



**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.*

*No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.*

# Understanding Food-Away-From-Home Expenditures in Urban China

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

<sup>c</sup> Food and Resource Economics Department, University of Florida,  
Gainesville, FL 32611-0240, USA

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

*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, Junfei Bai, and James L. Seale, Jr.]. 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**

While abundant studies have been done on food-away-from-home (FAFH) consumption in U.S. and other developed countries, little is known about Chinese FAFH patterns. This study examines the impact of income and time constraints along with household-composition characteristics 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. Participation and expenditure elasticities are comparable to previous studies. The participation elasticity with respect to income is a bit lower, while the expenditure elasticities are significantly higher. Families with busy and highly educated working wives tend to dine away from home more often than their counterparts.

**Keywords:** Chines Food Expenditures, Food-away-from-home, Box-Cox double-hurdle model

JEL classifications: D12, D13

## Introduction

With an almost 10% average annual economic growth and deeper involvement in globalization, food-away-from-home (FAFH) consumption is increasing significantly in China. The value-added of hotel and catering services has increased from 4.46 billion in year 1978 to 20.43 billion in year 2009 (National Bureau of Statistical China, 2010). More and more business people, students and other workers are having their meals outside the home on weekdays, especially breakfast which they usually buy from roadside stalls or restaurants including McDonalds and Kentucky Fried Chicken stores. For lunch and dinner, many Chinese dine out, often with friends or the whole family. FAFH consumption not only facilitates the development of the Chinese catering industry and other related businesses, but also provides great opportunities to foreign expansion into this sector.

This paper focuses on household expenditure of FAFH in six Chinese cities: Beijing, Nanjing, Chengdu, Xi'an, Shenyang and Xiamen. Although the literature on household expenditure of FAFH is well developed, few studies exist on household expenditures of FAFH in China. Of the studies that exist on FAFH in China, some are limited in scope (e.g., Curtis, McClusky, and Wahl 2007; Gale 2006), while others are limited by the time period of the data studied (e.g., Gale and Huang 2007; Gould 2002; Gould and Villarreal 2006; Ma *et al.* 2006; Min, Fang and Li, 2004) or by the smallness of sample size (e.g., Bai *et al.* 2010). This paper uses a unique, current, and large data set to overcome the shortcomings of the previous studies on Chinese FAFH. The data are collected recently by the authors through a diary-based household survey in the six cities that are spread throughout China. Effects of income, wife's labor supply, and household structure on FAFH expenditures are analyzed.

The remainder of this article is organized as follows. First, a review of literature is presented. This is followed by a discussion of the model along with the estimation procedure. Careful attention is given to a description of the survey and data. We then look at the current situation of China's urban FAFH expenditures and discuss our empirical results. Finally, we conclude the paper by summarizing the major findings.

## **Literature Review**

The literature on FAFH often focuses on the effects of income and time on the consumption of FAFH at the household level. Those that find a positive effect of income on the consumption of FAFH include Prochaska and Schrimper (1973), McCracken and Brandt (1987), Yen (1993), Gould and Villarreal (2006), and Bai *et al.* (2010). The time constraint of the wife as measured by labor hours is also found to have a significant effect on household consumption of FAFH (e.g., Bellante and Foster 1984; Kinsey 1983; McCracken and Brandt 1987; Prochaska and Schrimper 1973; Soberon-Ferrer and Dardis 1991; Yen 1993). Nayga and Capps (1993) find that the share of total expenditure that goes to FAFH increases as the labor force participation rate of women increases. Mihalopoulos and Demoussis (2001) and Stewart *et al.* (2004) find that the convenience factor associated with consumption of FAFH is also important in explaining the demand for FAFH.

Others have found that socioeconomic and demographic factors affect consumption of FAFH, such as household size, family composition, age, education, race, region and urbanization (Derrick, Dardis, and Lehfel'd 1982; Kinsey 1983; Lee and Brown 1986; Lipper and Love 1986; McCracken and Brandt 1987; Nayga and Capps 1993; Redman 1980;

Sexauer 1979). Gould (2002) finds that household composition has a significant effect on food choice for food consumed at home in China, but he does not study FAFH. Empirical analyses have further shown how specific household economic and demographic characteristics can influence its demand for FAFH by market segment. Using the 1970s and 1980s household survey data, McCracken and Brandt (1987) and Byrne, Capps, and Saha (1998) analyzed the relationship between some key household characteristics and expenditures at each type of restaurants. Also, Nayga and Capps (1993) studied the relationship between a household's characteristics and its frequency of dining at each type of facility.

The limited amount of research on FAFH in China includes Bai *et al.* (2010), Curtis, McClusky and Wahl (2007), Gale (2006), Gale and Huang (2007), Gould and Villarreal (2006), Ma *et al.* (2006), and Min, Fang, and Li (2004). Bai *et al.* (2010) focus their study on FAFH in Beijing. Curtis, McClusky and Wahl (2007) study which consumer characteristics and attitudes determine the probability of consuming three processed potato products (French fries, mashed potatoes (dehydrated), and potato chips) using a 2002 survey of consumers in Beijing. Gale (2006) identifies the top 10 percent of Chinese urban households as “high income” and then analyzes their food expenditures, based on China National Bureau of Statistics urban household survey data between 1996 and 2003. Gale’s (2006) analysis of FAFH, however, is limited to the descriptive reporting that FAFH constitutes 30% of food expenditure for high-income consumers and that this group of consumers spent more than three times the amount spent by the median household. Gale and Huang (2007) analyze food consumed at home and FAFH, noting that the expenditure elasticity of FAFH is elastic and

greater than that of any of the foods consumed at home. Gould and Villarreal (2006) analyze both food consumed at home and FAFH, and they find the share of FAFH expenditure to total food expenditure to be positively associated with household income and negatively related to household size. Min, Fang, and Li (2004) analyze FAFH and find that family size significantly affects FAFH consumption.

Although these studies are helpful for understanding Chinese urban household's food consumption patterns, the data used are not sufficient enough to reflect current Chinese food structures, especially expenditures on FAFH. For example, Gale (2006), Gale and Huang (2007), Gould and Villarreal (2006), and Min, Fang, and Li (2004) base their studies on the Urban Household Income and Expenditure (UHIE) survey conducted by China's National Bureau of Statistics (NBS). While the UHIE data does include aggregate expenditures on FAFH, the vague definition and ambiguous explanation of FAFH in the survey raises several concerns about the completeness of the data. First, FAFH is defined to include self-paid meals only. Second, it is unclear whether student food consumption while at school is included. Third, it is also unknown whether the family member who is in charge of recording the daily food consumption diary in the UHIE survey is aware of the food consumption away from home by other family members. Finally, the UHIE survey tells nothing about household consumption of hosted meals paid for by other parties.

On the other hand, most of the existing research uses data sets either too small or too old. Food consumption patterns may change over time, so previous findings may not hold today. Ma *et al.* (2006) use a large sample across five cities in China, but the data are collected in 1998, and, therefore, may not reflect the latest food consumption patterns. Bai *et al.* (2010)

use a relatively new data set from 2007, but the household sample is relatively small (315 households), and the data are not representative of China as a whole since all the households are from Beijing.

## Methodology

### Theoretical model

The household production model (Becker 1965) provides a basis for empirical specification (e.g., McCracken and Brandt 1987; Mutlu and Gracia 2006; Prochaska and Schrimper 1973; Yen 1993; Bai *et al.* 2010). In the model, a household maximizes its utility:

$$(1) U = U(z_1, z_2, \dots, z_n) ,$$

subject to household production function, time constraints and full-income constraints:

$$(2) z_i = z_i(x_i, t_{i1}, t_{i2}, \dots, t_{im}), i=1, 2, \dots, n$$

$$T_k = l_k + \sum_{i=1}^n t_{ik}, k=1, 2, \dots, m$$

$$\sum_{k=1}^m w_k l_k + v = \sum_{i=1}^n p_i x_i$$

where  $z_i$  is commodity  $i$  produced in the household,  $x_i$  is the consumer good used in the production of  $z_i$ ,  $p_i$  is the price of  $x_i$ ,  $t_{ik}$  is the time spent by household member  $k$  in producing  $z_i$ ,  $T_k$  is the total time available to household member  $k$  ( $T_1=T_2=\dots=T_m$ ),  $w_k$  is the wage rate for household member  $k$ ,  $l_k$  is the time input by household member  $k$  in market production, and  $v$  is unearned income. Then the demand function for  $x_i$  is

$$(3) x_i = f_i(p_1, \dots, p_n, w_1, \dots, w_m, v).$$

Considering the wife's potentially dominant role in household meal preparation, the expenditure on FAFH can be derived as

$$(4) \text{ EXP}_{FAFH} = \sum_{i=1}^n p_i x_i = \sum_{i=1}^n f_i(l_2, w_2, v', D),$$

where  $v' = \sum_{k=1}^m w_k l_k + v$ ,  $k \neq 2$  is the household's exogenous income excluding the household wife's wage earnings; subscript 2 indicates wife; and D is a vector of demographic and dummy variables reflecting heterogeneity in preferences. Following Yen (1993), the wife's working hours in labor market are used to reflect her opportunity cost in household production, which means (5)  $\text{EXP}_{FAFH} = \sum_{i=1}^n p_i x_i = \sum_{i=1}^n f_i(l_2, v', D)$ .

### **Box-Cox Double-Hurdle model**

Consider the decision to consume FAFH as a two-step decision. Firstly, 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 of dining 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

$$(6) y_i = \begin{cases} y_{2i}^* = x'_{2i}\beta_2 + u_{2i} & \text{if } \begin{cases} y_{1i}^* = x'_{1i}\beta_1 + u_{1i} > 0 \\ \text{and} \\ y_{2i}^* = x'_{2i}\beta_2 + u_{2i} > 0 \end{cases} \\ 0 & \text{otherwise} \end{cases},$$

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

$[u_{1i}, u_{2i}]' \sim \text{BVN}(0, \Sigma)$ ,  $\Sigma = \begin{bmatrix} 1 & \rho\sigma_i \\ \rho\sigma_i & \sigma_i^2 \end{bmatrix}$ , 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 (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 the analysis. The Box-Cox transformation (Poirier 1978) on the observed dependent variable  $y_i$  is

$$(7) y_i^T = \begin{cases} \frac{y_i^\lambda - 1}{\lambda} & \text{if } \lambda \neq 0 \\ \log(y_i) & \text{if } \lambda = 0 \end{cases},$$

where  $\lambda$  is an unknown parameter. The sample likelihood function for the Box-Cox double-hurdle model can be derived from (6) and (7) as

$$(8) L = \prod_{y_i=0} [1 - \Psi(x'_{1i}\beta_1, \frac{x'_{2i}\beta_2 + 1/\lambda}{\sigma_i}, \rho)] \cdot \prod_{y_i>0} \left\{ \Phi \left[ \frac{x'_{1i}\beta_1 + (\rho/\sigma)(y_i^T - x'_{2i}\beta_2)}{(1-\rho^2)^{1/2}} \right] y_i^{\lambda-1} \frac{1}{\sigma_i} \phi \left( \frac{y_i^T - x'_{2i}\beta_2}{\sigma_i} \right) \right\},$$

where  $\Psi(\cdot)$  is the standard bivariate normal cumulative distribution function with correlation  $\rho$ ,  $\Phi(\cdot)$  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

$$(9) \sigma_i = w_i' \gamma,$$

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 earnings). Thus, the normality, homoskedasticity and independence of error terms can be statistically tested.

## **Dependent and Independent variables**

The dependent variable is household weekly FAFH expenditure. Since in China, a sizable portion of the FAFH consumption is hosted by parties other than the household itself, we use household member's weight to calculate the proportion of food consumed by the household members and the expenditures.

The independent variables in the participation hurdle  $x'_{1i}$  are hypothesized to include household size, household disposable income excluding wife's wage earnings (heretofore referred to as household income unless particular illustration), wife's labor supply, wife's education, number of children less than 6 years, number of children between 6 and 17 years, and number of seniors 65 years or older. 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, and two other variables measuring the effects of weekends --- number of FAFH visits on weekends and proportion of FAFH visits on weekends.

The inclusion of the weekend variables is based on the study of Byrne *et al.* (1996). They find both the number and proportion of FAFH visits on weekends have 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.

## **Data**

The empirical analysis is based on a survey of 1340 households from six cities in Beijing, Nanjing, Chengdu, Xi'an, Shenyang and Xiamen, China. The Beijing survey is the first of these conducted by the authors in 2007. The Nanjing data are collected in 2009, Chengdu data in 2010, and data of the other three cities in 2011. The number 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. This paper only considers households both with a husband and wife, therefore, 150 households are eliminated and the final sample includes 1190 households.

Our samples are subsets of the households participating in the Urban Household Income and Expenditure (UHIE) survey conducted by the National Bureau of Statistics of China (NBSC). The UHIE is a national survey, which provides the primary official information on urban consumers' income and expenditures. The data from the UHIE survey has been widely used by scholars for food consumption and expenditure research, including studies on FAFH (e.g., Gale and Huang 2007; Min, Fang, and Li 2004).

The survey for this study includes two parts. The first part collects detailed information on demographics and socioeconomics of the household and is carried out by enumerators with in-house and face-to-face interviews. The second part records food consumption information. During the survey, enumerators explain and demonstrate to respondents how to

record every family member's food consumption and expenditures. Part two is then left with the respondent for one week (including the drop-off day) for diary-based recording. The selected households are asked to record their consumption of and expenditures on food consumed away from home and prepared at home as well as related information, such as who paid for each meal, types of food facility, purchase venues, and so forth. This diary record approach is also used in the Consumer Expenditure Dairy Survey (1998) conducted by the US Department of Commerce. Compared to the recall-based approach (e.g., Ma *et al.* 2006), the diary recording method is believed to have an advantage in generating reliable data because it could eliminate the possibility of forgetting food consumption activities.

Food away from home in our survey is defined to include almost all meals that are not prepared at home. According to this definition, all meals served in general restaurants, fast food outlets, cafeteria, and small vendor or stands where consumers or those who host the meal have to pay for (1) the ordered meals; (2) food preparation and service; and (3) any cost to provide dining place and environment. The FAFH definition, however, rules out all food and food products that are purchased ready-to-eat from food stores, such as supermarkets, convenience stores, and some special food stores. Instead, these types of foods are treated as full-processed foods consumed at home although they are not prepared at home. A criterion to differentiate these foods from FAFH is whether the venue provides a dining place for consumers to sit down and eat.

Several additional efforts were also made to improve data quality. First, extensively trained enumerators select the person who is most familiar with food shopping and food consumption in the household as the recorder for the survey. This procedure is able to

generate more reliable data than random selection because these recorders normally play decisive roles in food expenditure and consumption activities in their households. Second, the family member who is in charge of recording food consumption is asked to obtain detailed information on the food consumed by other family members if they are not together for the meal to avoid potential missing consumption due to unawareness. Third, during the survey week, enumerators call the surveyed respondents twice to answer any questions and to provide a reminder. Fourth, the finished survey forms are carefully checked in front of the respondents when they are collected and by calling back in the following week. Fifth, two thirds of the enumerators involved in this survey are from the Beijing branch of the NBSC. These enumerators are mainly in charge of the UHIE survey and have good relationships with the households in the survey. Thus, their participation in our survey facilitates access to, and cooperation from the surveyed households. Sixth, each respondent is provided with a telephone card valued at 30 yuan (\$4) so that the respondent can contact enumerators or survey leaders for any questions about the survey without cost, and they could also use the card to call their family members who eat separately from the respondent to learn what they consume at work, school or elsewhere. Finally, the household receives 100 yuan (\$14) upon completion of the survey as an incentive.

## **Results**

Overall, 84% 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%). Nanjing is a bit lower, Xi'an and Chengdu are next, and fewest urban households in Shenyang and Xiamen dine out (Table 1). The average expenditure on

FAFH by all households is 123 yuan weekly and is 147 yuan weekly by those households with positive FAFH expenditures during the survey week. The difference of FAFH expenditure between the full sample and the truncated sample (those households that had positive FAFH expenditures) is basically 24 yuan; however, Chengdu had the largest discrepancy (Table 1). Once households in Chengdu decide to eat out, they consume more than people in other cities.

The statistical descriptions of exogenous variables specified in the Box-Cox double-hurdle model are reported in Table 2. Chinese urban households eat away from home on weekends less than two times per week, but it takes a large portion of total weekly FAFH visits, 18% in the full sample and 21% in the truncated sample, respectively. The average household size is 2.96 persons in all, but a bit higher for the sample with positive FAFH expenditures. Monthly household disposable income is 4640 yuan and 4830 yuan in the full and truncated samples, respectively. Wife's wage earning is about 790 yuan per month, contributing 17% to the household's total disposable income, and works for 21 hours in the labor market, a bit lower than the results in Bai *et al.* (2010). A typical wife in the full sample is 49 years old, and 48 years in the truncated sample. Around 40% of the wives received education above high school.

The female spouse's working hours is typically treated as endogenously determined in the expenditure function of FAFH (Kinsey 1983; McCracken & Brandt, 1987; Prochaska and Schrimper 1973; Yen 1993; Bai *et al.* 2010), which would bias the ML estimates of Box-Cox double-hurdle model. Thereby, we conducted an endogeneity test first by applying Smith and Blundell's (1966) technique. Wife's labor supply is specified as a linear function of wife's age

and education, household size, household income excluding wife's wage earnings and its square, number of kids younger than 6 years and number of kids between 6 and 17 years as well as the interaction term between them, and the number of seniors 65 years or older. Given the size and heavy traffic in our sample cities, wife's labor hours include working hours as well as the commute time between home and the working place.

Results show that wife's labor supply is endogenous, thus, its predicted value is included in the Box-Cox double-hurdle model as proxy to deal with the endogeneity problem.

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.

Estimation of the Box-Cox Double Hurdle model is done by maximizing the log-likelihood function corresponding to equation (8). ML estimates are presented in table 3. The Box-Cox parameter lambda equals 0.723, 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.

In the full Box-Cox double hurdle model, the predicted impact of the individual regressors in  $x_1$  and  $x_2$  on the probability of consuming food away from home and on the observed level of FAFH expenditure 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 (6) are difficult to interpret. Elasticities give a more

intuitive interpretation of the marginal effects. Table 4 gives the elasticities of the probability of participating, conditional consumption, and unconditional consumption 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.

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). The marginal probability elasticity and conditional expenditure elasticity are 0.105 and 0.639, respectively, indicating that a 10% increase of household income will result in a rise of 1.05% in the probability of eating out and 6.39% in the conditional expenditure on FAFH. 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.

Consistent with many previous studies (Yen 1993; Nayga and Capps 1993; Byrne, Capps, and Saha 1996), the longer time the wife works in the labor market, the more likely that the household participates in FAFH consumption and the more money it spends on FAFH. This finding clearly shows the effect of opportunity cost; however, the effect is not substantial. A 10% increase in the wife's labor hours will cause the probability of dining out to increase by only 0.1% and the conditional expenditure to increase by 0.3%.

The weekend variables also have noteworthy influences on Chinese urban households' FAFH expenditure. The cost of additional visits (number of FAFH visits on weekends) is 0.644 yuan overall, and the expenditure on FAFH increases by 4.38% for each one percent

increase in the number of FAFH visits on weekends. The coefficient associated with the weekend proportion data can be interpreted as a measure of the change in expenditures due to 100% weekend dining versus no weekend dining (Byrne, Capps, and Saha 1996). Households that purchase FAFH all on weekends spent 1.9 yuan less than those households that consume solely on weekdays, but this proportion data is less elastic than the level data.

A number of other variables also appear to affect the household FAFH participation and expenditure. Consistent with Mihalopoulos and Demoussis (2001), household size has a significant and positive effect on the probability of consuming FAFH. Since we are examining household food consumption rather than individual consumption, given all other conditions, the more people a household has, the more likely that this household consumes FAFH as a whole. The possibility of dining out will increase by 1.85% if the household size increases by 10% on average. However, the effect of household size on FAFH expenditure is not significant. The number of seniors 65 years old or older significantly decreases both the likelihood of eating out and the expenditure on FAFH. This result is consistent with previous studies (e.g., Bai *et al.* 2010; Jensen and Yen 1996; Min, Fang, and Li 2004). Neither the number of younger children or elder children has significant influence on Chinese urban household's FAFH.

In addition, wife's education has a significant relationship both to the likelihood of eating out and the expenditure of eating out. Households with wife that received education above high school demonstrate a higher probability to consume FAFH than their counterparts, and they tend to consume more if eating out. Moreover, there exist obvious differences between the six cities. Compared with Chengdu, urban households in Nanjing, Xi'an and Xiamen

spend a significantly less amount of money on FAFH consumption, while the difference is not statistically significant for Beijing and Shenyang.

## Conclusions

In this article, we seek to improve our understanding of the quickly evolving FAFH consumption in urban China. Based on the classical household production and consumption model, we analyze the effects of household's income, time, and family composition. A double-hurdle model with Box-Cox transformation is estimated using data from Beijing, Nanjing, Chengdu, Xi'an, Shenyang and Xiamen, China. We find that income contributes positively to both the probability and expenditure of FAFH consumption. The conditional income elasticity is 0.639 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, Ma et al. (2006) for China, and Bai *et al.* (2010) for Beijing. However, it is quite a bit smaller than that found by Min, Fang and Li (2004) and Gale and Huang (2007). The wife's labor supply increases both the probability and expenditure of FAFH purchase.

Dining out on weekends increases the expenditure significantly, but when all the FAFH occurs on weekends, the FAFH expenditure decreases. Parameters associated with certain family structure variables are generally significant, supporting the hypothesis that household composition does matter in FAFH consumption. Households with wife receiving education above high school are more likely to consume FAFH, and the expenditures are higher, while the number of seniors over 65 years (including 65 years) does the contrary work. Also, larger households are more likely to dine out.

## 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.
- Becker, G. S. 1965. "Theory of the allocation of time." *Economic Journal* 75:493–508.
- Bellante, D., and Foster, A.C. 1984. "Working Wives and Expenditure on Services." *Journal of Consumer Research* 11(2): 700-707.
- Byrne, P.J., O. Capps, Jr., and A. Saha. 1996. "Analysis of Food-Away-from-Home Expenditure Patterns for U.S. Households, 1982-89." *Amer. J. Agr. Econ.* 78: 614-627.
- Byrne, P.J., O. Capps, Jr., and A. Saha. 1998. "Analysis of Quick-serve, Mid-scale, and Up-scale Food Away from Home Expenditures." *International Food and Agribusiness Management Review* 1(1):51-72.
- Cragg, J. G. 1971. "Some statistical models for limited dependent variables with applications to the demand for durable goods." *Econometrica* 39(5): 829–844.
- Curtis, K.R., J.J. McCluskey, and T.I. Wahl. 2007. "Consumer preferences for western-style convenience foods in China." *China Economic Review* 18:1–14.
- Derrick, F., R. Dardis, and A. Lehfeld. 1982. "The Impact of Demographic Variables on Expenditures for Food Away from Home," *Journal of the Northeastern Agricultural Economics Council* 11: 1-10.
- Gale, F. 2006. "Food Expenditures by China's High-Income Households." *Journal of Food Distribution Research* 37(1): 13-19.
- 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.
- Jensen, H. H., & Yen, S. T. 1996. "Food expenditure away from home by type of meal." *Canadian Journal of Agricultural Economics* 44:67–80.
- Jones, A. M., and S. T. Yen. 2000. "A Box–Cox double-hurdle model." *The Manchester School* 68(2): 203–221.
- Kinsey, J., 1983. "Working Wives and the Marginal Propensity to Consume Food Away From

- Home,” *American Journal of Agricultural Economics*, 65:10-19.
- 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.
- Lippert, A. and D. Love, 1986. “Family Expenditures for Food Away from Home and Prepared Foods,” *Family Economics Review* 3:9-14.
- 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.
- Mihalopoulos, V.G. and M.P. Demoussis. 2001. “Greek Household Consumption of Food Away from Home: A Microeconometric Approach.” *European Review of Agricultural Economics* 28:421-432.
- 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.
- Mutlu, S., and A. Gracia. 2006. “Spanish food expenditure away from home (FAFH): by type of meal.” *Applied Economics* 38:1037–1047.
- National Bureau of Statistical China. 2010. Chinese statistics yearbook, Beijing.
- Nayga, R.M. Jr., and O. Capps, Jr. 1993. “Analysis of Socioeconomic and Demographic Factors Affecting Food Away from Home Consumption.” *Journal of Food Distribution Research* 24:69-86.
- 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." *Amer. J. Agr. Econ.* 55:595-603.
- Redman, B., 1980. “The Impact of Women’s Time Allocation on Expenditure for Meals Away from Home and Prepared Foods,” *American Journal of Agricultural Economics*, 62(2):234-37.
- Sexauer, B., 1979. “The Effects of Demographic Shift and Changes in the Income Distributions of Food Away From Home Expenditure,” *American Journal of Agricultural*

*Economics* 61:1046-57.

Smith, R. J., & Blundell, R. W. 1986. "An exogeneity test for a simultaneous equation Tobit model with an application to labor supply." *Econometrica* 54:679–685.

Soberon-Ferrer, H., and D. Rachel. 1991. "Determinants of Household Expenditures for Services." *Journal of Consumer Research* 17(4): 385-397.

Stewart, H., N. Blisard, S. Bhuyan, and R. Nayga, Jr. 2004. "The Demand for Food Away From Home: Full-Service or Fast Food?" Available from:  
<http://www.ers.usda.gov/publications/AER829/>.

Yen, S. 1993. "Working Wives and Food Away from Home: The Box-Cox Double Hurdle Model." *Amer. J. Agr. Econ.* 75:884-95.

Yen S.T., and A.M. Jones. 1996. "Individual Cigarette Consumption and Addiction: A Flexible Limited Dependent Variable Approach." *Health Economics* 5:105-117.

Yen S.T., and A.M. Jones. 1997. "Household Consumption of Cheese: An Inverse Hyperbolic Sine Double-Hurdle Model with Dependent Errors." *Amer. J. Agr. Econ.* 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.

**Table 1**

Weekly Household food away from home expenditures by urban cities

	Total	BJ	NJ	CD	XA	SY	XM
HH with positive FAFH expenditure (%)	84	88	85	82	83	81	81
FAFH expenditure , all HH (Yuan)	123	146	119	138	112	106	101
FAFH expenditure, HH with positive FAFH consumption (Yuan)	147	166	140	168	135	131	124

Notes: BJ=Beijing, NJ=Nanjing, CD=Chengdu, XA=Xi'an, SY=Shenyang, XM=Xiamen, HH=households, FAFH=food away from home

**Table 2 Summary statistics**

Description of Variable	All HH		HH with FAFH consumption	
	Mean	Std. Dev.	Mean	Std. Dev.
Household (HH) FAFH Expenditures (yuan/wk)	123.274	150.370	146.990	153.219
Share of HH with positive FAFH expenditure	0.839	0.368	1.000	0.000
Number of FAFH visits on weekends	1.866	2.180	2.225	2.206
Proportion of FAFH visits on weekends	17.638	20.788	21.032	21.069
HH size (persons)	2.963	0.808	3.025	0.780
HH monthly disposable income (10,000yuan)	0.464	0.270	0.483	0.269
HH income excluding wife's wage earnings	0.385	0.254	0.395	0.253
Wife's wage earnings	0.079	0.111	0.088	0.116
Wife's labor supply (hours/wk)	21.398	22.864	23.286	22.793
Wife's age (years)	49.040	11.127	47.773	10.647
Wife's education (1 if above high school)	0.399	0.490	0.427	0.495
Number of kids younger than 6 years	0.111	0.322	0.119	0.330
Number of kids between 6 years and 17 years	0.292	0.475	0.306	0.476
Number of seniors 65 years or older	0.287	0.635	0.216	0.559
Beijing (1=Beijing)	0.246	0.431	0.258	0.437
Nanjing (1=Nanjing)	0.182	0.386	0.183	0.387
Chengdu (1=Chengdu)	0.150	0.357	0.146	0.354
Xian (1=Xian)	0.166	0.373	0.165	0.372
Shenyang (1=Shenyang)	0.149	0.356	0.143	0.351
Xiamen (1=Xiamen)	0.108	0.310	0.104	0.306
Observations	1190		998	

Note: Household income and wife's wage earnings are 10,000 yuan in 2007. Household FAFH expenditures are yuan in 2007. HH=households, FAFH=food away from home

**Table 3**

ML Estimation of the Box-Cox double-hurdle Model

<b>Participation</b>		
HH income excluding wife's wage earnings	0.921***	(0.302)
Predicted wife's labor supply	0.008***	(0.003)
1 if wife's education is above high school	0.229**	(0.110)
HH size (person)	0.212***	(0.079)
Number of kids younger than 6 years	-0.113	(0.172)
Number of kids between 6 years and 17 years	-0.110	(0.114)
Number of seniors 65 years or older	-0.247**	(0.106)
Beijing	0.062	(0.148)
Nanjing	0.120	(0.156)
Chengdu (control group)	.	.
Xi'an	-0.032	(0.151)
Shenyang	0.009	(0.155)
Xiamen	-0.081	(0.173)
Constant	0.050	(0.219)
<b>Expenditure</b>		
HH income excluding wife's wage earnings	7.227***	(1.282)
HH income square	-3.167***	(0.766)
Predicted wife's labor supply	0.020***	(0.006)
Number of FAFH visits on weekends	0.644***	(0.079)
Proportion of FAFH visits on weekends	-0.019***	(0.004)
1 if wife's education is above high school	0.446**	(0.206)
HH size (person)	0.033	(0.142)
Number of kids younger than 6 years	0.224	(0.306)
Number of kids between 6 years and 17 years	0.213	(0.208)
Number of seniors 65 years or older	-0.412*	(0.221)
Beijing	0.101	(0.271)
Nanjing	-0.538*	(0.294)
Chengdu (control group)	.	.
Xi'an	-0.832***	(0.302)
Shenyang	-0.256	(0.297)
Xiamen	-0.954***	(0.354)
Constant	4.936***	(0.515)
<b>Sigma</b>		
HH monthly disposable income	1.040***	(0.284)
Constant	2.122***	(0.255)

---

<b>Lambda</b>		
Constant	0.723***	(0.071)

---

<b>Rho</b>		
Constant	0.530***	(0.065)
Observations	1190	

---

Standard errors in parentheses

\*  $p < .10$ , \*\*  $p < .05$ , \*\*\*  $p < .01$

Notes: HH=households, FAFH=food away from home

**Table 4**

Elasticities with respect to selected exogenous variables

Variable	Probability	Conditional	Unconditional
HH income excluding wife's wage earnings	0.105	0.639	0.743
Wife's labor supply	0.010	0.030	0.039
Number of FAFH visits on weekends	0.000	0.438	0.438
Proportion of FAFH visits on weekends	0.000	-0.123	-0.123
HH size	0.185	-0.022	0.163
Number of kids younger than 6 years	-0.004	0.010	0.006
Number of kids between 6 years and 17 years	-0.009	0.026	0.016
Number of seniors 65 years or older	-0.021	-0.036	-0.057
Wife's education (1 if above high school)	0.067	0.141	0.209

Notes: Elasticities with respect to continuous variables are evaluated at the sample means while elasticities with respect to dummy variables denote discrete change ratios from 0 to 1.