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Food away from home in Beijing: Effects of wealth, time and "free" meals ☆

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ABSTRACT

Based on a modified Becker household consumption and production model and newly surveyed data set collected by the authors, this study investigated household expenditure on food away from home (FAFH) and its determinants in Beijing, China. A Box–Cox double-hurdle regression is estimated. The key findings suggest that household expenditure on dining out might be significantly underestimated when using the data most commonly used in food consumption research in China. Excluding hosted meals that are not paid for by individual consumers comprises nearly one half of the underestimation. Meanwhile, this exclusion could bias estimates of income effects on the demand for food away from home.

1. Introduction

Increasingly prosperous and busy consumers in China are eating more and more meals away from home. Studies on this issue in the country, however, are limited by a lack of a suitable theoretical framework and data. Becker's household consumption and production model has been used extensively to provide a theoretical basis for modeling household expenditures on food away from home (FAFH) consumption (e.g. McCracken & Brandt, 1987; Mutlu & Gracia, 2006; Prochaska & Schrimper, 1973; Yen, 1993). This model suggests that household expenditure on FAFH is subject to both income and time constraints (Becker, 1965). Nevertheless, none of available studies of China's FAFH, such as Min, Fang and Li (2004), Ma, Huang, Fuller and Rozelle (2006) and Gould and Villarreal (2006), has considered the factor of time value. As a result, the empirical models of the determinants of eating out could be misspecified and thus could generate biased parameter estimates for other explanatory variables in the model (Mincer, 1963; Prochaska & Schrimper, 1973).

In terms of data, except Ma et al. (2006) who surveyed households, nearly all other available studies used data from the Urban Household Income and Expenditure (UHIE) survey conducted by China's National Bureau of Statistics (NBS). While the UHIE data does

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report expenditures on food consumed away from home, 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.

In China, while much of the food consumed away from home is paid for by the consumer, a sizable portion is hosted (paid for) by other parties. For example, employers in China typically pay all or most of the costs of meals for their employees during working hours. For larger employers, this may be through company owned restaurants, cafeterias, and food shops where meals are provided to employees free or at a charge that is notably below the market price for an equivalent meal. Other employers may provide employees with food coupons or gift cards that can be used to buy meals at nearby food outlets. In most cases, these food coupons are not cashable for employees, so they are not treated as the receivers' income. In addition, hosted banquets, particularly in the public sector, and hosted meals between friends or between relatives are common and recognized as a part of social culture in China.

The incomplete and unclear measurement of food away from home in the UHIE survey likely results in underestimating total consumption of FAFH and biased results from studies using the data. In particular, excluding hosted meals from consideration in such studies could result in biased estimates of income effects in models of the determinants of eating out since consumption of hosted meals in most cases is not treated as part of the household's budget constraint. Therefore, in addition to a suitable theoretical basis, a clear understanding of consumers' demand for FAFH in China also requires a careful investigation of potentially underestimated self-paid FAFH in the UHIE survey, as well as these excluded “free” meals.

In this article, we use a unique data set to overcome the above shortcomings of the NBS data. The data was collected recently by the authors through a diary-based household survey in Beijing. In addition, we slightly modify the Becker's household production and consumption model by incorporating the “free” meals into the income constraint. The modified model provides a theoretical basis for analyzing the roles of hosted meals in FAFH expenditure. The modified empirical model specification includes the households' opportunity cost of time, household income, value of received meals, and several demographic variables as well.

The remainder of this article is organized as follows. We begin by presenting the theoretical framework. We then discuss the empirical model specification and estimation issues, followed by a description of the survey and a discussion of the empirical results. We finally conclude the paper by summarizing major findings.

2. Theoretical model

Becker's household production and consumption model (HPCM) provides a basis for the empirical specification of demand for food that is consumed away from home (e.g. McCracken & Brandt, 1987; Mutlu & Gracia, 2006; Prochaska & Schrimper, 1973; Yen, 1993). The basic framework of this model is to maximize a household utility function, subject to the household production function, time constraint and income constraint (Becker, 1965).

$$\begin{aligned} &U = U(z_1, z_2, ..., z_n) \\ &s.t.\ z_i = z_i(x_i, t_{i1}, t_{i2}, ..., t_{im}), \quad i = 1, 2, ..., n \\ &T_k = l_k + \textstyle\sum_{i=1}^{n} t_{ik},\ k = 1, 2, ..., m \\ &\textstyle\sum_{k=1}^{m} w_k l_k + v = \sum_{i=1}^{n} p_i x_i \end{aligned} \tag{1}$$

where

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

When a household receives any hosted meal, denoted by H, it will enter the utility function as

$$U = U(z_1, z_2, ..., z_n; H) \tag{2}$$

Since the number of meals an individual can consume in a given period is limited by his/her biological capacity, receiving H for the household typically means less of the consumer good (x_i) to be used to produce commodityz_i. Then, the income constraint can be rewritten as

$$\textstyle\sum_{k=1}^{m} w_k l_k + v = \sum_{i=1}^{n} p_i x_i - p_h f^{-1}(H) \tag{3}$$

Table 1
Summary statistics.

Description of variable	Full sample		Truncated sample	
	Mean	Std. Dev.	Mean	Std. Dev.
Household (HH) FAFH consumption (yuan/wk)	148.66	157.95	174.45	160.97
HH expenditure on self-paid FAFH	108.71	142.14	131.70	146.47
Value of FAFH meals the HH was hosted	39.96	59.31	42.75	60.90
Share of HH with zero FAFH expenditure in sample	0.17	0.38	0.00	0.00
Total HH income (1000 yuan/wk)	1.27	0.65	1.29	0.62
HH income excluding wife's wage earnings	1.05	0.65	1.05	0.62
Wife's wage earnings	0.22	0.26	0.24	0.27
Wife's labor supply (hour/wk)	24.64	22.04	26.12	21.61
HH size (person)	2.95	0.66	2.97	0.64
Number of children under 16 yrs (include) in HH	0.27	0.46	0.26	0.45
Number of seniors over 65 yrs in HH	0.19	0.52	0.13	0.44
Wife's education level (0–1 dummy: 1 = above high school)	0.44	0.50	0.43	0.50
Chaoyang district (0–1 dummy: 1 = Chaoyang)	0.31	0.46	0.34	0.47
Haidian district (0–1 dummy: 1 = Haidian)	0.31	0.46	0.29	0.46
Fengtai district (0–1 dummy: 1 = Fengtai)	0.19	0.39	0.18	0.38
Dongcheng district (0–1 dummy: 1 = Dongcheng) [a]	0.19	0.39	0.19	0.39
Obs.	315		260	

[a] Used as reference in model estimation.

where $f^{-1}(H)$ denotes consumer goods to use if the household is assumed to produce the received H, and p_h is price of $f^{-1}(H)$. Then, the item $p_h f^{-1}(H)$ represents how much received hosted meals would cost if the household had to pay for them. In other words, $p_h f^{-1}(H)$ represents the latent expenditure for the receivers on the hosted meals or market value of these "free" meals if they were purchased.

Now, let's assume that people will always take the free meal if they have choices to produce a meal by themselves, purchase a meal, or consume a hosted meal. In other words, when the receiver decides to take the hosted meal, he/she would not think that the offer needs to be reciprocated at a future date. This assumption usually holds because (1) meals hosted by work units are often treated as a part of working benefits and do not need to be reciprocated (these types of hosted meals in our survey data used in this study account for 83% of total hosted meals received by households in occurrence number), and (2) meals hosted by others often do not need to be reciprocated by offering another meal but by offering something else, such as bureaucratic resource. Given this assumption, the value of hosted meals,$p_h f^{-1}(H)$, could be treated as determined exogenously for receivers.

Let $V_h = p_h f^{-1}(H)$, and replace the utility function and income constraint in the Becker's model (1) with Eqs. (2) and (3) correspondingly. Then, the household's expenditures on FAFH can be derived by maximizing the utility function as

$$EXP_{\text{FAFH}} = px_i^{sp} = f(w_1, \ldots, w_m, v, V_h, \mathbf{D}) \text{or} = f(l_1, \ldots, l_m, v, V_h, \mathbf{D}) \tag{4}$$

where **D**is a vector of demographic and dummy variables reflecting heterogeneity in preference, and x_i^{sp} represents inputs excluding time for producing meals away from home that are actually paid for by the household[4].

Eq. (4) without V_h is the fundamental form of the FAFH expenditure extensively used in previous studies with some adjustments for specific features of the study. For example, Prochaska and Schrimper (1973) replaced the FAFH expenditure with the number of meals purchased and consumed out of home per unit of time. Their study used the female spouse's wage rate as time opportunity cost due to wife's dominant role in household meal preparation. The conceptual model in the study is specified as $EXP_{\text{FAFH}} = f(w_2, v', \mathbf{D})$, where w_2 represents female spouse's wage rate, and $v' = \sum_{k=1}^{m} w_k l_k + v$, $k \neq 2$ is the household's exogenous income excluding the household wife's wage earnings. Yen (1993) replaced the female spouse's wage rate with their labor hours to explain a household's decisions on FAFH. In this study, we follow Yen's approach to use the female spouse's labor hours to capture the effects of the opportunity cost of time on FAFH, but add the value of hosted meal, V_h, into the model to have $EXP_{\text{FAFH}} = f(w_2, v', V_h, \mathbf{D})$.

3. Empirical specification and estimation

Consumers implicitly make two decisions when determining food away from home consumption. The first decision is whether or not to consume FAFH, referred to as the participation decision. The second decision is how much to spend given one has decided to dine out, referred to as the expenditure decision. The two-step feature of consumption decision results in the observed expenditures on dining out to be censored at zero, which affects the unbiased and consistency properties of ordinary least squares (OLS) estimates (Amemiya, 1984).

[4] According to the theory of the Becker model, food consumed away from home is assumed to be able to be produced at home, but with different input combinations.

This article applies a double-hurdle model with the Box–Cox transformation to address the above problem. The double-hurdle model, originally attributable to Cragg (1971), is one of many extensions of the tobit model (Tobin, 1958) which was specifically designed for two-step cases. The fundamental difference between tobit and the double-hurdle models is that the double-hurdle model allows for the two decisions to be determined by different sets of variables, while the Tobit requires that both decisions be determined by the same set of variables simultaneously (Cragg, 1971). Researchers have used both models in studies on food away from home (e.g., Jensen & Yen, 1996; Jones, 1989; McCracken & Brandt, 1987; Yen, 1993).

The double-hurdle model can be mathematically expressed as

$$y_i = \begin{cases} y_i^{**} = \mathbf{X}_i'\boldsymbol{\beta} + v_i & \text{if } \begin{cases} y_i^{*} = \mathbf{Z}_i'\boldsymbol{\alpha} + u_i > 0 \\ \text{and} \\ y_i^{**} = \mathbf{X}_i'\boldsymbol{\beta} + v_i > 0 \end{cases} \\ 0 & \text{otherwise} \end{cases} \tag{6}$$

where y_i is the observed dependent variable; y_i^* and y_i^{**} are two unobservable latent variables representing two decision hurdles, the participation hurdle and the consumption hurdle, respectively; they can be modeled as linear functions of two sets of explanatory variables $\mathbf{Z}_i$ and $\mathbf{X}_i$, respectively; u_i and v_i are error terms that are assumed to be distributed as $(u_i v_i) \sim N(0,\Sigma)$ where $\Sigma = \begin{bmatrix} 1 & \rho\sigma_i \\ \rho\sigma_i & \sigma_i^2 \end{bmatrix}$. For positive consumption to occur, consumers need to effectively pass the both hurdles.

In this article, the dependent variable y denotes the household's actual dining out expenditure[5]. The variable $\boldsymbol{Z}_i'$ in the participation hurdle function is hypothesized to include household disposable income excluding the wife's wage earnings (heretofore referred to as household income unless particular illustration)[6], the wife's education level, number of children, number of seniors, predicted wife's labor hours, and value of hosted meals the household received. The variable $\boldsymbol{X}_i'$ in the expenditure hurdle function includes all variables in $\boldsymbol{Z}_i'$, as well as several additional exogenous variables, including a quadratic term of household income and three dummy variables to represent variations due to survey locations. The statistic descriptions of these variables are given in Table 1. The theoretical framework and literature provide support for the selection of the most of these variables.

Household income is a significant determinant of food away from home consumption in previous studies. For instance, Prochaska and Schrimper (1973) empirically show that families with higher incomes consumed significantly more food away from home than families with low incomes in urban areas of the United States. McCracken and Brandt (1987) and Yen (1993), in separate studies, show that the market participation response to increases in income is a more important component in total income elasticity than income's effect on expenditures. A number of studies, including Redman (1980), Kinsey (1983), Byrne, Capps and Saha (1996), Jensen and Yen (1996), Min, Fang and Li (2004), and Ma et al. (2006), have also found the positive effect of income on FAFH participation and/or expenditure.

Several studies have shown that time valuation, in particular for the female spouse in the household who participates in the labor market, plays an important role in food away from home demand (Byrne, Capps and Saha, 1996; Jensen & Yen, 1996; Kinsey, 1983; Manrique & Jensen, 1998; Prochaska & Schrimper, 1973; Redman 1980; Yen, 1993). However, quantification of the variable varies across studies. For example, Prochaska and Schrimper (1973) used the predicted wage as the opportunity cost of time. Redman (1980) and Kinsey (1983) used dummy variables to differentiate working and nonworking wives in order to account for time influences in their dining out demand models. Yen (1993) used household wife's labor hours instead of wage earning in his study to explain the two-step decisions of food away from home consumption.

Family size and structure are also important determinants of expenditure patterns on food away from home. Redman (1980) suggested that family size has a negative effect on meals consumed out, and families with preschool aged children and older women spent significantly less on FAFH than other families. The results from McCracken and Brandt (1987) found that the presence of children 7–14 year olds may positively influence expenditures for small households, but have a negative effect for larger households. Similar results were also found in Nayga (1996).

The inclusion of the value of hosted meals received by the household is based on the theoretical framework discussed above. In our survey, both total expenditure on a meal and how much was paid for by consumers were asked, so in most cases the value of hosted meals received is easily to calculate. For those free meals or discounted meals offered by food outlets run by individual's work unit, our survey asked individuals who consumed the meal to estimate its market price by assuming that the meal had been purchased at a similar level commercial food outlet.

Despite the lack of direct evidence that the wife's education level has a significant impact on households' consumption behavior for consuming FAFH, it is included in our model to capture potential variation in the wife's awareness of nutrition and health issues related to food consumption. In addition, several location dummies are employed in the model to capture food price variation across districts.

4. Estimation issues

To obtain consistent estimates, the double-hurdle model requires that the error terms in both decision equations to be normally distributed (Arabmazar & Schmidt, 1981, 1982). Following Yen (1993), this study applies the Box–Cox transformation to

[5] We also estimated a model using the number of meals eaten outside as the dependent variable. Since the results have no significant differences between both models, we did not report the results from the frequency model for the sake of saving space.

[6] In the survey data used in this study, there are four unmarried households (without a wife to report). For these households, the wife's labor hours and wage earning were replaced by household head's information.

allow for non-normal distributions in the dependent variable. The Box–Cox transformation is defined as $y_i^T=(y_i^\lambda-1)/\lambda, 0<\lambda\leq 1$ [7]. Then, the sample likelihood function for the Box–Cox double-hurdle model can be derived as

$$L=\prod_{y_i=0}\left[1-\Psi\left(\mathbf{Z}_i'\boldsymbol{\alpha},\frac{\mathbf{X}_i'\boldsymbol{\beta}+1/\lambda}{\sigma_i},\rho\right)\right]\prod_{y_i>0}\Phi\left[\frac{\mathbf{Z}_i'\boldsymbol{\alpha}+(\rho/\sigma_i)\left(y_i^T-\mathbf{X}_i'\boldsymbol{\beta}\right)}{(1-\rho^2)^{1/2}}\right]y_i^{\lambda-1}\frac{1}{\sigma_i}\phi\left(\frac{y_i^T-\mathbf{X}_i'\boldsymbol{\beta}}{\sigma_i}\right) \quad (7)$$

where $\Psi(\bullet)$ is the standard bivariate normal cumulative distribution function with correlation ρ, $\Phi(\bullet)$and $\phi(\bullet)$ are the univariate standard normal distribution and density functions, respectively. Then, we maximize the above likelihood function to estimate parameters $\alpha,\beta,\sigma,\lambda$ and ρ. To allow for heteroscedasticity of errors in the Box-Cox double-hurdle model, we follow Poirier (1978) to specify the standard deviation as $\sigma_i=\mathbf{W}_i'\boldsymbol{\gamma}$, where $\mathbf{W}_i'$ is a set of exogenous variables, and $\boldsymbol{\gamma}$ are parameters to be estimated. In our model, $\mathbf{W}_i'$ is hypothesized to only include total household income (here it includes the wife's wage earnings). Based on estimated results from the maximum likelihood method, normality, homoscedasticity and independence of error terms can be statistically tested.

The female spouse's working hours is typically treaded as endogenously determined in the expenditure function of food away from home (Kinsey, 1983; McCracken & Brandt, 1987; Prochaska & Schrimper, 1973; Yen, 1993). If endogenous, then the maximum likelihood estimates described above are biased and inconsistent. Thus, we apply a technique suggested by Smith and Blundell (1986) to test for endogeneity. The procedure works as follows: first, both the wife's labor supply is specified as a function of the wife's age and education, household disposable income excluding the wife's wage earnings, and dummy variables for the wife's ethnic background and district locations. Second, the predicted residuals from the ordinary least squares (OLS) regression are included as extra regressors in the Box–Cox double-hurdle model. If the estimate of the coefficient on the residuals is significantly different from zero, then we fail to reject the null hypothesis of endogeneity. Finally, if endogeneity is not rejected, the labor supply equation is re-estimated using a Tobit model due to the presence of nonworking female spouses. The predictions for the wife's labor hours from the Tobit model can then be inserted in the Box-Cox double-hurdle model as proxies to replace their corresponding observed values. Given Beijing's size and heavy traffic, the female spouse's labor hours in this study include not only their working hours, but also the time spent commuting between the home and the work place.

5. Survey and data description

The empirical analysis is based on a survey of 315 households from 4 districts in Beijing, China, conducted by the lead author in July 2007. This sample is a subset of the households participating in the Urban Household Income and Expenditure (UHIE) survey conducted by the NBS. 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 & Huang, 2007; Min, Fang, & Li, 2004). In 2007, the UHIE survey in Beijing consisted of 1,165 households randomly selected from eight central city districts, representing about 7 million urban residents in these districts. Our samples were selected from four (Chaoyang, Haidian, Fengtai, and Dongcheng) out of these eight districts using stratified and random sampling approaches. Weighting our target sample size by the household samples in the UHIE survey in these four districts, we selected 100 households each in two of the districts, and 60 households each in the remaining two districts[8].

The survey instrument used to obtain data for this study includes two parts. The first part collected detailed information on demographics and socioeconomics of the household and was carried out by enumerators with in-house, and face-to-face interviews. The second part of the survey collected food consumption information. During the survey, enumerators explained the instructions for the second part and demonstrated to respondents how to record every family member's food consumption and expenditures. Part two was then left with the respondent for one week (including the drop-off day) for diary-based recording. The selected households were 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, type of food facility, purchase venue, and etc. This diary record approach was 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 dinning 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 dinning place for consumers to sit down and eat.

Several additional efforts were also made to improve data quality. First, extensively trained enumerators selected the person who was 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

[7] When λ tends to be zero, y_i^T becomes logarithm transformation, that is, $\lim_{\lambda\to 0} y_i^T=\log(y_i)$.
[8] Five selected households could not finish our survey and thus were removed from final database.

and consumption activities in their households. Second, the family member who was in charge of recording food consumption was asked to obtain detailed information on the food consumed by other family members if they were not together for the meal to avoid potential missing consumption due to unawareness. Third, during the survey week, enumerators called the surveyed respondents twice to answer any questions and to provide a reminder. Fourth, the finished survey forms were carefully checked in front of the respondents when they were collected and by calling back in the following week. Fifth, two thirds of the enumerators involved in this survey were from the Beijing branch of the NBS. These enumerators were mainly in charge of the UHIE survey and had good relationships with the households in the survey. Thus, their participation in our survey facilitated access to, and cooperation from the surveyed households. Sixth, each respondent was provided with a telephone card valued at 30 yuan ($4) so that the respondent could 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 consumed at work, school or elsewhere. Finally, the household received 100 yuan ($14) upon completion of the survey as an incentive.

Table 2
Estimation results for household expenditure on FAFH.

Independent variables	With hosted meals	Without hosted meals
Participation equation		
Value of FAFH that HH was hosted	0.007	
	(0.00)	
HH income excluding wife's wage earnings	0.354*	0.451**
	(0.20)	(0.22)
Wife's labor supply	0.027***	0.030***
	(0.01)	(0.01)
Education of wife	−0.364**	−0.363**
	(0.19)	(0.18)
Number of children in HH	−0.344*	−0.366*
	(0.19)	(0.19)
Number of seniors in HH	−0.339**	−0.377***
	(0.15)	(0.14)
_cons	0.052	0.178
	(0.34)	(0.32)
Expenditure equation		
Value of FAFH that household (HH) was hosted	0.026**	
	(0.01)	
HH income excluding wife's wage earnings	1.528	2.139**
	(0.97)	(1.01)
	(1.01)	
Quadratic term of HH income excluding wife's wage	−0.463*	−0.546*
	(0.27)	(0.28)
Wife's labor supply	0.046**	0.057**
	(0.02)	(0.02)
Education of wife	−0.377	−0.363
	(0.49)	(0.51)
Number of children in HH	0.690	0.689
	(0.50)	(0.53)
Number of seniors in HH	−1.386***	−1.619***
	(0.53)	(0.58)
District of Chaoyang	2.325***	2.394***
	(0.70)	(0.74)
District of Haidian	1.840***	1.833***
	(0.67)	(0.70)
District of Fengtai	0.471	0.584
	(0.64)	(0.68)
_cons	3.030***	3.493***
	(1.03)	(1.06)
Sigma (σ_i)		
Total HH income	0.814**	0.801**
	(0.34)	(0.36)
_cons	2.204***	2.375***
	(0.58)	(0.63)
Lambda (λ)	0.709***	0.735***
	(0.13)	(0.14)
Rho (ρ)	0.472***	0.484***
	(0.11)	(0.10)
Number of Observations	315	315
Log-likelihood	−1627.123	−1630.36

Notes: standard errors in parentheses; *$p<.1$, **$p<.05$, ***$p<.01$.

Table 3
Elasticities with respect to selected exogenous variables [a].

	Probability		Conditional		Unconditional	
	UR [b]	*R*	UR	*R*	UR	*R*
Value of FAFH that HH was hosted	0.09	–	0.60	–	0.69	–
HH income excluding wife's wage earnings	0.12	0.15*	0.32	0.46***	0.43	0.61***
Wife's labor supply	0.19	0.21	0.57	0.57	0.76	0.78
Number of children in HH	−0.03	−0.03	0.11	0.09	0.08	0.06
Number of seniors in HH	−0.02	−0.02	−0.15	−0.14	−0.17	−0.16
Education of wife	−0.11	−0.11	−0.20	−0.15	−0.31	−0.27

Notes: *, **, *** mean the difference of elasticities between unrestricted and restricted models is significant at .1, .05, and .01 levels, respectively.
[a] 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.
[b] UR denotes estimated elasticities from the unrestricted model while R denotes ones from the restricted model.

6. Empirical results

Table 1 indicates that hosted meals play a significant role in total household consumption for food away from home. Per household consumption for FAFH during the surveyed week was 149 yuan, consisting of 109 yuan of self-paid and 40 yuan of hosted meals. In the full (all households included) and truncated samples (household expenditure on FAFH is greater than zero), the value of hosted meals accounts for about 27% and 24% of total FAFH consumption, respectively. Seventeen percent of surveyed households reported zero expenditure on FAFH.

The statistical descriptions of exogenous variables specified in the Box-Cox double-hurdle model are also reported in Table 1. Weekly household disposable income is 1,270 yuan in the sample, which is not significantly different from the estimate (1283 yuan) based on the NBS 2000–2006 official data reported in the Statistical Yearbooks. The wife's wage earning is about 220 yuan a week in the full sample, contributing near 20% to the household's disposable income. An average wife works in the labor market for about 25 labor hours a week in full sample, and 26 h in truncated sample. The average household size is 2.95 persons. About 44% of household wives in the survey received above high school education.

The result of endogeneity test of the wife's working hours fails to reject the null hypothesis, meaning that this variable suffers from endogeneity in the model. Therefore, its predicted value is included in the Box–Cox double-hurdle model as proxy to deal with the endogenous problem. Also, since the estimates for household income in the equation $\sigma_i = \mathbf{W}_i'\boldsymbol{\gamma}$ and correlation coefficient of error terms u_j and v_j are significantly unequal to zero, suggesting heteroscedastic and dependent stochastic terms, respectively. Thus, allowing for unequal variance across households and existence of ρ in the final model is necessary for ML method to generate consistent estimates.

Table 2 presents our econometric results. To directly measure the effects of hosted meals on household decisions on self-paid dining out, a restricted model (assuming parameters of the hosted meal equal to zero) was estimated and reported as well. Elasticities of probability, conditional expenditure and unconditional level of food away from home with respect to several selected exogenous variables are reported in Table 3. The formulas used to compute the marginal effects and associated elasticities of the Box–Cox double-hurdle model are given in the Appendix.

Apparently, both the probability of a household deciding to dine out and the expenditure meals outside will significantly increase as income rises, but the expenditure level increases at a decreasing rate as the estimate for the quadratic term of household income is negative. Correspondingly, the estimated probability elasticity and the expenditure elasticity with respect to household income are 0.12 and 0.32, respectively, indicating that a 10% increase in household income will cause the probability of eating out to increase by about 1.2% and 3.2% rise in conditional expenditure on FAFH in the unrestricted model (with hosted meals included). These elasticities become 1.5% and 4.6% in the restricted model (without hosted meals), respectively (Table 3). A bootstrap simulation with 200 subsamples and 200 iterations shows that the elasticities with respect to household income in the restricted model are significantly higher than those in the unrestricted model. This strongly suggests that excluding the value of hosted meals from the household expenditure function on FAFH could generate significantly biased estimates for income elasticities and cause invalid implications to be drawn.

The effects of opportunity cost of time on food away from home are significant and positive for both participation and expenditure decisions. This result is evident in the estimates for the coefficient on the household wife's labor supply. This finding clearly shows that when the household wife's opportunity cost of time increases, the household is more likely to dine out and to spend more money on dining out (Table 2). The probability and conditional elasticities with respect to the household wife's labor supply are 0.19 and 0.57, respectively (Table 3). These results are consistent with those found in many previous studies conducted in developed countries, such as Yen (1993) and McCracken and Brandt (1987).

However, several studies on Chinese household dining out consumption provided different views on time effects. For example, Watson (1997) and Yan (1997) found that eating out at many western restaurants in China was usually for family gatherings, birthday parties and other social events, which took more time rather than less. Curtis, McCluskey and Wahl (2007) also indicated that a household with two working spouses was not a significant indicator of convenience food consumption in Beijing in a 2002 consumer survey. There are two likely explanations for the differences in the effects of time opportunity cost between those studies

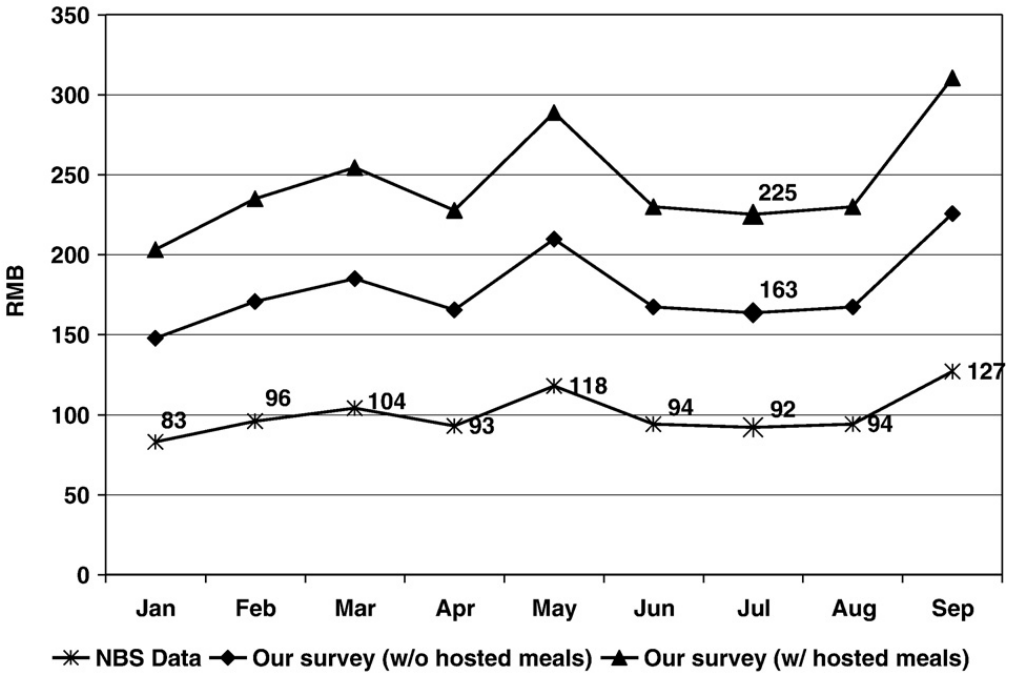

Fig. 1. Per capita expenditure/consumption of FAFH in urban Beijing, 2007. Note: the numbers for months other than July in triangle and diamond dot lines were extrapolated by assuming the same percentage differences.

and our current study. First, "eating out" meals in the current study are defined not only as including meals consumed at full-service restaurants and convenience food outlets, but also those eaten at cafeterias and other commercial facilities. While special events, which usually take more time, make up a large part of eating out consumption that takes place at restaurants and quick meal service locations, saving cost and time was indicated as a reason for almost all dining out consumption at Chinese style fast food outlets and cafeterias. Second, the difference might reflect the dynamic changes of Beijing households' eating out patterns and trends over the last several years. As one of the most developed cities, Beijing has dramatically and remarkably extended its metro area over the last decade. As a result, average traffic time for a person to commute between the home and the work place reached near 100 min in 2008 according to a recent survey, which forced most working people to eat out at least for lunch, rather than go home to eat as they did before.

The consumption of hosted meals by a household has not significant influence on the probability to dine out, but significantly increases the expenditure on food away from home on their own (Table 2). On average, a 10% increase in value of consumed hosted meals by a household will generate a 6% rise in the level of expenditure on self-paid FAFH, but only increase one percent in probability of dine out (Table 3). This result is not surprising because of the potential diminishing marginal utility of consuming FAFH, which results in that people who are hosted a lot on their jobs tend to choose quality over quantity on their personal dining out choices.

A number of other variables also appear to affect the households' participation and expenditure on food away from home. For instance, both the number of children and the number of seniors in the household are significantly and negatively related to the probability of eating out. Meanwhile, households with more seniors also tend to spend less than those with fewer seniors if they dine out. These results are mostly consistent with previous studies (e.g., Jensen & Yen, 1996; Redman, 1980), suggesting that household composition significant influences household's participation and expenditure level on FAFH. In addition, households with the wife's education level above high school are less likely to eat out on their own than other families, but this may not cause a significant difference in their expenditures on food away from home. The estimated results also show that the level of expenditure on FAFH varies across survey districts. Relative to those in Dongcheng, one of four 'old' downtown districts in Beijing, households in three surrounding districts, Chaoyang, Haidian and Fengtai, were spending more on FAFH. This may reflect the potential difference in food costs due to geographic locations.

To compare household expenditure on food consumed away from home between our survey results and that reported in the UHIE survey by the NBS of China, we converted our observed weekly per capita FAFH expenditure and the value of received hosted meals into the monthly levels by assuming that the households' dinning out behaviors in the survey week would have no significant difference from the rest of July, 2007. As a result, per capita expenditure on FAFH (paid for by consumers) in the month was 163 yuan, which almost doubled the level (92 yuan) reported in the UHIE survey during the same period (Fig. 1). This has not counted the value of received hosted meals. If we do so, the total value of FAFH consumption per capita was apparently higher, reached 225 yuan, which is about two and half times of the UHIE level. These results suggest the UHIE survey might notably underestimate household consumption of FAFH, as well as the expenditures on dining out. The incomplete and unclear measurement of food away from home mentioned earlier could be major reasons contributing to the underestimation. As we can see in Fig. 1, the gap between below two

lines is likely due to the unclear definition of FAFH in the UHIE survey and the diary recorders' unawareness of FAFH consumed by other members in their households, while the gap between above two lines are due to the exclusion of hosted meals in the survey.

7. Conclusions

In this article, we seek to improve our understanding of the rapidly increasing food consumed away from home in China. The results from this study suggest a likely notable underestimation in the NBS survey. Not capturing hosted meals contributes to about half of this gap, while the remaining half may be due to the vague definition of FAFH in their survey. Moreover, this study shows that the exclusion of hosted meals may bias the estimates for exogenous variables in models of the determinants for dining out. In particular, it could amplify income effects on both the likelihood of dining out for the household and the level of expenditures on FAFH.

In addition, both the probability of a household dining out and the expenditure level are found to be significantly related to a number of factors derived from the modified Becker's model. These factors include household income, the time opportunity cost, and the value of received hosted meals. Meanwhile, household's decisions on dining out are also significantly affected by other demographics. For instance, households with fewer children and fewer seniors are more likely to purchase their own meals out and to spend more when they decide to dine out relative to others.

Appendix. Elasticities of the Box–Cox double-hurdle model

In the Box–Cox double-hurdle (BCDH) model, the total change in the unconditional consumption in term of an independent variable can be disaggregated into the change in conditional consumption and the change in the probability of consuming. For the BCDH model, the unconditional expectation of y_i is

$$E(y_i) = P(y_i > 0)E(y_i|y_i > 0) \tag{A.1}$$

By taking the derivative of Eq. (1) with respect to x_{ij}, McDonald and Moffitt (1980) and Maddala (1983) showed that the total change in the unconditional purchases in term of an independent variable x_j can be disaggregated into two parts: the change in conditional purchases weighted by the probability of purchasing and the change in the probability of purchasing weighted by the conditional expected value of purchases, i.e.

$$\frac{\partial E(y_i)}{\partial x_{ij}} = P(y_i > 0)\frac{\partial E(y_i|y_i > 0)}{\partial x_{ij}} + E(y_i|y_i > 0)\frac{\partial P(y_i > 0)}{\partial x_{ij}} \tag{A.2}$$

Multiplying both sides of Eq. (A.2) by $\frac{x_{ij}}{E(y_i)}$ and simplifying, the elasticities can be expressed as

$$\frac{\partial E(y_i)}{\partial x_{ij}}\frac{x_{ij}}{E(y_i)} = \frac{\partial E(y_i|y_i > 0)}{\partial x_{ij}}\frac{x_{ij}}{E(y_i|y_i > 0)} + \frac{\partial P(y_i > 0)}{\partial x_{ij}}\frac{x_{ij}}{P(y_i > 0)} \tag{A.3}$$

i.e. $\eta_{uncon} = \zeta_{cond} + \delta_{pp}$

where $\eta_{uncon} = \frac{\partial E(y_i)}{\partial x_{ij}}\frac{x_{ij}}{E(y_i)}$, $\zeta_{cond} = \frac{\partial E(y_i|y_i > 0)}{\partial x_{ij}}\frac{x_{ij}}{E(y_i|y_i > 0)}$, and $\delta_j = \frac{\partial P(y_i > 0)}{\partial x_{ij}}\frac{x_{ij}}{P(y_i > 0)}$ and are the unconditional elasticity, the conditional elasticity, and the elasticity of the probability of purchasing, respectively.

Notice that $\frac{\partial E(y_i)}{\partial x_{ij}}$, $\frac{\partial E(y_i|y_i > 0)}{\partial x_{ij}}$, and $\frac{\partial P(y_i > 0)}{\partial x_{ij}}$ represent the unconditional marginal effect, conditional marginal effect, and the marginal effect of probability of positive observation, respectively. These marginal effects for calculating associated elasticities of the BCDH model in this study were derived on the basis of Jones and Yen (2000). The details are available upon request. Their general formula can also be found in Jones and Yen (2000).

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