name | | | | | |
| REGION | -0.0287 | -0.0909 | -0.0495 | 0.0836 | 0.0856 |
| YAGE | -0.0276 | -0.0872 | -0.0468 | 0.0804 | 0.0812 |
| MARRIAGE | -0.0294 | -0.0858 | -0.0386 | 0.0815 | 0.0723 |
| LEDUC | 0.0498 | 0.1557 | 0.0904 | -0.1373 | -0.1586 |
| Cooking Convenience | | | | | |
| YAGE | -0.0172 | -0.0516 | -0.0655 | 0.0600 | 0.0742 |
| FAMILY | -0.0057 | -0.0189 | -0.0273 | 0.0207 | 0.0312 |
| Shopping Environment | | | | | |
| GENDER | 0.0175 | 0.0450 | 0.0398 | -0.0511 | -0.0512 |
| YAGE | -0.0188 | -0.0483 | -0.0426 | 0.0548 | 0.0549 |
| MINCOME | -0.0139 | -0.0361 | -0.0325 | 0.0409 | 0.0415 |
| Packing | | | | | |
| REGION | -0.0338 | -0.0477 | 0.0266 | 0.0341 | 0.0208 |
| LEDUC | 0.0757 | 0.1086 | -0.0572 | -0.0776 | -0.0495 |
| FAMILY | -0.0229 | -0.0369 | 0.0170 | 0.0259 | 0.0170 |

Livestock distributors also need to specify their targeted markets such as specific regions or consumer groups, and to develop different marketing strategies accordingly. In this study, Shanghai consumers are found to have high importance ratings on attributes of “Price.” Consequently, compared with Nanjing market, livestock distributors might adopt a lower price market access strategy.

Product quality has been identified as the most important attribute in livestock products purchased from food stores and super markets. Since domestic livestock product quality is not yet upheld to the highest standard presently, as compared to wet markets, Chinese consumers may look for food stores and supermarkets as ideal outlets for quality products. So it is imperative for livestock distributors to maintain the image of having high quality products so as to keep the loyalty of their customers.

## LIMITATIONS OF THE STUDY

The analysis in this study may have been tanned with some inaccuracies due to the misunderstanding of some survey respondents. The survey was conducted in summer, which may introduced some seasonal effects. Under some circumstances, the preference for an individual shopper may not reflect the consumption pattern of the whole family. To get more accurate accounts for Chinese consumer preferences, it may also require a larger sample size.

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