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Away-from-Home Meat Consumption in China

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ABSTRACT

This paper investigates significant forces that affect away-from-home (AFH) meat consumption in China. Multivariate Tobit models were used to analyze a set of survey data from 340 households in Jiangsu, Shandong, Inner Mongolia, Liaoning, and Sichuan Provinces in 2005. AFH meat consumption accounts for an increasing share of food consumption expenditure in China. Aside from income level and urban location, family characteristics (e.g., the employment status of the wife and the opportunity to participate in collective consumption) also influence AFH meat consumption. Beef and mutton consumption is higher in Inner Mongolia and Liaoning.

This paper makes the case that studies of food consumption in China should focus on expenditure on food away from home. In addition, future studies should integrate food consumption at home with food consumption away from home. As the Chinese economy continues to grow and the country becomes more urbanized, the wealth generated will result in further rapid growth in AFH beef consumption. Sourcing an adequate supply to meet the increasing demand will pose a significant challenge for the Chinese beef industry and the Chinese government.

INTRODUCTION

China's remarkable economic growth since 1978 has resulted in striking alterations in food consumption patterns (Lewis and Andrews 1989; Halbrendt et al. 1994; Fan et al. 1995; Wu 1999; Hsu et al. 2002; Zhou and Tian 2005). One marked change is the increase in food-away-from-home (FAFH) consumption (Min et al. 2004; Gould and Villarreal 2006; Ma et al. 2006; Zhu 2006; Bai et al. 2010). For example, up to 30 percent of total food expenditure of rich households in urban China is spent on FAFH (Gould and Villarreal 2006). FAFH expenditure in urban China as a whole more than tripled from 30.5 billion to 98.4 billion China Yuan Renminbi (CNY) (from 4.5 US Dollars [USD] to USD 14.4 billion) in real terms from 1992 to 1999 (National Statistics Bureau [NSB] 1993, 2000). In addition, per capita FAFH expenditure in urban China increased by 163 percent between 1992 and 2005 (NSB 1993; 2006a).

Rising income is one of the factors that greatly affect the type of food consumed. The increase in FAFH consumption is closely related to rising income. FAFH expenditure is expected to rise if per capita income continues to increase in China (Min et al. 2004; Gould and Villarreal 2006; Ma et al. 2006; Zhu 2006). At the same time, the rising FAFH consumption has stimulated the development of not only the catering industry in terms of employment, incomes, and profit (Gould and Villarreal 2006; Ma et al. 2006), but also other related industries dealing with processed and semi-processed food items for home consumption (Mihalopoulos and Demoussis 2001; Ma et al. 2006; Zhu 2006). To some extent, the popularity of FAFH is both a cause and an effect of economic change (Ma et al. 2006). In addition, the apparent slow growth trend of at-home meat consumption and the widening gap between China's meat production and consumption statistics were found to be related to the increase in FAFH meat consumption (Ma et al. 2006). Unfortunately, such consumption has not been properly accounted for by NSB statistics (Min et al. 2004; Wang et al. 2005; Gould and Villarreal 2006; Ma et al. 2006). Nonetheless, the increasing FAFH meat consumption is a crucial component when studying food consumption in China.

Most existing studies tend to examine general food consumption, with FAFH expenditure being treated as an aspect of consumer eating habits. Some have identified income growth, urbanization, and market development as three critical determinants of the changing food consumption pattern (Wang and Chern 1992; Huang and David 1993; Halbrendt et al. 1994; Fan et al. 1995; Gao et al. 1996; Huang and Rozelle 1998; Rae 1998; Huang and Bouis 2001; Gould 2002). There is a dearth of literature focusing on China's FAFH consumption, with the exception of studies by Ma (2000), Min et al. (2004), Ma et al. (2006), and Bai et al. (2010). These authors analyzed China's FAFH demand and concluded that (1) income growth has a major impact on FAFH consumption, and (2) FAFH meat consumption could be a major reason for the gap in official data between meat supply and demand. Due to lack of reliable data, studies on FAFH meat consumption in the Chinese context are scarce. However, examining China's FAFH meat consumption is warranted, given China's rapid economic transformation, the continuous upward trend of FAFH consumption, and its impact on increasing meat consumption.

While this study has some similarities to Ma et al. (2006) (e.g., both studies use single and multivariate approaches to analyze FAFH expenditure), it adds to the literature in several important aspects. First, while Ma et al. (2006) covered urban China only, the present study

provides some comparison between urban and rural regions. Another difference is in product focus. Ma et al. (2006) disaggregated FAFH expenditure into three broad product groups: grains, meats and eggs, and liquor and beverages. Meanwhile, the present study focuses on meats. Finally, Ma et al. (2006) explored relationships among the product groups mentioned above. This study examines links between home and away-from-home (AFH) consumption of the same meat product.

This research provides empirical evidence of FAFH meat consumption in China. A theoretically more appealing econometric model, which accommodates zero expenditure, was used in the analysis.

METHODS OF ANALYSIS

This section outlines the methods used, including the Tobit and multivariate Tobit models. Three analyses were conducted: (1) FAFH consumption in general, (2) AFH beef consumption, and (3) AFH beef consumption relative to beef consumption at home.

FAFH consumption can be analyzed within the theoretical context of household production economics (Becker 1965; McCracken and Brandt 1987; Mihalopoulos and Demoussis 2001). Drawing on household production theory, the literature on United States FAFH consumption has analyzed the value of the meal planner's time, income, race, residence, and size and composition of the household as key factors that could affect food consumption (Prochaska and Schrimper 1973; Redman 1980; Kinsey 1983; McCracken and Brandt 1987; Piggott 2003; Yen et al. 2003). Since women are usually responsible for meal preparation, factors that are presumed to affect the opportunity cost of women's time (e.g., employment status, income, age, and education) are included as explanatory variables in FAFH consumption analyses (Redman 1980; Kinsey 1983; McCracken and Brandt 1987; Yen 1993).

In this study, the Ordinary Least Squares technique was ruled out for estimation because 22 percent of the surveyed households reported that they had incurred zero FAFH expenditure (McCracken and Brandt 1987; Ma et al. 2006). Previous studies on FAFH consumption in other countries have used different models such as the simple Tobit model (Tobin 1958; McCracken and Brandt 1987), the Box-Cox double-hurdle model (Yen 1993), and switching regression (Manrique and Jensen 1998). The choice of model depends on the underlying cause of zero expenditure (Mihalopoulos and Demoussis 2001). Based on earlier studies, corner solutions are regarded as the main cause of zero FAFH expenditure in China (Wu 1999; Min et al. 2004; Gould and Villarreal 2006; Ma et al. 2006). In these circumstances, the Tobit model provides a theoretically consistent technique that uses information from all observations in the estimation process. It has also been proven appropriate for studies such as this (McCracken and Brandt 1987; Reynolds and Shonkwiler 1991; Mihalopoulos and Demoussis 2001).

In this study, FAFH is defined to include only food consumed at commercial food facilities. Following the theoretical framework and model specification of McCracken and Brandt (1987), total food expenditure away from home can be defined as:

$$Exp_h = E(Y_h, Z_{h,} E_h) \quad (1)$$

where Exp_h is the expenditure on FAFH of the *hth* household, Y_h is the *hth* household's income, Z_h are vectors of other explanatory variables that capture differences in demand among households households (e.g., age, presence of a child, and opportunity to attend collective consumption); and E_h contains all other variables affecting expenditure that are excluded from Y_h

and Z_h, (e.g., location of the sample households). Equation 1 was used to identify the main factors that influence FAFH consumption (Table 1). The following propositions were tested: (1) employment of household wife will increase FAFH expenditure, (2) household size and composition will affect FAFH expenditure, and (3) urban or rural residency will affect FAFH expenditure.

Initially, it was considered that ethnic group might be an important influence. However, once regional location was included as an explanatory variable, ethnicity was always insignificant.

Variables in the analysis were measured in ways consistent with other FAFH studies (Redman 1980; Kinsey 1983; McCracken and Brandt 1987; Yen 1993; Mihalopoulos and Demoussis 2001; Ma et al. 2006; Heng and Guan 2007). The dependent variable was weekly household expenditure on FAFH consumption. The independent variables were household income; household size; age of meal planner; education level of meal planner; number of males in the household; and dummy variables, which reflect the locations of the households, employment status of household wife, attendance at collective consumption[1] activities, and whether there is a child in the household.

As with most previous FAFH studies, dummy variables for age and education level were used in the first analysis. Such variables also gave the best results. In the second analysis, the best results were obtained with age and level of education as simple numerical variables.

Equation 1 can also be used to investigate external factors affecting FAFH expenditure on beef. The variables are defined in Table 2. The major additional variables included when analyzing expenditure on beef was the type of food facility. It was expected that the type of facility available to different consumers would influence their AFH meat consumption patterns.

In the third analysis, the interrelationship between home and FAFH meat consumption was explored since they constitute a complete meat demand system. Though the Tobit model provides consistent estimates of FAFH consumption, it may not be an appropriate method for analyses involving interrelated food groupings (Cornick et al. 1994). Importantly, the decision to consume a certain meat item away from home is probably a function of the level of its home consumption, the level of FAFH consumption of other meat items, and other factors included in Equation 1.

An alternative censored-system estimator was adopted by specifying a set of equations, accounting for interdependence between meat items and linkages across FAFH and home consumption. It provided a framework for investigating the multi-market implications of meat consumption patterns in China. In the model, observable meat expenditure variables are determined by:

$$y_{ij}^{*} = X_{ij}^{'}\beta_i + \varepsilon_{ij}, \qquad 1 \le i \le p, \quad 1 \le j \le n \quad (2)$$

where y_{ij}^{*} is a latent variable, x_{ij} is a vector of independent variables,

$$\varepsilon_j = (\varepsilon_{1j}, \varepsilon_{2j}, \cdots, \varepsilon_{pj})' \sim iid\ N_p(0, \Omega)$$

and y_{ij} is a variable defined by Equation 3.

$$y_{ij} = \begin{cases} y_{ij}^{*} & if\ y_{ij}^{*} \ge 0 \\ 0 & if\ y_{ij}^{*} \le 0 \end{cases} \qquad (3)$$

1 Collective consumption is defined as a group of people eating out at a middle or top-end hotel or restaurant financed either by an individual or collective enterprises or state institutions.

Table 1. Categories and definitions of independent variables used in the Tobit model for total FAFH expenditure

Category	Description
Income	Annual household income
Age (no dummy if over 60)	
<30	Dummy variable; 1 if meal planner's age is below 30
30-60	Dummy variable; 1 if meal planner's age is between 30 and 60
Education (no dummy if less than 6 years)	
6-12 years	Dummy variable; 1 if meal planner's years of education is between 6 and 12
>12 years	Dummy variable; 1 if the meal planner's years of education is over 12
Household size	Number of people in the household surveyed
Number of males	Number of males over 16 in household surveyed
Presence of a child	Dummy variable; 1 if there is at least one child in the household
Employment status of wife	Dummy variable; 1 if the wife in the household is working
Opportunity to attend collective consumption	Dummy variable; 1 if a family member attends collective consumption
Urban or rural resident	Dummy variable; 1 if consumer is in an urban area
Regional dummies (no dummy for Shandong)	
Liaoning	Dummy variable; 1 if the household is in Liaoning province
Inner Mongolia	Dummy variable; 1 if the household is in Inner Mongolia
Jiangsu	Dummy variable; 1 if the household is in Jiangsu province
Sichuan	Dummy variable; 1 if the household is in Sichuan province

Table 2. Categories and definitions of independent variables used in the Tobit model for FAFH beef expenditure

Category	Description
Income	Annual household income
Age	Meal planner's age
Education	Meal planner's education level
Number of males	Number of males over 16 in household surveyed
Employment status of wife	Dummy variable; 1 if the wife in the household is working
Opportunity to attend collective consumption	Dummy variable; 1 if a family member attends collective consumption
Types of food facilities	
Chinese fast food	Dummy variable; 1 if they eat at Chinese fast food facilities
Western fast food	Dummy variable; 1 if they eat at western fast food facilities
Chinese restaurant	Dummy variable; 1 if they eat at Chinese restaurants
Western restaurant	Dummy variable; 1 if they eat at western restaurants
Grill houses	Dummy variable; 1 if they eat at grill houses
Urban or rural resident	Dummy variable; 1 if the consumer is in an urban area
Regional dummies (no dummy for Shandong)	
Liaoning	Dummy variable; 1 if the household is in Liaoning province
Inner Mongolia	Dummy variable; 1 if the household is in Inner Mongolia
Jiangsu	Dummy variable; 1 if the household is in Jiangsu province
Sichuan	Dummy variable; 1 if the household is in Sichuan province

Hence, the latent expenditure on the *ith* meat item of the *jth* household is denoted by y_{ij}^* , and the observed expenditure by y_{ij} which is either positive or zero. Following Huang (2001), the equations can be expressed as

$$y_j^* = X_j\beta + \varepsilon_j, \qquad j = 1,2,\cdots,n \tag{4}$$

or

$$\begin{bmatrix} y_{1j}^* \\ y_{2j}^* \\ \vdots \\ y_{pj}^* \end{bmatrix} = \begin{bmatrix} x_{1j}' & 0 & \cdots & 0 \\ 0 & x_{2j}' & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & x_{pj}' \end{bmatrix} \theta \begin{bmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_p \end{bmatrix} + \begin{bmatrix} \varepsilon_{ij} \\ \varepsilon_{2j} \\ \vdots \\ \varepsilon_{pj} \end{bmatrix} \tag{5}$$

where:

$$y_j^* = \left(y_{1j}^*, y_{2j}^*, \cdots, y_{pj}^*\right)', X_j = diag(x_{1j}', x_{2j}', \cdots),$$
$$\text{and } \beta = \left(\beta_1', \beta_2', \cdots, \beta_p'\right)'$$

is a $k \times 1$ vector with $k = \sum_{i=1}^{p} k_i$. One of the main points in Equation 5 is that some or possibly many consumers will not buy every meat item. When there are p meat items, there would be 2^p possible combinations of meat items at their censoring points. The 2^p possible combinations are represented by the 2^p *X 1* vector S_k, k=1,2,...,2^p, as

$$\begin{cases} S_1 = (0,0,\cdots\cdots\cdots,0)' \\ \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \\ S_k = \left(i_1, i_2, \cdots, i_r, \cdots i_p\right) \quad i_r = \begin{cases} 1 \; if \; y_{ij}^* \geq 0 \\ 0 \; if \; y_{ij}^* \leq 0 \end{cases} \\ \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \\ S_{2p} = (1,1,\cdots\cdots\cdots,1)' \end{cases} \tag{6}$$

where '1' means that the observed expenditure is positive and equals the desired expenditure, and '0' means the desired expenditure is non-positive, meaning that any expenditure on that particular meat cannot be observed. Therefore, the likelihood function for the expenditure pattern of the *jth* consumer falling in the S_k combination is given by:

$$L_j^{S_k}\left(y_j;\beta,\Omega\right) = \int_{-\infty}^{x_{1j}'\beta_1} \cdots \int_{-\infty}^{-x_{rj}'\beta_r} L\left(y_{yj}^*;\beta,\Omega\right) dy_{rj}^* \cdots dy_{1j}^* \tag{7}$$

where:

$$\left(y_{yj}^*;\beta,\Omega\right) = (2\pi)^{-0.5p}|\Omega^{-1}|^{0.5} \; exp\left[-0.5 \times \left(y_j^* - X_j\beta\right)\right]' \times \Omega^{-1}\left(y_j^* - X_j\beta\right)$$

(Judge et al. 1988), is the multivariate normal density function, and r stands for the number of zeros in the possible combination vector. The likelihood function, accounting for all censoring combinations of all observations, is:

$$L(Y;\beta,\Omega) = \prod_{j=1}^{n} L_j^{S_k}(Y;\beta,\Omega) \tag{8}$$

where $Y = \left(y_1', y_2', \cdots, y_n'\right)'$ and $L_j^{S_k}$ gives the likelihood that the expenditure pattern of the *jth* household falls into regime *k*.

Though it is difficult to estimate models containing more than three censored dependent variables with current numerical optimisation software (McCracken and Brandt 1987; Ma et al. 2006), if p is less than 3, parameter estimates in Equation 2 can be obtained by standard maximum likelihood estimation (Chavas and Kim 2004). The resulting framework is called "a multivariate Tobit model," which is a generalization of the Tobit system (Amemiya 1974).

In this model, the dependent variables were defined as FAFH expenditure shares of pork and beef and mutton (Table 3), following the theoretical framework and model specification of McCracken and Brandt (1987). They were chosen because (1) pork is the main meat item in the Chinese diet, (2) beef and mutton are increasingly consumed by non-traditional eaters, and (3) the limitations of the estimation techniques restrict attention to just a couple of meats. The independent variables were (1) household income, (2) age of meal planner, (3) share of expenditure on the same meat item, (4) share of expenditure on the other meat items in

Table 3. Categories and definitions of independent variables used in the multivariate Tobit model for FAFH expenditure on different meat items

Category	Description
Income	Annual household income
Age	
<30	Dummy variable; 1 if meal planner's age is below 30
30-60	Dummy variable; 1 if meal planner's age is between 30 and 60
FAFH expenditure on pork for beef-and-mutton equation	Share of FAFH expenditure on pork
FAFH expenditure on beef and mutton for pork equation	Share of FAFH expenditure on beef and mutton
Home consumption of pork for pork equation	Share of home expenditure on pork
Home consumption of beef and mutton for beef and mutton equation	Share of home expenditure on beef and mutton
Urban or rural resident	Dummy variable; 1 if consumer is in an urban area
Regional dummies (no dummy for Shandong)	
Liaoning	Dummy variable; 1 if the household is in Liaoning province
Inner Mongolia	Dummy variable; 1 if the household is in Inner Mongolia
Jiangsu	Dummy variable; 1 if the household is in Jiangsu province
Sichuan	Dummy variable; 1 if the household is in Sichuan province

the system, and (5) dummy variables reflecting the locations of the households.

DATA

Household surveys for both urban and rural areas were carried out in Jiangsu, Shandong, Inner Mongolia, Liaoning, and Sichuan from September to December 2005 as part of a research collaboration between Meat and Livestock Australia and the Faculty of Rural Management, University of Sydney. The surveys collected data that were essential in examining meat consumption patterns in China. A stratified data sampling method was applied. The total number of responses was 232 for urban areas and 108 for rural areas (Table 4). A sample of 340 was considered appropriate to ensure validity in this exploratory study. Table 4 shows that the household size, age, and years of education of the meal planner were as expected. However, only data for household size could be compared directly to NSB data. In the sample, there were no large differences in household size and age among the five provinces. Meanwhile, years of education were lower in rural areas and very low in Liaoning.

Characteristics of the sampled households, disaggregated by urban and rural residents, are reported in Table 5. Education and income levels were lower in rural areas. Most means of the key variables generated in the sample were consistent with those observed in NSB (2006a, 2006b) and Information Technology Associates (2008). For example, per capita annual income of the urban sample was CNY 11,202 (USD 1,640) whereas that of NSB (2006a) was CNY 10,493 (USD 1,540); family size in the sample was 3.1 whereas that of NSB (2006b) was 3.4; and the 2005 NSB estimate provided by Information Technology Associates (2008) was 3.16. For educational attainment, the sample

Table 4. Basic statistics of the surveyed households at province level

Province	Households	Household Size	Age	Education
Urban				
Inner Mongolia	56	3.07 (3.13)	42.9	10.2
Liaoning	46	2.91 (3.12)	43.2	10.7
Shandong	40	3.03 (3.04)	44.6	10.2
Sichuan	30	3.00 (3.34)	44.3	11.0
Jiangsu	60	3.40 (3.15)	45.9	9.7
Rural				
Liaoning	35	3.23(3.12)	45.7	5.8
Shandong	34	2.74(3.04)	43.4	7.1
Jiangsu	39	3.26(3.15)	44.6	7.9

Note: Household size is the average household size; age is the average age of the meal planner of the household; and education is the average years of education that the meal planner has attained. For comparison, the figures in parentheses are 2005 NSB province averages for urban and rural areas combined (Information Technology Associates 2008).

Table 5. Characteristics of the surveyed households

Characteristics	Survey Sample		
	Urban	Rural	All
Average household size	3.1	3.1	3.1 (3.16)
Age	44.2	44.6	44.4
Maximum age	7.0	77	79
Minimum age	22.0	20	20
Education (% of the samples)			
Primary school or less	28.0	75.9	43.2 (41.3)
Middle school graduate	32.3	24.1	29.7 (40.3)
High school graduate	38.8	0.0	26.5 (12.9)
College graduate	0.9	0.0	0.6 (5.3)
Ethnic group (% of the sample)			
Han Chinese	92.5	91.7	92.1
Non-Han Chinese	7.5	8.3	7.9
Annual household income (% of the sample)			
Less than CNY 6000	2.2	28.7	10.6
CNY 6000–10000	3.0	28.7	11.2
CNY 10001–20000	22.0	26.9	23.5
CNY 20001–30000	28.5	9.3	22.4
More than CNY 30001	44.4	6.5	32.4
Total number of the samples	232	108	340

Note: Age is the average age of meal planner of the household surveyed and education is the education level attained by the meal planner of the household surveyed. For comparison, the figures in parentheses are 2005 averages across the five provinces in our study, calculated from NSB data (Information Technology Associates 2008). The education distribution in the comparison figures is across the whole population, not just meal planners, as in the sample.

indicates the level achieved by the meal planner whereas the comparison figure in Table 5 is for all household members. However, taken at face value, the comparison suggests that the sample included more high school graduates and fewer middle school and college graduates than in the population. Nevertheless, overall the survey data were considered representative, indicating that the survey was a reliable source for further estimation.

RESULTS AND DISCUSSION

Maximum likelihood methods were used to obtain parameter estimates for the Tobit model of total FAFH expenditure. Table 6 shows the mean values of the weekly FAFH expenditure (i.e., the dependent variable) and the proportion of this expenditure on different meats in the five provinces. FAFH expenditure was significantly higher in the urban areas, especially in Jiangsu. In terms of meat types, rural Liaoning stood out from the other regions because of its traditional stance. It had a higher and lower proportion of expenditure on pork and beef and mutton, respectively.

Most explanatory variables had the expected signs and coefficients were significantly different from zero (Table 7). In addition, an analysis of the residuals revealed no pattern, suggesting that there was neither autocorrelation nor omitted variables. The model indicates a strong relationship between income and demand for FAFH, which is consistent with other literature on FAFH consumption (Ma et al. 2006). According to the survey, on average, the households spend about 10 percent of their total income on FAFH consumption. The results also show that urban households spend more on FAFH than rural households. Contrary to expectations, the model shows that households with less educated meal planners were more inclined to consume meals outside the home. A possible explanation is that less educated meal planners, mostly women, have to work longer because of low salaries. As such, they have less time to prepare meals at home than their educated counterparts. Hence, the households with a less educated working woman (wife) were more likely to consume FAFH that they can afford.

Table 6. Descriptive statistics of FAFH expenditure (dependent variables)

	Overall		Jiangsu		Liaoning		Shandong		Inner Mongolia	Sichuan
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Urban
Weekly FAFH expenditure/ household/ week (CNY)	108.32	13.52	126.17	10.53	103.04	8.57	101.25	22.35	104.64	97.00
% FAFH expenditure										
Pork	26	33	27	23	25	61	25	16	27	23
Poultry	18	17	20	17	11	21	17	13	19	26
Beef	18	17	18	18	20	6	17	27	15	17
Mutton	15	14	10	13	14	4	17	25	22	7
Aquatic	24	18	24	28	31	9	23	19	17	28

Table 7. Maximum likelihood estimates using Tobit model for total FAFH expenditure

Independent Variables	Estimated Coefficients	Standard Errors
Income	0.0005**	0.0001
Age		
<30	15.24*	9.35
30-60	14.31**	6.98
Education		
6-12 years	−6.89	5.64
>12 years	−12.39*	6.92
Household size	−1.49	3.39
Number of males	10.30**	4.39
Presence of a child	−10.19**	4.90
Employment status of woman (wife)	27.34**	4.88
Opportunity to access collective consumption	54.67**	5.99
Regional dummies (no dummy for Shandong)		
Urban	43.92**	5.68
Liaoning	3.80	6.12
Inner Mongolia	1.39	6.71
Jiangsu	−5.25	6.00
Sichuan	−4.30	8.04
Constant	−41.59**	10.39
Scale factor	33.91**	1.49
Log likelihood	−1358.12	
R-squared	0.63	

Note: A child is defined as being less than 14 years old; ** and * indicate statistical significance at 5 percent and 10 percent levels, respectively.

Also, the model indicates that males spend more money on FAFH than females. This is in line with the observation from fieldwork that in a Chinese context, males are more outgoing than females and enjoy mingling with friends. As expected, the presence of a working wife in the household increases expenditure on FAFH, aligning with the principles of household production economics and other earlier studies (Veeck and Veeck 2000, Ma et al. 2006; Curtis, McCluskey, and Wahl 2007). The presence of children has a negative influence on FAFH consumption. This probably reflects a family effect in which families with children are more constrained by time or income because money has to be spent elsewhere (e.g., tuition fees). Alternatively, inconvenience for adults with children in a restaurant or parents' concern about the quality or hygiene of restaurant food for their children could also affect FAFH consumption negatively.

The model shows that urban residents spend more money on FAFH than rural residents. In part, this may be because time is scarcer in urban China, at least for those gainfully employed. At the same time, the greater propensity to consume FAFH reflects the fact that urban consumers have greater access to processed food markets, fast food chains, and restaurants compared to rural consumers. Rural food consumption patterns are conditioned by rural lifestyle, exhibiting less propensity and opportunity to consume FAFH. However, no evidence was found to show distinct regional FAFH consumption patterns apart from this.

Billions of public money are spent on collective consumption each year. Collective consumption is regarded as a cultural and social product. In the estimated model, the opportunity to access collective consumption has positive and considerable impact on FAFH consumption. In contrast, although consumers enjoy dining out with their family, this only accounts for a small proportion of FAFH expenditure in China (Cai, Longworth, and Brown 1998).

The parameter estimates for the second model that analyzes expenditure on FAFH beef consumption are shown in Table 8. Most of the explanatory variables had the expected signs and coefficients that were significantly different from zero. The analysis of residuals again showed no indication that key variables were omitted. The model shows that although income plays a positive role in FAFH beef expenditure, it is not statistically significant. As well, at this more disaggregated level, factors such as type of restaurant become important to FAFH beef consumption. The results indicate that young people consume more beef dishes than their seniors. During the survey, older consumers reported negative perceptions towards beef because (1) it is viewed as not easily digestible, (2) it is tough and gets trapped in the teeth of older people,[2] and (3) it is considered to aggravate cardiac health risk.

Table 8. Maximum likelihood estimates using a Tobit model for FAFH beef expenditure

Independent Variables	Estimated Coefficients	Standard Errors
Income	0.0129	0.0241
Age	−1.96**	0.65
Education	−0.42	1.23
Number of males	1.87**	0.68
Employment status of woman (wife)	3.89**	1.00
Opportunity to access collective consumption	4.46**	1.11
Types of food facilities		
Chinese fast food facilities	3.40**	0.96
Western fast food facilities	0.39	0.94
Chinese restaurants	4.62**	1.33
Western restaurants	5.77**	1.25
Grill houses	3.14**	0.86
Regional dummies (no dummy for Shandong)		
Urban	3.27**	1.28
Liaoning	0.56	1.25
Inner Mongolia	4.62**	1.28
Jiangsu	−1.13	1.19
Sichuan	−1.17	1.54
Constant	−20.84**	8.36
Scale factor	6.16**	0.30
Log likelihood	−764.20	
R-squared	0.57	

Note: ** Indicates statistical significance at 5 percent level

2 Prior to 1978 most beef sold in China came from very old animals. This memory perhaps has remained in the minds of the elderly.

Similar to the previous analysis, males are shown to spend more money on beef dishes than females, confirming the observation that the Chinese perceive beef as a man's food. The presence of a working woman increases FAFH beef expenditure because beef is thought to be difficult and time consuming to cook at home. Also, collective consumption has a strong influence on FAFH beef expenditure. This is not unexpected given that beef dishes are usually included in banquets (Cai, Longworth, and Brown 1998). Generally, beef dishes were found to be more popular in urban areas than rural areas. Consumers in Inner Mongolia were more likely to eat beef dishes than in other provinces. In contrast, there was no evidence of any distinct beef consumption preference among the other provinces surveyed. Importantly, this study indicates that expenditure on beef will likely increase if consumers have access to Chinese fast food facilities, Chinese restaurants, western restaurants, and grill houses when eating out.

In the third analysis, when attempting to link at-home and FAFH meat consumption, the multivariate Tobit model did not perform as well as in the previous two analyses. This was due to limitations of the estimation technique and the small dataset. Only some of the explanatory variables had expected signs and coefficients that were significantly different from zero (Table 9).

The residuals analysis also suggested that another specification of the model may be more appropriate. However, each alternative model considered presented a similar residual problem. The best of these models is presented here. The model indicates that although income is positively related to FAFH expenditure on both pork and beef and mutton, the income coefficients were not significant. Thus, it may not be the most influential factor. The age variables were also not significant.

Table 9. Maximum likelihood estimates using a multivariate Tobit model for FAFH expenditure on different meat items

Independents	FAFH Expenditure on Pork	FAFH Expenditure on Beef and Mutton
Income	0.0193 (0.0895)	0.0559 (0.2443)
Age		
<30	0.2256 (3.6455)	0.4884 (0.3867)
30-60	0.0580 (0.5384)	−0.0089 (0.0320)
FAFH expenditure on pork		0.7260**
FAFH expenditure on beef and mutton	4.7138** (2.1344)	
Home consumption of pork	−0.2101 (0.1428)	
Home consumption of beef and mutton		0.5762 (0.3951)
Urban	−0.0673 (0.0902)	−0.1647 (0.2268)
Inner Mongolia	−0.1719** (0.0817)	0.4465** (0.1830)
Liaoning	−0.1223* (0.0733)	0.2042* (0.1224)
Sichuan	0.0167 (0.0626)	−0.0717 (0.1706)
Jiangsu	−0.0011 (0.0532)	−0.1650 (0.2010)
Pseudo *R*-squared	0.068	0.053
Log likelihood	−203.19	−422.03

Note: Age is the average age of the meal planner of the household surveyed and education is the education level attained by the meal planner of the household survey. Standard errors are in parentheses; ** and * indicate statistical significance at 5 percent and 10 percent levels, respectively.

FAFH expenditure on pork was related significantly to FAFH expenditure on beef and mutton, and vice versa. This indicates that consumers who have higher AFH expenditures for one meat product are also more likely to have higher expenditures for the other.

Though the third part of the study showed minimal difference between urban and rural consumers, it indicated a distinct preference for beef and mutton in Inner Mongolia and Liaoning provinces. Inner Mongolia is a traditional beef and mutton production region. In Liaoning province, the preference for beef and mutton may be related to an outbreak of avian influenza during the survey period. Consumers possibly switched from eating poultry meat to beef and mutton. However, no evidence of a distinct pork preference or beef and mutton preference existed among most of the provinces surveyed.

CONCLUSION

FAFH meat consumption accounts for an increasingly greater part of total meat consumption in China. As such, forces affecting FAFH consumption (e.g., rising income and urbanization), consequently have a strong impact on overall meat consumption. Other factors, such as employment status of women (wife), number of males, and number of children affect FAFH consumption differently. In addition, collective consumption plays an important role in increasing household FAFH expenditure. Given the large amount of money spent on collective consumption in China every year, this issue is worthy of more detailed study.

FAFH beef consumption was strongly related to the types of food facilities to which consumers had access. Chinese fast food facilities, Chinese restaurants, western restaurants, and grill houses were found to have a positive impact on beef expenditure. Demographic, geographic, and social factors such as meal planner's age, urban location of the household, employment status of women (wife), number of males, and a family member's access to collective consumption were shown to influence FAFH beef expenditure significantly. In addition, past eating habits had an impact on FAFH beef expenditure; consumer preference for beef and mutton in Inner Mongolia is a good example. Beef consumption is expected to continue to expand over time because of the underlying trends in these key explanatory variables.

Due to the limitations of estimation techniques and datasets, the multivariate Tobit model relating at-home to AFH meat consumption did not perform well in terms of a small pseudo R^2 and the insignificant estimates of some explanatory variables. However, it revealed expected relationships showing preference for beef and mutton in Inner Mongolia, and a positive relationship between FAFH expenditure on beef and pork. Such results provide a basis for further research on interrelationships between at-home and FAFH consumption. Larger consumer surveys than that of the current study will facilitate such research.

In the future, a busier lifestyle and rising income could generate promising market segments for FAFH and convenience foods. The findings of this study offer a promising picture for the future of the Chinese FAFH industry and its supplying industries. It is clear that the study of food consumption in China should focus on FAFH expenditure. In addition, future studies should probably integrate food consumption at home with food consumption away from home.

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