



**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.*

# Household Composition and Food Away From Home Expenditures in Urban China

Haiyan Liu<sup>a</sup>, Thomas I. Wahl<sup>a</sup>, James L. Seale, Jr.<sup>b</sup> and Junfei Bai<sup>c</sup>,

<sup>a</sup> Department of Agribusiness and Applied Economics,  
North Dakota State University, Fargo, ND 58108-6050, USA

Email: [haiyan.liu@my.ndsu.edu](mailto:haiyan.liu@my.ndsu.edu)

[Tom.Wahl@ndsu.edu](mailto:Tom.Wahl@ndsu.edu)

<sup>b</sup> Food and Resource Economics Department, University of Florida,

Gainesville, FL 32611-0240, USA

Email: [jseale@ufl.edu](mailto:jseale@ufl.edu)

<sup>c</sup> Center for Chinese Agricultural Policy, Institute of Geographical Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing 100101, China

Email: [jfbai.ccap@igsnr.ac.cn](mailto:jfbai.ccap@igsnr.ac.cn)

*Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's 2012 AAEA Annual Meeting, Seattle, Washington, August 12-14, 2012*

The authors acknowledge financial support from the Agriculture and Food Research Initiative Competitive Grants Program No. 09093019, NIFA, U.S. Department of Agriculture; Emerging Markets Program Agreement No. 2010-27, Commodity Credit Corporation, U.S. Department of Agriculture; and National Natural Science Foundation of China (70903062).

*Copyright 2012 by [Haiyan Liu, Thomas I. Wahl, James L. Seale, Jr., and Junfei Bai]. 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.*

## **Abstract**

Though numerous researchers have analyzed the effects of socioeconomic factors on food-away-from-home (FAFH) consumption, little is known about how household composition will affect China's FAFH patterns. This study focuses on the effects of household composition along with income and education on FAFH expenditures in urban China. A Box-Cox double-hurdle model is estimated using recent household survey data collected by the authors from Beijing, Nanjing, Chengdu, Xi'an, Shenyang and Xiamen, China. Household composition indeed has significant effects on FAFH consumption, both at the participation and expenditure steps. Different age groups have different influences. Seniors old than 60 years eat out less frequently and spend less when they consume FAFH, while adults between 20-49 are the major FAFH consumers in urban China. Children younger than 10 years have no significant effect on either FAFH participation or expenditure. Also, we find both income and wife's education have positive effects on FAFH consumption. The participation elasticity with respect to income is a bit lower, while the expenditure elasticity is significantly higher. Families with highly educated wives tend to dine away from home more often than their counterparts.

**Keywords:** Household composition, China's Food Expenditures, Food-away-from-home, Box-Cox double-hurdle model

JEL classifications: D12, D13

# Household Composition and Food Away From Home Expenditures in Urban China

## INTRODUCTION

Expenditure on food-away-from-home (FAFH) has grown rapidly in urban China since the mid-1990s and is becoming an even larger portion of total food expenditure (National Bureau Statistics of China, 1996-2011). Urban household average per capita annual FAFH expenditure increased to 1019 Yuan in year 2010, more than six times that in 1995. In terms of proportion, only 9.8% of China's food expenditure was FAFH expenditure in 1995, but in 2010 it had expanded to 22.8%. Similar results are found in each province, and Beijing's FAFH expenditure increases the most to 28% in 2010. The rise of China's FAFH consumption will not only promote China's domestic economy by stimulating the development of catering and other industry, influence the way food is produced, processed and sold, but also provide great opportunities for foreign food producers and exporters and will contribute to the growth of the global economy. Therefore, it is important to understand the determinants of China's FAFH consumption.

The notable increase of FAFH expenditure is the consequence of several factors. First, it is attributed to rising incomes resulting from China's economic structural change. Studies have found a significant, positive effect of income on FAFH expenditure (e.g., Prochaska and Schrimper, 1973; McCracken and Brandt, 1987; Yen, 1993; Gould and Villarreal, 2006; Bai *et al.*, 2010). Second, China's agricultural system reform facilitates farmers' participation in agricultural and other commercial markets, which drives the development of urbanization and then boosts the increase of urban households' FAFH consumption in a sense.

In addition to structural change in the economy, another important factor impacting China's urban FAFH consumption is the changing age structure of the population. Due in part to

improved living and medical conditions, the mortality rate of urban population has decreased dramatically since 1980s. By 2010, 12.3% of China's urban population were aged 60 or above, and it is expected to increase to 17.4% by 2020 and 33.9% by 2050 (United Nations, Department of Economic and Social Affairs, 2012). In addition, because of "later marriages, fewer births, the one couple one child in urban areas" policy, the urban birth rate has also decreased. The population between 0 to 9 years old is expected to be reduced from 12.3% in 2010 to 8.8% in 2050 (United Nations, Department of Economic and Social Affairs, 2012). As a result of these factors, there has been a significant aging of the urban population. Such demographic changes will likely impact the participation and quantities of future FAFH purchases.

A great deal of research has been done in the U.S. on urban household food consumption in which household composition has proven to be a significant factor influencing FAFH consumption. Focusing on the age and gender of household members, Lee and Brown (1986) create 12 household composition variables and find households with members between age four and 14 tend to have a greater chance of eating away from home than those with people 26 to 50 years. Similarly, Byrne, Capps and Saha (1996) construct 11 adult equivalence terms, and find household composition matters in U.S. FAFH consumption. Younger members contribute less to FAFH expenditures than adults; however, their contributions have increased over time. Yen and Jones (1997) find small children less than 10 years old have a significant and positive effect on U.S. households' cheese participation and consumption, while other age groups are only significant for cheese consumption. Using similar age categories, Su and Yen (1996) find all five age composition variables have significant and positive effects on both the probability and level of pork consumption, but household members of different ages contribute differently and those aged "20-44" have a much greater effect than others.

However, little is known about China's urban household composition and its effect on FAFH consumption. Although Ma et al. (2006) find young people consume more FAFH, as well as eat more meat when they are away from home, their study is based on individuals not households, and it does not address household composition effects on FAFH consumption. Gould (2002) analyzes the effects of different age and gender groups on Chinese urban household's food consumption but he focuses on food at home consumption. In terms of data, Ma et al. (2006) use a 1998 field survey data in Sichuan, Chongqing, Jilin and Shandong, including 250 households while Gould (2002) uses a 1995-1997 urban survey data for Jiangsu, Shandong and Guangdong provinces conducted by the National Bureau of Statistics of China. Both data are relatively old and their coverage of China is limited.

Given the profound importance of FAFH consumption, the significant effects of household composition in other countries, and the scarce research in China, there is a need to develop a deep and detailed analysis of the relationship between household composition and China's urban FAFH consumption. Using recently collected survey data from six cities throughout China, this paper focuses on the effect of household age composition on urban China's FAFH expenditure. The second part of this article is a brief introduction of the methodology, followed by a descriptive analysis of the data. Then, we present our empirical results in section four, and finally we discuss the major findings.

## **METHODOLOGY**

Consider the decision to consume FAFH as a two-step decision. First, consumers make the participation decision (i.e., whether or not to dine out). Secondly, they decide how much to spend once they participate in the FAFH market, referred to as the expenditure decision. This two-step feature results in zero-observed expenditure on dining out for those who choose not to

dine out, and thereby ordinary least squares (OLS) estimates are biased and inconsistent (Amemiya, 1984).

Various types of limited dependent models have been employed to avert the biasedness and inconsistency of OLS estimates resulting from zero consumption when modeling consumer behavior. McCracken and Brandt (1987) use the Tobit technique. While the Tobit procedure considers the two-step nature of the FAFH-decision process, it assumes the explanatory variables on the participation decision and the expenditure decision are the same, which is very restrictive.

The double-hurdle model (Cragg 1971), a more flexible approach, is proposed by Yen (1993), Yen and Huang (1996), and Yen and Jones (1997). With the double-hurdle model, one can explicitly take into account the two-stage decision. Further, the double-hurdle model can take into account the interaction between the participation and consumption decisions as suggested by the studies of Jones and Yen (2000) and Bai *et al.* (2010). Following Jones and Yen (2000), for household  $i$ , the double-hurdle model is

$$(1)y_i = \begin{cases} y_{2i}^* = x_{2i}'\beta_2 + u_{2i} & \text{if } \begin{cases} y_{1i}^* = x_{1i}'\beta_1 + u_{1i} > 0 \\ \text{and} \\ y_{2i}^* = x_{2i}'\beta_2 + u_{2i} > 0 \end{cases} \\ 0 & \text{otherwise} \end{cases},$$

where  $y_i$  is the observed expenditure,  $y_{1i}^*$  and  $y_{2i}^*$  are two unobserved latent variables representing the first hurdle (participation hurdle) and the second hurdle (consumption hurdle), respectively. They are specified as linear functions of each hurdle regressors.  $\beta_1$  and  $\beta_2$  are parameter vectors and the error terms  $u_{1i}$  and  $u_{2i}$  are distributed as

$$[u_{1i}, u_{2i}]' \sim \text{BVN}(0, \Sigma), \quad \Sigma = \begin{bmatrix} 1 & \rho\sigma_i \\ \rho\sigma_i & \sigma_i^2 \end{bmatrix},$$

which means the conditional distribution of the latent variables is bivariate normal.

Since evidence of non-normal errors has been reported in double-hurdle models (e.g., Yen 1993; Yen and Jones 1996), resulting in biased and inconsistent maximum-likelihood estimates, the Box-Cox transformation (Yen 1993; Yen and Jones 1996; Bai *et al.* 2010) is applied in this analysis. The Box-Cox transformation (Poirier 1978) on the observed dependent variable  $y_i$  is

$$(2) y_i^T = \begin{cases} \frac{y_i^\lambda - 1}{\lambda} & \text{if } \lambda \neq 0, \\ \log(y_i) & \text{if } \lambda = 0 \end{cases},$$

where  $\lambda$  is an unknown parameter. The sample likelihood function for the Box-Cox double-hurdle model can be derived from (1) and (2) as

$$(3) L = \prod_{y_i=0} [1 - \Psi(x'_{1i}\beta_1, \frac{x'_{2i}\beta_2 + 1/\lambda}{\sigma_i}, \rho)] \cdot \prod_{y_i>0} \left\{ \Phi \left[ \frac{x'_{1i}\beta_1 + (\rho/\sigma)(y_i^T - x'_{2i}\beta_2)}{(1-\rho^2)^{1/2}} \right] y_i^{\lambda-1} \frac{1}{\sigma_i} \phi \left( \frac{y_i^T - x'_{2i}\beta_2}{\sigma_i} \right) \right\},$$

where  $\Psi(\cdot)$  is the standard bivariate normal cumulative distribution function with correlation  $\rho$ , and  $\Phi(\cdot)$  and  $\phi(\cdot)$  are the univariate standard normal distribution and density functions, respectively.

To allow for heteroskedasticity in this transformed model, the standard deviation of errors  $\sigma_i$  is specified as

$$(4) \sigma_i = w_i' \gamma,$$

where  $w_i$  is a vector of exogenous variables and  $\gamma$  is the parameter vector. Following Bai *et al.* (2010),  $w_i$  is hypothesized to only include total household income (including the wife's wage earning). Thus, the normality, homoskedasticity and independence of error terms can be statistically tested.

## DATA

The empirical analysis is based on a survey of 1340 households from six cities in China: Beijing, Nanjing, Chengdu, Xi'an, Shenyang and Xiamen. The Beijing survey, collected in 2007,

is the first of six surveys conducted by the authors. The Nanjing data were collected in 2009, Chengdu data in 2010, and data of the other three cities (Xi'an, Shenyang, and Xiamen) in 2011. The numbers of sampled households are 315 in Beijing, 246 in Nanjing, 208 in Chengdu, 215 in Xi'an, 207 in Shenyang, and 149 in Xiamen. For each household, seven continuous days and three meals per day are recorded. See Bai et al. (2010) for detailed information of the survey.

The dependent variable is household weekly FAFH expenditures. The independent variables in the participation hurdle  $x'_{1i}$  are hypothesized to include household disposable income, wife's education, household composition variables, and city dummies. Household composition variables are defined as: number of individuals aged between 0-9, 10-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79, 80+ (including 80) in a household. The variable  $x'_{2i}$  in the expenditure hurdle function includes all variables in  $x'_{1i}$  plus several additional exogenous variables: a quadratic term of household income; two other variables measuring the effects of weekends and social network; the number of FAFH visits on weekends; and the number of non-household members eating with household away from home during the week.

The inclusion of the weekend variable is based on the study of Byrne *et al.* (1996). They find the number of FAFH visits on weekends has significantly positive effects on U.S. FAFH expenditures during 1982 to 1989. Considering that more and more people in China work regularly on weekdays while taking days off on weekends, the FAFH consumption could be different on weekends from weekdays. As to the non-household member variable, it is due to China's social tradition. In China, people usually treat their friends, relatives and others by dining away from home instead of eating at home, which may have some effect on household's FAFH consumption. Actually, Bai et al. (2010) have found a significant and positive effect of hosted meals on household FAFH expenditure.

**Table 1**

Household weekly FAFH consumption by city

City	Full Sample			Reported FAFH Expenditures	
	HH consuming FAFH	FAFH expenditure	FAFH visits on weekends	FAFH expenditure	FAFH visits on weekends
Total	83%	147	1.84	176	2.22
Beijing	88%	177	1.65	201	1.87
Nanjing	83%	144	1.73	172	2.07
Chengdu	82%	158	1.88	193	2.31
Xi'an	84%	140	2.55	167	3.03
Shenyang	78%	123	1.68	157	2.14
Xiamen	80%	115	1.59	144	1.99

Note: FAFH expenditure is Yuan per week in 2010 adjusted using regional monthly consumer price indices for food.

Source: Compiled by authors between 2007 and 2011.

Overall, 83% of the sampled Chinese urban households participate in the FAFH market. Beijing, as the capital of China and one of the busiest cities in China, has the largest share of FAFH participation (88%). Xi'an is a bit lower, Nanjing, Chengdu and Xiamen are next, and fewest urban households in Shenyang dine out (Table 1). The average weekly expenditure on FAFH for all households is 147 Yuan and 176 Yuan for those households with positive FAFH expenditures during the survey week. The difference of FAFH expenditure between the full sample and those households reporting positive FAFH expenditures is basically 29 Yuan; however, Chengdu had the largest discrepancy and Beijing has the smallest disparity (Table 1). Once households in Chengdu decide to eat out, they consume more than people in any of the other five cities. Citizens in Xiamen have the least FAFH expenditure and far less than in the other five cities.

Chinese urban households eat away from home on weekends less than two times per week (1.84) on average; however, people in Xi'an dine away from home on weekends more

often than people in the other five cities. The average number of FAFH visits on weekends in Xi'an is 2.55, much higher than that for Xiamen (1.59). Furthermore, if we simply look at households with positive FAFH expenditure during the week, all households in the six cities dine out more often on weekends. For those residing in Xi'an, they consume FAFH more than three times on Saturday and Sunday, whereas households in Beijing and Xiamen eat out of home more frequently on weekdays.

**Table 2**

Summary statistics of exogenous variables used in regression estimation

	Full Sample		Reported FAFH Expenditures	
	Mean	SD	Mean	SD
<b>Age groups</b>				
# of HH members 0<=age<=9	0.18	0.40	0.19	0.41
# of HH members 10<=age<=19	0.26	0.45	0.27	0.45
# of HH members 20<=age<=29	0.37	0.55	0.41	0.57
# of HH members 30<=age<=39	0.41	0.70	0.45	0.73
# of HH members 40<=age<=49	0.59	0.80	0.64	0.82
# of HH members 50<=age<=59	0.61	0.82	0.62	0.82
# of HH members 60<=age<=69	0.32	0.65	0.28	0.61
# of HH members 70<=age<=79	0.14	0.42	0.10	0.37
# of HH members age>=80	0.04	0.22	0.03	0.19
HH monthly disposable income	0.58	0.37	0.61	0.37
Wife's education (1 > high school)	0.35	0.48	0.38	0.49
FAFH visits on weekends (#)	1.84	2.17	2.22	2.20
Non-HH members FAFH (#)	1.14	3.91	1.37	4.25
<b>Location</b>				
Beijing	0.24	0.42	0.25	0.43
Nanjing	0.18	0.39	0.18	0.39
Chengdu	0.16	0.36	0.15	0.36
Xian	0.16	0.37	0.16	0.37
Shenyang	0.15	0.36	0.15	0.35
Xiamen	0.11	0.31	0.11	0.31
Observation	1340		1115	

Note: Household income is measured in 10,000 Yuan and adjusted to 2010 income using national annual income indices.

Source: Compiled by authors between 2007 and 2011.

From table 2, we can see that the largest number of people in our sample is between 50 and 59 years, with 40-49 years following. People in their 30s and 20s are two groups with the third and fourth highest amount. But at the same time, we need to notice that a certain number of China's urban citizens are older than 60 years, even more than the sum of children and adolescents.

The statistical descriptions of exogenous variables specified in the Box-Cox double-hurdle model are reported in Table 2. The average number of non-household members eating with household members during a whole week is 1.14 for the full sample and 1.37 for those reporting FAFH expenditure, no significant difference. Monthly household disposable income is 5800 Yuan and 6100 Yuan in the two groupings. According to our survey, households in Beijing, Xiamen and Nanjing all have a monthly income above 6000 Yuan, significantly higher than Shenyang's income, while Chengdu and Xi'an are in between. In terms of wife's education, 35% of them received education above high school.

## **ESTIMATION RESULTS**

The empirical estimation is based on the sample of 1340 households in six Chinese cities. Estimation of the Box-Cox Double Hurdle model is accomplished by maximizing the log-likelihood function corresponding to equation (3). ML estimates are presented in table 3. The Box-Cox parameter lambda equals 0.721, which is significantly different from both zero and one at the 0.01 level. Thus, both the generalized Tobit model (lambda=0) and standard double hurdle model (lambda=1) are rejected.

Household monthly disposable income is significant in the sigma equation, meaning that

the errors suffer from heteroskedasticity. Also, the coefficient on the correlation term  $\rho$  is significant, suggesting dependence between the two hurdles. Hence, it is necessary to allow for unequal variances across households and the existence of dependence in the model to generate consistent estimates.

Household composition does matter for household FAFH consumption both for participation and consumption, and different age groups have different effects. As expected, households with higher income are more likely to purchase FAFH than poor households. Also, expenditures for these households are significantly higher, similar to the findings by Yen (1993), Gould and Villarreal (2006), and Bai *et al.* (2010). However, the expenditure level is found to increase at a decreasing rate as income increases as indicated by the significantly negative coefficient on the quadratic term of household income (Table 3). Wife's education is positively correlated to both FAFH participation and expenditure as well, thus, the higher education a wife receives, the more likely the household dines out and the higher the amount of money they spend. The coefficient on weekend FAFH visits is significant and positive, meaning the more frequently a household eats away from home on weekends, the more it consumes. Also, the increase of non-household members' eating away from home with household members increases household expenditure of FAFH.

The negative signs on the location dummies for households that reside in Nanjing, Chengdu, Xi'an, Shenyang and Xiamen show that, all other things equal, FAFH demand is higher in the base city (Beijing). Given Beijing's relatively higher development level as the national capital, this is easy to understand. However, this regional difference is only significant for FAFH expenditure rather than the probability of participating.

**Table 3**

ML Estimation of the Box-Cox Double-hurdle Model

	HH weekly FAFH expenditure	
<b>Participation</b>		
# of household members 0<=age<=9	-0.0031	(0.131)
# of household members 10<=age<=19	0.199*	(0.120)
# of household members 20<=age<=29	0.445***	(0.102)
# of household members 30<=age<=39	0.384***	(0.0980)
# of household members 40<=age<=49	0.238**	(0.0928)
# of household members 50<=age<=59	0.0772	(0.0881)
# of household members 60<=age<=69	-0.119	(0.0871)
# of household members 70<=age<=79	-0.356***	(0.102)
# of household members age>=80	-0.543***	(0.152)
HH total disposable income	0.569***	(0.166)
Wife's education(1=above high school)	0.200**	(0.100)
Nanjing	0.0294	(0.141)
Chengdu	-0.0597	(0.143)
Xi'an	-0.0500	(0.143)
Shenyang	-0.0755	(0.142)
Xiamen	-0.221	(0.155)
Constant	0.280	(0.192)
<b>Expenditure</b>		
# of household members 0<=age<=9	0.275	(0.250)
# of household members 10<=age<=19	0.624***	(0.230)
# of household members 20<=age<=29	0.520***	(0.191)
# of household members 30<=age<=39	0.776***	(0.208)
# of household members 40<=age<=49	0.308*	(0.175)
# of household members 50<=age<=59	0.207	(0.166)
# of household members 60<=age<=69	-0.315*	(0.172)
# of household members 70<=age<=79	-0.662***	(0.247)
# of household members age>=80	-1.587***	(0.445)
HH total disposable income	3.501***	(0.730)
HH income square	-0.521*	(0.282)
Wife's education(1=above high school)	0.462**	(0.183)
# of non-household members FAFH	0.127***	(0.0232)
# of FAFH visits on weekends	0.571***	(0.0720)
Nanjing	-0.624**	(0.259)
Chengdu	-0.174	(0.257)
Xi'an	-1.279***	(0.299)
Shenyang	-0.666**	(0.281)
Xiamen	-1.492***	(0.346)
Constant	5.057***	(0.440)
sigma		
HH total disposable income	0.877***	(0.240)
Constant	2.090***	(0.240)
lambda		

Constant	0.721***	(0.0706)
rho		
Constant	0.483***	(0.0583)
N	1340	
Log Likelihood	-7057.7	

Standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

From the estimates in the full Box-Cox double hurdle model, one can calculate the predicted impact of the individual regressors in  $x_1$  and  $x_2$  on the probability of consuming FAFH and on the observed level of FAFH expenditure. The predictions are complicated by the dependence between the two hurdles and by the nonlinear transformation between  $y_2^*$  and  $y$ . As a result, the magnitudes of the coefficients  $\beta_1$  and  $\beta_2$  in model (1) are difficult to interpret. Elasticities give a more intuitive interpretation of the marginal effects. Table 4 gives the elasticities of the probability of participating, expenditures, and total expenditure with respect to all exogenous variables. For continuous variables, the elasticities are evaluated at sample means, and for discrete regressors, average effects are calculated when the value of these variables changes from zero to one.

**Table 4**

Elasticities with respect to selected exogenous variables

Variable	Participation	Expenditure	Total
# of household members $0 \leq \text{age} \leq 9$	0.000	0.022	0.022
# of household members $10 \leq \text{age} \leq 19$	0.015	0.068	0.084
# of household members $20 \leq \text{age} \leq 29$	0.049	0.075	0.124
# of household members $30 \leq \text{age} \leq 39$	0.047	0.131	0.178
# of household members $40 \leq \text{age} \leq 49$	0.042	0.072	0.114
# of household members $50 \leq \text{age} \leq 59$	0.014	0.054	0.068
# of household members $60 \leq \text{age} \leq 69$	-0.011	-0.043	-0.054
# of household members $70 \leq \text{age} \leq 79$	-0.015	-0.037	-0.052
# of household members $\text{age} \geq 80$	-0.007	-0.029	-0.036
HH total disposable income	0.099	0.735	0.834
Wife's education(1=above high school)	0.060	0.194	0.254
# of FAFH visits on weekends	--	0.476	0.476
# of non-household members FAFH	--	0.065	0.065

The household composition variables are majorly significant in both the participation and expenditure models. Consistent with previous studies (e.g., Ma et al., 2006), younger people eat more often away from home. Except for the youngest age group in the participation equation, coefficients on all age group variables when age<60 are positive and become negative thereafter. However, only those older than 69 years significantly reduce the frequency that a household participates in FAFH consumption but all aged older than 60 have significant effects on the expenditure. Furthermore, seniors between 70 and 79 years have the largest probability marginal effects and those 60-69 years have the largest expenditure marginal effects among all old age groups. When the number of seniors at their 70s increases by 10% in a household, the probability that this household consumes food out of home will decrease by 0.15%, and the total expenditure will go down by 0.52% (a little smaller than that of age group 60-69 whose total elasticity is negative 0.054), more than twice the probability marginal effect brought by seniors 80 years above. Such negative effects of seniors are consistent with Bai et al. (2010).

Unexpectedly, the number of children younger than 10 years old has no significant effect on either the household's participation in the FAFH market or FAFH consumption which is contrary to Su and Yen (1996), Yen and Jones (1997) and Bai et al. (2010). However, Su and Yen (1996) and Yen and Jones (1997) are only analyzing a single type of food consumption, not total FAFH consumption, while Bai et al. (2010) define children as 7-14 years old, different from our definition here (age between 0 and 9). In fact, the number of household members between 10 and 19 years has significantly positive effects on both the probability and consumption level of FAFH, and these effects are much greater than that of younger children (younger than 10 years). Therefore, as a whole, the results here are consistent with the previous literature as well as Ma et al. (2006) that people younger than 20 years have positively significant influence on a

household's FAFH consumption.

The number of household members in their 20s, 30s and 40s all has positive and significant effects on the household's FAFH participation and expenditure, and the elasticities are the top three largest among adults 20-59. Considering that almost half of China's urban populations are between 20 and 49 years (United Nations, Department of Economic and Social Affairs, 2012), there should be a huge increase of FAFH consumption for China as a whole in the near future. As for people between 50 and 59 years, they are important to FAFH consumption, but the effect is not significant either for participation or expenditure.

The total elasticity with respect to household monthly income is 0.834, indicating that a 10% rise in monthly income generates an increase in expenditure on FAFH by 8.34%. The decomposition of this total expenditure elasticity into probability elasticity and conditional expenditure elasticity shows that it is mainly the consumption that drives the rise in FAFH demand. The additional growth in demand that is caused by participation is not significant (only 12%). This is consistent with Yen (1993) and Bai et al. (2010), but in contrast to McCracken and Brandt (1987) and Ma et al. (2006) where the participation effect dominates. The inconsistency might be due to the different data sets, since food consumption patterns are truly different in different regions and change quickly over time.

From table 3, we know that the wife's education plays a significant role in a household's FAFH consumption in both decision steps. Households with a wife that has an education level above high school tend to dine out more often. On average, such households are 6% more likely to consume FAFH than their counterparts, and the total FAFH expenditures are 25.4% higher. This finding is in conflict with Yen (1993) where he found a significantly positive effect of wife's education (college) on probability but a negative effect on conditional level of

consumption. Also, this result is inconsistent with Bai et al. (2010) who found negative effects in a sample of Beijing households on both the probability to consume FAFH and conditional level of FAFH consumption.

Weekend FAFH visits have significant and positive effects on FAFH expenditures. A 10% increase in the FAFH visits on weekends will cause a 4.76% increase in a household's FAFH expenditure. The number of non-household members is significantly related to household's FAFH expenditure, but the marginal effect is relatively minuscule. A 10% rise in this number only leads to a 0.65 % increase of FAFH expenditure.

## **DISCUSSION**

In this paper, we seek to explore the factors that induce the rapid rise of FAFH consumption in urban China, and particular attention is given to household composition. The results show that household age structure indeed moves the FAFH consumption by both the probability of consuming and expenditure level. People older than 60 years are less likely to eat away from home, especially those 70 years old and above. On the contrary, people younger than 60 years consume more FAFH; adults between 20 and 49 are the major consumers and have the largest potential in expanding the FAFH market.

Figure 1 indicates that people at their 30s (30-39) have the largest marginal effects on FAFH consumption, and those aged 20-29 as well as 40-49 are second and third to them, respectively. The median age of urban Chinese is 33 (United Nations, Department of Economic and Social Affairs, 2012), falling in the area with the biggest positive marginal effects. Thus, until 2040, there will be a dramatic increase in the FAFH consumption if people of all age groups remain consistent with their current food preferences for all their lives. But if people all adopt their former elders' food preference completely, then by 2040, China's urban FAFH industry may

start to shrink. However, as most people will probably not totally keep their current preferences or totally adopt their former elders' preferences, there should still be a huge potential for the FAFH industry to exploit at least until 2040. Given that by 2025, the median age of urban Chinese will be 40, workers in the FAFH industry are in a very favorable period now.

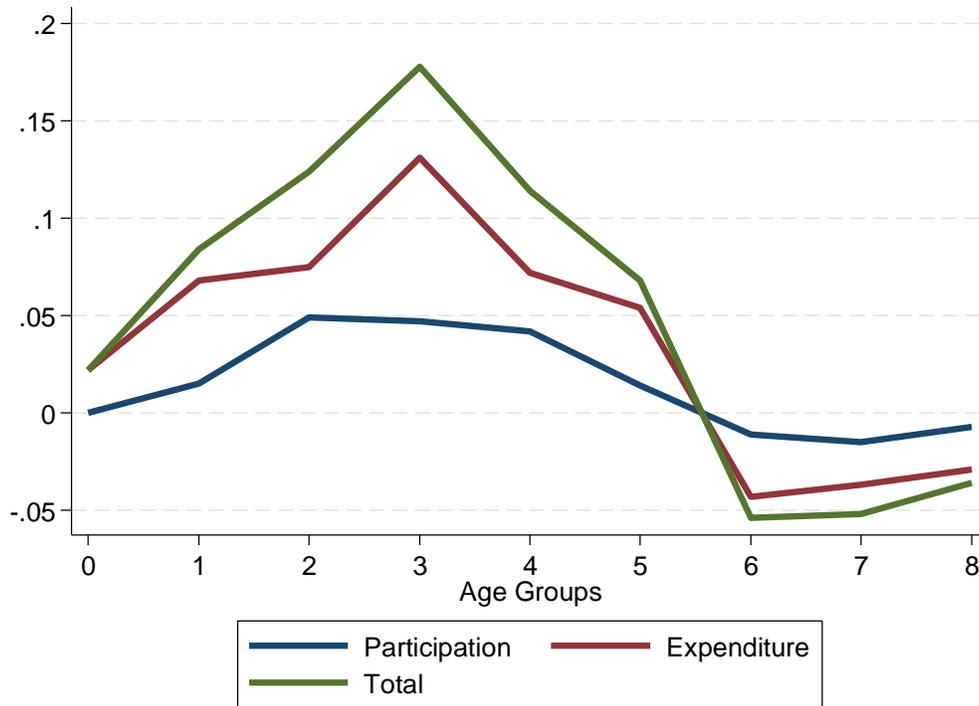


Figure 1. Elasticities with respect to household composition

As noticed before, income contributes positively to both the probability and expenditure of FAFH consumption; however, the magnitudes differ to some extent. The unconditional income elasticity is 0.834 and greater than many previous studies on FAFH in the U.S. (e.g., Byrne, Capps, and Saha 1996; McCracken and Brandt 1987; Prochaska and Schrimper 1973). It is also larger than that found by Lee and Tan (2006) for Malaysia, and Bai *et al.* (2010) for Beijing. However, it is quite a bit smaller than that found by Min, Fang and Li (2004), Ma *et al.* (2006), and Gale and Huang (2007). There are significant regional differences in the FAFH expenditures. Since Beijing has the highest income and its FAFH consumption is the largest, we

could imagine that, with the increase of income in other areas in China, FAFH consumption will increase significantly.

Empirical results in this paper show that wife's education (above high school) is positively correlated with urban China's FAFH participation and consumption, and this is not completely consistent with preceding literature. However, taking account of China's educational, working and living situations, it is a reasonable result, and it is projected that China's urban FAFH consumption is going to increase dramatically with more highly educated women. Also, we find that weekend FAFH visits and non-household members both have significant and positive effects on the development of the FAFH market.

Although this article explores the relationship between household composition and FAFH consumption in detail, people of different ages contribute differently to the probability and consumption levels of FAFH as a whole and for different food categories. Accordingly, future work is needed to do a multivariate model analysis to see how household composition affects the consumption of different commodities. Researchers have found some analogous results. Su and Yen (1996) find both the elasticities of probability and conditional level of pork consumption with respect to "age 20-44" are much greater than the corresponding elasticities with respect to other age composition variables. Yen and Jones (1997) find the effects of "Age $\leq$ 9" are significant and positive at the 0.01 level for both participation and consumption of cheese, but all other household composition variables only have significant effects on consumption but not participation. These studies of single commodities contribute to some degree.

## REFERENCES

- Amemiya, T. 1984. "Tobit Models: A Survey." *Journal of Econometrics* 24:3–61.
- Bai, J., T.I. Wahl, B.T. Lohmar, and J. Huang. 2010. "Food Away From Home In Beijing: Effects Of Wealth, Time And "Free" Meals." *China Economic Review* 21:432-441.
- Byrne, P.J., O. Capps, Jr., and A. Saha. 1996. "Analysis of Food-Away-from-Home Expenditure Patterns for U.S. Households, 1982-89." *American Journal of Agricultural Economics* 78: 614-627.
- Cragg, J. G. 1971. "Some Statistical Models For Limited Dependent Variables With Applications To The Demand For Durable Goods." *Econometrica* 39(5): 829–844.
- Gale, F., and K. Huang. 2007. "Demand For Food Quantity And Quality In China." *Economic Research Report* No. ERR-32. US Department of Agriculture.
- Gould B.W. 2002. "Household Composition And Food Expenditures In China." *Agribusiness* 18(3): 387–407.
- Gould B.W., and H. J. Villarreal. 2006. "An Assessment Of The Current Structure Of Food Demand In Urban China." *Agricultural Economics* 34:1–16.
- Jones, A. M., and S. T. Yen. 2000. "A Box–Cox Double-Hurdle Model." *The Manchester School* 68(2): 203–221.
- Lee H., and A. Tan. 2006. "Determinants Of Malaysian Household Expenditures Of Food-Away-From-Home." Paper presented for IAAE Conference, Gold Coast, Australia, August 12-18.
- Lee, J. and M. Brown. 1986. "Food Expenditures At Home And Away From Home In The United States- A Switching Regression Analysis," *The Review of Economics and Statistics*, 68:142-47.
- Ma, H., J. Huang, F. Fuller, and S. Rozelle. 2006. "Getting Rich And Eating Out: Consumption Of Food Away From Home In Urban China." *Canadian Journal of Agricultural Economics* 54:101–119.
- McCracken, V. A., and J. A. Brandt. 1987. "Household Consumption Of Food Away From Home: Total Expenditure And By Type Of Food Facility," *American Journal of Agricultural Economics* 69:274-284.
- Min, I., C. Fang, and Q. Li. 2004. "Investigation Of Patterns In Food-Away-From-Home Expenditure For China." *China Economic Review* 15:457–476.
- National Bureau Statistics of China. 1996-2011. *Chinese Statistical Yearbook*. 1996-2011.
- Poirier, D. J. 1978. "The Use Of The Box-Cox Transformation In Limited Dependent Variable Models." *Journal of American Statistics Association* 73: 284–287.

- Prochaska, F., and R. Schrimper. 1973. "Opportunity Cost Of Time And Other Socioeconomic Effects On Away From Home Food Consumption." *American Journal of Agricultural Economics* 55:595-603.
- Su, S.B., and S.T. Yen. 1996. "Microeconometric Models Of Infrequently Purchased Goods: An Application To Household Pork Consumption." *Empirical Economics* 21:513-533.
- United Nations, Department of Economic and Social Affairs. 2012. World Population Prospects, the 2010 Revision. <http://esa.un.org/unpd/wpp/index.htm>.
- Yen, S. 1993. "Working Wives And Food Away From Home: The Box-Cox Double Hurdle Model." *American Journal of Agricultural Economics* 75:884-95.
- Yen S.T., and A.M. Jones. 1997. "Household Consumption Of Cheese: An Inverse Hyperbolic Sine Double-Hurdle Model With Dependent Errors." *American Journal of Agricultural Economics* 79: 246-251.
- Yen S.T., and C.L. Huang. 1996. "Household Demand For Finfish: A Generalized Double-Hurdle Model." *Journal of Agricultural and Resource Economics* 21(2):220-234.